NASA SP-7046(11) January 1985

Technology for Large Space Systems

A Bibliography with Indexes

NASA SP - 7048(1)

echnology-for_Large=Space-Systems

A Bibliography with Indexes

January 1985



(NASA-SP-7046 (11)) TECHNCLOGY FOR LARGE N85-25277 SPACE SYSTEMS: A BIBILOGELFEY WITH INDEXES, SUPPLEMENT 11 (National Aeronautics and pace Administration) 142 p EC \$14.50 Unclas CSCL 22A 00/12 17070

NASA SP-7046(11)

TECHNOLOGY FOR LARGE SPACE SYSTEMS

A BIBLIOGRAPHY WITH INDEXES

Supplement 11

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system between January 1 and June 30, 1984 in

- Scientific and Technical Aerospace Reports (STAR)
- International Aerospace Abstracts (IAA).



NOTE TO AUTHORS OF PROSPECTIVE ENTRIES:

The compilation of this bibliography results from a complete search of the *STAR* and *IAA* files. Many times a report or article is not identified because either the title, abstract, or key words did not contain appropriate words for the search. A number of words are used, but to best insure that your work is included in the bibliography, use the words *Large Space Structures* somewhere in your title or abstract, or include them as a key word.

..

This supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161 at the price code A07 (\$14.50 domestic; \$29.00 foreign).

•

INTRODUCTION

This bibliography is designed to be helpful to the researcher and manager engaged in developing technology within the discipline areas of the Large Space Systems Technology. Also, the designers of large space systems for approved missions (in the future) will utilize the technology described in the documents referenced herein.

This literature survey lists 539 reports, articles and other documents announced between January 1, 1984 and June 30, 1984 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents that define specific missions that will require large space structures to achieve their objectives. The methods of integrating advanced technology into system configurations and ascertaining the resulting capabilities is also addressed.

A wide range of structural concepts are identified. These include erectable structures which are earth fabricated and space assembled, deployable platforms and deployable antennas which are fabricated, assembled, and packaged on Earth with automatic deployment in space, and space fabricated structures which use pre-processed materials to build the structure in orbit.

The supportive technology that is necessary for full utilization of these concepts is also included. These technologies are identified as analysis and design techniques, structural and thermal analysis, structural dynamics and control, electronics, advanced materials, assembly concepts, and propulsion.

A General category completes the list of subjects addressed by this document.

The selected items are grouped into ten categories as listed in the Table of Contents with notes regarding the scope of each category. These categories were especially selected for this publication and differ from those normally found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract where available, and appears with the original accession numbers from the respective announcement journals.

Under each of the ten categories, the entries are presented in one of two groups that appear in the following order:

- 1) *IAA* entries identified by accession number series A84-10,000 in ascending accession number order;
- 2) STAR entries identified by accession number series N84-10,000 in ascending accession number order.

After the abstract section there are six indexes - subject, personal author, corporate source, contract number, report number, and accession number.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A84-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at \$8.50 per document. Microfiche⁽¹⁾ of documents announced in *IAA* are available at the rate of \$4.00 per microfiche on demand. Standing order microfiche are available at the rate of \$1.45 per microfiche for *IAA* source documents.

Minimum air-mail postage to foreign countries is \$2.50 and all foreign orders are shipped on payment of pro-forma invoices.

All inquiries and requests should be addressed to AIAA Technical Information Service. Please refer to the accession number when requesting publications.

STAR ENTRIES (N84-10000 Series)

One or more sources from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The most commonly indicated sources and their acronyms or abbreviations are listed below. If the publication is available from a source other than those listed, the publisher and his address will be displayed on the availability line or in combination with the corporate source line.

Avail: NTIS. Sold by the National Technical Information Service. Prices for hard copy (HC) and microfiche (MF) are indicated by a price code preceded by the letters HC or MF in the *STAR* citation. Current values for the price codes are given in the tables on page viii.

Documents on microfiche are designated by a pound sign (#) following the accession number. The pound sign is used without regard to the source or quality of the microfiche.

Initially distributed microfiche under the NTIS SRIM (Selected Research in Microfiche) is available at greatly reduced unit prices. For this service and for information concerning subscription to NASA printed reports, consult the NTIS Subscription Section, Springfield, Va. 22161.

NOTE ON ORDERING DOCUMENTS: When ordering NASA publications (those followed by the * symbol), use the N accession number. NASA patent applications (only the specifications are offered) should be ordered by the US-Patent-Appl-SN number. Non-NASA publications (no asterisk) should be ordered by the AD, PB, or other *report* number shown on the last line of the citation, not by the N accession number. It is also advisable to cite the title and other bibliographic identification.

- Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, as indicated above, for those documents identified by a # symbol.)
- Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Document Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

⁽¹⁾ A microfiche is a transparent sheet of film, 105 by 148 mm in size containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 26.1 reduction).

- Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts.* Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.
- Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.
- Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.
- Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.
- Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)
- Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, Federal Republic of Germany, at the price shown in deutschmarks (DM).
- Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.
- Avail: U.S. Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of 50 cents each, postage free.
- Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address, both of which are on page vii.
- Other availabilities: If the publication is available from a source other than the above, the publisher and his address will be displayed entirely on the availability line or in combination with the corporate author line.

v

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC: NASA and NASA-sponsored documents and a large number of aerospace publications are available to the public for reference purposes at the library maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

EUROPEAN: An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England for public access. The British Library Lending Division also has available many of the non-NASA publications cited in *Star*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols # and * from ESA - Information Retrieval Service European Space Agency, 8-10 rue Mario-Nikis, 75738 Paris CEDEX 15, France.

FEDERAL DEPOSITORY LIBRARY PROGRAM

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 50 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. Over 1,300 other depositories also exist. A list of the regional GPO libraries appears on the inside back cover.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics and Astronautics Technical Information Service 555 West 57th Street, 12th Floor New York, New York 10019

British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England

Commissioner of Patents and Trademarks U.S. Patent and Trademark Office Washington, D.C. 20231

Department of Energy Technical Information Center P.O. Box 62 Oak Ridge, Tennessee 37830

ESA-Information Retrieval Service ESRIN Via Galileo Galilei 00044 Frascati (Rome) Italy

ESDU International, Ltd. 1495 Chain Bridge Road McLean, Virginia 22101

ESDU International, Ltd. 251-259 Regent Street London, W1R 7AD, England

Fachinformationszentrum Energie, Physik, Mathematik GMBH 7514 Eggenstein Leopoldshafen Federal Republic of Germany

Her Majesty's Stationery Office P.O. Box 569, S.E. 1 London, England

NASA Scientific and Technical Information Facility P.O. Box 8757 B.W.I. Airport, Maryland 21240 National Aeronautics and Space Administration Scientific and Technical Information Branch (NIT-1) Washington, D.C. 20546

National Technical Information Service 5285 Port Royal Road Springfield, Virginia 22161

Pendragon House, Inc. 899 Broadway Avenue Redwood City, California 94063

Superintendent of Documents U.S. Government Printing Office Washington, D.C. 20402

University Microfilms A Xerox Company 300 North Zeeb Road Ann Arbor, Michigan 48106

University Microfilms, Ltd. Tylers Green London, England

U.S. Geological Survey Library National Center – MS 950 12201 Sunrise Valley Drive Reston, Virginia 22092

U.S. Geological Survey Library 2255 North Gemini Drive Flagstaff, Arizona 86001

U.S. Geological Survey 345 Middlefield Road Menlo Park, California 94025

U.S. Geological Survey Library Box 25046 Denver Federal Center, MS 914 Denver, Colorado 80225

NTIS PRICE SCHEDULES

Schedule A

STANDARD PAPER COPY PRICE SCHEDULE

(Effective January 1, 1983)

Price Code	Page Range	North American Price	Foreign Price
A01	Microfiche	\$ 4.50	\$ 9.00
A02	001-025	7.00	14.00
A03	026-050	8.50	17.00
A04	051-075	10.00	20.00
A05	07 6 -100	11.50	23.00
A06	101-125	13.00	26.00
A07	126-150	14.50	29.00
A08	151-175	16.00	32.00
A09	176-200	17.50	35.00
A10	201-225	19.00	38.00
A11	226-250	20.50	41.00
A12	251-275	22.00	44.00
A13	276-300	23.50	47.00
A14	301-325	25.00	50.00
A15	326-350	26.50	53.00
A16	351-375	28.00	56.00
A17	376-400	29.50	59.00
A18	401-425	31.00	62.00
A19	426-450	32.50	65.00
A20	451-475	34.00	68.00
A21	476-500	35.50	71.00
A22	501-525	37.00	74.00
A23	526-550	38.50	77.00
A24	551-575	40.00	80.00
A25	576-600	41.50	83.00
A99	601-up	- 1	- 2

1/ Add \$1.50 for each additional 25 page increment or portion thereof for 601 pages up.

2/ Add \$3.00 for each additional 25 page increment or portion thereof for 601 pages and more.

Schedule E

EXCEPTION PRICE SCHEDULE

Paper Copy & Microfiche

.

Price Code	North American Price	Foreigr Price
E01	\$ 6.50	\$ 13.50
E02	7.50	15.50
E03	9.50	19.50
E04	11.50	23.50
E05	13.50	27.50
E06	15.50	31.5
E07	17.50	35.5
E08	19.50	39.5
E09	21.50	43.5
E10	23.50	47.50
E11	25.50	51.5
E12	28.50	57.5
E13	31.50	63.5
E14	34.50	69.5
E15	37.50	75.5
E16	40.50	81.5
E17	43.50	88.5
E18	46.50	93.5
E19	51.50	102.5
E20	61.50	123.5

E-99 - Write for quote

N01

DIE

TABLE OF CONTENTS	Page
Category 01 Systems Includes mission and program concepts and requirements, focus missions, conceptual studies, technology planning, systems analysis and integration, and flight experiments.	1
Category 02 Analysis and Design Techniques Includes interactive techniques, computerized technology design and development programs, dynamic analysis techniques, environmental modeling, thermal modeling, and math modeling.	15
Category 03 Structural Concepts Includes erectable structures (joints, struts, and columns), deployable platforms and booms, solar sail, deployable reflectors, space fabrication techniques and protrusion processing.	19
Category 04 Structural and Thermal Analysis Includes structural analysis and design, thermal analysis and design, analysis and design techniques, and thermal control systems.	22
Category 05 Structural Dynamics and Control Includes modeling, systems identification, attitude and control techniques, surface accuracy measurement and control techniques and systems, sensors and actuators.	30
Category 06 Electronics Includes techniques for power and data distribution, antenna RF performance analysis, communications systems, and spacecraft charging effects.	43
Category 07 Advanced Materials Includes matrix composites, polyimide films and thermal control coatings, bonding agents, antenna components, manufacturing techniques, and space environmental effects on materials.	52
Category 08 Assembly Concepts Includes automated manipulator techniques, EVA, robot assembly, teleoperators, and equipment installation.	57
Category 09 Propulsion Includes propulsion concepts and designs utilizing solar sailing, solar electric, ion, and low thrust chemical concepts.	61
Category 10 General Includes either state-of-the-art or advanced technology which may apply to Large Space Systems and does not fit within the previous categories. Publications of conferences, seminars, and workshops are covered in this area.	63
Subject Index	A- 1
Personal Author Index	
Corporate Source Index	
Contract Number Index	
	••• •

Report / Accession Number Index E-1

.

TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT		
NASA ACCESSION	↓	MICHOFICHE
NUMBER		CORPORATE
NOMBEN.	Washington, D. C.	SOURCE
TITLE	SECOND ALL-UNION SEMINAR ON HYDROMECHANICS AND	0001102
11122	HEAT-MASS TRANSFER IN WEIGHTLESSNESS. ABSTRACTS	
	OF REPORTS: TABLE OF CONTENTS	PUBLICATION
AUTHORS	G, Z, GERSHUNI and Y, M, ZHUKHOVITSKIY Jan, 1984 15 p	DATE
	refs Transl. into ENGLISH of conf. papers, 1981 p 176-186	
CONTRACT	Seminar held in Perm, USSR, 1981	
OR GRANT		AVAILABILITY
	A01 CSCL 20D	SOURCE
REPORT	Abstracts of reports are given which were presented at the	
NUMBER	Second All Union Seminar on Hydromechanics and Heat-Mass	
	Transfer in Weightlessness. Topics inlcude: (1) features of	
	crystallization of semiconductor materials under conditions of	
	microacceleration; (2) experimental results of crystallization of solid	
	solutions of CDTE-HGTE under conditions of weightlessness; (3)	
	impurities in crystals cultivated under conditions of weightlessness;	
	and (4) a numerical investigation of the distribution of impurities	
	during guided crystallization of a melt. B.W.	
	uunny yuureu uystamzauun or a mert. 0.11.	

TYPICAL CITATION AND ABSTRACT FROM IAA

DOCUMENT	······································	AVAILABLE OF
AA ACCESSION		MICROFICHI
UMBER	A84-11811*# Jet Propulsion Lab., California Inst. of Tech.,	
	Pasadena.	
	TECHNOLOGY REQUIREMENTS FOR LARGE FLEXIBLE SPACE	TITL!
	STRUCTURES	
UTHORS	B. K. WADA, R. E. FREELAND (California Institute of Technology,	
	Jet Propulsion Laboratory, Applied Mechanics Technology Section,	
	Pasadena, CA), and N. F. GARCIA (Lockheed Missiles and Space -	AUTHOR'
	Co., Inc., Sunnyvale, CA) International Astronautical Federation,	AFFILIATIO
	International Astronautical Congress, 34th, Budapest, Hungary, Oct.	MEETING
	10-15, 1983 <u>, 6 p. refs</u>	——
	Research, test, and demonstration experiments necessary for	MEETIN
	establishing a data base that will permit construction of large,	DAT
	lightweight flexible space structures meeting on-orbit pointing and	
	surface precesion criteria are discussed. Attention is focused on	
	the wrap-rib proof-of-concept antenna structures developed from	
	technology used on the ATS-6 satellite. The target structure will	
	be up to 150 m in diameter or smaller, operate at RF levels, be	
	amenable to packaging for carriage in the Shuttle bay, be capable	
	of being ground-tested, and permit on-orbit deployment and	
	retraction. Graphite/epoxy has been chosen as the antenna ribs	
	material, and the antenna mesh will be gold-plated Mo wire. A	
	55-m diam reflector was built as proof-of-concept with ground-test	
	capability. Tests will proceed on components, a model, the entire	
	structure, and in-flight. An analytical model has been formulated	
	to characterize the antenna's thermal behavior. The flight test of	
	the 55-m prototype in-orbit offers the chance to validate the	
	analytical model and characterize the control, mechanical, and	
	thermal characteristics of the antenna configuration. M.S.K.	

TECHNOLOGY FOR LARGE SPACE SYSTEMS

A Bibliography (Suppl. 11)

JANUARY 1985

01

SYSTEMS

Includes mission and program concepts and requirements, focus missions, conceptual studies, technology planning, systems analysis and integration, and flight experiments.

A84-11724#

PAYLOAD PLACING USING AN OPERATIONAL SUPPORT

J. J. RUNAVOT and O. GROSJEAN (Centre National d'Etudes Spatiales, Toulouse, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 10 p. (IAF PAPER 83-44)

Feasibility studies on а space-platform/orbital-maneuvering-vehicle (OMV) method for placing large (greater than 3000-kg) payloads in geosynchronous orbit are reported. This capability is seen as required by current European plans for the period 1990-2005; an alternate procedure currently being evaluated involves the use of an electronuclear tug. The approach considered here comprises a platform on low, near-equatorial orbit and a cryogenically propelled OMV capable of rendezvous, docking, fuel transfer, assembly, and checking. The payload (here, a telecommunications satellite) is launched in two parts by two Ariane-type expendable rockets: the satellite itself first, and then its propulsion unit. If the propellants can be stored on the platform (from earlier operations), the maximum payload in GEO can be about 12.5 tons. This potential plus the greater flexibility and safety of this approach make it more practical, at least with current technology, than the approach using the electronuclear tug. D.G.

A84-11726*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

OVERVIEW OF NASA SPACE STATION ACTIVITIES

E. L. TILTON, III (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Bay St. Louis, MS) and E. B. PRITCHARD (NASA, Langley Research Center, Hampton, VA) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 12 p. (IAF PAPER 83-48)

The architecture, functions, and human activities on-board a space station are discussed. A manned presence is regarded as essential for innovative actions and successful exploitation of weightless conditions. The station itself could be a cluster of for habitation, power, operations, modules docking, experimentation, and storage. Additionally, the station could provide an interface for free-flying platforms and teleoperated satellite services, as well as a base for establishing space-based manufacturing facilities. NASA has projected timelines that include initial development funding in 1987, full capabilities before the year 2000, and initial costs for minimum capabilities of \$7.5-9 billion. Architecture, mission requirements, trade-offs, and concepts are currently being defined as a prelude to systems development. Attention is being given to participation by both the DoD and other governments, and to defining the capabilities of the station,

including habitability, closed-loop life-support system, the scope of science application and data transfer, and the power requirements. M.S.K.

A84-11731#

APPLICATION OF A COMMON REFLECTOR CONFIGURATION TO A MULTIMISSION SATELLITE OF THE 90'S

C. COUGNET, J. L. PERBOS, P. SAINT-AUBERT (Matra, S.A., Centre Spatiale de Toulouse, Toulouse, France), and G. BERRETTA (ESA, Paris, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 10 p.

(IAF PAPER 83-60)

A telecommunication satellite concept is presented in which a single reflector, common to different payloads, is applied to Kaand Ku-band European coverage and, as a development for the late 1990s, C-band coverage of Africa. Attention is given to the configurations of the satellite and its antenna, as well as the definition of this mission and its traffic prediction analysis. No insurmountable problems have thus far been encountered in the application of this satellite concept to the mission in question, and a single, long payload-fairing Ariane 4 launch appears to be suitable. O.C.

A84-11793*# National Aeronautics and Space Administration, Washington, D. C.

NASA PRIORITY TECHNOLOGIES

S. R. SADIN (NASA, Office of Aeronautics and Space Technology, Washington, DC) and H. O. SLONE (NASA, Lewis Research Center, Cleveland, OH) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 10 p.

(IAF PAPER 83-345)

Significant research areas deserving of attention within the NASA Space Research and Technology program are discussed, noting that the program is pursed to strengthen the U.S. technology base, improve low-cost access to space, and to aid in the expanded use of space, including a space station. Study areas being pursued include new Orbiter thermal protection system materials, developing longer-life reusable engines, and providing the technology for orbital transfer vehicle propulsion and aeroassisted braking. Attention is also being given to CFD techniques for entry body and rocket engine design, verifying the feasibility of advanced sensor concepts, defining the technology for large deployable RF antennas, and improving on-board data management systems. Of particular concern is to establish technologies which will enhance and extend a permanent manned presence in space.

A84-11811*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

TECHNOLOGY REQUIREMENTS FOR LARGE FLEXIBLE SPACE STRUCTURES

B. K. WADA, R. E. FREELAND (California Institute of Technology, Jet Propulsion Laboratory, Applied Mechanics Technology Section, Pasadena, CA), and N. F. GARCIA (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 6 p. refs

(IAF PAPER 83-404)

Research, test, and demonstration experiments necessary for establishing a data base that will permit construction of large. lightweight flexible space structures meeting on-orbit pointing and surface precesion criteria are discussed. Attention is focused on the wrap-rib proof-of-concept antenna structures developed from technology used on the ATS-6 satellite. The target structure will be up to 150 m in diameter or smaller, operate at RF levels, be amenable to packaging for carriage in the Shuttle bay, be capable of being ground-tested, and permit on-orbit deployment and retraction. Graphite/epoxy has been chosen as the antenna ribs material, and the antenna mesh will be gold-plated Mo wire. A 55-m diam reflector was built as proof-of-concept with ground-test capability. Tests will proceed on components, a model, the entire structure, and in-flight. An analytical model has been formulated to characterize the antenna's thermal behavior. The flight test of the 55-m prototype in-orbit offers the chance to validate the analytical model and characterize the control, mechanical, and thermal characteristics of the antenna configuration. M.S.K.

A84-13330

POTENTIAL MILITARY APPLICATIONS OF SPACE PLATFORMS AND SPACE STATIONS

J. LEVY, E. RADANY, and J. TUTTLE (ORI, Inc., Silver Spring, MD) IN: EASCON '82; Annual Electronics and Aerospace Systems Conference, 15th, Washington, DC, September 20-22, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 269-276.

The potential applicability of space platforms and space stations to perform several military functions is discussed, and the role of man with regard to the station applications is identified. Additional space station concepts for providing military support functions are described, and the usefulness of man in each concept is identified. Author

A84-14762

THE TIROS-BASED ASTEROID MISSION

R. MAEHL (RCA, Astro-Electronics Div., Princeton, NJ) Spaceflight (ISSN 0038-6340), vol. 25, Dec. 1983, p. 430-435.

Mission features for a survey of the physical and chemical properties of asteroids that are candidates for a shift to GEO as raw material supplies for building large space structures are described. Modified Tiros satellites could probe near-earth objects in multiple-rendezvous scenarios, which would also yield data on the evolution of the solar system. Attention would be given to surface morphology, bulk density, density distribution, chemical and mineral composition, and magnetic properties. A mission profile including Shuttle launch, IUS boost, repeated orbits, and a soft landing on a single asteroid is detailed. D.H.K.

A84-15301

MANAGEMENT OF LARGE SPACE PROJECTS; COURSE ON SPACE TECHNOLOGY, TOULOUSE, FRANCE, MAY 3-14, 1982, PROCEEDINGS [LA GESTION DES GRANDS PROJETS SPATIAUX; COURS DE TECHNOLOGIE SPATIALE, TOULOUSE, FRANCE, MAY 3-14, 1982, EXPOSES] Course sponsored by the Centre National d'Etudes Spatiales.

Course sponsored by the Centre National d'Etudes Spatiales. Toulouse, Cepadues-Editions, 1983, 872 p. In French and English.

Topics discussed in an 11-day course on space technology sponsored by CNES to characterize the management techniques involved in the development of large space projects are presented, with attention focused on the production of the Ariane launch vehicle. Consideration is devoted to management of the day-to-day progress of a project that involved ESA, CNES, and European industries. Note is taken of contract features which distributed authority for various management and manufacturing tasks, established production and delivery schedules, specified performances, and characterized interface components. Scheduling techniques included setting margins for delivery dates in order to ameliorate the effects of the delay of delivery of any one subsystem on the project as a whole. Examples are cited from the Ariane, SPOT, and Spacelab projects. M.S.K.

A84-15303

HUMAN ORGANIZATION [ORGANISATION HUMAINE]

M. G. DELMAS (Centre National d'Etudes Spatiales, Toulouse, France) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings . Toulouse, Cepadues-Editions, 1983, p. 95-108. In French.

The organizations required for a large space project are discussed, along with several of the tasks involved. A large space project is affected by its international effects, the necessary technical interfaces, the environments in the various countries manufacturing subsystems, and political and industrial limitations. The Telecom I project is cited as an example of a goal with international implications. The participants were the client, the project manager, the industries involved, the work managers, the subcontractors, and the equipment suppliers. It was found that the organization was not amenable to technical hierarchies, and a matrix organization functioned instead. A project head was appointed and supplied with a management structure to administer the work. The project leader coordinated the individual subprograms and reported directly to the governing agency. Simultaneously, a ground station network was established for tracking and controlling the satellite, as well as transmitting signals and receiving data. The human interactions on an organization level were affected by the location of authority, the dynamism of the organization, the relations between the people involved, the management actions, and the experience of the participants. MSK

A84-15304

THE CONTRACT [LE CONTRAT]

M. M. VANHEMS (Centre National d'Etudes Spatiales, Toulouse, France) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings . Toulouse, Cepadues-Editions, 1983, p. 121-140. In French.

Features of contracts, negotiations, and other considerations which are germane to the realization of large space projects are described. The justifications, specifications, consultations, selection of suppliers, and negotiating considerations for contracts are outlined. Three types of contracts are used: fixed price, controlled expenses, and incentive contracts with penalty clauses for delays. The contracts must take account of interest, carry a bill of particulars, detail the costs, cite administrative fees and assign duties, and identify suppliers. Price sampling techniques are detailed in terms of units of account, and attention is given to methods of modifying contracts in order to meet new or reformulated requirements, particularly those due to unanticipated cost increases for supplies. M.S.K.

A84-15305

THE PROGRESSION OF PROJECTS [LE DEROULEMENT DES PROJETS]

B. ESTADIEU (Centre National d'Etudes Spatiales, Toulouse, France) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings Toulouse, Cepadues-Editions, 1983, p. 141-165. In French. refs

Milestones and managerial actions which are necessary during various specified phases of a large space project are explored. The space projects are organized by phases to coordinate dispersed work, reduce risk, and for economic purposes such as selecting areas needing the greatest attention. The phases include mission analysis, feasibility analysis, design, manufacture, production, and use. NASA avoids following the phases rigorously in order to maintain flexibility during development. Industrial feedback is required during the different phases, as is constant monitoring of developments carried out in other countries. Reviews are performed at each phase to maintain coherence in the work and assure that the goals are being met or suitably modified. The reviews cover all aspects of the projects. M.S.K.

A84-15310

MANAGEMENT OF LARGE SPACE PROJECTS - QUALITY ASSURANCE OR 'PRODUCT ASSURANCE' [GESTION DES GRANDS PROJETS SPATIAUX - ASSURANCE DE LA QUALITEOU 'ASSURANCE PRODUIT']

A. DE CACQUEREY (Matra, S.A., Toulouse, France) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings . Toulouse, Cepadues-Editions, 1983, p. 287-320. In French.

Quality assurance comprises predefined procedures for obtaining products which meet all flight, ground, testing, environmental, and performance specifications. Products for space use are usually not production line items and therefore must be built right the first time, with testing covering all mechanical, electrical. thermal, radiation, and interface performance components. A large amount of written documentation becomes necessary in order to trace the progress of development of all subsystems and ameliorate any adverse effects due to the differing motivations of the industrial sector and other participants engaged in the enterprise. Product assurance is constrained by the large number of interfaces within both the product, which may originate from off-the-shelf, original, and modified designs with subsystems manufactured in diverse places, and the organizations participating in the project. M.S.K.

A84-15325

THE SPACELAB PROGRAM - THE MANAGEMENT OF THE PROGRAM, PROBLEMS ENCOUNTERED AND THE SOLUTIONS ADOPTED [LE PROGRAMME SPACELAB - LA GESTION DU PROGRAMME, LES PROBLEMES RENCONTRES ET LES SOLUTIONS ADOPTEES]

B. R. K. PFEIFFER (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings Toulouse, Cepadues-Editions, 1983, p. 773-838. In French.

The management techniques applied by ESA in the Spacelab (SL) development program are reviewed critically. The history, objectives, and contractual responsibilities of ESA and NASA are summarized, and the SL modules to besupplied by ESA are characterized. The management structure is presented, with discussion of the roles of ESA and industry, the phases of the program, the principal reviews, documentation, verification, ongoing control of specifications, quality control and security, cost control and the evolution of the budget, the geographical distribution of the contracts, delay control, and configuration management. Block diagrams, sample worksheets, graphs, and maps are provided. The problems of the SL program are seen as primarily technical, associated with an insufficient initial technical base, overly diffuse management control, substantial modifications during development, and contractual and economic difficulties arising from the technical problems. It is shown that the management techniques adopted during the second half of the program limited the cost overrun to 40 percent of the original budget and ensured the successful fulfillment of the technical objectives. T.K.

A84-15363

COHERENT ARRAYS OF SEPARATE OPTICAL TELESCOPES IN SPACE PROJECT TRIO

A. LABEYRIE (Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Saint-Vallier-de-Thiey, Alpes-Maritimes, France), J. KIBBLEWHITE (Cambridge University, Cambridge, England), T. DE GRAAUW, H. ROUSSEL (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands), J. NOORDAM (Dwingeloo, Radiosterrewacht, Dwingeloo, Netherlands), and G. WEIGELT (Erlangen-Nuernberg, Universitaet, Erlangen, West Germany) IN: Very long baseline interferometry techniques; International Colloquium, Toulouse, France, August 31-September 2, 1982, Proceedings . Toulouse, Cepadues-Editions, 1983, p. 477-488.

The present investigation is concerned with optical arrays in space, taking into account floating arrays of three (Trio) or more satellites. 'Floating arrays' consist of independent satellites which carry the optical elements separately but according to a stabilized configuration. It is pointed out that floating optical arrays are superior to rigid structures for large apertures, in the range from 100 m to 10 km. If they are feasible, their intrinsic modularity and flexibility should accelerate the implementation and growth of giant telescopes in space. Attention is given to the employment of different types of satellites, orbits, and pointing procedures, in a large floating optical array. G.R.

A84-15634* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AM ADVANCED GENERATION LAND MOBILE SATELLITE SYSTEM AND ITS CRITICAL TECHNOLOGIES

F. NADERI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B1.1.1-B1.1.8. NASA-supported research.

A conceptual design for a Land Mobile Satellite System (LMSS) for the 1990s is presented. LMSS involves small tranceivers accessing satellites directly, with ground reception through small car-top antennas. The satellite would have a large antenna and blanket coverage areas in the UHF. The call may originate from a home, be carried by wire to a gateway, transmitted to satellite on the S-band, converted to UHF on the satellite, and transmitted to the vehicle. The system design is constrained by the number of users in an area during the busiest hours, Shuttle storage, controllability factors, and the total area served. A 55-m antenna has been selected, with 87 spot beams and two 10 MHz UHF bands in the 806-890 MHz band. A 17 dB interbeam isolation level is required, implying that sufficient sub-bands can be generated to assure 8265 total channels. The mobile satellite (MSAT) would have an 83 m mast lower segment, a 34 m upper segment, and a second, 10 m antenna made of a deployable mesh. Various antenna function modes are considered. M.S.K.

A84-15695

SPACE OPERATIONS CENTER COMMUNICATIONS PATH OBSCURATION

J. R. CARL and B. P. LU (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: NTC '82; National Telesystems Conference, Galveston, TX; November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. F1.2.1-F1.2.5.

Computer assisted techniques were developed to determine the obscuration of a communications path caused by the physical objects that comprise the Space Operations Center (SOC). Of particular interest in this paper is the obscuration of the line-of-sight path from an antenna, mounted somewhere on or in the vicinity of the SOC, to a geosynchronous satellite, such as a Telemetry Data Relay Satellite. The dynamic geometry of this type of problem makes it difficult to visualize, in a complete manner, without the aid of a computer. Blockage is shown graphically by computer-generated displays, and the percentage of time that the path is blocked is calculated. Graphics permit a ready comparison of one antenna location to another. Author

A84-18005#

LOW COST SPACE SCIENCE AND ASTRONOMY PLATFORMS IN ORBIT

P. M. MITCHELL (Martin Marietta Aerospace, New Orleans, LA) and T. C. TAYLOR (Taylor and Associates, Inc., Wrightwood, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 12 p. refs (AIAA PAPER 84-0297)

Design concepts for orbital space-science or astronomy platforms utilizing the STS external propellant tank (ET) as primary structure are presented. It is pointed out that the 68,000-pound, 154-ft-long, 27.5-ft-diameter ET currently attains 98 percent of orbital velocity and could be placed in LEO for little additional cost. General modifications to the ET, such as additional wiring and tubing, the bolt-on aft cargo carrier, an environmental protection system, avionics, and attitude control, are discussed. Hardware for four specific missions is described in detail: a dedicated commercial platform; a life-science platform with growth chambers for algae, marine fauna, or aeroponically grown plants; a large-deployable-reflector platform; and a gamma-ray imaging telescope. Drawings illustrating the design concepts are provided. D.G.

A84-21573

SPACE VEHICLES [O KOSMOLETAKH]

K. FEOKTISTOV and I. BUBNOV Moscow, Izdatel'stvo Molodaia Gvardiia, 1982, 208 p. In Russian.

The Soviet cosmonaut Feoktistov gives an informal, popular sketch of his participation in the Soviet space program. Part of the book consists of a dialogue on space issues conducted with the journalist Bubnov. Topics discussed include the development of the first spacecraft, problems in the planning of the first manned flights and the first space stations, and the future of man in space. **B.J**.

A84-24628*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INTEGRATED REQUIREMENTS FOR A SPACE STATION

E. B. PRITCHARD (NASA, Langley Research Center, Hampton, VA) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 23-32.

The time-phased mission set developed for the proposed space station program (including the manned facility, coorbiting and remote free flyers and platforms, orbital maneuvering and transfer systems, and storage and service facilities) by the Space Station Mission Requirements Workshop in May 1983, is presented in figures and tables and discussed. The scientific, commercial, and technology-development proposals are characterized, and the requirements for a station and coorbiting platform at 28.5-deg orbital inclination are listed for the period 1991-2000. Japanese, ESA, and Canadian utilization is considered, special requirements are and functional characteristics are summarized. outlined. Developmental strategies to meet the concerns of the user community are suggested. T.K.

A84-24633*# National Aeronautics and Space Administration, Washington, D. C.

ARCHITECTURAL OPTIONS AND DEVELOPMENT ISSUES

L. E. POWELL (NASA, Washington, DC) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 131-135.

The design options for the space station are discussed in general terms, reflecting the approach taken by the NASA Concept Development Group. Primary aims are flexibility and transparency, to fulfill as many scientific and commercial user requirements as possible and to open the station to as many new users as possible; utilities, facilities, and functional support must be designed to meet these aims. General architecture options considered include the present STS, an extended STS, a limited-duration manned transportation node with unmanned platforms, and a manned

station with unmanned platforms and transportation-node capability (OTV, TMS). The latter option is found most promising and developed further, with consideration of the technical challenges involved. Ť.K.

A84-24634*# National Aeronautics and Space Administration, Washington, D. C.

SPACE STATION ARCHITECTURAL ISSUES AS VIEWED BY THE USER COMMUNITY - APPLICATIONS

W. P. RANEY (NASA, Washington, DC) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 139-141.

Potential applications of the proposed space station are briefly examined. Areas considered include communications (bulk traffic, direct broadcast, and assembly of GEO platforms), earth sciences (repair and refurbishment of long-term spacecraft), and materials processing. The importance of developing a comfortable habitat is stressed. T.K.

A84-25260#

THE FRANCO-GERMAN DBS PROGRAM 'TV-SAT/TDF-1'

R. ARNIM (Eurosatellite GmbH, Munich, West Germany) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 75-83. (AIAA PAPER 84-0661)

Governmental authorities of Germany and France have jointly awarded a contract to industry for two DBS satellites, to be launched in 1985, which will then serve Germany and France with direct-to-home broadcasting. This paper provides an overview of the background of the Franco-German program, the scope of the program, its technical baseline and configuration, its delivery schedule, its present status, and information on the customer and contractor side. Author

A84-25282#

DEVELOPMENT AND APPLICATION OF NEW TECHNOLOGIES IN THE ESA OLYMPUS PROGRAMME

R. BONHOMME, B. L. HERDAN, and R. STEELS (ESA, Olympus Programme Office, Noordwijk, Netherlands) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 249-262.

(AIAA PAPER 84-0706)

The European Space Agency (ESA) Olympus Program constitutes one of the most ambitious current developments in the communications satellite field. The development program has now been underway for nearly two years. This paper describes a number of the innovative features and new technologies being incorporated in the satellite design. The latest status of design, analysis and test of platform and payload hardware is given together with planning for near-term future activities, and commentary on future prospects for Olympus large spacecraft derivatives.

Author

A84-25287#

TELE-X - THE FIRST STEP IN A SATELLITE COMMUNICATIONS SYSTEM FOR THE NORDIC COUNTRIES

L. BACKLUND, L. ANDERSON, A. EKMAN, S. GRAHN, L. JALMARSSON, LUNDSTROM (Svenska L.-I. and Rymdaktiebolaget, Solna, Sweden) **IN: Communication Satellite** Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 299-309.

(AIAA PAPER 84-0713)

The development and design of Tele-X, an experimental TV and telecommunications satellite to be launched in 1986 by Sweden, Norway, and Finland, are discussed. The history of the cooperative R&D venture is traced from the beginning of Nordsat studies in 1974 through the 1977 WARC frequency and orbit allocations and the initiation of the Viking research-satellite program and the Tele-X program in the late 1970s. The Tele-X spacecraft and its payload are modified versions of the TV-Sat/TDF-1 satellite design being completed by France and the FRG. Primary services to be provided include TV (using two 230-W TWTA transponders in the 18/12-GHz bands) and data/video communication (using one wide-band and one narrow-band transponder in the 14/12-GHz bands and serving a fully switched digital network at 64 kbit/sec and 2 Mbit/sec). Experimental transmissions at 8, 34, and 140 Mbit/sec will also be undertaken. Block diagrams, drawings, tables of performance data, and a coverage map are included. T.K.

A84-25308#

LAND-MOBILE COMMUNICATIONS SATELLITE SYSTEM DESIGN

M. HORSTEIN (TRW, Inc., TRW Space and Technology Group, Redondo Beach, CA) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 467-475. refs

(AIAA PAPER 84-0753)

Satellite system designs capable of providing land-mobile satellite service to a population of 350,000 radio-telephone subcribers are considered. The problems discussed include frequency allocation, modulation, system sizing, carrier assignment, satellite/gateway links, satellite-link design, and mobile unit antenna design. Data on link noise allocation and satellite-to-mobile and mobile-to-satellite link budgets are presented. A satellite description is briefly given, and the feed-cluster approach to beam formation is summarized. Economic aspects and alternate system designs are also addressed. C.D.

A84-25326*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NASA'S GEOSTATIONARY COMMUNICATIONS PLATFORM PROGRAM

J. RAMLER (NASA, Lewis Research Center, Cleveland, OH) and R. DURRETT (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 613-621. refs

(AIAA PAPER 84-0702)

This paper reviews recent trends in communications satellites and explains NASA's current interest in geostationary communications platforms. Large communications platforms capable of supporting multiple payloads with common utilities have been examined in a number of studies since 1974 and appear to offer a number of potential advantages. In 1981, an Industry Briefing and Workshop sponsord by NASA focused on the institutional, operational and technical issues that will influence the implementation of geostationary platforms. The workshop identified numerous issues and problem areas that needed more detailed study. To address the issues/problems identified, a NASA geostationary communications platform program has been developed. This program is described, focusing on the initial studies to be performed. Author

A84-26926

EVOLUTIONARY CONCEPTS FOR A SPACE STATION AND THE RELEVANT UTILISATION POTENTIAL

P. W. SHARP (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) British Interplanetary Society, Journal (Space Technology) (ISSN 0007-084X), vol. 37, April 1984, p. 157-162.

Two basic evolutionary concept approaches for the realisation of a space station are discussed in this paper. They are respectively the US manned station and the European unmanned station. Both concepts as detailed here are currently under investigation; the goal of both programmes is to have an operational system early in the 1990's. Even though no single space discipline can justify the establishment of such a station, it is this author's opinion that both will be built, not in competition but as two compatible systems being part of a larger space infrastructure. The majority of payloads which will utilise the facilities of the space station will be of a scientific nature e.g. life sciences, extraterrestrial research, etc. Only in a few cases - materials science and processing, and space sciences (earth observation) - can possible commercial usage be realised. This, of course, does not exclude the creation of so-called by-products/spin-offs which have been a feature of existing space programmes e.g. pocket computers, microminiaturised solid state electronics, quartz watches, etc. The participation of Europe in developing hardware and facilities for a US Space Station is seen as a major near and long term goal. Author

A84-27945

LEASECRAFT - AN INNOVATIVE SPACE VEHICLE

J. DESKEVICH (Fairchild Space Co., Germantown, MD) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-20, Jan. 1984, p. 25-37.

The Leasecraft system has been developed by an American aerospace company with the objective to further the industrialization of space with its significant business potential. This system comprises a low orbit space platform, an operation control center, user accommodations, and services such as payload interfaces, documentation, and ground support equipment and procedures. Potential applications of Leasecraft considered are related to the processing of pharmaceuticals and materials, satellite-aided search and rescue, data collection, and support of NASA's astrophysics programs. The Leasecraft space vehicle will accommodate up to five modular power subsystems, including a communications and data handling module, a modular attitude control subsystem, a special function module, two alternative solar array assemblies, a tracking and data relay satellite system antenna assembly, a propulsion module, and optional primary and secondary payload modules. G.R.

A84-29043* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ENVIRONMENTAL CONTROL AND LIFE SUPPORT FOR AN EVOLUTIONARY SPACE STATION

P. D. QUATTRONE (NASA, Ames Research Center, Moffett Field, CA) and R. A. WYNVEEN (Life Systems, Inc., Cleveland, OH) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 18 p. refs

(SAE PAPER 831108)

The requirements for the Space Station are being defined. The Environmental Control/Life Support System (ECLSS) is one of its 13 systems. The ECLSS is further divided into five functional categories. Major ones are the Air Revitalization and Water Reclamation Systems. The paper presents ECLSS performance requirements, average design loads and fluids interfaces. The major cost savings of regenerable ECLSS techniques versus the open loop approach are quantified. Issues impacting ECLSS design are cited. Priority regenerable ECLSS developments are reviewed including the Electrochemical CO2 Concentrator, Static Feed Electrolyzer and Automated Control/Monitor Instrumentation. Baseline and alternative approaches are cited. The ECLSS planning issues are reviewed including functional boundaries, planning schedule, technology maturity definition and technology gaps. The paper concludes with a review of water electrolysis as a Space Station utility impacting ECLSS design. Author

A84-29044* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SYSTEMS ENGINEERING ASPECTS OF A PRELIMINARY CONCEPTUAL DESIGN OF THE SPACE STATION ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM

C. H. LIN and M. S. MEYER (NASA, Johnson Space Center, Houston, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 19 p.

(SAE PAPER 831109)

The systems engineering aspects of developing a conceptual design of the Space Station Environmental Control and Life Support System (ECLSS) are discussed. Topics covered include defining system requirements and groundrules for approach, formulating possible cycle closure options, and establishing a system-level

mass balance on the essential materials processed in oxygen and water cycles. Consideration is also given to the performance of a system trade-off study to determine the best degree of cycle closure for the ECLSS, and the construction of a conceptual design of the ECLSS with subsystem performance specifications and candidate concepts. For the optimum balance between development costs, technological risks, and resupply penalties, a partially closed cycle ECLSS option is suggested. C.M.

A84-29046* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

INTEGRATED WATER MANAGEMENT SYSTEM - DESCRIPTION AND TEST RESULTS

N. C. ELDEN, H. E. WINKLER, D. F. PRICE (NASA, Johnson Space Center, Houston, TX), and R. P. REYSA (Boeing Aerospace Co., Houston, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 13 p. refs

(SAE PAPER 831111)

Water recovery subsystems are being tested at the NASA Lyndon B. Johnson Space Center for Space Station use to process waste water generated from urine and wash water collection facilities. These subsystems are being integrated into a water management system that will incorporate wash water and urine processing through the use of hyperfiltration and vapor compression distillation subsystems. Other hardware in the water management system includes a whole body shower, a clothes washing facility, a urine collection and pretreatment unit, a recovered water post-treatment system, and a water quality monitor. This paper describes the integrated test configuration, pertinent performance data, and feasibility and design compatibility conclusions of the integrated water management system. Author

A84-29047* Boeing Aerospace Co., Houston, Tex. HYPERFILTRATION WASH WATER RECOVERY SUBSYSTEM -DESIGN AND TEST RESULTS

R. P. REYSA (Boeing Aerospace Co., Houston, TX), D. F. PRICE (NASA, Johnson Space Center, Houston, TX), T. OLCOTT (Lockheed Missiles and Space Corp., Palo Alto, CA), and J. L. GADDIS (Clemson University, Clemson, SC) AIAA, SAE, ASME, AlChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 12 p. refs (SAE PAPER 831112)

The Hyperfiltration Wash Water Recovery (HWWR) subsystem, designed to offer low-power high-volume wash water purification for extended mission spacecraft, is discussed in terms of preprototype design and configuration. Heated wash water collected from the shower, hand wash, and laundry flows into a temperature-controlled (374 K) waste storage tank. Two parallel 25 micron absolute filters at the tank outlet remove large particles from the feed stream. A positive displacement feed pump delivers wash water to the hyperfiltration module at a constant flow rate of 0.20 lpm with discharge pressure variations from 4181-7239 Kpa. The hyperfiltration membrane module is a single-pass design including 36 porous stainless steel tubes, and is designed to provide an approximate water recovery rate of 90 percent. Permeate and brine water flows are monitored by flow meters, and removal of urea and ammonia is achieved by adding 15 percent NaOCI solution to the permeate fluid stream. An alternate module design using two diameters of tubing (allowing a smaller pressure drop and a larger membrane area) gave a superior predicted performance over the first module with larger tubing throughout. J.N.

A84-29054

ELECTROCHEMICAL AND STEAM-DESORBED AMINE CO2 CONCENTRATION SUBSYSTEM COMPARISON

D. B. HEPPNER and F. H. SCHUBERT (Life Systems, Inc., Cleveland, OH) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 11 p. refs

(SAE PAPER 831120)

A comparative study has been conducted for the continuous Electrochemical Depolarized CO2 Concentration (EDC) and amine resin bed cyclic absorption/desorption systems which may furnish CO2 removal for a regenerative space station environmental control and life support system, with attention to the sizing of their respective subsystems. The analysis includes identification of subsystem boundaries, which are defined as the hardware required for the replacement of the nonregenerable substances otherwise employed in the space station system. It is found that the EDC concept has a far lower equivalent weight than the alternative.

O.C.

A84-29056

PHASE CHANGE WATER RECOVERY TECHNIQUES - VAPOR COMPRESSION DISTILLATION AND THERMOELECTRIC/MEMBRANE CONCEPTS

F. H. SCHUBERT (Life Systems, Inc., Cleveland, OH) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 17 p. refs (SAE PAPER 831122)

Compression The Vapor Distillation (VCD) and thermoelectric/membrane evaporation concepts, both of which involve phase change recovery processes and attempt to minimize the energy input/unit mass of water recovered by using heat released by condensation as energy for further evaporation, are being considered for the recovery of water from urine and other waste waters in a space station regenerative life support system. Comparisons between these alternatives are conducted in light of configurational and subsystem schematics, component sizing considerations, and projected operational characteristics. The thermoelectric concept is found to be 26 percent heavier, with 56 percent higher total equivalent weight and more than twice the energy/unit mass of water recovered by the alternative VCD process. O.C.

A84-29666#

SERVICING VEHICLE FOR SATELLITES AND PLATFORMS IN EARTH ORBITS [WARTUNGSFAHRZEUG FUER LO₩ PLATTFORMEN SATELLITEN UND IN NIEDRIGEN ERDUMLAUFBAHNEN]

W. KLEINAU (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 58 p. In German.

(DGLR PAPER 83-102)

A report is presented of studies which were conducted by two German aerospace companies. A scenario for the time period from 1988 to 2000 is considered, and the concept of an Interorbital Transfer and Logistics Vehicle (IOTLV) for applications involving the low earth orbit (LEO) is presented. The IOTLV is based on existing European technology, and a modular concept has been employed. A description is given of the individual modules of the 'Modular Orbital Operations Systems' (MOOS). Six types of vehicles can be obtained for more than 16 identified missions by using six modules in appropriate combinations. The modules include the Modular Orbital Propulsion System (MOPS), the Modular Auxiliary Tank System (MATS), the Modular Orbital Servicing System (MOSS), the Modular Equipment and Avionics System (MEAS). the Modular Orbital Reentry System (MORS), and the Modular Orbital Crew Cabin (MOCC). It is pointed out that the modular IOTLV is cost effective with respect to total costs and yearly maximum costs. The development can be easily assigned to different European countries and firms. It is estimated that the transfer stage could be available in 1989 and the servicing vehicle in 1990. G.R.

A84-29853* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

HABITABILITY DESIGN ELEMENTS FOR A SPACE STATION M. C. DALTON (NASA, Johnson Space Center, Houston, TX) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 9-26.

(AAS PAPER 83-200)

Habitability in space refers to the components, characteristics, conditions, and design parameters that go beyond but include the basic life sustaining requirements. Elements of habitability covered include internal environment, architecture, mobility and restraint, food, clothing, personal hygiene, housekeeping, communications, and crew activities. All elements are interrelated and need to be treated as an overall discipline. Designing for a space station is similar to designing on earth but with 'space rules' instead of ground rules. It is concluded that some habitability problems require behavioral science solutions. C.M.

A84-29858

REUSABLE COMMERCIAL SPACE PROCESSING PLATFORMS D. E. KOELLE (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 119-133.

(AAS PAPER 83-208)

The paper deals with the new concept of reusable Shuttle platforms: it describes their special features and the specific applications. The first demonstration of this concept is performed by the SPAS-01 platform developed by MBB as commercial venture, launched on STS-07. Reusable platforms provide advantages for commercial space processing operations. They provide an essential cost reduction compared to previous alternatives, together with extended operation periods (several months) and high microgravity level. The characteristics of the EURECA platform are given and a commercial version (OMNI-SPAS) of similar performance is discussed. Finally, economic and cost aspects are dealt with for reusable platforms as well as for future permanent space platforms. Author

N84-12026*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RESEARCH AND TECHNOLOGY, 1983 Annual Report

Nov. 1983 96 p

(NASA-TM-85702; NAS 1.15:85702) Avail: NTIS HC A05/MF A01 CSCL 05B

Highlights of major accomplishments and applications made during the past year illustrate the broad range of research and technology activities at the Langley Research Center. Advances are reported in the following areas: systems engineering and operation; aeronautics; electronics; space applications; aircraft and spacecraft structures; composite structures; laminar flow control; subsonic transport aircraft; and supersonic fighter concepts. Technology utilization efforts described cover a hyperthermia monitor, a lightweight composite wheelchair; and a vehicle ride quality meter. A.R.H.

N84-14234# Committee on Science and Technology (U. S. House).

NASA'S SPACE STATION ACTIVITIES

Washington GPO 1983 161 p Hearing before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 98th Congr., 1st Sess., no. 37, 2 Aug. 1983

(GPO-27-393) Avail: Subcommittee on Space Science and

Applications The status, plans, and activities associated with NASA's space

station effort are reviewed. N.W.

N84-15171*# Teledyne Brown Engineering, Huntsville, Ala. Payload Missions Integration Div.

PAYLOAD MISSIONS INTEGRATION Progress Report, 19 Sep. - 11 Nov. 1983

28 Nov. 1983 52 p

(Contract NAS8-32712)

(NASA-CR-170949; NAS 1.26:170949; PMIC-MA03-469-29;

PO-83-506) Avail: NTIS HC A04/MF A01 CSCL 22B

Spacelab missions 1 to 3, OSTA partial payloads, Astro-1 mission, premission definition, and mission peculiar equipment support structure are discussed. Author

N84-15172*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN ÁLTERNATE CONCEPT FOR EXPANDING MAN'S PRESENCE IN SPACE

W. R. HOOK and R. S. OSBORNE Feb. 1983 43 p refs (NASA-TM-84617; NAS 1.15:84617) Avail: NTIS HC A03/MF A01 CSCL 22A

A logical next step after shuttle is a manned orbital service system (MOSS) consisting of a two-man crew module mated with a propulsion module. The resulting spacecraft would remain in low Earth orbit for months or years at a time conducting civil or military satellite servicing, experimental, or applications missions while being periodically supplied and refueled by Shuttle flights from the ground. The system would accumulate experience invaluable to the design of future large and more expensive spacecraft. Key features of the vehicle are versatility and mobility. With Centaur-type propulsion and a large payload, the MOSS could leave an initial orbit of 370 km (200 nmi) altitude and inclinations up to 56 deg, make a plane change of up to + or - 14 deg, reach altitudes to 5500 km (2970 nmi), and then return the payload to the original orbit altitude and inclination. Obviously, the size of the performance envelope varies with the payload and propulsion-unit selected. The MOSS can reach orbits and perform tasks not possible with Shuttle alone or with the much larger space stations currently being proposed. Author

N84-15179*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. CAPTURE-EJECTOR SATELLITES

I. O. MACCONOCHIE, C. H. ELDRED, and J. A. MARTIN Oct. 1983 23 p refs Previously announced in IAA as A82-43265 (NASA-TM-85686; NAS 1.15:85686) Avail: NTIS HC A02/MF A01 CSCL 22B

A satellite in the form of a large rotating rim which can be used to boost spacecraft from low-Earth orbit to higher orbits is described. The rim rotates in the plane of its orbit such that the lower portion of the rim is traveling at suborbital velocity, while the upper portion is travelling at greater than orbital velocity. Ascending spacecraft or payloads arrive at the lowest portion of the rim at suborbital velocities, where the payloads are released on a trajectory for higher orbits; descending payloads employ the reverse procedure. Electric thrusters placed on the rim maintain rim rotational speed and altitude. From the standpoint of currently known materials, the capture-ejector concept may be useful for relatively small velocity increments.

N84-17211*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STEP EXPERIMENT REQUIREMENTS

M. L. BRUMFIELD, comp. Jan. 1984 347 p refs Workshop held in Hampton, Va., 28 Jun. - 1 Jul. 1983

(NASA-CP-2294; L-15733; NAS 1.55:2294) Avail: NTIS HC A15/MF A01 CSCL 22B

A plan to develop a space technology experiments platform (STEP) was examined. NASA Langley Research Center held a STEP Experiment Requirements Workshop on June 29 and 30 and July 1, 1983, at which experiment proposers were invited to present more detailed information on their experiment concept and requirements. A feasibility and preliminary definition study was conducted and the preliminary definition of STEP capabilities and experiment concepts and expected requirements for support

services are presented. The preliminary definition of STEP capabilities based on detailed review of potential experiment requirements is investigated. Topics discussed include: Shuttle on-orbit dynamics; effects of the space environment on damping materials; erectable beam experiment; technology for development of very large solar array deployers; thermal energy management process experiment; photovoltaic concentrater pointing dynamics and plasma interactions; vibration isolation technology; flight tests of a synthetic aperture radar antenna with use of STEP.

N84-17212*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPACE TECHNOLOGY EXPERIMENTS PLATFORM (STEP) OVERVIEW

J. E. HARRIS In its STEP Expt. Requirements p 1-12 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The Space Technology Experiments Platform (STEP) concept is summarized. It is shown that STEP is the enabling link between the research community and the space environment made accessible by the Space Transportation System (STS). The constituent elements of the research community are identified, the pertinent space environment attributes are listed, and the major guidelines applicable to establishing the specific STEP configuration are identified. E.A.K.

N84-17213*# National Aeronautics and Space Administration. Langlev Research Center, Hampton, Va. STEP MECHANICAL SYSTEMS

O. H. BRADLEY, JR. In its STEP Expt. Requirements p 13-34 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The key elements in the STEP system are depicted including the Spacelab pallet, a modular interface structure, and pallet mounted electronics. Several concepts for potential experiments are illustrated. E.A.K.

N84-17215*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STEP EXPERIMENT INTEGRATION J. C. MOORMAN In its STEP Expt. Requirements p 47-54

Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The space technology experiments platform (STEP) integration was examined. Topics include: experiment design, fabrication, and assembly; experiment performance and environmental testing; STEP compatibility testing; STEP experiment integration; STS/payload requirements definition documentation. E.A.K.

N84-17218*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEPLOYABLE BEAM FLIGHT EXPERIMENT (MAST)

B. R. HANKS and J. L. ALLEN, JR. In its STEP Expt. Requirements p 103-120 Jan. 1984 refs Avail: NTIS HC A15/MF A01

CSCL 22B

Improvement of technology of space systems control is discussed. Future space systems such as large antennas or a space station may have dimensions on the order of 30 m to 200 m, yet their basic structures may be relatively lightweight and flexible, making ground tests for loads, controls analyses, and design verifications questionable if not impossible. Abandoning the extensive ground test and analysis verification program that led to the success of previous spacecraft is not a sensible option; making it meaningful using current technology will require inefficient, ultraconservative structure and control designs. New test methods are outlined. E.A.K.

N84-17220*# Astro Research Corp., Carpinteria, Calif. THE STEP/STACBEAM EXPERIMENT TECHNOLOGY DEVELOPMENT FOR VERY SOLAR LARGE ARRAY DEPLOYERS

R. SAMUELS In NASA. Langley Research Center STEP Expt. Requirements p 135-146 Jan. 1984 refs Avail: NTIS HC A15/MF A01 CSCL 22B

The Stacking Triangular Articulated Compact Beam (STACBEAM) is discussed with reference to structural testing experiments afforded by ground simulation and the Space Technology Experiments Platform (STEP). The STACBEAM lends itself to a deployment technique which offers a radical improvement in flexible blanket solar array technology. A system for deployment and support of a solar array blanket is described which consists of the blanket, its containment structure, the support structure and its deployer, the blanket stiffening battens, and the deployable boom standoffs. In operation, the blanket is pulled out and supported by the STACBEAM which packages next to the folded blanket. Since the STACBEAM does not rotate during extension, complete control of the blanket is maintained during extension. Deployment of this system occurs one bay at a time in a sequential manner. The deployer provides sufficient rigidity so that beam stiffness is not degraded during the deployment process. M.G.

N84-17221*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.

GENERAL REQUIREMENTS FOR SHUTTLE FLIGHT **EXPERIMENTS**

E. F. CRAWLEY In NASA. Langley Research Center STEP Expt. Requirements p 147-154 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22A

Requirements and guiding principles for flight space structures experiments are defined. Shuttle mid-deck experiments, Space Technology Experiments Platform (STEP) tests, and the EVA Assembly of Structures Experiment (EASE) are addressed. M.G.

N84-17231*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

STEP FLIGHT **EXPERIMENTS** LARGE DEPLOYABLE **REFLECTOR (LDR) TELESCOPE**

F. C. RUNGE In NASA. Langley Research Center STEP Expt. Requirements p 257-278 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 03A

Flight testing plans for a large deployable infrared reflector telescope to be tested on a space platform are discussed. Subsystem parts, subassemblies, and whole assemblies are discussed. Assurance of operational deployability, rigidization, alignment, and serviceability will be sought. R.J.F.

N84-17232*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LARGE DEPLOYABLE ANTENNA FLIGHT EXPERIMENT FOR THE SPACE TECHNOLOGY EXPERIMENTS PLATFORM (STEP)

B. C. TANKERSLY (Harris Corp.) and T. G. CAMPBELL In its STEP Expt. Requirements p 279-300 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

Spaceborne experiments to test the deployment reliability of large space antennas are discussed. Retraction, reflector surface tolerance, thermal distortion, electromagnetic performance, and dynamic controls are discussed. R.J.F.

N84-17233*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE 55-METER-STRUCTURE FLIGHT EXPERIMENT

J. A. GARBA, R. FREELAND, B. K. WADA, K. J. OKEEFE (Lockheed Missile and Space Co., Sunnyvale, Calif.), and A. WOODS (Lockheed Missile and Space Co., Sunnyvale, Calif.) In NASA. Langley Research Center STEP Expt. Requirements p 301-310 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The verification and demonstration of the structural performance related parameters for large flexible space structures are discussed. The objectives are to verify the deployment repeatability of static surface contour, to demonstrate the feasibility of in-flight static shape correction, to verify predicted shape in a zero gravity thermal environment, to determine zero gravity structural dynamic characteristics, and to verify the instrumentation and excitation system for in-flight measurements. B.IF

N84-17234*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LARGE INFLATED-ANTENNA SYSTEM

W. F. HINSON and L. S. KEAFER In its STEP Expt. Requirements p 311-324 Jan. 1984 refs Avail: NTIS HC A15/MF A01

CSCL 22B

It is proposed that for inflatable antenna systems, technology feasibility can be demonstrated and parametric design and scalability (scale factor 10 to 20) can be validated with an experiment using a 16-m-diameter antenna attached to the Shuttle. The antenna configuration consists of a thin film cone and paraboloid held to proper shape by internal pressure and a self-rigidizing torus. The cone and paraboloid would be made using pie-shaped gores with the paraboloid being coated with aluminum to provide reflectivity. The torus would be constructed using an aluminum polyester composite that when inflated would erect to a smooth shell that can withstand loads without internal pressure. R.J.F.

N84-17237*# Department of Communications, Ottawa (Ontario). Directorate of Space Mechanics.

FLIGHT TEST OF A SYNTHETIC APERTURE RADAR ANTENNA USING STEP

D. G. ZIMCIK, F. R. VIGERON, and S. AHMED In NASA. Langley Research Center STEP Expt. Requirements p 339-354 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 171

To establish confidence in its overall performance, credible information on the synthetic aperture radar antenna's mechanical properties in orbit must be obtained. However, the antenna's size, design, and operating environment make it difficult to simulate operating conditions under 1-g Earth conditions. The Space Technology Experiments Platform (STEP) offers a timely opportunity to mechanically qualify and characterize the antenna design in a representative environment. The proposed experimental configuration would employ a half-system of the full-scale RADARSAT antenna which would be mounted on the STEP platform in the orbiter cargo bay such that it could be deployed and retracted in orbit (as shown in this figure). The antenna would be subjected to typical environmental exposures while an array of targets and sensors on the antenna support structure and reflecting surface are observed and monitored. In particular, the typical environments would include deployment and retraction, dynamic response to vehicle thruster or base exciter inputs, and thermal soak and transient effects upon entering or exiting Earth eclipse. The proposed experiment would also provide generic information on the properties of large space structures in space and on techniques to obtain the desired information. R.J.F.

N84-17248*# Martin Marietta Aerospace, Denver, Colo. TECHNOLOGY NEEDS OF ADVANCED EARTH OBSERVATION SPACECRAFT Final Report

J. J. HERBERT, J. R. POSTUCHOW, and W. A. SCHARTEL Washington NASA Jan. 1984 261 p

(Contract NAS1-16756)

(NASA-CR-3698; NAS 1.26:3698; MCR-81-630) Avail: NTIS HC A12/MF A01 CSCL 22B

Remote sensing missions were synthesized which could contribute significantly to the understanding of global environmental parameters. Instruments capable of sensing important land and sea parameters are combined with a large antenna designed to passively quantify surface emitted radiation at several wavelengths. A conceptual design for this large deployable antenna was developed. All subsystems required to make the antenna an autonomous spacecraft were conceptually designed. The entire package, including necessary orbit transfer propulsion, is folded

to package within the Space Transportation System (STS) cargo bay. After separation, the antenna, its integral feed mast, radiometer receivers, power system, and other instruments are automatically deployed and transferred to the operational orbit. The design resulted in an antenna with a major antenna dimension of 120 meters, weighing 7650 kilograms, and operating at an altitude of 700 kilometers. Author

N84-17947# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPLINE-BASED ESTIMATION TECHNIQUES FOR PARAMETERS IN ELLIPTIC DISTRIBUTED SYSTEMS

H. T. BANKS (Brown Univ.), P. L. DANIEL (Southern Methodist Univ.), and E. S. ARMSTRONG Jun. 1983 19 p (Contract AF-AFOSR-0198-81; AF PROJ. 2304)

(NASA-TM-85439; NAS 1.15:85439; AD-A135109; LCDS-83-22; AFOSR-83-0926TR) Avail: NTIS HC A02/MF A01 CSCL 12A

Parameter and state estimation techniques are discussed for an elliptic system arising in a developmental model for the antenna surface in the Maypole Hoop/Column antenna. A computational algorithm based on spline approximations for the state and elastic parameters is given and numerical results obtained using this algorithm are summarized. Author (GRA)

N84-18116# Committee on Science and Technology (U. S. House).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION ACT, 1985

Washington GPO 1984 10 p A bill referred to the Comm. on Sci. and Technol., 98th Congr., 2nd Sess., 8 Feb. 1984 Avail: US Capitol, House Document Room

Appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes were authorized. Author

N84-18265*# Boeing Aerospace Co., Seattle, Wash. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS STUDY. VOLUME 1: EXECUTIVE STUDY Final** Report

21 Apr. 1983 69 p refs

(Contract NASW-3680)

(NASA-CR-173334; NAS 1.26:173334; D180-27477-1-VOL-1) Avail: NTIS HC A04/MF A01 CSCL 22B

Mission identification and validation, the benefits of a manned presence in space; attributes and architectures; time-phased mission and system requirements imposed on the space station; orbit selection; space station architectural options; technology selection; and program planning are addressed. N.Ŵ.

N84-18266*# Boeing Aerospace Co., Seattle, Wash. SPACE STATION NEEDS. ATTRIBUTES AND ARCHITECTURAL **OPTIONS STUDY. VOLUME 2: MISSION ANALYSIS Final** Report

21 Apr. 1983 412 p refs

(Contract NASW-3680)

(NASA-CR-173333; NAS 1.26:173333; D180-27477-2-VOL-2) Avail: NTIS HC A18/MF A01 CSCL 22B

Space environment studies, astrophysics, Earth environment, life sciences, and material sciences are discussed. Commercial communication, materials processing, and Earth observation missions are addressed. Technology development, space operations, scenarios of operational capability, mission requirements, and benefits analysis results for space-produced gallium arsenide crystals, direct broadcasting satellite systems, and a high inclination space station are covered. N.W.

N84-18267*# Boeing Aerospace Co., Seattle, Wash. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS STUDY. VOLUME 3: REQUIREMENTS**

21 Apr. 1983 57 p refs (Contract NASW-3680)

(NASA-CR-173332; NAS 1.26:173332; D180-27477-3-VOL-3) Avail: NTIS HC A94/MF A01 CSCL 22B

A typical system specification format is presented and requirements are compiled. A Program Specification Tree is shown showing a high inclination space station and a low inclination space station with their typical element breakdown, also represented along the top blocks are the interfaces with other systems. The specification format is directed at the Low Inclination space station. Author

N84-18268*# Boeing Aerospace Co., Seattle, Wash. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS STUDY. VOLUME 4: ARCHITECTURAL OPTIONS, SUBSYSTEMS, TECHNOLOGY AND PROGRAMMATICS Final Report

21 Apr. 1983 207 p refs (Contract NASW-3680) (NASA-CR-173331; NAS 1.26:173331; D180-27477-4-VOL-4)

Avail: NTIS HC A10/MF A01 CSCL 22B Space station architectural options, habitability considerations and subsystem analyses, technology, and programmatics are reviewed. The methodology employed for conceiving and defining space station concepts is presented. As a result of this approach, architectures were conceived and along with their supporting rationale are described within this portion of the report. Habitability consideration and subsystem analyses describe the human factors associated with space station operations and includes subsections covering (1) data management, (2) communications and tracking, (3) environmental control and life support, (4) manipulator systems, (5) resupply, (6) pointing, (7) thermal management and (8) interface standardization. A consolidated matrix of subsystems technology issues as related to meeting the mission needs for a 1990's era space station is presented. Within the programmatics portion, a brief description of costing and program strategies is outlined.

Author

N84-18269*# Boeing Aerospace Co., Seattle, Wash. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS STUDY. FINAL EXECUTIVE REVIEW**

5 Apr. 1983 126 p refs (Contract NASW-3680)

(NASA-CR-173335; NÁS 1.26:173335; D180-27477-6) Avail: NTIS HC A07/MF A01 CSCL 22B

Identification and validation of missions, the benefits of manned presence in space, attributes and architectures, space station requirements, orbit selection, space station architectural options, technology selection, and program planning are addressed.

N.W.

N84-18270*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. PART 1: SUMMARY Final Briefing Report 9 Apr. 1983 150 p refs Prepared in cooperation with COMSAT

General and General Electric

(Contract NASW-3685)

(NASA-CR-175382; NAS 1.26:175382; SA-SSP-RP009-PT-1) Avail: NTIS HC A07/MF A01 CSCL 22B

Candidate missions for the space station were subjected to an evaluation/filtering process which included the application of budgetary constraints and performance of benefits analysis. Results show that the initial space station should be manned, placed in a 28.5 deg orbit, and provide capabilities which include a space test facility, satellite service, a transport harbor, and an observatory. A space industrial park may be added once further development effort validates the cost and expanding commercial market for space-processed material. Using the space station as a national space test facility can enhance national security, as well as commercial and scientific interests alike. The potential accrued

gross mission model benefit derived from these capabilities is \$5.9B without the industrial park, and \$9.3B with it. Other benefits include the lowering of acquisition costs for NASA and DoD space assets and a basis for broadening international participation. A.R.H.

N84-18271*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS: SUMMARY BRIEFING Final Report** Apr. 1983 120 p refs

(Contract NASW-3687)

(NASA-CR-173328; NAS 1.26:173328; MDC-H0180A) Avail: NTIS HC A06/MF A01 CSCL 22B

Computerized data sorting and analysis techniques were used with a data base accumulated in over 20 years of space station studies to evaluate candidate missions and select a final model of 88 missions. The social, cultural, scientific, technical, and commercial benefits to be accrued from each mission were identified. Requirements were determined for satellite servicing; payload placement and retrieval; refueling; repair; testing; assembly; and construction. Missions drivers determined include crew, remote manipulating system, external parts, instrumentation, extravehicular activity/manned maneuvering unit, and voice/video equipment. User interest for commercial applications were determined. Variable architecture based on a modular concept with multi-use elements is proposed. A.R.H.

N84-18272*# TRW Space Technology Labs., Redondo Beach, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS STUDY. FINAL REVIEW EXECUTIVE SUMMARY BRIEFING

5 Apr. 1983 136 p refs

(Contract NASW-3681)

(NASA-CR-173674; NAS 1.26:173674) Avail: NTIS HC A07/MF A01 CSCL 22B

User needs and mission requirements, architecture and mission implementation, and program costs and benefits are discussed.

Author

N84-18273*# Martin Marietta Aerospace, Bethesda, Md. Space and Electronics Systems Div.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS STUDY. BRIEFING MATERIAL: FINAL REVIEW AND EXECUTIVE SUMMARY

Apr. 1983 70 p refs Sponsored in part by Department of Defense

(Contract NASW-3686)

(NASA-CR-173321; NAS 1.26:173321; SOC-SE-02-02) Avail:

NTIS HC A04/MF A01 CSCL 22B

Advantages and disadvantages were assessed for configuration options for a modular 14' diameter space station, a modular aft cargo carrier and a shuttle derived vehicle. Early, intermediate, and mature configurations were defined as well as power requirements, heat rejection, hydrazine usage, and the external scavenging concept. Subsystems were analyzed for propulsion, attitude control, data processing, and communications. Areas of uncertainties, associated costs and benefits, and the cost by phase of the modular and shuttle derived vehicle configurations were identified. Technologies assessed included solar vs nuclear; gravity gradient vs active control; heat pipe radiators vs fluid loops; distributed processors vs centralized, and modular vs shuttle derived configuration. It was determined that the early space station architecture should include: (1) reusable OTV with aerobraking; (2) TMS with telepresence services; (3) OTV/TMS refueling and servicing capability; and (4) attached research laboratories for life sciences and materials processing. A.R.H.

N84-18274*# Rockwell International Corp., Downey, Calif. Shuttle Integration and Satellite Systems Div.

SPACE STATION NEEDS, ATTRIBUTES, AND ARCHITECTURAL **OPTIONS STUDY Final Executive Summary Briefing**

6 Apr. 1983 79 p

(Contract NASW-3683)

(NASA-CR-173327; NAS 1.26:173327; SSD-83-0037) Avail: NTIS HC A05/MF A01 CSCL 22B

Recommended program architecture; missions and requirements, programmatic evolution; space station architecture, technology, and cost; and space station attributes and benefits N.W. are discussed.

N84-18275*# General Dynamics/Convair, Fort Worth, Tex. SPACE STATION MEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. SUMMARY OF MAJOR STUDY ACTIVITIES AND RESULTS. SPACE STATION PROGRAM OBSERVATIONS Final **Briefing Report**

O. STEINBRONN and D. CHARHUT 5 Apr. 1983 136 p refs (Contract NASW-3682)

(NASA-CR-173345; NAS 1.26:173345) Avail: NTIS HC A07/MF A01 CSCL 22B

Space station study logic, commercial applications, total mission set space station system, mission requirements, free flyer missions, a baseline time phased mission set, and space systems architecture are discussed. NW

N84-18277*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPACE STATION TECHNOLOGY, 1983

R. L. WRIGHT, ed. and C. R. MAYS, ed. Feb. 1984 1 Workshop held in Williamsburg, Va., 28-31 Mar. 1983 (NASA-CP-2293; L-15732; NAS 1.55:2293) Avail: NTIS HC 189 p A09/MF A01 CSCL 22B

This publication is a compilation of the panel summaries presented in the following areas: systems/operations technology; crew and life support; EVA; crew and life support: ECLSS; attitude, control, and stabilization; human capabilities; auxillary propulsion; fluid management; communications; structures and mechanisms; data management; power; and thermal control. The objective of the workshop was to aid the Space Station Technology Steering Committee in defining and implementing a technology development program to support the establishment of a permanent human presence in space. This compilation will provide the participants and their organizations with the information presented at this workshop in a referenceable format. This information will establish a stepping stone for users of space station technology to develop new technology and plan future tasks.

N84-18278*# Boeing Aerospace Co., Seattle, Wash. SYSTEMS/OPERATIONS TECHNOLOGY

G. R. WOODCOCK In NASA. Langley Research Center Space Station Technol., 1983 p 1-24 Feb. 198 Avail: NTIS HC A09/MF A01 CSCL 22B Feb. 1984

The deliberations of the Systems/Operations Technology Panel are summarized. The first real question that arose was to develop an understanding of what systems/operations technology is. A relativelynew discipline in the NASA technology organization, necessitates the definition of the objectives. Two objectives were established: (1) to make new things possible, and (2) to make existing capabilities cost less or work better. Making new things possible is not really applicable in the case of a space station. Both Salyut 7 and Skylab indicate that space stations are possible with existing (not necessarily new) technology. There was a concern on the part of some of the penelists that work better might mean higher performance, and that is not necessarily the case at all. Work better may mean simply to provide better service to the users of the space station at lower cost. The panel felt this to be a more realistic viewpoint. As evidenced from interaction with users (and all of the contractors found this basically to be true), the users want low cost, no schedule constraints, and no hassles.

Author

N84-18279*# Texas Woman's Univ., Houston.

CREW AND LIFE SUPPORT: EVA

R. S. JOHNSTON In NASA. Langley Research Center Space Station Technol., 1983 p 25-32 Feb. 1984 Avail: NTIS HC A09/MF A01 CSCL 22B

Four general recommendations by the EVA subpanel are listed as follows: 1) EVA design standard document needs to be dveloped in the next 6 to 12 months and updated as technology progresses. 2) NASA needs to couple EVA design personnel closer to the user community. 3) there appears to be a lack of centralized NASA responsibility for the EVA community. 4) Panel activity should continue to promote exchange of information and understanding of user problems, and to stimulate technology activity. Author

N84-18280*# General Dynamics Corp., San Diego, Calif.

CREW AND LIFE SUPPORT: ECLSS

G. DRAKE In NASA. Langley Research Center Space Station Technol., 1983 p 33-40 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

The schedule NASA has proposed has four main elements. The focal point of all the life support activity is demonstrator for the initial space station. The demonstrator is composed of items that are ready for Phase C and D development. Technical options are scheduled during the early years to provide alternatives because the capability to substitute must be maintained. Growth technology and supporting research and technology (SR&T) will continue throughout the program life, and as new items emerge, the space station capability will be updated. Author

N84-18282*# Little (Arthur D.), Inc., Cambridge, Mass.

HUMAN CAPABILITIES

W. AUGERSON In NASA. Langley Research Center Space Station Technol., 1983 p 61-83 Feb. 1984 Avail: NTIS HC A09/MF A01 CSCL 22B

In conclusion, habitability is more than just life support and there is a substantial technology application void. Habitability needs both visibility and responsibility in the space station program to ensure the optimum use of man in space. In the area of work technology, IVA and EVA teleoperators and robotics should be considered as tools and not competitors. A generic work station is a contemporary of the early space stations. Flexibility of a future space station requires this. Author

N84-18283*# Aerojet-General Corp., Sacramento, Calif.

AUXILIARY PROPULSION

S. D. ROSENBERG In NASA. Langley Research Center Space Station Technol., 1983 p 85-87 Feb. 199 Avail: NTIS HC A09/MF A01 CSCL 22B Feb. 1984

When man is put in the loop, almost anything can happen. Caution must be exercised in permitting life cycle costs analysis to control technology investment. One of the ways of reducing cost is to stay with the old tried and true technology. However, when requirements of a permanent space station are considered (15-year life, the issues associated with health monitoring, maintenance, and repair), the conclusion is that very little, if anything, is really state of the art. Before investing in old technologies to make them comply with the requirements of a permanent space station, the question of whether or not it is worth putting the money there as opposed to advancing the state of the art should be considered. Program managers and system designers must not make the mistake of selecting old technologies in the belief that they are state of the art. Author

N84-18284*# Martin Marietta Corp., Denver, Colo.

FLUID MANAGEMENT

D. FESTER In NASA. Langley Research Center Space Station Technol., 1983 p 89-94 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

The Fluid Management Panel's assessment of the technology is summarized. Since a baseline space station was not defined as a reference guide and the results of the eight contracted space station studies were not available as input, the assessment focused on technology and not programmatics. The ground rules that were

key to the deliberations and guided the assessment are: (1) The space station will be operational in 1991, and (2) A space-based OTV will be operational in 1992. Thus, the capability to transport, transfer, and resupply all fluids, including those for the OTV, is required in the initial space station. The only evolutionary aspect is the refinement of capability. Fluid management includes fluid transport to orbit, liquid storage/supply, fluid transfer/resupply, and integral thermal control. Author

N84-18285*# TRW Electronic Systems Group, Redondo Beach, Calif.

COMMUNICATIONS

G. J. BONELLE In NASA. Langley Research Center Space Station Technol., 1983 p 95-108 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

Communications in any system is one of the last technologies to be considered, and sometimes it is considered too late to impact the system. This was somewhat the impression on reviewing the NASA budget for two mission scenarios for the space station. However, that budget fortunately was well spent, and the money was spent to get the most benefit per dollar. Another thing that is very often forgotten is that technology is not produced in a vacuum. In fact, in conducting independent research and development (IR&D), the first phase is to define the requirements which must be time phased, becuase very often the conditions will change during the life of the system. From the requirements, a set of architectures that are at least representative of that era are produced. If the exact requirements were not established, at least boundaries are set on the requirements for that architecture. When this is completed, then the technology that is really needed is defined. The major criticism of the work that was presented to the panel is the lack of a firm set of requirements. Author

N84-18287*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

DATA MANAGEMENT

G. LOVE In NASA. Langley Research Center Space Station Technol., 1983 p 137-154 Feb. 1984 Avail: NTIS HC A09/MF A01 CSCL 22B

The following tasks were prioritized: software acquisition management plan; space station flight data system architectural study; space station user data system interface; automation of software development process; automation of software testing; distributed data base management; ADA (automated data acquisition) evaluation and transition and planning; network operating system software; fault tolerant computer validation methodology for onboard data management system; systems integration; artificial intelligence/expert systems; space station data network concept; space station standard interface protocols; space station data networks systems; integrated software development facility; and language trade studies. Author

N84-18288*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

POWER

R. CORBETT In NASA. Langley Research Center Space Station Technol., 1983 p 155-163 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

The space station requires an increase in power or energy of at least several orders of magnitude compared to previous space missions. With the requirement up in the range of 10 kilowatt hours, this obviiously requires the development of new technology. Although the power area is very well integrated in the spacecraft itself, it represents a diverse set of components necessary for energy conversion, electronics, and energy distribution. Considerable work is ongoing at NASA Lewis in the power devices development area, including transformers, large area solid-state chips, transistors, and fast recovery diodes. This work is oriented toward eventual application to both AC and DC power conversion approaches. In the energy storage area, there are many options available to fit into the space station representing various degrees of risk and leverage combination, such as the near-term integral-pressure-vessel nickel hydrogen battery, an advanced

Ni-H2 battery concept, and the regenrative hydrogen-oxygen system utilizing essentially the Shuttle orbiter type of fuel cell. Author

N84-18290*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 4, ATTACHMENT 1: TASK 2 AND 3 **MISSION IMPLEMENTATION AND COST Final Study Report** 22 Apr. 1983 393 p refs

(Contract NASW-3684)

(NASA-CR-173330; NAS 1.26:173330;

LMSC-D889718-VOL-4-ATTACH-1) Avail: NTIS HC A17/MF A01 CSCL 22B

Mission scenario analysis and architectural concepts, alternative systems concepts, mission operations and architectural development, architectural analysis trades, evolution, configuration, and technology development are assessed. N.W.

N84-18291*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, ATTACHMENT 2: SUPPORTING DATA AND ANALYSIS REPORTS Final Study Report 22 Apr. 1983 174 p refs

(Contract NASW-3684)

(NASA-CR-173329: NAS 1.26:173329:

LMSC-D889718-VOL-2-ATTACH-2) Avail: NTIS HC A08/MF A01 CSCL 22B

Architectural impact analysis, configuration concepts evaluation, CADAM draining file, EVA technology needs and manned system technology requirements are provided. N.W.

Lockheed Missiles and Space Co., Sunnyvale, N84-18292*# Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 1: EXECUTIVE SUMMARY NASA Final Presentation Report

5 Apr. 1983 368 p refs

(Contract NASW-3684)

(NASA-CR-172792; NAS 1.26:172792; LMSC-D889718-VOL-1)

Avail: NTIS HC A16/MF A01 CSCL 22B

The uses alignment plan was implemented. The existing data bank was used to define a large number of station requirements. Ten to 20 valid mission scenarios were developed. Architectural options as they are influenced by communications operations, subsystem evolvability, and required technology growth are defined. Costing of evolutionary concepts, alternative approaches, and options, was based on minimum design details. N.W.

N84-18293*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS.** VOLUME 1, ATTACHMENT 1: EXECUTIVE **SUMMARY NASA Final Study Report**

22 Apr. 1983 . 281 p refs

(Contract NASW-3684)

(NASA-CR-173337; NÁS 1.26:173337;

LMSC-D889718-VOL-1-ATTACH-1) Avail: NTIS HC A13/MF A01 CSCL 22B

User alignment plan, physical and life sciences and applications, commercial requirements national security, space operations, user needs, foreign contacts, mission scenario analysis and architectural concepts, alternative systems concepts, mission operations architectural development, architectural analysis trades, evolution, configuration, and technology development are discussed. N.W.

N84-18294*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 1, ATTACHMENT 2: SUPPORTING DATA AND ANALYSIS REPORTS Final Study Report 22 Apr. 1983 402 p refs (Contract NASW-3684) (NASA-CR-173336; NAS 1.26:173336; LMSC-D889718-VOL-1-ATTACH-2) Avail: NTIS HC A18/MF A01 CSCL 22B Reference space station evolution, a contact list, a data base, scenarios, and subcontractor reports are considered. N.W. N84-18296*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL VOLUME 2, BOOK 1, PART 1: OPTIONS. MISSION **REQUIREMENTS Final Technical Report** 20 Apr. 1983 210 p refs (Contract NASW-3685)

(NASA-CR-173312; NÁS 1.26:173312;

SA-SSP-RP008-VOL-2-BK-1-PT-1) Avail: NTIS HC A10/MF A01 CSCL 22B

The baseline mission model used to develop the space station mission-related requirements is described as well as the 90 civil missions that were evaluated, (including the 62 missions that formed the baseline model). Mission-related requirements for the space station baseline are defined and related to space station architectural development. Mission-related sensitivity analyses are discussed. A.R.H.

N84-18297*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 1, PART 2, TASK 1: MISSION **REQUIREMENTS Final Technical Report** 20 Apr. 1983 239 p refs

(Contract NASW-3685)

(NASA-CR-173313; NÁS 1.26:173313;

SA-SPP-RP008-VOL-2-BK-1-PT-2) Avail: NTIS HC A11/MF A01 CSCL 22B

Mission areas analyzed for input to the baseline mission model including include: (1) commercial materials processing, representative missions for producing metallurgical, chemical and biological products; (2) commercial Earth observation, represented by a typical carry-on mission amenable to commercialization; (3) solar terrestrial and resource observations including missions in geoscience and scientific land observation; (4) global environment, including representative missions in meteorology, climatology, ocean science, and atmospheric science; (5) materials science, including missions for measuring material properties, studying chemical reactions and utilizing the high vacuum-pumping capacity of space; and (6) life sciences with experiments in biomedicine and animal and plant biology. A.R.H.

N84-18298*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 1, PART 3: MANNED SPACE RELEVANCE STATION TO COMMERCIAL **TELECOMMUNICATIONS SATELLITES Final Technical Report** 20 Apr. 1983 77 p refs

(Contract NASW-3685)

(NASA-CR-173314; NAS 1.26:173314;

SA-SSP-RP008-VOL-2-BK-1-PT-3) Avail: NTIS HC A05/MF A01 CSCL 22B

A document containing a forecast of satellite traffic and revelant technology trends to the year 2000 was prepared which includes those space station capabilities and characteristics that should be provided to make the station useful to commercial satellite owners. The document was circulated to key representative organizations within the commercial telecommunications satellite and related communities of interest, including spacecraft manufacturers, commercial satellite owners, communications carriers, networks and risk insurers. The prospectus document is presented as well as the transmittal letter and the mailing list of the people and companies that were asked to review it. Key commercial telecommunications comments are summarized the actual response letters from the industry are included. A.R.H.

N84-18299*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 1, PART 4: PAYLOAD ELEMENT **MISSION DATA SHEETS Final Technical Report** 20 Apr. 1984 299 p refs

(Contract NASW-3685)

(NASA-CR-173315; NAS 1.26:173315;

SA-SSP-RP008-VOL-2-BK-1-PT-4) Avail: NTIS HC A13/MF A01 CSCL 22B

Data sheets are presented for 11 internal payloads, 30 externally mounted payloads, and 46 free flyers. The importance of the space station to each payload element is rated on a scale of 1 to 10. The type of experiment noncommercial science and applications, commercial, technological, and operational is indicated and the payload and its objectives are described. Space is provided for noting requirements for power; data/communication; thermal environment; equipment physical characteristics; crew size; and service and maintenance. A.R.H.

N84-18300*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 2, PART 1: MINIPLEMENTATION CONCEPTS Final Technical Report MISSION 20 Apr. 1983 188 p refs

(Contract NASW-3685)

(NASA-CR-173316; NAS 1.26:173316;

SA-SSP-RP008-VOL-2-BK-2-PT-1) Avail: NTIS HC A09/MF A01 CSCL 22B

The overall configuration and modules of the initial and evolved space station are described as well as tended industrial and polar platforms. The mass properties that are the basis for costing are summarized. User friendly attributes (interfaces, resources, and facilities) are identified for commercial; science and applications; industrial park; international participation; national security; and the external tank option. Configuration alternates studied to determine a baseline are examined. Commonality for clustered 3-man and 9-man stations are considered as well as the use of tethered platforms. Requirements are indicated for electrical, communication and tracking; data management Subsystem requirements for electrical, data management, communication and tracking, environment control/life support system; and guidance navigation and control subsystems are identified. Á.R.H.

N84-18301*# Grumman Aerospace Corp., Bethpage, N.Y.

SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 2, PART 2, TASK 2: INFORMATION MANAGEMENT SYSTEM Final Technical Report

20 Apr. 1983 refs 315 p Prepared in cooperation with General Electric Corp.

(Contract NASW-3685)

(NASA-CR-173317; NAS 1.26:173317;

SA-SSP-RP008-VOL-2-BK-2-PT-2) Avail: NTIS HC A14/MF A01 CSCL 22B

Missions to be performed, station operations and functions to be carried out, and technologies anticipated during the time frame of the space station were examined in order to determine the scope of the overall information management system for the space station. This system comprises: (1) the data management system which includes onboard computer related hardware and software required to assume and exercise control of all activities performed on the station; (2) the communication system for both internal and external communications; and (3) the ground segment. Techniques used to examine the information system from a functional and performance point of view are described as well as the analyses performed to derive the architecture of both the onboard data management system and the system for internal and external communications. These architectures are then used to generate a conceptual design of the onboard elements in order

to determine the physical parameters (size/weight/power) of the hardware and software. The ground segment elements are summarized. A.R.H.

N84-18302*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS. VOLUME 2, BOOK 2, PART 3: COMMUNICATION **SYSTEM Final Technical Report** 20 Apr. 1983 64 p refs

(Contract NASW-3685)

(NASA-CR-173318; NAS 1.26:173318;

SA-SSP-RP008-VOL-2-BK-2-PT-3) Avail: NTIS HC A04/MF A01 CSCL 22B

Preliminary results of the study of the architecture and attributes of the RF communications and tracking subsystem of the space station are summarized. Only communications between the space station and other external elements such as TDRSS satellites, low-orbit spacecraft, OTV, MOTV, in the general environment of the space station are considered. The RF communications subsystem attributes and characteristics are defined and analyzed key issues are identified for evolution from an initial space station (1990) to a year 2000 space station. The mass and power characteristics of the communications subsystem for the initial space station are assessed as well as the impact of advanced technology developments. Changes needed to the second generation TDRSS to accomodate the evolutionary space station of the year 2000 are also identified. A.R.H.

N84-18303*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL OPTIONS, VOLUME 2, BOOK 2, PART 4: INTERNATIONAL **REPORTS Final Technical Report**

20 Apr. 1983 172 p refs (Contract NASW-3685)

(NASA-CR-173319; NAS 1.26:173319;

SA-SSP-RP008-VOL-2-BK-2-PT-4) Avail: NTIS HC A08/MF A01 CSCL 22B

The capabilities of the European Space Agency's SPAS and EURECA platforms for reference payload accommodation are considered. The instrument pointing subsystem, the position and hold mount, and the antenna pointing mechanism developed by Dornier are described. Relevant payloads for the space station are summarized and space station accommodation aspects are discussed. A.R.H.

N84-18304*# Grumman Aerospace Corp., Bethpage, N.Y. SPACE STATION NEEDS, ATTRIBUTES AND ARCHITECTURAL **OPTIONS, VOLUME 2, BOOK 3: COST AND PROGRAMMATICS Final Technical Report**

20 Apr. 1983 79 p refs (Contract NASW-3685)

(NASA-CR-173320; NAS 1.26:173320;

SA-SSP-RP008-VOL-2-BK-3) Avail: NTIS HC A05/MF A01 CSCL 22B

The cost and programmatic considerations which integrate mission requirements and architectural options into a cohesive system for exploitation of space opportunities within affordable limits are discussed. The mission requirements, baseline architecture, a top level baseline schedule, and acquisition costs are summarized. The work breakdown structure (WBS) used to structure the program, and the WBS dictionary are included. The costing approach used, including the operation of the primary costing tool, the SPACE cost model are described. The rationale for the choice of cost estimating relationships is given and costs at the module level are shown. Detailed costs at the subsystem level are shown. The baseline schedule and annual funding profiles are provided. Alternate schedules are developed to provide different funding profiles. Alternate funding sources are discussed and foreign and contractor participation is outlined. The results of the benefit analysis are given and the accrued benefits deriving from an implemented space station program are outlined. A.R.H.

N84-19377*# General Dynamics/Convair, Fort Worth, Tex. DEFINITION OF TECHNOLOGY DEVELOPMENT MISSIONS FOR EARLY SPACE STATIONS ORBIT TRANSFER VEHICLE SERVING. PHASE 2, TASK 1: SPACE STATION SUPPORT OF **OPERATIONAL OTV SERVICING**

Dec. 1983 245 p refs (Contract NAS8-35039)

(NASA-CR-170984; NAS 1.26:170984; GDC-SP-83-067) Avail: NTIS HC A11/MF A01 CSCL 22A

Representative space based orbital transfer vehicles (OTV), ground based vehicle turnaround assessment, functional operational requirements and facilities, mission turnaround operations, a comparison of ground based versus space based tasks, activation of servicing facilities prior to IOC, fleet operations requirements, maintenance facilities, OTV servicing facilities, space station support requirements, and packaging for delivery are discussed. N.W.

N84-20435*# Engineering and Economics Research, Inc., Vienna, Va. Data and Operations Subcommittee.

STARLAB GROUND SYSTEM GUIDELINES DOCUMENT Final Report

F. J. HAWKINS Jan. 1984 132 p refs Sponsored in part by National Research Council of Canada and Australian Department of Science and Technology

(Contract NAS5-27617)

(NASA-CR-175192; NAS 1.26:175192) Avail: NTIS HC A07/MF À01 CSCL 05B

Starlab science objectives, ground system considerations, space shuttle sortie, space platform/station, mission planning, and remote facilities are addressed. N.W.

N84-20604*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

A LARGE-AREA GAMMA-RAY IMAGING TELESCOPE SYSTEM Final Report, 24 Mar. - 1 Sep. 1983 D. G. KOCH Aug. 1983 100 p refs

(Contract NAS2-3743)

(NASA-CR-175435; NAS 1.26:175435) Avail: NTIS HC A05/MF A01 CSCL 22A

The concept definition of using the External Tank (ET) of the Space Shuttle as the basis for constructing a large area gamma ray imaging telescope in space is detailed. The telescope will be used to locate and study cosmic sources of gamma rays of energy greater than 100 MeV. Both the telescope properties and the means whereby an ET is used for this purpose are described. A parallel is drawn between those systems that would be common to both a Space Station and this ET application. In addition, those systems necessary for support of the telescope can form the basis for using the ET as part of the Space Station. The major conclusions of this concept definition are that the ET is ideal for making into a gamma ray telescope, and that this telescope will provide a substantial increase in collecting area. S.L.

N84-20610*# Michigan State Univ., East Lansing. Dept. of Botany and Plant Pathology.

THE ALPHA-HELIX CONCEPT: INNOVATIVE UTILIZATION OF THE SPACE STATION PROGRAM. A REPORT TO THE NATIONAL AERONAUTICAL AND SPACE ADMINISTRATION REQUESTING ESTABLISHMENT OF A SENSORY PHYSIOLOGY LABORATORY ON THE SPACE STATION Final Report

R. S. BANDURSKI and N. SINGH 17 Oct. 1983 71 p refs (Contract NASW-3748)

(NASA-CR-175436; NAS 1.26:175436) Avail: NTIS HC A04/MF A01 CSCL 22B

A major laboratory dedicated to biological-medical research is proposed for the Space Platform. The laboratory would focus on sensor physiology and biochemistry since sensory physiology represents the first impact of the new space environment on living organisms. Microgravity and the high radiation environment of space would be used to help solve the problems of prolonged sojourns in space but, more importantly, to help solve terrestrial problems of human health and agricultural productivity. The

emphasis would be on experimental use of microorganisms and small plants and small animals to minimize the space and time required to use the Space Platform for maximum human betterment. The Alpha Helix Concept, that is, the use of the Space Platform to bring experimental biomedicine to a new and extreme frontier is introduced so as to better understand the worldly environment. Staffing and instrumenting the Space Platform biomedical laboratory in a manner patterned after successful terrestrial sensory physiology laboratories is also proposed. Author

N84-21586*# Arizona State Univ., Tempe. Dept. of Geology. FEASIBILITY STUDY TO CONDUCT WINDBLOWN SEDIMENT **EXPERIMENTS ABOARD A SPACE STATION Final Report**

R. GREELEY and J. D. IVERSEN (Iowa State Univ., Ames) 30 Aug. 1983 36 p refs Original contains color illustrations (Contract NASW-3741)

(NASA-CR-175434; NAS 1.26:175434) Avail: NTIS HC A03/MF A01 CSCL 22A

A feasibility study was undertaken to determine if a suitable apparatus could be designed to analyze aeolian processes for operation in space and to assess the feasibility of conducting meaningful experiments to address key aspects of aeolian processes. To meet this objective a prototype apparatus was fabricated and some limited experiments were run to determine its suitability for this application. At least three general types of experiments were devised that could be carried out aboard a space station: threshold studies, swirl (dust devil) experiments, and analyses of windblown particle trajectories. How experiments in a zero-g environment could advance knowledge of aeolian processes was studied. M.A.C.

N84-21623# Consulenze Generali Roma (Italy).

PROPOSALS FOR ADDITIONS, MODIFICATIONS, AND NEW EXPERIMENTAL METHODS. PART 1: GROUND TESTS. PART 2: FLIGHT TESTS

U. PONZI In its Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. te] p 170-428 Dec. 1982 Avail: NTIS HC A19/MF A01 Dec. 1982 refs

The adaptation of ground test techniques to analysis of large space structures (LSS) is discussed using Space Construction Automated Fabrication Experiment Definition Study data. Analysis of gravitational effects is emphasized, and the difficulties and practical consequences in reducing scale when composite materials are involved are considered. The evolution of flight tests from aircraft to space applications is reviewed. Modeling of LSS is treated. Parameter identification approaches are compared with methods which consider the model/system performance/error problem as a whole. Identification algorithms and error representations are appended. Author (ESA)

02

ANALYSIS AND DESIGN TECHNIQUES

Includes interactive techniques, computerized technology design and development programs, dynamic analysis techniques, environmental modeling, thermal modeling, and math modeling.

A84-11930

SOME ASPECTS OF SIMULATION STUDIES IN SPACECRAFT DYNAMICS

V. J. MODI (British Columbia, University, Vancouver, Canada) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal. Canada, August 8-13, 1982, Proceedings. Volume 3 Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 204-206. refs

It is pointed out that numerous investigations involving active and passive stabilization procedures and accounting for internal as well as external forces have been carried out on the assumption that satellites are rigid. Since modern space vehicles carry lightweight, flexible deployable members, this assumption can no longer be made. Summaries are given of the papers presented at the 10th IMACS Congress. The question whether the availability of computers has tended to stifle fundamental mathematical inquiries leading to elegant analytical answers is addressed.

C.R.

A84-11946* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MODEL ERROR ESTIMATION FOR DISTRIBUTED SYSTEMS DESCRIBED BY ELLIPTIC EQUATIONS

G. RODRIGUEZ (California Institute of Technology, Jet Propulsion IN: World Congress on System Laboratory, Pasadena, CA) Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3 . Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 371-373. NASA-supported research. refs

A function space approach is used to develop a theory for estimation of the errors inherent in an elliptic partial differential equation model for a distributed parameter system. By establishing knowledge of the inevitable deficiencies in the model, the error estimates provide a foundation for updating the model. The function space solution leads to a specification of a method for computation of the model error estimates and development of model error analysis techniques for comparison between actual and estimated errors. The paper summarizes the model error estimation approach as well as an application arising in the area of modeling for static shape determination of large flexible systems. Author

A84-16841

A HEURISTIC METHOD FOR THE DESIGN OF MINIMUM WEIGHT TRUSSES USING DISCRETE MEMBER SIZES

D. F. YATES, T. B. BOFFEY, and A. B. TEMPLEMAN (Liverpool, University, Liverpool, England) Computer Methods in Applied Mechanics and Engineering (ISSN 0045-7825), vol. 37, March 1983, p. 37-55.

This paper describes a heuristic method for obtaining an approximate solution to the problem of determining the minimum weight design of a structural truss using only a discrete set of commercially available member gauges. The method treats constraints on joint deflection as well as constraints on member stress and gauge. A sufficient condition for convergence of the method to a global optimum is derived together with both an a priori and an a posteriori bound on the approximate solution. Finally, the results obtained from applying the method to several test problems are reported. Author

A84-19108

ALGORITHMS AND COMPUTATIONAL ASPECTS PERTAINING TO BLOCK DIAGONAL DOMINANCE METHODS FOR DESIGN OF DECENTRALIZED FEEDBACK COMPENSATION

W. H. BENNETT (U.S. Navy, Naval Research Laboratory, Washington, DC) and J. S. BARAS (Maryland, University, College Park, MD) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 479-484. refs

Reference is made to a study by Bennett and Baras (1979), in which the idea of a block diagonally dominant transfer function matrix is used to provide criteria for the design of decentralized feedback control. Computer implementable algorithms are developed here for determining the block diagonal dominance condition. Consideration is given to numerical stability in developing the algorithms. It is suggested that the algorithms be implemented in an interactive computing environment. At present, these algorithms are being integrated into an interactive package that will be used to assess feasibility of some large space structure decentralized control schemes. C.R.

A84-19129

MATRIX(X) - APPLICATION TO LARGE SPACE STRUCTURE CONTROL DESIGN PROBLEMS

C. GREGORY, JR., S. SHAH, and R. WALKER (Integrated Systems, IN: Conference on Decision and Control. Inc., Palo Alto, CA) 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1982, p. 912-917. refs

Matrix(X) is a computer-aided-design system for performing the steps in the control design cycle starting from system modeling to data analysis, identification, control synthesis, and simulation. In addition to a powerful matrix interpreter, the package features a user-friendly environment that involves device-independent graphics, state-of-the-art numerical algorithms for reliable computations, and user-transparent file management. A description is given of the design and application of Matrix(X) user interface and numerical algorithms for large space structures. It is pointed out that for large space structure problems, the bulk of the information involved in evaluating a control design tends to obscure the significant performance effects unless the results are summarized graphically in a way that allows the analyst to quickly obtain an overview of the system performance. Selected graphical overview results for different aspects of the design, such as eigenvalue locations, controllability/observability, modal cost, and rms errors, are illustrated. C.R.

A84-19887#

COMPARISON OF LINEAR AND GEOMETRICALLY NONLINEAR FINITE ELEMENT ANALYSES APPLIED TO LARGE SPACE STRUCTURES

A. E. CONAWAY (Alabama, University, Tuscaloosa, AL) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 7 p. refs

(AIAA PAPER 84-0069)

Many of the projects which are being considered to utilize the special characteristics of the space environment for some application require for their implementation a structure in space, which, in a number of cases, may be very large. One important problem regarding such structures is related to limitations on weight. The resulting fairly 'flimsy' configurations require special systems for the control of motion in response to dynamic loads. The design of these control systems requires information regarding the structure's mode shapes and natural frequencies. NASA employs currently numerical methods based on linear behavior of the structure to derive this information. However, it is entirely possible that such a linear approach is not adequate because of nonlinear effects. The considered project had as the objective to develop a means of nonlinear analysis for a structure modeled as having an applied static load. It is found that a dependence on linear assumptions might lead to inefficient control systems. G.R.

A84-21564

FOR THE FIRST TIME [VPERVYE]

A. IVANOV Moscow, Moskovskii Rabochii, 1982, 289 p. In Russian.

The author gives a personal account of his work as a spacecraft designer during the early years of the Soviet space program. Particular consideration is given to the beginnings of the Soviet space program; the launching of the first animal (the dog Laika) into space; the flights of Luna 1, 2, and 3; and the first manned flight. B.J.

A84-22131*# Teledyne Brown Engineering, Huntsville, Ala. SPACE PLATFORM ACCOMMODATIONS

W. BAILEY (Teledyne Brown Engineering, Base Programs Div., Huntsville, AL) and M. E. NEIN (NASA, Marshall Space Flight Center, Advanced Systems Office, Huntsville, AL) Journal of Spacecraft and Rockets (ISSN 0002-4650), vol. 20, Nov.-Dec. 1983, p. 546-552.

Previously cited in issue 23, p. 3590, Accession no. A82-46489

A84-25259#

UNFURLABLE OFFSET ANTENNA DESIGN FOR MULTIPURPOSE APPLICATIONS

W. SCHAEFER, F. DRACHENBERG, H. HERBIG, R. SCHAELLIG (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany), A. FESTA, A. ROEDERER (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands), and κ. IN: PONTOPPIDAN (TICRA A/S, Copenhagen, Denmark) Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 64-74. (AIAA PAPER 84-0659)

A European aerospace company has been awarded a contract by the European Space Agency (ESA) for the development of a European technological capability in the area of unfurlable antennas. Such antennas are to be employed by the next generation of ESA communication satellites. The present investigation is concerned with the results obtained during the first phase of the project. During the second phase, the hardware is being developed for the selected concept, and the final design of a Technology Demonstration Model (TDM) of the antenna reflector will be produced. Attention is given to mission examples for large offset deployable antennas, requirements and interfaces for antennas, the unfurlable reflector concepts, a thermo-structural analysis of the two different reflector concepts, and the selection of the optimum concept. G.R.

A84-25525* Brown Univ., Providence, R. I. PARAMETER IDENTIFICATION IN CONTINUUM MODELS

H. T. BANKS (Brown University, Providence, RI; Southern Methodist University, Dallas, TX) and J. M. CROWLEY (U.S. Air Force Academy, Colorado Springs, CO) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1983, p. 997-1001. refs

(Contract NSF MCS-82-05335; AF-AFOSR-81-0198;

DAAG29-79-C-0161; NAS1-15810; NAS1-16394)

Approximation techniques for use in numerical schemes for estimating spatially varying coefficients in continuum models such as those for Euler-Bernoulli beams are discussed. The techniques are based on quintic spline state approximations and cubic spline parameter approximations. Both theoretical and numerical results are presented. Previously announced in STAR as N83-28934

M.G.

A84-25551* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STATIC SHAPE FORMING FOR AN ELECTROSTATICALLY CONTROLLED MEMBRANE MIRROR

J. N. JUANG (NASA, Langley Research Center, Hampton, VA) and W. HUANG (Martin Marietta Aerospace, Denver, CO) IN American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1983, p. 1310-1316. refs

A design concept is described permitting the static construction of a flexible membrane reflector for use in a radiometer spacecraft. The scheme utilizes electrostatic forces to actively shape the membrane toward a specified reflector surface with a required degree of precision. The formulations of the required electrostatic attractive forces, and stress and strain distributed in the membrane are presented in this paper in terms of curvilinear coordinates. An example is given to illustrate a variety of spherical membrane characteristics associated with different boundary conditions.

McDonnell-Douglas Technical Services Co., Inc., N84-10114*# Huntsville, Ala.

A DEFINITION OF STS ACCOMMODATIONS FOR ATTACHED PAYLOADS

F. L. ECHOLS and P. A. BROOME Sep. 1983 125 p refs (Contract NAS8-32350)

(NASA-CR-172223; NAS 1.26:172223) Avail: NTIS HC A06/MF A01 CSCL 22B

An input to a study conducted to define a set of carrier avionics for supporting large structures experiments attached to the Space Shuttle Orbiter is reported. The 'baseline' Orbier interface used in developing the avionics concept for the Space Technology Experiments Platform, STEP, which Langley Research Center has proposed for supporting experiments of this sort is defined. Primarily, flight operations capabilities and considerations and the avionics systems capabilities that are available to a payload as a 'mixed cargo' user of the Space Transportation System are addressed. Ground operations for payload integration at Kennedy Space Center, and ground operations for payload support during the mission are also discussed. Author

N84-14233*# Grumman Aerospace Corp., Bethpage, N.Y. ORBITER-BASED CONSTRUCTION EQUIPMENT STUDY. THE HPA/DTA TECHNOLOGY ADVANCEMENT PLAN

Oct. 1983 15 p refs

(Contract NAS9-16468)

(NASA-CR-174605; NAS 1.26:174605; DRL-T-1701;

DRD-SE957T) Avail: NTIS HC A02/MF A01 CSCL 22B Satellite berthing mechanism, umbilicals for fluid and electrical

interfaces, EVA service platform, and large mass berthing mechanism are discussed. Author

N84-14759# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).

SOFTWARE QUALITY ASSURANCE SPACELAB EXPERIENCE AND FUTURE TRENDS

R. DAVENPORT In ESA Software Eng. p 235-241 Aug. 1983 refs

Avail: NTIS HC A13/MF A01

The quality assurance plan used when developing the command and data management software subsystem to support the functions of Spacelab in flight; automatic test equipment software subsystem to support the functions needed for ground checkout of Spacelab; and support software subsystem to generate and maintain a common data base and to provide a generation mechanism for software for the other two subsystems, is outlined. The software problem reports, unit development folders, verification control document, test data folder, acceptance data package, and certificate of acceptance are described. Trends in developing automated software quality assurance tools are reviewed.

Author (ESA)

N84-16427*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURFACE ACCURACY MEASUREMENT SENSOR TEST ON A **50-METER ANTENNA SURFACE MODEL**

R. B. SPIERS, E. E. BURCHER, C. W. STUMP, C. G. SAUNDERS, and G. F. BROOKS (Kentron International, Inc.) Jan. 1984 32 refs

(NASA-TM-85689; NAS 1.15:85689) Avail: NTIS HC A03/MF A01 CSCL 20N

The Surface Accuracy Measurement Sensor (SAMS) is a telescope with a focal plane photo electric detector that senses the lateral position of light source targets in its field of view. After extensive laboratory testing the engineering breadboard sensor system was installed and tested on a 30 degree segment of a 50-meter diameter, mesh surface, antenna model. Test results correlated well with the laboratory tests and indicated accuracies of approximately 0.59 arc seconds at 21 meters range. Test results presented and recommendations given for are sensor improvements. S1

N84-17225*# Rockwell International Corp., Seal Beach, Calif. Shuttle Integration and Satellite Systems Div.

LOW CONCENTRATION RATIO SOLAR ARRAY STRUCTURAL CONFIGURATION

S. J. NALBANDIAN In NASA. Langley Research Center STEP Expt. Requirements p 185-198 Jan. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 10A

The design and structural properties of a low concentration ratio solar array are discussed. The assembled module consists of six interconnected containers which are compactly stowed in a volume of 3.24 m(3) for delivery to orbit by the shuttle. The containers deploy in accordian fashion into a rectangular area of 19.4 x 68 meters and can be attached to the user spacecraft along the longitudinal centerline of the end container housing. Five rotary incremental actuators requiring about 8 watts each will execute the 180-degree rotation at each joint. Deployable masts (three per side) are used to extend endcaps from the housing in both directions. Each direction is extended by three masts requiring about 780 watts for about 27 minutes. Concentrator elements are extended by the endcaps and are supported by cable systems that are connected between the housings and endcaps. These power generating elements contain reflector panels which concentrate light onto the solar panels consisting of an aluminum radiator with solar cells positioned within the element base formed by the reflectors. A flat wire harness collects the power output of individual elements for transfer to the module container housing M.G. harnesses.

N84-17284# Contraves Corp., Zurich (Switzerland). STUDY ON LARGE, ULTRALIGHT LONG-LIFE STRUCTURES IN SPACE, PHASE 2C Final Report

M. C. BERNASCONI Paris ESA 2 Jul. 1983 84 p refs (Contract ESTEC-5156/82/NL-PB(SC))

(TM-EKR3; ESA-CR(P)-1796) Avail: "NTIS HC A05/MF A01

A design of an inflatable, space rigidized structure (ISRS) offset antenna reflector, its manufacturing approach, and the development of a light weight, inflatable stabilization torus to be used for this design are described. A structural concept for a 12 m aperture offset reflector was defined. A continuous fabrication method for the stabilization torus was identified. Instruments for the torus design which relate the mass added by the torus complex and the pressure level, necessary for stabilization purposes were prepared. Tests with an unreinforced simulacrum of the inflatable reflector, which validate the proposed pressure prediction formulas, were performed. A development plan, leading to a ground demonstration of the ISRS technology for large expandable structures is presented. Author (ESA)

British Aerospace Dynamics Group, Stevenage N84-18457# (England). Space and Communications Div.

DESIGN AND DEVELOPMENT OF AN ADVANCED SOLAR ARRAY DRIVE MECHANISM

J. S. SHEPPARD In ESA First European Space Mech. and Tribology Symp. p 19-26 Dec. 1983 refs Avail: NTIS HC A10/MF A01

The design and development of a solar array drive capable of transferring 7kW of power or more is described. Results of functional performance and environmental tests encompassing L-SAT/Olympus qualification levels are summarized. The drive consists of power slip ring, bearing support, drive actuator, and pyro/signal slip ring modules. Thermal vacuum, accelerated life test, and vibration tests are satisfactory. Author (ESA)

British Aerospace Dynamics Group, Stevenage N84-18475# (England). Space and Communications Div. BAE REACTION WHEELS FOR OLYMPUS

G. J. STURTIVANT In ESA First European Space Mech. and Tribology Symp. p 187-192 Dec. 1983 refs Avail: NTIS HC A10/MF/ A01

The design philosophy and achievements of the Olympus reaction wheel are presented. The design incorporates a compliant bearing preload arrangement which reduces the launch phase loads applied to the bearings. The fiber optic commutation sensor system is described, together with the four-phase brushless, ironless dc electric motor which achieves a very low output torque ripple. Author (ESA)

N84-20621 Purdue Univ., Lafayette, Ind. ANALYSIS OF LARGE SPACE STRUCTURES Ph.D. Thesis S. ABRATE 1983 182 p

Avail: Univ. Microfilms Order No. DA8400322

Typically, large space structures are latticed beams or plates made up of a very large number of elements assembled in a periodic pattern with overall dimensions possibly measured in miles. Efficient dynamic models are needed for design optimization, and control problems. Harmonic wave propagation analysis is used to determine the limits of applicability of the simple continuum models. Several equivalent continuum models are developed and evaluated comparatively. The range of validity of these continuum models is established in terms of wavelength. The presence of modes which are not predicted by the simple models is detected by considering a typical cell of the original structure. Procedures for including damping in the simple models are presented. Viscous, hysteretic, and a three parameter type damping models are discussed. The analysis of geometrically nonlinear trusses is performed, and the continuum beam models are shown to be efficient and accurate for both static and dynamic problems. Dissert. Abstr.

N84-21607*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TETHERS IN SPACE: BIRTH AND GROWTH OF A NEW AVENUE TO SPACE UTILIZATION

G. VONTIESENHAUSEN Feb. 1984 33 p refs

(NASA-TM-82571; NAS 1.15:82571) Avail: NTIS HC A03/MF A01 CSCL 22B

The evolution of the ideas of tether applications in space are traced from its origin in the last century past a dormant period of sixty-five years to the mid-seventies. At that time as a consequence of major revival efforts, NASA entered into serious investigations of the theoretical and practical feasibility of a large number of tethered concepts in space. These efforts culminated in the establishment of the Tethered Satellite System Project now at NASA in the advanced development phase. Extensive planning efforts are described, first, through a Tether Applications in Space Workshop which generated additional concepts and provided overall assessments and recommendations to NASA, and then through a NASA inter-center Tether Applications in Space Task Group which generated a four year program plan in the areas of further studies, technology, work and science and applications of tethers in space. An outlook into the future of tether applications that approaches some of the goals of the early visionaries is offered. Author

N84-21620# Consulenze Generali Roma (Italy). STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 3: EXPERIMENTAL DESIGN VERIFICATION TECHNIQUES Final Report

C. ARDUINI and U. PONZI Paris ESA Dec. 1982 428 p refs 5 Vol.

(Contract ESTEC-4348/80/NL-AK(SC))

(ESA-CR(P)-1779-VOL-5) Avail: NTIS HC A19/MF A01

Ground and flight tests of large space structures are discussed. Thermal balance tests, thermal cycle tests, the effects of scale reductions, and gravitational effects are considered. Static, dynamic, and modal structural analysis techniques are reviewed. N84-21624# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 1: ASSESSMENT OF DESIGN VERIFICATION ANALYTICAL METHODS. VOLUME 1: MECHANICAL DESIGN Final Report

C. ARDUINI and U. PONZI Paris ESA Dec. 1982 480 p refs 5 Vol.

(Contract ESTEC-4348/80/NL-AK(SC))

(ESA-CR(P)-1779-VOL-1) Avail: NTIS HC A21/MF A01

Softwares for large spacecraft structural dynamic/control dynamic verification are reviewed. The ASKA, NASTRAN, SPAR, DISCOS, and N-BOD programs are described. Decoupling, substructuring, and the effects of structural symmetry are discussed. For mechanical design verification, orbital flight conditions replace launch stresses tolerance as the main criterion. For thermal design, verifying thermal deformations is paramount for large space structures. Software for design verification of these structures should integrate thermal and mechanical parameters into an interactive scheme. Author (ESA)

N84-21625# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 1: ASSESSMENT OF DESIGN VERIFICATION ANALYTICAL METHODS. VOLUME 2: THERMAL DESIGN Final Report

C. ARDUINI and U. PONZI Paris ESA Dec. 1983 411 p refs 5 Vol.

(Contract ESTEC-4348/80/NL-AL(SC))

(ESA-CR(P)-1779-VOL-2) Avail: NTIS HC A18/MF A01

Thermal design verification of large space systems through software evaluation was studied. The analytical methods were summarized with special emphasis on the Lockheed orbital heat rate package, the thermal radiation analysis system, NASTRAN thermal analyzer, and the simplified shuttle payload thermal analyzer. Basic concepts of thermodynamic modeling and structural characteristics were included along with the relevant equilibrium equations. M.A.C.

N84-22179*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPUTER-AIDED GEOMETRY MODELING

J. N. SHOOSMITH, comp. and R. E. FULTON, comp. Washington Mar. 1984 387 p refs Symp. held in Hampton, Va., 20-22 Apr. 1983

(NASA-CP-2272; L-15618; NAS 1.55:2272) Avail: NTIS HC A17/MF A01 CSCL 12A

Techniques in computer-aided geometry modeling and their application are addressed. Mathematical modeling, solid geometry models, management of geometric data, development of geometry standards, and interactive and graphic procedures are discussed. The applications include aeronautical and aerospace structures design, fluid flow modeling, and gas turbine design.

N84-22191*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INTERACTIVE GEOMETRY MODELING OF SPACE STATION CONCEPTUAL DESIGNS Abstract Only

D. D. DERYDER, M. J. FEREBEE, JR., and M. L. MCMILLIN *In its* Computer-Aided Geometry Modeling p 101-102 Mar. 1984 Avail: NTIS HC A17/MF A01 CSCL 09B

With the advent of a serious interest in the design and implementaton of a low-Earth orbit, manned space station, the need has arisen to rapidly synthesize, characterize, and analyze many conceptual designs. Because the manual generation and analysis of a mathematical design model could consume many man-months, an interactive modeling and analysis capability is sought. This poster session will demonstrate the activities and current capabilities at NASA LaRC that could support the modeling analysis of space station conceptual designs. Author

N84-22224*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MATHEMATICAL SYNTHESIZATION OF COMPLEX STRUCTURES

L. B. GARRETT In its Computer-Aided Geometry Modeling p 389-398 Mar. 1984 refs

Avail: NTIS HC A17/MF A01 CSCL 12A

A mathematical synthesization approach for rapidly modeling and analyzing complex structures comprised of hundreds or thousands of repeating individual structural members, interconnecting hardware, and other components was described. The techniques are applicable to any structure with repeating structural members. The capabilities are embodied within the Interactive Design and Evaluation of Advanced Spacecraft (IDEAS) computer-aided design system. IDEAS has a full range of integrated spacecraft modeling, design, analysis, performance, and cost estimating capabilities which include about 40 technical program and executive, data base, and file management systems. With IDEAS, a single user at an interactive terminal can create. design. analyze, and conduct parametric studies of Earth orbiting spacecraft in a timely, cost-efficient manner. The system is particularly useful in the conceptual design phases of advanced space missions when a multiplicity of concepts must be evaluated. The IDEAS interactive capabilities are discussed. finite-element modeling The mathematical synthesization programs were structured not only to provide a detailed finite-element model of the structure but also to automatically perform the many auxiliary computations needed to analyze the spacecraft in its orbital operational environment. M.A.C.

03

STRUCTURAL CONCEPTS

Includes erectable structures (joints, struts, and columns), deployable platforms and booms, solar sail, deployable reflectors, space fabrication techniques, and protrusion processing.

A84-10141*# California Univ., Los Angeles.

APPROXIMATIONS METHOD FOR SPACE FRAME SYNTHESIS W. C. MILLS-CURRAN, R. V. LUST, and L. A. SCHMIT (California, University, Los Angeles, CA) (Structures, Structural Dynamics and Materials Conference, 23rd, New Orleans, LA, May 10-12, 1982, Collection of Technical Papers, Part 2, p. 187-200) AIAA Journal (ISSN 0001-1452), vol. 21, Nov. 1983, p. 1571-1580. refs

(Contract NSG-1490)

Previously cited in issue 13, p. 2109, Accession no. A82-30149

A84-11922

ANALYSIS AND DESIGN OF LEAF-SPRING FLEXIBLE JOINTS FOR DRIVING GYROSCOPIC ROTORS

J. L. SCIESZKO and W. M. MANSOUR (Rio de Janeiro, Universidade Federal, Rio de Janeiro, Brazil) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 2. Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 155, 156.

The present investigation is concerned with the development of algorithms for the exact solution of the nonlinear mathematical model which governs the static performance of the flexible joint employed to drive gyroscopic rotors. The constructed mathematical model takes into account the relationships between the internal forces and the deflections in each leaf. The model has nonlinear characteristics. The derived computing algorithm was implemented in a routine to evaluate the stress levels and buckling loads for the joints. Attention is given to the case where the two leaves are identical, and some typical plots. G.R.

A84-21517#

THE BEAM-LIKE BEHAVIOR OF SPACE TRUSSES

J. D. RENTON (Oxford University, Oxford, England) AIAA Journal (ISSN 0001-1452), vol. 22, Feb. 1984, p. 273-280. refs

A general approach is developed for determining the overall elastic behavior of space trusses. This is done by casting the matrix equations for pin-ended bars in a suitable algebraic form and using them to construct the finite difference equations for the truss under examination. Characteristic solutions of the homogeneous form of these equations are found in terms of simple polynomial functions. These correspond to the resultant forces and moments applied to the truss. All other modes decay toward these characteristic deflections. This means that the internal loads in the truss can be estimated from the resultant applied loading, even when the truss is not statically determinate. Also, the characteristic response yields elastic properties akin to the axial, torsional, bending, and shear stiffness of beams, although in some cases these effects are coupled. Values for a number of common space trusses are listed. It is also shown how the method may be used to give the natural frequencies of vibration of such structures. Author

A84-22153#

DESIGN AND DEVELOPMENT OF THE INTELSAT V GRAPHITE-EPOXY CENTRAL THRUST TUBE

N. BARBERIS (Ford Aerospace and Communications Corp., Palo Alto, CA), M. ZILANI, and C. GABRIEL (SocieteNationale Industrielle Aerospatiale, Cannes, France) (Structures, Structural Dynamics and Materials Conference, 23rd, New Orleans, LA, May 10-12, 1982, Collection of Technical Papers. Part 2, p. 594-602) Journal of Spacecraft and Rockets (ISSN 0022-4650), vol. 21, Jan.-Feb. 1983, p. 55-60. Research sponsored by the International Telecommunications Satellite Organization.

Previously cited in issue 13, p. 2030, Accession no. A82-30189

A84-22859#

LOCAL STABILITY OF SANDWICH STRUCTURES WITH THIN FIBRE REINFORCED FACE SKINS FOR SPACE APPLICATION H. BANSEMIR and K. PFEIFER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Society for the Advancement of Material and Process Engineering, Technology Conference on Engineering with Composites, 3rd, London, England, Mar. 14-16, 1983, Paper. 32 p.

(MBB-UD-381-83-OE)

Sandwich structures with thin carbon and aramid epoxy face skins are used in the INTELSAT V, INTELSAT VI, OTS and EXOSAT solar arrays. Structural instability of these structures can manifest itself in a number of different modes. The ultimate compressive stresses are defined by wrinkling stresses. These are related to a mode with short wave lengths in the face sheets. A theory of general stability is derived and the theoretical stresses are compared with test values. Author

A84-22965* Hughes Aircraft Co., Los Angeles, Calif. WELDED SOLAR CELL INTERCONNECTION

E. J. STOFEL, E. R. BROWNE, R. A. MEESE, and G. J. VENDURA (Hughes Aircraft Co., Space and Communications Group, Los Angeles, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 45-50.

(Contract JPL-956038)

The efficiency of the welding of solar-cell interconnects is compared with the efficiency of soldering such interconnects, and the cases in which welding may be superior are examined. Emphasis is placed on ultrasonic welding; attention is given to the solar-cell welding machine, the application of the welding process to different solar-cell configurations, producibility, and long-life performance of welded interconnects. Much of the present work has been directed toward providing increased confidence in the reliability of welding using conditions approximating those that would occur with large-scale array production. It is concluded that there is as yet insufficient data to determine which of three methods (soldering, parallel gap welding, and ultrasonic welding) provides the longest-duration solar panel life. B.J.

A84-23366#

OPTIMIZATION OF SHALLOW TRUSSES AGAINST LIMIT POINT INSTABILITY

M. P. KAMAT (Virginia Polytechnic Institute and State University, Blacksburg, VA), N. S. KHOT, and V. B. VENKAYYA (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) AIAA Journal (ISSN 0001-1452), vol. 22, March 1984, p. 403-408. refs

The problem of the maximization of the critical load (limit point instability) of shallow space trusses of constant volume or weight is considered. Exact solutions being possible in simple cases, a detailed investigation of the question of the uniqueness of the optimum designs for two- and four-bar shallow truss problems is carried out. The optimized trusses satisfy the constant-strain energy density criteria and the load maximization problem is verified to be the dual of the minimization of the total potential energy.

Author

A84-25258#

A DEPLOYABLE 30/20 GHZ MULTIBEAM OFFSET ANTENNA

B. ABT (Dornier System GmbH, Friedrichshafen, West Germany) and H. WOLLENHAUPT (ANT Nachrichtentechnik GmbH, Backnang, West Germany) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 54-63. Research supported by the Bundesministerium fuer Forschung und Technologie. (AIAA PAPER 84-0658)

This paper presents the results of a feasibility study for the

design of a 30/20 GHz multibeam satellite antenna with bandwidth of 2.5 GHz and for a continuous coverage of West Germany, including West Berlin. The required dual offset Cassegrain reflector system has a precision deployable (rigid panels) main reflector with a diameter of 4.7 m. The continuous coverage requires an edge gain of at least 47 dB. To maintain a high decoupling between the individual earth stations in different zones, a pointing accuracy of better than 0.3 deg RMS has to be achieved. This can only be realized by a closed loop RF-tracking system with a low power consumption pointing mechanism. Author

A84-29862

THE DEVELOPMENT OF A COMPOSITE BEAM BUILDING MACHINE FOR ON-SITE CONSTRUCTION OF LARGE SPACE STRUCTURES

W. B. GOLDSWORTHY (Goldsworthy Engineering, Inc., Torrance, CA) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 177-182. refs

(AAS PAPER 83-217)

Composites will be favored for beam construction in space for two reasons. The first is the need for materials of low density and high strength in projects where the cost of transportation will be dominant. The second is the requirement that the material have a zero thermal coefficient of expansion. An outline is presented of material selection and the development of prototype feasibility demonstration equipment for continuously producing, in space, triangular truss beams 1-1/2 meters on a side with closed beam caps. CR

N84-10175*# Rockwell International Corp., Downey, Calif. Shuttle Integration and Satellite Systems Div.

DEVELOPMENT OF DEPLOYABLE STRUCTURES FOR LARGE SPACE PLATFORM SYSTEMS. VOLUME 1: EXECUTIVE **SUMMARY Final Report**

H. S. GREENBERG Oct. 1983 27 p refs

(Contract NAS8-34677)

(NASA-CR-170913; NAS 1.26:170913; SSD-83-0094-1-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 22B

The preponderance of study effort was devoted toward the deployable platform systems study which culminated in the detailed design of a ground test article for future development testing. This design is representative of a prototype square-truss, single-fold building-block design that can construct deployable platform structures. This prototype design was selected through a comprehensive and traceable selection process applied to eight competitive designs. The selection process compared the competitive designs according to seven major selection criteria, i.e., design versatility, cost, thermal stability, meteoroid impact significance, reliability, performance predictability, and orbiter integration suitability. In support of the foregoing, a materials data base, and platform systems technology development needs were established. An erectable design of an OTV hangar was selected and recommended for further design development. This design was selected from five study-developed competitive single-fold and double-fold designs including hard-shell and inflatable designs. Also, two deployable manned module configurations, i.e., a hard-shell and an inflatable design were each developed to the same requirements as the composite of two Space station baseline N.W habitat modules.

N84-10176*# Rockwell International Corp., Downey, Calif. Shuttle Integration and Satellite Systems Div.

DEVELOPMENT OF DEPLOYABLE STRUCTURES FOR LARGE SPACE PLATFORMS. VOLUME 2: DESIGN DEVELOPMENT **Final Report**

H. S. GREENBERG Oct. 1983 183 p refs (Contract NAS8-34677)

(NASA-CR-170914; NAS 1.26:170914; SSD-83-0094-2-VOL-2) Avail: NTIS HC A09/MF A01 CSCL 22B

Design evolution, test article design, test article mass properties, and structural analysis of deployable platform systems are discussed. Orbit transfer vehicle (OTV) hangar development, OTV hangar concept selection, and manned module development are discussed. Deployable platform systems requirements, material data base, technology development needs, concept selection and deployable volume enclosures are also discussed. N.W.

N84-11199 Columbia Univ., New York. ACTUATOR PLACEMENT CONSIDERATIONS FOR THE **CONTROL OF LARGE SPACE STRUCTURES Ph.D. Thesis** R. E. LINDBERG 1982 126 p refs

Avail: Univ. Microfilms Order No. DA8307603

The problem of actuator placement for the control of distributed parameter systems such as large flexible space structures is considered. Focus is placed first on the concept of the degree of controllability. The behavior of the degree of controllability and its approximation is considered via application to simple problems for which the exact value may be computed. The upper bound approximation is found to be particularly exact for harmonic systems and an acceptable approximation for lightly damped systems. A method is proposed for avoiding the unacceptable behavior of the approximation in the neighborhood of a problem containing repeated roots. The divergence of the upper bound approximation in the problem of a double integral plant motivates the development of a new lower bound approximation based on discretization of the continuous time system. Dissert. Abstr.

N84-14561 Nebraska Univ., Lincoln.

NEW ELEMENTS FOR ANALYSIS OF SPACE FRAMES WITH **TAPERED MEMBERS Ph.D. Thesis**

Y. W. LEE 1983 204 p

Avail: Univ. Microfilms Order No. DA8314904

The closed forms of the linear stiffness matrix, geometric stiffness matrix, displacement functions and equivalent nodal loads are developed for analyses of space structures containing linearly tapered members with cross sections of thin-walled tubes, solid rectangles and I-sections. The series expansion forms of these are also developed because they avoid numerical failure in structural analyses under extremely small taper. The cross sectional properties are closely approximated by the ordering process if the geometric properties along the member do not follow a simple power law. Then, solutions are obtained by direct integration of the differential equations for displacements and the moment area

theorem. The elements presented can be used for the linear stability and the large deflection analysis of tapered and prismatic Dissert, Abstr. members.

N84-17226*# Rockwell International Corp., Downey, Calif. Shuttle Integration and Satellite Systems Div.

DEVELOPMENT OF TEST ARTICLE BUILDING BLOCK (TABB) FOR DEPLOYABLE PLATFORM SYSTEMS

H. S. GREENBERG and R. T. BARBOUR In NASA. Langley Research Center STEP Expt. Requirements p 199-210 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The concept of a Test Article Building Block (TABB) is described. The TABB is a ground test article that is representative of a future building block that can be used to construct LEO and GEO deployable space platforms for communications and scientific payloads. This building block contains a main housing within which the entire structure, utilities, and deployment/retraction mechanism are stowed during launch. The end adapter secures the foregoing components to the housing during launch. The main housing and adapter provide the necessary building-block-to-building-block attachments for automatically deployable platforms. Removal from the shuttle cargo bay can be accomplished with the remote manipulator system (RMS) and/or the handling and positioning aid (HAPA). In this concept, all the electrical connections are in place prior to launch with automatic latches for payload attachment provided on either the end adapters or housings. The housings also can contain orbiter docking ports for payload installation and maintenance. M.G.

N84-18286*# General Electric Co., Philadelphia, Pa. STRUCTURES AND MECHANISMS

D. PURDY In NASA. Langley Research Center Space Station Technol., 1983 p 109-135 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

Structures, materials, and mechanisms is one of the older technologies in the aerospace business. The Structures, Materials, and Mechanisms Panel was divided into the four basic categories that fit the overall responsibilities of the panel: materials, mechanisms, structural design, and analysis. Author

N84-18680*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.

COMPONENT MODE SYNTHESIS AND LARGE DEFLECTION **VIBRATIONS OF COMPLEX STRUCTURES Final Report, 1 Nov.** 1982 - 31 Oct. 1983

C. MEI Feb. 1984 16 p refs

(Contract NAG1-301)

(NASA-CR-173338; NAS 1.26:173338) Avail: NTIS HC A02/MF A01 CSCL 20K

The accuracy of the NASTRAN modal synthesis analysis was assessed by comparing it with full structure NASTRAN and nine other modal synthesis results using a nine-bay truss. A NASTRAN component mode transient response analysis was also performed on the free-free truss structure. A finite element method was developed for nonlinear vibration of beam structures subjected to harmonic excitation. Longitudinal deformation and inertia are both included in the formula. Tables show the finite element free vibration results with and without considering the effects of longitudinal deformation and inertia as well as the frequency ratios for a simply supported and a clamped beam subjected to a uniform harmonic force. ARH

N84-19395*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MANNED-MACHINE SPACE STATION CONSTRUCTION CONCEPT

M. M. MIKULAS, JR., H. G. BUSH, R. E. WALLSOM, J. T. DORSEY, and M. D. RHODES Feb. 1984 33 p refs

(NASA-TM-85762; NAS 1.15:85762) Avail: NTIS HC A03/MF A01 CSCL 22B

A design concept for the construction of a permanent manned space station is developed and discussed. The main considerations

examined in developing the design concept are: (1) the support structure of the station be stiff enough to preclude the need for an elaborate on-orbit system to control structural response. (2) the station support structure and solar power system be compatible with existing technology, and (3) the station be capable of growing in a systematic modular fashion. The concept is developed around the assembly of truss platforms by pressure-suited astronauts operating in extravehicular activity (EVA), assisted by a machine (Assembly and Transport Vehicle, ATV) to position the astronauts at joint locations where they latch truss members in place. The ATV is a mobile platform that is attached to and moves on the station support structure using pegs attached to each truss joint. The operation of the ATV is described and a number of conceptual configurations for potential space stations are developed. Author

N84-19899# Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering. COMPUTER AIDED SYNTHESIS OF A SATELLITE ANTENNA

STRUCTURE WITH PROBABILISTIC CONSTRAINTS

V. K. JHA (SPAR Aerospace Ltd.), T. S. SANKAR, and R. B. BHAT In Shock and Vibration Inform. Center The Shock and Vibration Bull., part 3 p 79-89 May 1983 refs

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20M

The satellite antenna structures have to be designed to withstand the severe environmental conditions encountered by the satellite without failure, and hence they have to be designed with very strict reliability requirements. At the same time these structures should be as light as possible, in weight, to minimize the cost of launching the satellites into space. A computer aided design procedure capable of meeting these design requirements in presented. The procedure involves synthesis of a finite element analysis program capable of analyzing complex structures and a state of the art optimization algorithm into one unified design system. This system is used for designing antenna structures subjected to random excitations and having design requirements specified in a probabilistic manner. An approach is presented to handle probabilistic design requirements. The design of a typical satellite antenna structure realized using the proposed design procedure is presented. Starting from the best guessed design, a saving of 43% in weight is demonstrated. The proposed system is very versatile and the possibilities of extending it for designing other complex structures are also discussed. MG

N84-21608*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MODULES OPERÁTIONAL SPACE FOR STATION CONSTRUCTION

L. R. JACKSON, P. L. MOSES (Kentron International, Inc.), S. J. SCOTT (Kentron International, Inc.), and M. L. BLOSSER Apr. 1984 34 p refs

(NASA-TM-85772; NAS 1.15:85772) Avail: NTIS HC A03/MF A01 CSCL 22B

Identification of an effective space construction concept is a current objective of NASA studies. One concept, described in this memorandum, consists of repetitive use of operational modules, which minimizes on-orbit stay time for the shuttle. A space station constructed of operational modules may benefit from fabrication and system checkout in ground-based facilities, and since the modules are the primary structure of the space station, a minimum of additional structure, and trips and on-orbit stay time of the shuttle are required. Author

N84-21615# Consulenze Generali Roma (Italy). FINITE ELEMENT FORMULATIONS FOR

TENSIONED MEMBERS

S. SGUBINI In its Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 p 277-360 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

The geometrical stiffness matrices are evaluated for typical structures, and the effects of shear deformations and rotary inertia on large space structure design are discussed. In plane and longitudinal deformations, and beam torque moment coupling with all other displacements are considered. Analysis shows that these effects are small, but not negligible. Evaluation of the geometrical stiffness matrix of a square section beam reveals that axial and shear force effects can be of the same order of magnitude with slender beams. Author (ESA)

W84-21914# Technische Univ., Hanover (West Germany). Inst. fuer Statik.

GEOMETRICALLY NONLINEAR ANALYSIS OF BEAM-IN-SPACE STRUCTURES Thesis

G. LUMPE 15 Dec. 1982 107 p refs In GERMAN; ENGLISH summary

(MITT-28; ISSN-0073-0300) Avail: NTIS HC A06/MF A01

A finite element concept for complex beam-in-space structures based on large displacement and small strain theory is developed. Derivation of a beam theory from the three dimensional theory with consistent approaches and error estimations combined with separation of rigid body motion and actual deformation allowed the derivation of a simple tangent stiffness matrix which takes into account geometrically nonlinear effects. The magnitude of error is a function of element length. The rotation of each cross section is described by an orthogonal tensor as a rotation about one skew axis to avoid nonsymmetric stiffness matrices. The range of application includes hinge fitting combination, shear deformation, and hindered torsion. For cable-roll-connections, a simple algorithm which overcomes the difficult kinematic relations of cable rolls by energetical considerations is presented. Efficiency of the computation method is demonstrated by the example of a tower Author (ESA) crane.

N84-2225^{*}# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GEOMETRIC MODELING OF LARGE SPACE ANTENNA DEPLOYMENT Abstract Only

J. NAZEMETZ (Oklahoma State Univ.), K. SAGE (Kentron International), R. L. GATES (Computer Services Corp.), and D. D. DERYDER *In its* Computer-Aided Geometry Modeling p 399 Mar. 1984

Avail: NTIS HC A17/MF A01 CSCL 09B

A dynamic visualization of large antenna deployment was created to be used as a precursor to further analysis of the structure as it is being deployed. The configuration chosen for this investigation was a box-truss structure consisting of a large reflector 60 meters wide by 120 meters long with a 120-meter mast. The entire space structure is folded and compressed into a container 17.8 meters long by 3.75 meters in diameter for transportation to orbit by the Space Transportation System (STS). A geometric model of this structure was created using an interactive solid modeling package. The building blocks of the structure are boxes and cylinders which are put together to form elements connected by joints and hinges. The elements, joints, and hinges make up the box-truss structure. The geometric model was then passed to the MOVIE.BYU software package. The 'utility' module of this program was used to manipulate the elements of the structure to represent 13 different stages of deployment. The 'animate' command was then used to create a smooth sequence between stages. Each step in the sequence was recorded on magnetic tape and a short movie was produced. MAC

STRUCTURAL AND THERMAL ANALYSIS

Includes structural analysis and design, thermal analysis and design, analysis and design techniques, and thermal control systems.

A84-10224

SPACECRAFT THERMAL CONTROL, DESIGN, AND OPERATION

H. E. COLLICOTT, ED. (Boeing Co., Seattle, WA) and P. E. BAUER, ED. (McDonnell Douglas Astronautics Co., St. Louis, MO) New York, American Institute of Aeronautics and Astronautics (Progress in Astronautics and Aeronautics. Volume 86), 1983, 371 p.

Requirements and challenges concerning military spacecraft thermal management are considered along with a Shuttle Orbiter thermal control postflight evaluation, the orbital test satellite thermal experience after 3 1/2 years in orbit, the thermal design and experiment thermal integration of the long duration exposure facility, and satellite thermal design and analyses for expendable and Shuttle launch environments. Topics related to subsystem and discussed, taking components are into account the thermo-mechanical design and analysis system for a 76-in. parabolic antenna reflector, the thermodynamic optimization of a cryogenic storage system for minimum boiloff, and a molecular absorption cryogenic cooler for liquid hydrogen propulsion system. Subjects concerned with material properties and interfaces are explored along with finite-element analysis techniques. A description of heat pipes is also provided, giving attention to osmotic pumped heat pipes for large space platforms, the development of a double-wall artery high-capacity heat pipe, and the Marangoni effect. No individual items are abstracted in this volume G.R.

A84-10440

THERMAL CONTROL OF TUBULAR COMPOSITE STRUCTURES IN SPACE ENVIRONMENT

R. D. KARAM (Fairchild Space Co., Germantown, MD) IN: Composite structures 2; Proceedings of the Second International Conference, Paisley, Scotland, September 14-16, 1983. London, Applied Science Publishers, 1983, p. 235-248. refs

Thermal control of spacecraft tubular composites is discussed. The equations used to calculate orbital temperatures are presented with a description of the design techniques which limit temperature excursions and associated distortions. Laminate fiber orientation is related to heat transfer characteristics, and it is shown that orientations selected to yield high axial strength and least thermal deformations will generally lead to excessive fin effect heat losses. A perforation procedure is proposed to eliminate in-plane deflections in a space environment independently of laminate construction. The lamination sequence may then be optimized to meet strength and heat loss requirements.

A84-11814#

THERMO-MECHANICAL BEHAVIOUR OF CFRP TUBES FOR SPACE STRUCTURES

G. REIBALDI (ESA, Mechanical Systems Div., Noordwijk, Netherlands) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 16 p. refs

(IAF PAPER 83-417)

Relationships between the coefficient of thermal expansion (CTE), thermal cycling, and microcracking were obtained experimentally for carbon fiber reinforced tubes considered by the ESA as candidates for space structural components. Tests were performed on the mechanical properties, outgassing, thermal expansion, fast thermal cycling tolerance, and microcracking, and also on the long-term durability of the tubes to all the test stresses. The CTE decreased with decreasing temperature and increases in thermal cycling. The variation in the CTS decreased with

A84-14050* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

BUCKLING AND VIBRATION OF ANY PRISMATIC ASSEMBLY OF SHEAR AND COMPRESSION LOADED ANISOTROPIC PLATES WITH AN ARBITRARY SUPPORTING STRUCTURE M. S. ANDERSON (NASA, Langley Research Center, Structural Concepts Branch, Hampton, VA), F. W. WILLIAMS (University of Wales Institute of Science and Technology, Cardiff, Wales), and C. J. WRIGHT (british Aerospace PLC, Bristol, England) International Journal of Mechanical Sciences (ISSN 0020-7403), vol. 25, no. 8, 1983, p. 585-596. refs

(Contract NCCW-000002)

The computer program designated 'VIPASA', which accurately treats buckling and vibration in prismatic plate assemblies with a response that varies sinusoidally in the longitudinal direction, has been found to be limited by the production of an in-plane shear loading of component plates that produces skewed mode shapes. These do not conform to desired support conditions. This problem is presently overcome through a coupling of the VIPASA stiffness matrices for different wavelength responses by means of the Lagrangian Multipliers method. The theory extends to supports at arbitrary locations, and even to the support provided by any elastic structure. The generality and capabilities of VIPASA have been retained in the computer program designated 'VICON', which permits constraints and a supporting structure consisting of any number of transverse beam columns. O.C.

A84-17850#

WEIGHT CHARACTERISTICS OF FUTURE SPACECRAFT THERMAL MANAGEMENT SYSTEMS

J. W. SHEFFIELD (Missouri-Rolla, University, Rolla, MO) and V. J. VAN GRIETHUYSEN (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 6 p. refs

(AIAA PAPER 84-0054)

This paper presents the results of an investigation on the weight characteristics of future spacecraft thermal management systems. The sensitivity of the thermal management system weight to the performance requirements of both evolutionary and revolutionary spacecraft missions has been studied. A numerical analysis modeling the transient heat flow through the thermal management system was performed. The performance parameters included the peak thermal load, the peak-to-average thermal load ratio and length of peak load. In addition the sensitivity of the thermal management system weight to the choice of phase change material for heat storage was determined via a heat of fusion parametric analysis. Author

A84-17853#

STRUCTURAL PARAMETER IDENTIFICATION FOR FLEXIBLE SPACECRAFT

S. L. HENDRICKS, S. M. HAYES, and J. L. JUNKINS (Virginia Polytechnic Institute and State University, Blacksburg, VA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 5 p. USAF-supported research. refs

(AIAA PAPER 84-0060)

A system identification procedure applicable to large flexible spacecraft is presented. An iteration scheme is used to obtain best estimates for a small set of key system parameters so that the predicted natural frequencies and damping factors agree with measured values. Numerical simulations are presented based on an actual test structure under development at the Charles Stark Draper Laboratories. Author

A84-17910#

SPACECRÄFT THERMAL DESIGN USING INTERACTIVE GRAPHICS

M. S. CROUTHAMEL (RCA Advanced Technology Laboratories, Camden, NJ) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 8 p.

(AIAA PAPER 84-0143)

This paper describes the thermal analysis of a geosynchronous communications satellite in launch configuration. PATRAN was used as the interactive solid geometry modeler. Some PATRAN models were coupled to the TRASYS thermal radiation analyzer to determine radiative couplings and environmental inputs. Other PATRAN models were coupled to SINDA to determine conductive couplings and thermal masses. Finally, the TRASYS and SINDA inputs from PATRAN were combined to determine transient and steady-state temperature distributions. Author

A84-17911*# Washington Univ., Seattle.

RADIATION CONDUCTION INTERACTION IN LARGE SPACE STRUCTURES

A. F. EMERY, H. R. MORTAZAVI, and S. O. SMITH (Washington, University, Seattle, WA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 9 p. refs

(Contract NAG1-41)

(AIAA PAPER 84-0144)

The effects of a penumbra due to the long wave radiation emitted by the earth or to solar energy reflected from the earth on temperature distributions, deflections and stresses in plates are studied to determine their importance in the design of space structures. An examination of the state of stress in a thin plate exposed to the sun suggests that deflections are only slightly modified by the penumbra, but that stresses in the vicinity of the shadow line are more affected. Even with the smoothing due to the penumbra, these stresses should be considered in the design of space structures. A simple relationship is given by which albedo viewfactors can be easily derived from the direct viewfactor, thus simplifying the radiation analysis.

A84-21284#

MULTI-MEGAWATT SPACE POWER THERMAL MANAGEMENT SYSTEM REQUIREMENTS

R. T. TAUSSIG (Mathematical Sciences Northwest, Inc., Bellevue, WA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 7

(AIAA PAPER 84-0056)

Multi-megawatt space power systems will require a novel approach to manage the enormous amounts of waste heat generated. Mission constraints such as average and peak power requirements, power system duty cycle, on-board end use power requirements, and mission lifetime, orbit parameters, maneuver and attitude control accelerations, speed of deployment, and other related requirements are used to define the amounts, temperatures, and temporal duration of waste heat production. These quantities are then applied to the design and optimization of a thermal management system based on a thermal bus. Applications include 100 kw to 1 MW space platforms and burst mode missions requiring up to several hundred MW of electric power.

A84-28237

THERMAL-MECHANICAL BEHAVIOR OF GRAPHITE/MAGNESIUM COMPOSITES

B. J. MACLEAN and M. S. MISRA (Martin Marietta Aerospace, Denver, CO) IN: Mechanical behavior of metal-matrix composites; Proceedings of the Symposium, Dallas, TX, February 16-18, 1982 . Warrendale, PA, The Metallurgical Society of AIME, 1983, p. 195-212. refs

Continuous-filament, graphite-reinforced magnesium composites exhibit exceptional unidirectional mechanical properties fo their weight. For aerospace applications requiring high modulus, light-weight, thermal deformation-resistant materials, Gr/Mg promises substantial payoffs, and is compared to other more conventional materials. Single-ply and 3-ply VSB32/AZ91C/AZ31B panels and single ply VS0054/AZ91C/AZ31B panels were evaluated. NDI techniques of X-radiography, ultrasonic C-scan, and liquid penetrant were used to assess filament collimation, face sheet disbonds, and sheet tears or pitting, respectively. Ambient temperature tensile testing yielded longitudinal elastic modulus values predicted by the rule-of-mixtures (32.4 Msi for 28.4 volume-percent Pitch 100 Gr/Mg) and ultimate tensile strengths of better than 83 ksi. Failure analysis and fractography were then conducted to determine failure modes.

A84-29032* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THERMAL MANAGEMENT SYSTEM TECHNOLOGY DEVELOPMENT FOR SPACE STATION APPLICATIONS

J. G. RANKIN and P. F. MARSHALL (NASA, Johnson Space Center, Houston, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 14 p. refs

(SAE PAPER 831097)

A short discussion of the history to date of the NASA thermal management system technology development program is presented, and the current status of several ongoing studies and hardware demonstration tasks is reported. One element of technology that is required for long-life, high-power orbital platforms/stations that is being developed is heat rejection and a space-constructable radiator system. Aspects of this project include high-efficiency fin concepts, a heat pipe quick-disconnect device, high-capacity heat pipes, and an alternate interface heat exchanger design. In the area of heat acquisition and transport, developments in a pumped two-phase transport loop, a capillary pumped transport loop using the concept of thermal utility are reported. An example of a thermal management system concept is provided.

A84-29036

A CONTACT CONDUCTANCE INTERFACE FOR A SPACE CONSTRUCTABLE HEAT PIPE RADIATOR

J. A. OREN and M. L. FLEMING (Vought Corp., Dallas, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 11 p.

(SAE PAPER 831101)

The design, development, feasibility demonstration, and testing of a prototype heat exchanger device which will provide an interface thermal control spacecraft subsystem with a at connectable/disconnectable joint is described. The approach taken involves pressurized clamping of a segmented cylindrical heat exchanger on the outside of a round heat pipe evaporator section, and is intended to provide a contact heat exchanger which could be connected or disconnected without breaking of fluid systems in the assembly/dissembly of radiator panels. The heat pipe radiators are 9 to 18 m in length and use a single high-capacity heat pipe attached to a fin 15 to 30 cm wide. In testing, thermal conductance across the interface of 8500 w/sq m-deg C and overall conductance of 4300 w/sq m-deg C were obtained.

A84-29067

THERMAL CONTROL OF THE TETHERED SATELLITE MODULE

G. BORRIELLO and G. PELLIS (Aeritalia S.p.A., Turin, Italy) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 11 p.

(SAE PAPER 831138)

Thermal analytical modeling plays an important role in the design, development and evaluation of the Space Shuttle's Tethered Satellite System (TSS) module, which in accomodating a wide range of experiments and instruments requires variable thermal control features. The TSS design approach to thermal control encompasses external and internal coatings, control of thermally conductive paths, the use of multilayer insulation blankets, and electrical heaters. Standard thermal computer programs are used to evaluate spacecraft radiative exchange, quantify heat flux impingements on surfaces, and predict resulting temperature variations, at various Space Shuttle Orbiter orientations with respect to solar flux.

A84-29071

THE THERMAL DESIGN OF THE EUROPEAN COMPLEMENT OF FSLP

U. LAUX (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 11 p.

(SAE PAPER 831144)

Due to the unique requirements of the First Spacelab Mission, extensive analytical efforts have had to be made to determine instrument rack thermal characteristics. In the case of Space Shuttle Orbiter cargo bay-located payloads, such analytical studies can be less demanding provided that the instrumentation whose thermal control is in question employs the Shuttle's Freon-cooling loop and makes effective use of thermal insulation. In the case of complex experiment configurations, additional systems for the optimal control of human contact areas rather than heat rejection capabilities must be developed. It is noted that the thermal insulation practices developed for the European Bridge Assembly yield both higher thermal performance and greater integration flexibility. O.C.

A84-29076* United Technologies Corp., Windsor Locks, Conn. REGENERABLE NON-VENTING THERMAL CONTROL SUBSYSTEM FOR EXTRAVEHICULAR ACTIVITY

G. J. ROEBELEN, JR., K. J. DRESSER, E. W. HODGSON, JR. (United Technologies Corp., Hamilton, Standard Div., Windsor Locks, CT), and C. LIN (NASA, Johnson Space Center, Houston, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 15 p. (Contract NAS9-16609)

(SAE PAPER 831151)

Extravehicular Mobility Unit heat rejection requirements have been formulated for both Space Shuttle Orbiter and space station regenerable nonventing thermal sink (RNTS) applications, where the former involve nonventing extravehicular activity (EVA) missions and the latter both nonventing and regenerable EVA. The present conceptual study notes that while the exclusive use of thermal storage is suitable for the Space Shuttle mission, space station requirements are best satisfied by a hybrid system which combines thermal storage with radiator and heat pump. The Space Shuttle RNTS thermal control subsystem's thermal storage unit uses water as a phase change medium. It is noted that the same heat storage unit can satisfy the Space Shuttle and space station requirements. O.C. N84-11200 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Betriebsbereich.

SPACECRAFT THERMAL CONTROL SELECTION FOR SEVEN YEARS OF LIFETIME IN SYNCHRONOUS ORBIT

L PREUSS Presented at 55th AGARD/SMP 1982 16 p Panel Meeting/Specialists Meeting on Environ. Effects on Mater. for Space Appl., Toronto, 19-24 Sep. 1982

(MBB-UR-584-82-OE) Avail: Issuing Activity

Nonconductive and conductive flexible second surface mirrors (SSM) with interference filters on top for satellite use are presented. The SSM composition is analyzed and defined. The optimization procedure for the SSM is outlined. The qualification of the SSM on laboratory scale for synchronous orbit is demonstrated. Handling, application and performance specifications are given.

Author (ESA)

N84-15329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA NEEDS AND TRENDS IN CRYOGENIC COOLING

A. SHERMAN In its Refrig. for for Cryogenic Sensors p 13-27 Dec. 1983 refs Avail: NTIS HC A19/MF A01 CSCL 20L

Projected NASA needs in spaceborne cryogenic systems and recent results of NASA cryogenic cooling technology efforts in infrared astronomy, X-ray astronomy, gamma ray astronomy, liquid helium and space stations are discussed.

N84-15426*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THERMAL ANALYSIS RESEARCH APPLICABLE TO SPACE STATION TECHNOLOGY NEEDS

H. M. ADELMAN Apr. 1983 53 p Presented at the Space State Technol. Workshop, Williamsburg, Va., 28-31 Mar. 1983 (NASA-TM-84658; NAS 1.15:84658) Avail: NTIS HC A04/MF A01 CSCL 20D

Thermal analysis, optimization, and software research and development at the NASA Langley Research Center which is applicable to analytical design calculations for space station structures are summarized. Topics discussed include integrated thermal-structural software, improved thermal radiation analysis, techniques for transient temperatures. solution unified thermal-structural finite elements, thermal structural sensitivity analysis and optimization, and concept and performance analysis for heat pipes. Author

N84-15562# National Centre of Tribology, Risley (England). European Space Tribology Lab.

THERMAL CONDUCTANCE AND TORQUE OF THIN SECTION FOUR-POINT CONTACT BALL BEARINGS IN VACUUM Mar. 1983

R. A. ROWNTREE and M. J. TODD Paris ESA 57 p refs

(Contract ESTEC-4099/79/NL-PP(SC))

(ESA-ESTL-54; ESA-CR(P)-1772) Avail: NTIS HC A04/MF A01 Ball bearings for the L-SAT antenna pointing mechanism (APM) were tested in vacuum with external diameter clearance (i.e., free fit rings) and held in-situ with clamp rings. The influence of speed, temperature, internal preload, axial ring clamping force, lubricant and cage type was examined. As the inner race becomes warmer than the outer, the conductance increases linearly with the temperature difference, whereas the increase in torque is almost a square law relation. With a colder inner race, the bearing develops internal diametral clearance and thus gives low conductance and a small constant torque. Bearing torque and conductance are also shown to be dependent on axial clamping force, internal preload and lubricant quantity. Hysteresis effects of temperature on conductance and torque, and the contribution of the cage to the overall bearing torque are noted. By suitable selection of internal preload and clamping force, the design requirements for L-SAT APM bearings can be achieved. Author (ESA) N84-16509# Sandia Labs., Livermore, Calif. Systems Evaluation Div

SODIUM HEAT TRANSFER SYSTEM MODELING

A. F. BAKER and M. E. FEWELL (Sandia Labs., Albuquerque, N. 6 p refs Presented at the ASME Winter Ann. 1983 Mex.) Meeting, Boston, 13-18 Nov. 1983

(Contract DE-AC04-76DP-00789)

(DE84-002051; SAND-83-1631C; CONF-831111-9) Avail: NTIS HC A02/MF A01

The sodium heat transfer system of the international energy agency (IEA) small solar power systems (SSPS) central receiver system (CRS), which includes the heliostat field, receiver, hot and cold storage vessels, and sodium/water steam generator was modeled. The computer code SOLTES (simulator of large thermal energy systems), was used to model this system. The results from SOLTES are compared to measured data. DOF

N84-16565*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics. SELF-SHADOWING OF ORBITING TRUSSES Progress Report

J. MAHANEY and E. A. THORNTON Aug. 1983 48 p

(Contract NAG1-257)

(NASA-CR-173215; NAS 1.26:173215) Avail: NTIS HC A03/MF A01 CSCL 131

The approach used to assess shadowing reductions on the heating of orbiting trusses involves determining the heating rates with slender member shadowing effects included and then obtaining the thermal response of the shadowed member. Steps taken to identify shadowers, find locations where shadowing occurs and calculate shadow intensity are listed. The finite element thermal structural analysis of cable stiffened space structure is delineated and the exact solution of the caternary problem is given. Typical cable surface heating rates are plotted. The structural analysis includes large deformation (nonlinear), thermal effect, and the pretension effect. Displacements and stresses are computed at different orbital positions for an orbit. A.R.H.

N84-17222*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THERMAL ENERGY MANAGEMENT PROCESS EXPERIMENT S. OLLENDORF In NASA. Langley Research Center STEP Expt. Requirements p 161-163 Jan. 1984 Avail: NTIS HC A15/MF A01 CSCL 22B

The thermal energy management processes experiment (TEMP) will demonstrate that through the use of two-phase flow technology, thermal systems can be significantly enhanced by increasing heat transport capabilities at reduced power consumption while operating within narrow temperature limits. It has been noted that such phenomena as excess fluid puddling, priming, stratification, and surface tension effects all tend to mask the performance of two-phase flow systems in a 1-g field. The flight experiment approach would be to attack the experiment to an appropriate mounting surface with a 15 to 20 meter effective length and provide a heat input and output station in the form of heaters and a radiator. Using environmental data, the size, location, and orientation of the experiment can be optimized. The approach would be to provide a self-contained panel and mount it to the STEP through a frame. A small electronics package would be developed to interface with the STEP avionics for command and data handling. During the flight, heaters on the evaporator will be exercised to determine performance. Flight data will be evaluated against the ground tests to determine any anomalous behavior.

M.G.

N84-18289*# Grumman Aerospace Corp., Bethpage, N.Y. THERMAL CONTROL

B. HASLETT In NASA. Langley Research Center Space Station Technol., 1983 p 165-186 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

There are basically three key ingredients to the thermal control system for any large space platform or space station. These are heat rejection (from a centralized radiator or from body mounted radiators), heat acquisition (from payloads), and heat transport (via a transport loop to the radiator). The echnical approach in the heat rejection area is to construct the radiator from individual elements so that it can be built on-orbit, is very insensitive to meteoroid and debris hazards, and is repairable. In the area of thermal acquisition and transport an added effort to better understand two phase flow in zero gravity by analysis and testing is suggested. Author

N84-18576*# National Aeronautics and Space Administration, Washington, D. C.

SECOND ALL-UNION SEMINAR ON HYDROMECHANICS AND HEAT-MASS TRANSFER IN WEIGHTLESSNESS. ABSTRACTS OF REPORTS: TABLE OF CONTENTS

G. Z. GERSHUNI and Y. M. ZHUKHOVITSKIY Jan. 1984 15 p Transl. into ENGLISH of conf. papers, 1981 p 176-186 refs Seminar held in Perm, USSR, 1981

(Contract NASW-3542)

(NASA-TM-77534; NAS 1.15:77534) Avail: NTIS HC A02/MF A01 CSCL 20D

Abstracts of reports are given which were presented at the Second All Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Topics inlcude: (1) features of crystallization of semiconductor materials under conditions of microacceleration: (2) experimental results of crystallization of solid solutions of CDTE-HGTE under conditions of weightlessness; (3) impurities in crystals cultivated under conditions of weightlessness; and (4) a numerical investigation of the distribution of impurities during guided crystallization of a melt. B.W.

N84-19396# European Space Agency, Paris (France). ENVIRONMENTAL AND THERMAL CONTROL SYSTEMS FOR SPACE VEHICLES

T. D. GUYENNE, ed. and J. J. HUNT, ed. Dec. 1983 576 p refs Partly in FRENCH and ENGLISH Proc. of Intern. Symp., 576 p Toulouse, 4-7 Oct. 1983; sponsored by CNES and ESA Original contains color illustrations

(ESA-SP-200; ISSN-0379-6566) Avail: NTIS HC A25/MF A01; ESA, Paris FF 250, Member States, AU, CN and NO (+20% others)

Spacecraft thermal testing, thermal control technology, thermal control design, cryogenics, and thermal analysis were discussed. Environmental control systems for space stations and platforms, and in flight experience were considered.

N84-19398# Aeritalia S.p.A., Torino (Italy).

DEVELOPMENT OF A SPACECRAFT INFRARED TEST TECHNIQUE AS AN ALTERNATIVE TO SOLAR SIMULATION: FIRST STEPS ON L-SAT THERMAL MODEL

P. MESSIDORO, D. BOGGIATTO, M. PATACCIA, and P. BURATTI In ESA Environ. and Thermal Control Systems for Space Vehicles p 11-17 D Avail: NTIS HC A25/MF A01 Dec. 1983 refs

The L-Sat satellite was used for an off-line investigation to develop an infrared test technique alternative to solar simulation, because of its large size and the presence of heat pipes on its north/south radiators. The infrared test set-up facility and test sequence; lamp characteristics; surface property measurements; flux calculation; flux measurement; power control system; lamp rig design; and test prediction and correlation are described. Improvements to the test technique are suggested.

Author (ESA)

N84-19399# European Space Research and Technology Center, Noordwijk (Netherlands).

THERMAL BALANCE TESTING SPACECRAFT USING INFRARED LAMPS ON A DUMMY SPACECRAFT

G. B. T. TAN and J. B. WALKER In ESA Environ. and Thermal Control Systems for Space Vehicles p 19-25 Dec. 1983 refs Avail: NTIS HC A25/MF A01

The use of tungsten lamp infrared sources placed in close proximity to a spacecraft undergoing thermal balance testing is discussed. The technique has economic advantages for thermal balance testing of spaceborne objects which are too large to fit into existing conventional solar simulation facilities. It was assessed by using a telecommunication satellite model with typical radiator faces. Comparison of the mathematical model and test model temperatures is considered acceptable, allowing for the difference between infrared and solar simulation. Author (ESA)

N84-19400# European Space Research and Technology Center, Noordwijk (Netherlands).

IRSIM: A PROGRAM FOR THE CALCULATION OF INFRARED FLUX INTENSITY INCIDENT ON A SPACECRAFT INSIDE A TEST CHAMBER

R. P. ROGERS In ESA Environ. and Thermal Control Systems for Space Vehicles p 27-37 Dec. 1983 refs Avail: NTIS HC A25/MF A01

A computer program which calculates the infrared flux intensity received by a specimen in a test chamber is described. Illumination by an array of infrared lamps in thermal testing of spacecraft too large for conventional solar simulators is considered. The code is used to decide on a sensor/baffle/lamp arrangement at an early stage in the test process; and to help resolve discrepancies observed in the test measurements. The modelling of the NOSAT dummy spacecraft is described. Author (ESA)

N84-19401# European Space Agency, Paris (France). THERMAL CYCLING TESTS IN SPACE ENVIRONMENT SIMULATION CHAMBERS [LES ESSAIS DE CYCLAGES THERMIQUES DANS LES CHAMBRES DE SIMULATION SPATIALE1

C. POUX (Intespace, Toulouse) In its Envi Control Systems for Space Vehicles p 39-42 In its Environ. and Thermal Dec. 1983 In FRENCH

Avail: NTIS HC A25/MF A01

Thermal cycling/thermal vacuum test facilities to simulate space environments are described. Solar simulation at 1400 W/sgm is possible. Thermal cycling test temperatures can vary from 100 to 360 K. Thermal vacuum test temperatures between -60 and +55 C are achieved. Infrared tests using 500 W quartz lamps are carried out. The vacuum chambers allow a main satellite spherical body of 3 m diameter, or a deployed configuration of 6 m diameter, 7 m height, to be tested. Author (ESA)

National Aeronautics and Space Administration. N84-19402*# Goddard Space Flight Center, Greenbelt, Md.

RECENT AND PLANNED DEVELOPMENTS AT THE GODDARD FLIGHT SPACE CENTER IN THERMAL CONTROL TECHNOLOGY

S. OLLENDORF In ESA Environ, and Thermal Control Systems for Space Vehicles p 45-51 Dec. 1983 refs

Avail: NTIS HC A25/MF A01

Thermal control technology for advanced spacecraft and space stations is presented. Results of proof of concept two phase laboratory devices indicate that large amounts of energy (1 to 2 kw) can be transported long distances (10 to 20 m) with very small temperature differences. An evolutionary test bed for advanced development of thermal technology, which provides data on components and systems for space station designs is described. Results of the STS-3 Thermal Canister Experiment show that the enclosure held simulated instruments to + or - 1 C over a wide range of thermal environments. Author (ESA)

N84-19405# Aeritalia S.p.A., Torino (Italy). Space Sector. HEAT PIPES FOR THE L-SAT COMMUNICATIONS MODULE RADIATORS

M. PAPACCIA, V. PEROTTO, B. SESSIONS, and H. KREEB (Dornier-Werke G.m.b.H., Friedrichshafen, West Germany) In ESA Environ. and Thermal Control Systems for Space Vehicles p 67-74 Dec. 1983 refs

Avail: NTIS HC A25/MF A01

Constant conductance aluminum axial groove ammonia heat pipes for L-SAT 1 north/south radiators were developed. Twenty-four pipes on the south radiator and 38 on the north reject directly imposed heat loads of 600 W and 700 W, respectively. Pipe inner diameter is 5.0 mm, outer square dimension = 9.0

mm. Integral fins provide equipment mounting support and increased thermal efficiency. Pipe lengths range from 0.72 m to 1.238 m. The L-SAT honeycomb radiators offer up to 5.23 sam radiating area each (2.1 x 2.58 m less the solar array drive mechanism). To establish the manufacturing techniques for the heat pipe radiators and to acquire confidence in the analytical modeling approach, a development model heat pipe radiator measuring 0.8 m x 1.6 m with ten 1.5 m long heat pipes was tested in a vacuum chamber. Author (ESA)

N84-19406# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.

A VARIABLE CONDUCTANCE HEAT PIPE (VCHP) RADIATOR SYSTEM FOR COMMUNICATIONS PAYLOADS

N. H. PENNINGS and C. J. SAVAGE (ESTEC, Noorwidjk, Netherlands) In ESA Environ. and Thermal Control Systems for Space Vehicles p 75-81 Dec. 1983 Sponsored by ESTEC Avail: NTIS HC A25/MF A01

A thermal control system to support the development of a multibeam antenna array system for communication satellites is discussed. Trade-off shows that for the antenna power amplifiers a system using variable conductance heat pipes (VCHPs) is the optimum heat rejection system. The VCHP-concept is compared with louvers, phase change materials, feedback controlled heat pipes, and heaters. With passively controlled reservoirs and subject to a factor of 3 variation in the power dissipation, the VCHP concept features a temperature range of 10 to 50 C. The system is suitable for all spacecraft with remote dissipating and radiating elements. Author (ESA)

N84-19414# Aeritalia S.p.A., Torino (Italy).

DESIGN L-SAT THERMAL LARGE THE OF **TELECOMMUNICATION SATELLITE**

D. BOGGIATTO, E. COLIZZI, R. VENERI, and E. SACCHI In ESA Environ. and Thermal Control Systems for Space Vehicles p 149-159 Dec. 1983 refs Sponsored by ESA and British Aerospace Dynamics Group

Avail: NTIS HC A25/MF A01

The passive thermal control design of the L-SAT series of satellites is outlined. Multilayer insulation blankets, heaters, thermal doublers, paints, and thermal fillers/stand offs are supplemented by constant conductance heat pipes, electrically conductive coated second surface mirrors, and a multilayer insulation outer layer. The heat rejection philosophy is standard for a three axis stabilized geostationary satellite, with external appendages insulated from the spacecraft body. Author (ESA)

N84-19423# Institute of Space and Astronautical Science, Tokyo (Japan).

THERMOFLUIDYNAMICS OF HEAT PIPES

K. OSHIMA and M. MURAKAMI (Tsukuba University, Japan) In ESA Environ. and Thermal Control Systems for Space Vehicles p 231-234 Dec. 1983 refs

Avail: NTIS HC A25/MF A01

The operation of high heat flux heat pipes is analyzed using a thermodynamic phase diagram, and the gasdynamic heat pipe which uses the gasdynamic effect of the vapor flow for pumping up the liquid onto the evaporator is discussed. A space station thermal control system using the gasdynamic heat pipe is introduced. This system does not need any external force and is self-controlled. It ensures high system reliability as well as wide design flexibility. Author (ESA)

Aeritalia S.p.A., Torino (Italy). N84-19434# System Engineering-Space Sector.

DESIGN AND MANUFACTURING OF A HEAT REJECTION SYSTEM FOR ADVANCED THERMAL CONTROL

L. BUSSOLINO and J. P. BOUCHEZ (ESTEC, Noordwijk, Netherlands) In ESA Environ. and Thermal Control System for Space Vehicles p 329-335 Avail: NTIS HC A25/MF A01 Dec. 1983 refs

A Technology Demonstration Model (TDM) of a heat rejection system dedicated to advanced spacecraft and payload thermal control was manufactured. The TDM consists of radiator panels (1.2 x 1.85 m), Spacelab type piping, fluid loop servicer with pump package, thermal control valves (bypass and flow metering) and a microprocessor based electronic control unit. Studies leading to the definition of the TDM; the design and manufacturing activities of the components; and the test program are described.

Author (ESA)

N84-19444# Aeritalia S.p.A., Torino (Italy). Space Sector. THERMAL CONTROL OF TETHERED SATELLITE IN A VERY LOW ALTITUDE AERODYNAMIC MISSION

G. BORRIELLO, C. CHIARELLI, G. PELLIS, and F. AL-ASTRABADI In ESA Environ. and Thermal Control Systems for Space Vehicles p 407-416 Dec. 1983 refs Avail: NTIS HC A25/MF A01

Aerodynamic heating rates that a very low altitude satellite (100 km) can experience were calculated. A theoretical analysis, evaluating Knudsen number for flow regimes from free molecular to transition, is presented. Although it is not possible to predict with high confidence level the heating rates in transition flow regimes, the analysis data can be used to facilitate theoretical development. Metallic and ceramic thermal shields to protect the satellite primary structure were investigated. Conventional design methods are proposed to control internal unit temperature.

Author (ESA)

N84-19449# Lockheed Missiles and Space Co., Palo Alto, Calif. EFFECTS OF COMBINED ULTRAVIOLET AND OXYGEN ENVIRONMENT ON SPACECRAFT THERMAL PLASMA CONTROL MATERIALS

M. MCCARGO, R. E. DAMMANN, J. C. ROBINSON, and R. J. MILLIGAN In ESA Environ. and Thermal Control Systems for Space Vehicles p 447-454 Dec. 1983 refs Sponsored by Lockheed Palo Alto Research Laboratory Directorate

Avail: NTIS HC A25/MF A01

A laboratory plasma reactor was built to study the effects on surface properties of materials flown in space shuttle cargo bays of the interaction of the surfaces with atomic oxygen in low Earth orbit. The apparatus, the effects of oxygen plasma plus ultraviolet radiation on thermal control materials, changes in optical properties, and rate of weight loss are described. Results show that UV effects are negligible in all cases, and that changes are due to the oxygen environment. Author (ESA)

N84-19454# Centre National d'Etudes Spatiales, Toulouse (France).

A MALTESE CROSS SHAPED MOBILE THERMAL CONTROL SHUTTER [VOLET MOBILE DE CONTROLE THERMIQUE DU TYPE CROIX DE MALTE]

In ESA Environ. and Thermal Control Systems for I. ALET Space Vehicles p 477-480 Dec. 1983 In FRENCH Avail: NTIS HC A25/MF A01

The advantages of a Maltese cross shaped shutter over venetian blind type systems for satellite thermal control are described. It has low power consumption, is mechanically simple, and can be used against the Sun. Its low surface efficiency makes it unsuitable for geostationary telecommunication satellites, but presents no problems in low Earth orbit. Thermal, vibration, and shock tests demonstrate its robustness and reliability.

Author (ESA)

N84-19458# European Space Research and Technology Center, Noordwijk (Netherlands).

THE LARGE SPACE SIMULATOR (LSS) AT ESA/ESTEC (A SUMMARY OF THE MAIN CHARACTERISTICS)

P. W. BRINKMANN In ESA Environ. and Thermal Control Systems for Space Vehicles p 501-503 Dec. 1983 refs Avail: NTIS HC A25/MF A01

Parameters of ESA's Space Simulator for thermal balance tests on satellites and satellite equipment with large geometries are listed. A vertical main chamber and horizontal auxiliary chamber are interfaced by a 8 m dia nozzle. Main chamber and nozzle will be equipped with a shroud lining the complete chamber surface,

04 STRUCTURAL AND THERMAL ANALYSIS

while the shroud elements in the auxiliary chamber have the form of light baffles. The collimation mirror is suspended from the rear stiffening ring of the auxiliary chamber. A spout provides the interface between the vacuum chamber and the lamp house. The lamp house contains 19 lamp modules, collection optics and transfer optics and provides a protective environment for all optical elements. The test articles can be mounted on a vibration-free support platform (eventually via a motion simulator) or suspended from support lugs in the upper part of the main chamber.

Author (ESA)

N84-19906# National Space Development Agency, Tokyo (Japan).

EVALUATION OF MODAL TESTING TECHNIQUES FOR SPACECRAFT STRUCTURES

K. SHIRAKI and H. MITSUMA *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., part 3 p 161-170 May 1983 refs

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 22B

A comparative study of modal testing techniques with a base classical sine sweep and random test methods based upon digital analysis techniques are compared by measuring transfer functions of a simple beam specimen. For the random test data, modal analyses were performed using two kinds of analyzers, for two steps of input levels, respectively. The modal parameters obtained by both analyzers were in good agreement. And the structural response nonlinear characteristics due to the input level change were investigated. An example of the application of these techniques to the development of the Engineering Test Satellite 3 is shown. M.G.

N84-20622*# Vought Corp., Dallas, Tex.

FLEXIBLE RADIATOR THERMAL VACUUM TEST REPORT J. A. OREN and C. W. HIXON 29 Oct. 1982 103 p refs (Contract NAS9-14776)

(NASA-CR-171764; NAS 1.26:171764; REPT-2-32300/IR-03) Avail: NTIS HC A06/MF A01 CSCL 22B

Two flexible, deployable/retraction radiators were designed and fabricated. The two radiator panels are distinguishable by their mission life design. One panel is designed with a 90 percent probability of withstanding the micrometeoroid environment of a low earth orbit for 30 days. This panel is designated the soft tube radiator after the PFA Teflon tubes which distribute the transport fluid over the panel. The second panel is designed with armored flow tubes to withstand the same micrometeoroid environment for 5 years. It is designated the hard tube radiator after its stainless steel flow tubes. The thermal performance of the radiators was tested under anticipated environmental conditions. The two deployment systems of the radiators were evaluated in a thermal vacuum environment.

N84-20623*# Vought Corp., Dallas, Tex. FLEXIBLE RADIATOR SYSTEM J. A. OREN 30 Oct. 1982 82 p refs (Contract NAS9-14776) (NASA-CR-171765; NAS 1.26:171765; REPT-2-19200/3R-1195B) Avail: NTIS HC A05/MF A01 CSCL 22B

The soft tube radiator subsystem is described including applicable system requirements, the design and limitations of the subsystem components, and the panel manufacturing method. The soft tube radiator subsystem is applicable to payloads requiring 1 to 12 kW of heat rejection for orbital lifetimes per mission of 30 days or less. The flexible radiator stowage volume required is about 60% and the system weight is about 40% of an equivalent heat rejection rigid panel. The cost should also be considerably less. The flexible radiator is particularly suited to shuttle orbiter sortie payloads and also whose mission lengths do not exceed the 30 day design life. A.R.H.

N84-20624*# Vought Corp., Dallas, Tex. FLEXIBLE RADIATOR SYSTEM: EXECUTIVE SUMMARY J. R. OREN and R. L. COX 30 Oct. 1982 49 p (Contract NAS9-14776)

(NASA-CR-171766; NÁS 1.26:171766; REPT-2-19200/3R-1062B) Avail: NTIS HC A03/MF A01 CSCL 22B

A full scale prototype flexible radiator panel was designed, built and tested. The panel, has approximately 173 sq ft of radiating area and is designed to reject 1.33 kW of heat to a 0 F sink with a 100 F fluid inlet. The panel is constructed from a flexible Teflon/silver mesh fin surrounding 1/8 inch Teflon tubes. The prototype panel is stowed on a 10 inch diameter by 4 foot wide drum. (It rolls up to a diameter of 17 inches when fully stowed). Deployment of the soft tube prototype is via two four inch diameter Kevlar/Mylar inflation tubes with flat springs incorporated in each tube. Nitrogen is normally used for the deployment with approximately 1 psi required. The springs retract the panels when the inflation tubes are deflated. Another method of deployment available for the soft tube flexible is a motor driven deployable boom. This eliminates the need for expendables when the panel area is varied during the mission for heat load control. The soft tube panel is designed for a 90% probability of no punctured tube in a 30 day mission. The acceptable working fluids for this soft tube flexible are Coolanol 15, Coolanol 20 and Glycol/water (a eutectic mixture). SI

N84-21613#Consulenze Generali Roma (Italy).COMPUTINGTHERADIATIONPRESSURE

COMPUTING THE RADIATION PRESSURE FORCES BY ADAPTING THERMAL DESIGN VERIFICATION SOFTWARES Final Report

C. ARDUINI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications, and New Anal. Methods, Vol. 1 p 169-208 Dec. 1982

Avail: NTIS HC A16/MF A01

Formulas for computing radiation forces on large space structures are provided, and insertion of the formulas in thermal softwares is indicated. Radiation coming directly from the Sun or Earth, and direct reflection of this impinging radiation are considered. Except for thermal radiation, all cases can be covered by a single program run, and with a model limited to the spacecraft external surfaces. Formulas for general reflected flux distribution are generated. The formulas are specialized for diffuse, specular, and specular-diffuse reflection. Applications for Sun primary reflection are treated. Author (ESA)

N84-21614# Consulenze Generali Roma (Italy). SIMPLIFIED MODELS AND COMPUTATIONAL SCHEMES OF THE AERODYNAMIC LOAD

U. PONZI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 p 209-276 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

A scheme for computing the aerodynamic load on large space structures during the preliminary design phase is outlined. The scheme is based on simplified interaction models able to reduce the aerodynamic aspect of the problem into a simple form with a reasonable accuracy; and the adaptation and/or use of existing softwares in order to solve the geometrical implications. The Lockheed orbital heat rate program, the Thermal Radiation Analysis System program, and the Simplified Shuttle Payload Thermal Analyzer are described. Author (ESA) N84-21616# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 2: PROPOSALS FOR ADDITIONS, MODIFICATIONS AND NEW ANALYTICAL METHODS, VOLUME 2 Final Report

C. ANDUINI and U. PONZI Paris ESA Dec. 1982 368 p refs 5 Vol.

(Contract ESTEC-4348/80/NL-AK(SC))

(ESA-CR(P)-1779-VOL-4) Avail: NTIS HC A16/MF A01

Thermal design verification of large open truss structures of large spacecraft (the local approach and the shadow problem); computational savings in view factor evaluation by node prescreening; analytical formulations of the interactive structural thermal control problem (thermostructural self excitation); and design oriented control theories in continuous models are discussed.

N84-21617# Consulenze Generali Roma (Italy). THERMAL DESIGN VERIFICATION OF THE LARGE OPEN TRUSS STRUCTURES. THE LOCAL APPROACH AND THE SHADOW PROBLEM Final Report

C. ARDUINI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 p 13-120 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

For large space structure thermal design verification, an approximation which considers a single bay (or a module made by a finite number of bays) as isolated from the rest of the system (the "local" approach) was suggested. Conditions under which the approximation is acceptable; and expressing heat input to the isolated bay, while not considering all the complex shadow effects of the complete system, are discussed. Analysis shows that the local approach causes appreciable errors only at the boundaries, and considerably reduces computational loads. The method can also be applied when both trusses and finite bodies are present. For these systems an iterative scheme which solves in one step the system of the main bodies only (taking truss temperatures to be known) and in a successive step solves the truss, using the local approach (taking main body temperature as known) is proposed. Author (ESA)

N84-21618# Consulenze Generali Roma (Italy). COMPUTATIONAL SAVINGS IN VIEW FACTOR EVALUATION ON MODE PRESCREENING Final Report

S. SGUBINI and C. ARDUINI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 p 121-170 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

Criteria for reducing the number of view factors of each node with respect to the surroundings to the absolute minimum compatible with a prescribed accuracy for large space structures thermal design verification; and minimizing the number of elements required per node for a given accuracy are discussed. A multiple screening technique, using the Simplified Shuttle Payload Thermal Analyzer (SSPTA) program, is investigated. The SSPTA contains a mixed surface-contour integral type view factor routine. Additional surfaces can be screened out after the shadow check, if a substantial blockage is detected. Computation of view factors among the remaining nodes can be effected, after the appropriate number of elements in the node is selected, in agreement with the desired accuracy. It is shown that this procedure can drastically reduce the total number of elements in large systems, being equivalent, from the radiative point of view only, to a local approach, without however any arbitrary substructure isolation.

Author (ESA)

N84-21619# Consulenze Generali Roma (Italy). INTERACTIVE STRUCTURAL-THERMAL-CONTROL ANALYTICAL FORMULATIONS Final Report

C. ARDUINI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 2 p 171-368 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

The suitability of analytic solutions for large space structure interactive thermal control dynamic problems was studied for the case of a beam subjected to the thermal environment of space, and possibly actively controlled by sensors and actuators. It is shown that the basic interactive equations can be constructed in a variety of conditions based on a menu of component terms derived from basic theories and limited special developments, such as a thermal theory of the beam. The approach is limited, however, to considering a fixed, generally simple, geometry, although the size can be increased by adding modes without changing the reduced size model. Author (ESA)

N84-21621# Consulenze Generali Roma (Italy).

ASSESSMENT OF THE EXISTING GROUND TEST TECHNOLOGY AND CONFRONTING WITH THE LARGE SPACE STRUCTURES (LSS) REQUIREMENTS. EXPERIMENTAL TECHNIQUES IN STRUCTURAL ANALYSIS

U. PONZI and A. AGNENI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. te] p 13-103 Dec. 1982 refs

Avail: NTIS HC A19/MF A01

Static, dynamic and modal structural analysis of large space structures (LSS) on ground are discussed. Standard excitation tests, and the effect of the surrounding fluid in vibration are reviewed. For LSS ground testing, constraints due to the large size; to the peculiar physics of the problem; and originating from the Earth environment are the most important. These constraints act in general all together, so that the effect of one factor is exasperated by the presence of the remaining ones. The combination size-gravity is the most significant example. Size constraints are best tackled by partial model methods for static tests and reconstruction of the behavior of the entire system by modal synthesis for dynamic tests. Investigation of physics related constraints is severely limited by scarcity of data on large configurations. Earth environment effects can be assessed by comparing the effect, e.g., gravity with each experimental parameter. Author (ESA)

N84-21622# Consulenze Generali Roma (Italy).

ASSESSMENT OF THE EXISTING GROUND TEST TECHNOLOGY AND CONFRONTING WITH THE LARGE SPACE STRUCTURES (LSS) REQUIREMENTS. THERMAL TEST TECHNIQUES

U. PONZI *In its* Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 3: Expt. Design Verification Tech. te] p 104-169 Dec. 1982 refs

Avail: NTIS HC A19/MF A01

Thermal balance and thermal cycle ground testing of large space structures is reviewed. Scale reduction is identified as the major problem. For the combined dynamical - radiation - thermal structural problem, no length-scaling appears possible. For the combined radiation - thermal - structural problem (statistically distorting structures) slight length-scaling is possible. For uncoupled radiation - distortion, full length-scaling is possible. For uncoupled radiation characteristics; albedo and Earth radiation; vacuum; heat sink; and spacecraft mounting are reviewed. Author (ESA) N84-21626# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

DEVELOPMENT OF PROCEDURES FOR COMPONENT MODE SYNTHESIS Final Report

A. BERTRAM and P. CONRAD Paris ESA 15 Mar. 1983 163 p refs

(Contract ESTEC-4350/80/NL-PP; DFVLR-232-11;

DFVLR-3-719-101)

(DFVLR-IB-232-82-C-09; ESA-CR(P)-1826) Avail: NTIS HC A08/MF A01

The requirements of a rational, cost effective component mode synthesis were established by performing modal coupling analyses on a spacecraft model composed of two modules with a highly redundant interface. Parameter studies defined criteria for the selection of the most suitable mode sets, the definition of boundary conditions, the number of modes and the accuracy of the mathematical mass model. Finite element models of the actual structure were used. The studies reveal the dynamic behavior of a structure with complicated interfaces, and enable optimum test boundary conditions to be defined. Author (ESA)

05

STRUCTURAL DYNAMICS AND CONTROL

Includes modeling, systems identification, attitude and control techniques and systems, surface accuracy measurement and control techniques and systems, sensors, and actuators.

A84-10956#

A. METHODOLOGY TO INCLUDE STATIC AND KINETIC FRICTION EFFECTS IN SPACE SHUTTLE PAYLOAD TRANSIENT LOADS ANALYSIS

E. E. HENKEL, J. E. MISEL, and D. H. FREDERICK (Rockwell International Corp., Shuttle Integration and Satellite Systems Div., Downey, CA) IN: Shuttle Environment and Operations Meeting, Washington, DC, October 31-November 2, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p. 171-177. refs

(AIAA PAPER 83-2654)

This paper presents a methodology that includes both static and kinetic friction effects for Space Shuttle payload transient loads. The methodology employs a residual flexibility correction to the normal modes of vibration. An alteration to the dynamic finite difference equations of motion is discussed which allows one to include friction effects at reasonable cost for large structural systems such as the Space Shuttle. Numerical results of an idealized and highly simplified structural transient response problem are included to demonstrate the completeness of the approach. The extension of the basic NASTRAN nonlinear methodology is presented through several stages of development to the point where constraint equations and residual flexibility effects are incorporated. It is shown how residual flexibilities improve the accuracy of the forced dynamic response for payloads mounted in the orbiter vehicle. Data are presented to demonstrate the possible impact of transient friction loads to the payload designer. Author

A84-11815#

TESTS AND PREDICTION OF COMPOSITE MATERIAL VISCOELASTIC BEHAVIOUR FOR LARGE SPACE STRUCTURE

L. B. CREMA, R. BARBONI, A. CASTELLANI (Roma, Universita, Rome, Italy), and I. PERONI International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 13 p. refs

(IAF PAPER 83-418)

Experimental and analytical investigations of the damping behavior of glass-fiber and carbon-fiber reinforced composites are reported. Specimens 15 mm wide and 250, 300, or 400 mm long with 8 or 16 laminations and different laminate layups were subjected to flexure-modulus and flexural-strength tests at excitation frequencies of 5-350 Hz and temperatures of 25-120 C in an environmental chamber at 0.001 torr. The results are presented graphically. The frequency effect on the damping coefficient is found to be minimal, while a correlation between stiffness factors (due to lavup sequences) and damping and a significant increase in damping above 90 C are observed. Glass-fiber damping coefficients are shown to be higher than those of carbon fibers overall. These results are in good agreement with numerical calculations based on classical laminate theory. An analysis of the bounds on the complex viscoelastic moduli based on the correspondence principle is presented, and the bounds calculated are compared to the measured values. тк

A84-11932

HARDWARE SIMULATION OF SPACECRAFT DYNAMICS AND CONTROL

K. REINEL (Deutsche Forschungs- und Versuchsanstalt fuer Luftund Raumfahrt, Oberpfaffenhofen, West Germany) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3. Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 210-212. refs

An overview is given of the hardware simulation activities of the spaceflight dynamics section at the German Space Operation Center. Two simulation methods for spacecraft attitude control hardware are discussed. Air-bearing simulation is used mainly for verifying the spacecraft dynamics and for identifying the mathematical model of actuators and torque generators. It is noted that disturbance torques in the laboratory and time-consuming adjustments of the platform limit the air-bearing simulation to small angle motion and preferably to tests that require the actuator hardware in the loop. The servo-driven motion simulator is controlled by computer and readily allows changes in the spacecraft configuration and the control system during the design and development phases. System tests of the attitude determination control are therefore performed to advantage on the three-axes motion simulator as soon as the actuators and the control torques can be modeled mathematically. Large angle motion is limited only by the freedom of the gimbal system. C.R.

A84-11933

ON MODELING AND SIMULATION OF THE DYNAMICS OF TETHER CONNECTED SATELLITE SYSTEMS

V. J. MODI (British Columbia, University, Vancouver, Canada), A. K. MISRA (McGill University, Montreal, Canada), and D. M. XU IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3 . Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 217-219. refs

A general dynamical model for a system consisting of two satellites connected by a tether is presented. Three dimensional large rotational motion, longitudinal as well as transverse vibrations of the tether treated as a continuum, eccentricity of the orbit and aerodynamic drag in a rotating oblate atmosphere are taken into account. Equations of motion are obtained using a Lagrangian formulation. As the frequencies associated with rotational and vibrational motions differ by orders of magnitude, Gear's method is used for numerical integration. Attention is focused on the dynamics during retrieval of a subsatellite to the Shuttle and schemes for successful retrieval are suggested. Author

ATTITUDE CONTROL AND DYNAMICS OF THE SPACE OPERATIONS CENTER

G. C. MCGEE and A. M. ANDRONIKOU (Rockwell International Corp., Space Operations/Integration and Satellite Systems Div., Downey, CA) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3 . Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 222-224.

Attitude control of the Space Operations Center (SOC) when it is visited by the Shuttle orbiter has been studied in order to idenify the constraining requirements. A computer simulation of spacecraft disturbances was employed as an important element of the study, and time histories of control capabilities were developed. Results show that the propulsion and momentum storage requirements are achievable without undue spacecraft design impact if the prescribed approaches are used. Author

A84-11945

AGGREGATE MODELS FOR DISTRIBUTED PARAMETER SYSTEMS WITH APPLICATIONS TO FLEXIBLE AIR AND SPACECRAFT

T. L. JOHNSON (Bolt Beranek and Newman, Inc., Cambridge, MA) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3 . Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 365-367. refs

Even though the method of aggregation based on sensor and actuator influences presented here has been developed with a view to large space structure applications, it is of more general applicability. Unlike most aggregation methods, which attempt to preserve the plant dynamics, the proposed method first attempts to preserve input-output coupling; in this way, the order of the reduced model is related to the sum of the number of synthetic inputs and outputs, which is assumed to be much smaller than the order of the dynamics. Although general guidelines for controller design compatibility with the method are given, the aggregation method is not restricted to any particular control design algorithm. One important property is that the effect of model truncation can be precalculated independently of the feedback gains employed in the controller. Results are presented for general linear time-invariant multivariable systems, and a description is given of further results that can be obtained specifically for structural models. C.R.

A84-12483#

SATELLITE ATTITUDE DYNAMICS AND CONTROL IN THE PRESENCE OF ENVIRONMENTAL TORQUES - A BRIEF SURVEY

S. K. SHRIVASTAVA (British Columbia, University, Vancouver, Canada) and V. J. MODI (Indian Institute of Science, Bangalore, India) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 6, Nov.-Dec. 1983, p. 461-471. refs

Previously cited in issue 20, p. 3157, Accession no. A82-40002

A84-12488#

DYNAMICS AND CONTROL OF A DEFORMABLE GYROSTAT, UTILIZING CONTINUUM VEHICLE MODES

H. B. HABLANI (Rockwell International Corp., Seal Beach, CA) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 6, Nov.-Dec. 1983, p. 499-510. Research supported by the U.S. National Research Council. refs

The paper deals with dynamics of a specific gyroscopic flexible spacecraft and with synthesis of its controller. The infinite number of associated gyroscopic modes are shown to have alternately a precession parallel and antiparallel to the stored momentum. Dependence of mode shapes on the rotor's momentum is investigated. Identities based on the vehicle's momentum and inertia considerations are devised. The stochastic response analysis of the spacecraft subject to arbitrary excitation permits a 'modal cost analysis' of the vehicle. These developments show that, as rotor's momentum escalates, a larger number of modes are required to construct a truncated model having a prespecified accuracy. A controller is designed on the basis of the 'minimum error excitation' approach, which is found to be almost as effective as an optimal state feedback controller. The destabilizing influence of the truncated modes is exposed by utilizing the robustness inequalities available in the literature. Author

A84-12489#

TORQUE FROM SOLAR RADIATION PRESSURE GRADIENT DURING ECLIPSE

G. B. SINCARSIN and P. C. HUGHES (Toronto, University, Toronto, Canada) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 6, Nov.-Dec. 1983, p. 511-517. Sponsorship: Natural Sciences and Engineering Research Council of Canada. refs

(Contract NSERC-A-4183)

Previously cited in issue 20, p. 3159, Accession no. A82-40433

A84-13320

THE TOYSAT STRUCTURAL CONTROL EXPERIMENT

J. A. BREAKWELL (Lockheed Research Laboratories, Palo Alto, CA) and G. J. CHAMBERS (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 31, July-Sept. 1983, p. 441-454. Research supported by the Lockheed Independent Research and Development Program. refs

The hardware setup and experimental results of the Toysat structural control experiment are described in this paper. The experiment is designed to test theoretical analyses and hypotheses concerning the application of modern control methods to the control of a flexible structure. Linear-quadratic-Gaussian (LQG) optimal estimation and control algorithms are tested on the experimental hardware and shown to have desirable stability properties and reasonable robustness characteristics. Author

A84-13321

A HARDWARE DEMONSTRATION OF CONTROL FOR A FLEXIBLE OFFSET-FEED ANTENNA

R. D. BAULDRY, G. J. CHAMBERS, K. F. JOHANSEN, N. C. NGUYEN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA), J. A. BREAKWELL, and D. B. SCHAECHTER (Lockheed Research Laboratories, Palo Alto, CA) Journal of the Astronautical Sciences (ISSN 0021-9142), vol. 31, July-Sept. 1983, p. 455-470. Research supported by the Lockheed Independent Research and Development Program.

A hardware model of a flexible offset-feed antenna has been constructed in the laboratory in order to validate the applicability of modern control theory to the control of flexible structures involving realistic space hardware. In the model, principal control actuation is provided by a cluster of three control-moment gyros; sensing is provided by a cluster of three control-moment gyros; sensing is provided by three rate-gyros, ten distributed accelerometers, and two laser attitude sensing devices. Optimal estimation algorithms and optimal control laws have been successfully implemented with an array processor to control this multi-input, multi-output, high-order system. The laboratory hardware, the dynamics of the antenna, and the control approach used are discussed in detail, and recent closed-loop control results are reported. V.L.

A84-15785

GEODETIC CONTROL OF THE REFLECTORS OF LARGE ANTENNAS [GEODEZICHESKII KONTROL' REFLEKTOROV BOL'SHIKH ANTENN]

G. A. TEREKHOVA Geodeziia i Kartografiia (ISSN 0016-7126), Sept. 1983, p. 12-17. In Russian. refs

Attention is given to the precise geodetic control and adjustment of large-antenna reflectors intended for radio astronomy and space communications. A number of control methods are examined, with attention given to hardware realizations, main characteristics, and practical applications. B.J.

05 STRUCTURAL DYNAMICS AND CONTROL

A84-16885

INSTABILITY ANALYSIS OF SPACE TRUSSES

A. K. NOOR and J. M. PETERS (George Washington University, Hampton, VA) Computer Methods in Applied Mechanics and Engineering (ISSN 0045-7825), vol. 40, Oct. 1983, p. 199-218. refs

Reduction methods and computational procedures are presented for the instability analysis of space trusses with both geometric and material nonlinearities subjected to combined loads. A mixed formulation is used with the fundamental unknowns consisting of both the member forces and the joint displacements. The governing equations of the truss consist of the two sets of member constitutive relations and joint equilibrium equations. The vector of fundamental unknowns is expressed as a linear combination of a small number of path derivatives (derivatives of nodal displacements and member forces with respect to path parameters), and a Bubnov-Galerkin technique is used to approximate the governing equations by a small system of algebraic equations. The reduced equations are then used to determine the stability boundary and trace the nonlinear equilibrium paths. The potential of the proposed approach is discussed and its effectiveness is demonstrated by means of numerical examples of space trusses with combined geometric and material nonlinearities. The constitutive relations in these examples are assumed, for convenience, to be represented by Ramberg-Osgood polynomials. Author

A34-17355*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SCIENCE PLATFORM AND ATTITUDE SUBSYSTEM IN-FLIGHT CALIBRATION FOR THE GALILEO SPACECRAFT

S. A. HAYATI and J. Y. LAI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) (Guidance and Control Conference, Albuquerque, NM, August 19-21, 1981, Collection of Technical Papers, p. 500-512) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Jan.-Feb. 1984, p. 29-35. NASA-supported research.

Previously cited in issue 21, p. 3640, Accession no. A81-44136

A84-17359# SEMIAUTONOMOUS STATIONKEEPING OF GEOSYNCHRONOUS SATELLITES

C. C. CHAO (Aerospace Corp., Astrodynamics Dept., El Segundo, CA) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Jan.-Feb. 1984, p. 57-61. Research sponsored by the Aerospace Corp. refs (Contract F04701-82-C-0083)

Previously cited in issue 19, p. 2992, Accession no.

A82-38883

A84-17361*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DYNAMICS AND CONTROL OF A LARGE SPACE ANTENNA S. J. WANG and J. M. CAMERON (California Institute of Technology, Jet Propulsion Laboratory, Control and Energy Conversion Div., Pasadena, CA) (Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers, p. 394-402) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Jan.-Feb. 1984, p. 69-76. NASA-supported research. refs

Previously cited in issue 19, p. 2997, Accession no. A82-38967

A84-17369#

A FLEXIBLE STRUCTURE CONTROLLER DESIGN METHOD USING MODE RESIDUALIZATION AND OUTPUT FEEDBACK

J. A. BOSSI (Washington, University, Seattle, WA) and G. A. PRICE (Boeing Aerospace Co., Seattle, WA) (Guidance and Control Conference, San Diego, CA, August 9-11, 1982, Collection of Technical Papers, p. 388-393) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Jan.-Feb. 1984, p. 125-127. refs

Previously cited in issue 19, p. 2997, Accession no. A82-38966

A84-17370#

COMMENTS ON 'DYNAMICS OF A SPACECRAFT DURING EXTENSION OF FLEXIBLE APPENDAGES'

M. S. JANKOVIC (Dome Petroleum, Ltd., Calgary, Alberta, Canada) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Jan.-Feb. 1984, p. 128.

A84-17854#

ON THE DYNAMICS OF A SUBSATELLITE SYSTEM SUPPORTED BY TWO TETHERS

A. K. MISRA and G. S. DIAMOND (McGill University, Montreal, Canada) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 6

(AIAA PAPER 84-0062)

The dynamics of a subsatellite system connected to a main orbiter by two extensible but massless tethers is studied. The points of attachment of these two tethers are offset from the centre of mass of the orbiter. Both constant length and retrieval cases are considered. Lagrangian formulation for constrained systems is used to derive the nonlinear equations of motion. These along with the constraint equations are solved numerically. It is noted that the rotational motion in the plane of the attachment points can be damped quite effectively using a simple control scheme. Comparisons are made with the single tether case. A two tether system has superior rotational behaviour, but seems to have disadvantages as far as longitudinal oscillations are concerned. Author

A84-17866#

CONTROL OF LARGE SPACE STRUCTURES

W. J. JASPER (Hughes Aircraft Co., Space and Communications Group, El Segundo, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 5 p.

(AIAA PAPER 84-0081)

In the presence of disturbances, large flexible space structures will exhibit excessive vibration which, in the case of a space antenna, will degrade its pointing and focusing abilities. A velocity output feedback control system will augment damping to selected modes of vibration. The performance of the design derived from a reduced order model is degraded when evaluated on a higher order model. This paper addresses this problem, and discusses a way to minimize performance degradation due to unmodelled dynamics. A numerical example is then given. Author

A84-18060#

AEROELASTIC STABILITY AND RESPONSE OF FLEXIBLE TACTICAL WEAPONS

P. CRIMI (Avco Corp., Avco Systems Div., Wilmington, MA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 9 p. refs (AIAA PAPER 84-0392)

Static and dynamic aeroelastic characteristics of flexible tactical weapons are investigated analytically. Formulation of the static problem uses finite beam elements to model the vehicle and local linearization to represent the aerodynamic loading. Analyses of a representative configuration define the effects of bending stiffness, spin rate and dynamic pressure on divergence and static longitudinal stability. The dynamic problem is formulated in body-fixed coordinates using complex variables. Effects of velocity,

spin rate and bending frequency on dynamic response and flutter are investigated. Author

A84-18168#

A DESIGN STRATEGY FOR MULTIPLE PAYLOAD POINTING FROM A THREE AXIS STABILIZED SPACECRAFT

J. R. VELMAN and W. L. BURKETT, JR. (Hughes Aircraft Co., Los Angeles, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 8 p.

(AIAA PAPER 84-0566)

When multiple articulated payloads are carried on a spacecraft, each payload may have separate pointing performance requirements on agility, accuracy, and pointing stability. By using synergetic combinations of sensors and actuators, the controller design for each loop may be nearly decoupled from the remaining loop designs. The physical rational of the decoupling approach is given, and its power is demonstrated by the performance of a sample design. The example includes the effects of actuator imperfections and non-linearities, and many flexible modes. The approach provides a simple direct means of designing multivariable controllers tailored to mission requirements. Author

A84-19056* Rensselaer Polytechnic Inst., Troy, N. Y. THE SPATIAL ORDER REDUCTION PROBLEM AND ITS EFFECT ON ADAPTIVE CONTROL OF DISTRIBUTED PARAMETER SYSTEMS

M. J. BALAS (Rensselaer Polytechnic Institute, Troy, NY) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 1. New York, Institute of Electrical and Electronics Engineers, 1982, p. 30-32. refs (Contract NSF ECS-80-16173; NAG1-171)

A84-19118

MULTIVARIABLE DIRECT ADAPTIVE CONTROL FOR A GENERAL CLASS OF TIME-VARYING COMMANDS

I. BAR-KANA and H. KAUFMAN (Rensselaer Polytechnic Institute, Troy, NY) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 750, 751. refs

(Contract NSF ECS-80-16173)

Direct multivariable model reference adaptive control (DMMRAC) procedures which are especially suitable for large scale structures (LSS) were in the past shown to be feasible provided that the input commands were constant. In this paper the feasibility of the MMRAC algorithms is extended to a large class of time-variable input commands. Author

A84-19127

A LARGE SPACE STRUCTURE BENCHMARK PROBLEM - ACOSS MODEL NO. 2

T. C. HENDERSON (Charles Stark Draper Labortory, Inc., Cambridge, MA) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 905-908.

Attention is called to the need for a universal system model in order to assess the performance, sensitivity, and hardware requirements of the various active structural control methods being developed. The design of the model described here, ACOSS Model No. 2 (ACOSS denoting active control of large space structures), incorporates certain desired features into the overall system characteristics. The structural design is based on realistic sizes and weights, and the model has a simple unclassified optical system with associated performance measures and tolerances. It also has a set of disturbances that are typical of equipment vibration and attitude control. The model comprises two subsystems: an optical support structure and an equipment section. These are connected by springs at three points, allowing either passive or active vibration isolation. The optical support structure contains four optical surfaces that are assumed to be rigid and kinematically mounted on the structure, it is assumed that the equipment section takes

the form of a rigid central section with two flexible solar panels cantilevered from it. C.R.

A84-19128

NUMBER CRUNCHING ON THE ACOSS MODEL NO. 2

R. GRAN and M. ROSSI (Grumman Aerospace Corp., Research and Development Center, Bethpage, NY) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1982, p. 909-911.

The spacecraft model called ACOSS Model Number 2 was used to develop a control system design for large space structures that have certain desirable characteristics. To achieve these characteristics, the control design approach used here is based on an optimal reduced order control design technique that explicitly computes the minimum of an expected quadratic cost function using a numerical search algorithm. The algorithm, developed by Rossi (1972), uses an explicit calculation of the gradient and Hessian tensors to guide a second order search. The algorithm and the 'number crunching' on the ACOSS model are both described. Author

A84-19675#

ATTITUDE STABILITY FOR THE YAW-WHEEL CLASS OF ORBITING GYROSTATS

P. C. HUGHES (Toronto, University, Toronto, Canada) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 29, Sept. 1983, p. 268-281. Research supported by the Natural Science and Engineering Research Council of Canada. refs

Motivated by the attitude stabilization of large, multibeam communcations satellites, the neoclassical problem of a rigid gyrostat in a circular orbit is considered. It is shown that the inclusion of a yaw wheel into the design can lead to a steady gyroscopic torque that is equal and opposite to the steady gravity-gradient external torque about the roll axis. This particular class of gyrostat equilibrium has not previously been studied in detail. Representative stability diagrams are presented which show that most (but not all) such equilibria are unstable. Author

A84-19728

PERIODIC OSCILLATIONS OF A GYROSTAT SATELLITE WITH RESPECT TO THE CENTERS OF MASS IN A CIRCULAR ORBIT [PERIODICHESKIE KOLEBANIIA SPUTNIKA-GIROSTATA OTNOSITEL'NO TSENTRA MASS NA KRUGOVOI ORBITE] V. V. SAZONOV Kosmicheskie Issledovanija (ISSN 0023-4206),

vol. 21, Nov.-Dec. 1983, p. 838-850. In Russian. refs The system of differential equations of motion of a gyrostat

satellite with respect to the center of mass under the effect of gravity moment in circular orbit is considered. It is assumed that the intrinsic kinetic moment of the gyrostat is large and that the system contains a large parameter. A search is made for symmetric periodic solutions of this system, close to the periodic solutions of a degenerate system, obtained from the initial system when the large parameter is equal to infinity. The solutions are obtained in formal series in whole negative powers of the large parameter, and are analyzed numerically.

A84-20047#

DETERMINATION OF CRITICAL PARAMETERS IN LARGE FLEXIBLE SPACE STRUCTURES WITH UNCERTAIN MODAL DATA

R. K. YEDAVALLI (Stevens Institute of Technology, Hoboken, NJ) and R. E. SKELTON (Purdue University, West Lafayette, IN) ASME, Transactions, Journal of Dynamic Systems, Measurement, and Control (ISSN 0022-0434), vol. 105, Dec. 1983, p. 238-244. refs

This paper addresses the problem of control design for large flexible space structures with uncertain modal data. The concepts of modal cost analysis are applied to flexible space structures with these uncertain parameters: modal damping, modal frequencies, and mode shapes at actuator (sensor) locations. A quadratic function of displacements and displacement rates is used as a performance metric. In this case, it is possible to obtain explicit formulas for the cost contributions labeled 'modal costs' and 'parameter costs.' This type of cost decomposition analysis by which one can determine the significant modes and parameters can be useful in model reduction, parameter estimation, and structure redesign. The proposed technique is applied to the 'Purdue Model,' a generic model for a two-dimensional flexible structure. Author

A84-21237

VIBRATION CHARACTERISTICS OF SELF-EXPANDING STAYED COLUMNS FOR USE IN SPACE

J. R. BANERJEE and F. W. WILLIAMS (University of Wales Institute of Science and Technology, Cardiff, Wales) Journal of Sound and Vibration (ISSN 0022-460X), vol. 90, Sept. 22, 1983, p. 245-261. Research supported by the Science and Engineering Research Council. refs

Reference is made to the report by Belvin (1982) which presented experimental and theoretical results obtained at NASA for the free vibration of a stayed column. Exact theoretical results are given here, including natural frequencies and mode types not given in the NASA results. A substitute column method is employed to achieve economy and a much deeper understanding of the modes. An alternative design is proposed which implements recent developments in the design method and has a graphite epoxy core. The proposed design has the advantage that its stay dominated frequencies are higher than those for the NASA column. C.R.

A84-21285#

TRANSIENT DYNAMICS DURING THE ORBITER BASED DEPLOYMENT OF FLEXIBLE MEMBERS

V. J. MODI (British Columbia, University, Vancouver, Canada) and A. M. IBRAHIM American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 11 p. refs

(AIAA PAPER 84-0061)

The paper presents a general formulation for studying librational dynamics of a large class of spacecraft during deployment of flexible members. It is applicable to a variety of mission ranging from deployment of antennas, booms and solar panels to manufacturing of trusses for space platforms using the Space Shuttle. The governing nonlinear, nonautonomous and coupled equations of motion are extremely difficult to solve even with the help of a computer, not to mention the cost involved. To get some appreciation as to the complex interactions between flexibility, deployment and attitude dynamics as well as to help pursue stability and control analysis, the equations are linearized about their nominal deflected equilibrium configuration. The procedure is applied to the Space Shuttle based deployment of plate-like members. Results suggest substantial influence of the inertia parameter, flexural rigidity of the appendages, orbit eccentricity, deployment velocity, initial conditions, etc. on the system response. This would indicate additional demand on the orbiter's control system during construction of space-platforms. Author

A84-24990#

ON THE NUMBER AND PLACEMENT OF ACTUATORS FOR INDEPENDENT MODAL SPACE CONTROL

R. E. LINDBERG, JR. (U.S. Navy, Naval Research Laboratory, Washington, DC) and R. W. LONGMAN (Columbia Un; iversity, New York, NY) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Mar.-Apr. 1984, p. 215-221. refs

Previously cited in issue 19, p. 2994, Accession no. A82-38874

A84-24991*# RCA Astro-Electronics Div., Princeton, N. J. A DEGREE OF CONTROLLABILITY DEFINITION -FUNDAMENTAL CONCEPTS AND APPLICATION TO MODAL SYSTEMS

C. N. VISWANATHAN (RCA, Astro-Electronics Div., Princeton, NJ), R. W. LONGMAN (Columbia University, New York, NY), and P. W. LIKINS (Lehigh University, Bethlehem, PA) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Mar.-Apr. 1984, p. 222-230. refs

(Contract NAS8-32212)

Starting from basic physical considerations, this paper develops a concept of the degree of controllability of a control system, and then develops numerical methods to generate approximate values of the degree of controllability for any linear time-invariant system. In many problems, such as the control of future, very large, flexible spacecraft and certain chemical process control problems, the question of how to choose the number and locations of the control system actuators is an important one. The results obtained here offer the control system designer a tool which allows him to rank the effectiveness of alternative actuator distributions, and hence to choose the actuator locations on a rational basis. The degree of controllability is shown to take a particularly simple form when the dynamic equations of a satellite are in second-order modal form. The degree of controllability concept has still other fundamental uses - it allows one to study the system structural relations between the various inputs and outputs of a linear system, which has applications to decoupling and model reduction.

Author

A84-24995#

IDENTIFICATION OF LARGE FLEXIBLE STRUCTURES MASS/STIFFNESS AND DAMPING FROM ON-ORBIT EXPERIMENTS

S. L. HENDRICKS, S. RAJARAM, M. P. KAMAT, and J. L. JUNKINS (Virginia Polytechnic Institute and State University, Blacksburg, VA) Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Mar.-Apr. 1984, p. 244, 245.

Previously cited in issue 19, p. 2993, Accession no. A82-38859

A84-25291#

EVOLUTION OF EUROPEAN TELECOMMUNICATION SATELLITE POINTING PERFORMANCE

N. BINGHAM, A. D. CRAIG, and L. FLOOK (British Aerospace PLC, Dynamics Group, Stevenage, Herts., England) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 336-344. refs (AIAA PAPER 84-0725)

The pointing performance of a range of European communications satellite projects is reviewed. The main factors contributing to the overall beam pointing error are discussed, emphasizing the satellite attitude error. Attitude control concepts adopted for ESA satellites are addressed, discussing the reasons for the choices and describing the systems in terms of hardware and control algorithms. The discussion is limited to on-station modes. Finally, the improvement achievable in beam pointing by using an RF sensor/antenna-pointing mechanism control loop is considered. C.D.

A84-25496* Rensselaer Polytechnic Inst., Troy, N. Y. SOME APPLICATIONS OF DIRECT ADAPTIVE CONTROL TO LARGE STRUCTURAL SYSTEMS

I. BAR-KANA and H. KAUFMAN (Rennselaer Polytechnic Institute, Troy, NY) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1983, p. 573, 574. (Contract NSF ECS-80-16173; NAG1-171)

Direct multivariable model reference adaptive control (DMMRAC) applications are considered with a representative

example of a large structural system (LSS). Such applications have in the past been shown to be feasible for multivariable systems, provided that there exists a constant feedback gain matrix such that the resulting input-output transfer function is (simply) positive real. Author

A84-25516

CONTROLLABILITY AND OBSERVABILITY CRITERIA FOR MULTIVARIABLE LINEAR SECOND-ORDER MODELS

A. J. LAUB (Southern California, University, Los Angeles, CA) and W. F. ARNOLD (U.S. Naval Weapons Center, China Lake, CA) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1983, p. 925, 926. refs (Contract DAAG29-81-K-0131)

Criteria are discussed for the determination of controllability, stabilizability, observability, or detectability of linear second-order multivariable models of, for example, large space structures. An initial modal transformation is not required and the criteria are thus applicable to models with arbitrary damping coefficients. Moreover, the criteria are modal in the sense that some or all of the modes may be tested for controllability or observability. This aspect has advantages if not all the modes are known or easily computable. The criteria are further illustrated for a number of important special cases in a series of corollaries. Author

A84-25552* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

USE OF ELECTROMAGNETIC MODELS IN THE OPTIMAL CONTROL OF LARGE SPACE ANTENNAS

F. MANSHADI and M. HAMIDI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 3 . New York, Institute of Electrical and Electronics Engineers, 1983, p. 1317-1323. NASA-supported research. refs

A general approach to the optimal control of large space antennas based on their RF/structural characteristics is described. The approach consists of defining a cost functional based on the degradation of the RF performance of the antenna and using the structural model as the dynamic system. The method is applied to the design of an optimal controller for a 55-m, wrap-rib offset-fed antenna. Simulation results show that control energy consumption is reduced to aproximately one third of the energy used to achieve the same RF performance with traditional control strategies.

Author

A84-25586

NUMERICAL SOLUTION OF SEVERAL CLASSES OF NONLINEAR FLEXIBLE SHELL THEORY PROBLEMS [CHISLENNOE RESHENIE NEKOTORYKH KLASSOV NELINEINYKH ZADACH TEORII GIBKIKH OBOLOCHEK]

IA. M. GRIGORENKO (Akademiia Nauk Ukrainskoi SSR, Institut Mekhaniki, Kiev, Ukrainian SSR) Vychislitel'naia i Prikladnaia Matematika (ISSN 0321-4117), no. 50, 1983, p. 73-83. In Russian. refs

Approaches to the solution of nonlinear boundary-value problems describing the stress-strained state of several classes of thin flexible multilayered shells with orthotropic plies of variable thickness are presented. The solution of one-dimensional nonlinear boundary-value problems for deformations in the subcritical region is obtained by linearization, reduction to a system of nonlinear equations and a Cauchy problem, and solution continuation by parameter. A modification of the method of reduction to nonlinear equations and a Cauchy problem is used to solve one-dimensional problems of nonlinear deformation in supercritical regions. Two-dimensional problems of nonaxisymmetric deformation of shells of revolution with variable rigidity are considered. The results of solutions of nonlinear problems for axisymmetric deformations of conical and ellipsoidal shells and for asymmetric deformations of spherical shells are presented.

A84-26717

A SIMULATOR TO STUDY DYNAMIC INTERACTION OF THE SPACE SHUTTLE ON-ORBIT FLIGHT CONTROL SYSTEM WITH DEPLOYED FLEXIBLE PAYLOADS

S. S. DAVID and L. L. SACKETT (Charles Stark Draper Laboratory, Inc., Cambridge, MA) IN: Digital Avionics Systems Conference, 5th, Seattle, WA, October 31-November 3, 1983, Proceedings . New York, Institute of Electrical and Electronics Engineers, 1983, p. 5.3.1-5.3.9. refs

A series of studies was undertaken to investigate the effects of the Space Shuttle's on-orbit flight control system (FCS) dynamically interacting with the Orbiter and deployed flexible payloads. In order to support these studies, an existing digital simulator was modified to include elastic body effects and finite element modal parameters. The simulator provides a closed-loop simulation of the flight software interacting with detailed models of the Shuttle vehicle and flight environment. The simulator and the modifications implemented to support these studies are described. Assumptions, design considerations, features, and limitations are discussed. Recent studies, where dynamic interactions between the Orbiter/FCS and deployed payloads were examined, illustrate the use of the simulator's range of model fidelity and diagnostic capability.

A84-26845

STABILITY OF LARGE FLEXIBLE DAMPED SPACECRAFT MODELED AS ELASTIC CONTINUA

P. K. MAHARANA and S. K. SHRIVASTAVA (Indian Institute of Science, Bangalore, India) Acta Astronautica (ISSN 0094-5765), vol. 11, Feb. 1984, p. 103-109. refs

Vibrational stability of a large flexible, structurally damped spacecraft subject to large rigid body rotations is analyzed modeling the system as an elastic continuum. Using solution of rigid body attitude motion under torque free conditions and modal analysis, the vibrational equations are reduced to ordinary differential equations with time-varying coefficients. Stability analysis is carried out using Floquet theory and Sonin-Polya theorem. The cases of spinning and non-spinning spacecraft idealized as a flexible beam/plate undergoing simple structural vibration are analyzed in detail. The critical damping required for stabilizatioon is shown to be a function of the spacecraft's inertia radio and the level of disturbance. Author

A84-26977

MOTION OF A SYMMETRIC SATELLITE ABOUT THE CENTER OF MASS IN CIRCULAR ORBIT IN THE PRESENCE OF FLEXIBLE VISCOELASTIC RODS [DVIZHENIE SIMMETRICHNOGO SPUTNIKA VOKRUG TSENTRA MASS NA KRUGOVOI ORBITE PRI NALICHII GIBKIKH VIAZKOUPRUGIKH STERZHNEI]

N. E. BOLOTINA and V. G. VILKE Kosmicheskie Issledovaniia (ISSN 0023-4206), vol. 22, Jan.-Feb. 1984, p. 13-19. In Russian.

An averaging method in canonical variables is used to obtain approximate equations describing the evolution of the rotational motion of a symmetric satellite with two flexible viscoelastic rods. The solution obtained corresponds to the rotation of the satellite about the symmetry axis, which coincides with the normal to the orbit; since the satellite is symmetric, its angular velocity does not have to coincide with the orbital angular velocity. In the approximation considered, the rods remain rectilinear and there is no energy dissipation. B.J.

A84-27934*# Indian Inst. of Science, Bangalore.

CONTROL STRUCTURE INTERACTIONS IN LARGE SPACE STRUCTURES ANALYSIS USING ENERGY APPROACH

S. K. SHRIVASTAVA (Indian Institute of Science, Bangalore, India), R. C. RIED (NASA, Johnson Space Center, Structures and Mechanics Div., Houston, TX), and M. G. MANOHARAN Aeronautical Society of India, Journal (ISSN 0001-9267), vol. 35, May 1983, p. 59-67. Research supported by the U.S. National Research Council. refs

A simple energy approach to study the problem of control structure interactions in large space structures is presented. For

the illustrative cases of free-free beam and free rectangular plate, the vibrational energy imparted during operation of constant and pulsed thrusters is found in a nondimensional form. Then based on a parametric study, suggestions are made on the choice of the thruster location and parameters to minimize the control structure interactions. Author

A84-29143#

ON TRANSIENT DYNAMICS AND STABILITY OF LARGE SPACE STRUCTURES

V. J. MODI (British Columbia, University, Vancouver, Canada) IN: U.S. National Congress of Applied Mechanics, 9th, Ithaca, NY, June 21-25, 1982, Proceedings . New York, American Society of Mechanical Engineers, 1982, p. 249-258. Sponsorship: Natural Sciences and Engineering Research Council of Canada. refs (Contract NSERC-A-2181; NSERC-G-0662; NSERC-A-0967)

Results of a study aimed at assessing dynamical response and stability of orbiting spacecraft during deployment and/or retrieval of mass elements leading to time dependent inertias are presented. In particular two classes of problems are discussed: (1) flexible beam type appendages such as solar panels, antennas, preassembled trusses, etc., deploying from a space platform in an orbit; and (2) Space Shuttle-based tethered systems. The study suggests that with critical combinations of parameters the systems can become unstable; however, suitable control strategies are available which can restore stability. The analysis is relevant to construction of the proposed Space Operations Center (SOC), tethered rescue systems, retrieval of satellites for servicing, repositioning of space platform based telescopes, and similar situations involving interactions between transient inertias, flexibility, and system response. Author

A84-29145#

MULTIBODY DYNAMICS - ANALYSIS OF FLEXIBILITY EFFECTS

R. L. HUSTON (Cincinnati, University, Cincinnati, OH) IN: U.S. National Congress of Applied Mechanics, 9th, Ithaca, NY, June 21-25, 1982, Proceedings . New York, American Society of Mechanical Engineers, 1982, p. 265-271. refs (Contract N00014-76-C-0139; NSF MEA-81-01110)

(AD-A132533)

This paper discusses flexibility effects in multibody systems. It presents a procedure for the efficient analysis of these effects in large systems containing many bodies. This procedure uses Kane's dynamical equations, Euler parameters, generalized speeds, relative coordinates, finite-segment modelling, and matrix-structural methods. It is a computer-oriented method with the governing equations written in algorithmic form. The procedure is applicable with multibody systems consisting of linked bodies in an 'open-tree' structure. It has specific applications with robots, flexible manipulators, antennae, and human body models. Author

A84-29471* Mational Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CLOSED-FORM SOLUTIONS FOR FEEDBACK CONTROL WITH TERMINAL CONSTRAINTS

J.-N. JUANG (NASA, Langley Research Center, Hampton, VA), J. D. TURNER, and H. M. CHUN (Charles Stark Draper Laboratory, Inc., Cambridge, MA) Virginia Polytechnic Institute and State University and American Institute of Aeronautics and Astronautics, Symposium on Dynamics and Control of Large Flexible Structures, 4th, Blacksburg, VA, June 6-8, 1983, Paper. 17 p. refs

The problem of closed-loop control of maneuvers between two states for linear dynamical systems, subject to an arbitrarily specified terminal state, is considered. The feedback controller design is based on finite-time quadratic regulator theory. Closed-form expressions for the optimal control law are developed. Solutions are presented for both conventional and smoothed control profiles with fixed and/or free end condition problems. In the maneuvers using control-rate penalties, smooth profiles are generated throughout the maneuvers, in the sense that the initial condition jump discontinuities have been eliminated. Several examples involving large-angle maneuvers of a spacecraft are demonstrated. Results include control maneuvers from one state to another such as rest to rest and spin to rest, which effectively justify the solutions developed in this paper. Author

N84-10173*# Howard Univ., Washington, D. C. THE DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES, 6 Final Report

P. M. BAINUM Sep. 1983 101 p refs

(Contract NSG-1414) (NASA-CR-174450; NAS 1.26:174450) Avail: NTIS HC A06/MF A01 CSCL 22B

The controls analysis based on a truncated finite element model of the 122m. Hoop/Column Antenna System focuses on an analysis of the controllability as well as the synthesis of control laws. Graph theoretic techniques are employed to consider controllability for different combinations of number and locations of actuators. Control law synthesis is based on an application of the linear regulator theory as well as pole placement techniques. Placement of an actuator on the hoop can result in a noticeable improvement in the transient characteristics. The problem of orientation and shape control of an orbiting flexible beam, previously examined, is now extended to include the influence of solar radiation environmental forces. For extremely flexible thin structures modification of control laws may be required and techniques for accomplishing this are explained. Effects of environmental torques are also included in previously developed models of orbiting flexible thin platforms.

B.W.

N84-11195# RAND Corp., Santa Monica, Calif. THE FLEXURAL BEHAVIOR OF PACSAT (PASSIVE COMMUNICATION SATELLITE) IN ORBIT Interim Report W. SOLLFREY Feb. 1983 131 p refs (Contract MDA903-82-C-0068; ARPA ORDER 3584-7)

(AD-A131406; RAND/R-2936-ARPA; LC-83-570;

ISBN-0-8330-0490-5) Avail: NTIS HC A07/MF A01 CSCL 22B This report presents an analysis of the libration and vibration of a passive communications satellite known as PACSAT. It addresses the effects of various disturbing mechanical forces on verticality and straightness. Phenomena considered include orbital ellipticity, earth oblateness, solar and lunar gravity, radiation pressure, micrometeorial impacts, and thermal bending effects. The last two are the most important. It is concluded that the flexural misbehavior of PACSAT in orbit is such that it is most improbable that the present design (unsupported linear array) can

perform its communications functions. Author (GRA)

N84-12222 Stanford Univ., Calif. CONTROL OF FLEXIBLE SPACECRAFT BY OPTIMAL MODEL FOLLOWING Ph.D. Thesis

J. A. QUIRK 1983 244 p

Avail: Univ. Microfilms Order No. DA8307199

Spacecraft flexibility resulting from increased size and light-weight design techniques significantly increases the interaction between the structural bending modes and the vehicle control system. The subject of this thesis is the use of the unique properties of Optimal Model Following (OMF) to simplify the controller design process for flexible spacecraft. Model following controllers force the plant states to follow the dynamics of a model which incorporates the system performance specifications. OMF, model following using a linear quadratic cost function, trades off the degree of dynamics matching with the control effort utilized. As part of this thesis, an OMF controller design program was developed. OMF controllers were designed for three examples: altitude control of a flexible spacecraft, pointing of a camera package on a flexible appendage, and control of a spacecraft based on the Galileo vehicle. The performance characteristics of the OMF designs were compared to those of optimal controllers. Dissert. Abstr.

National Aeronautics and Space Administration. N84-12234*# Marshall Space Flight Center, Huntsville, Ala.

SPACE STATION ATTITUDE CONTROL SYSTEM CONCEPT AND REQUIREMENTS

P. D. NICAISE In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 63-69 Dec. 1983 refs Avail: NTIS HC A10/MF A01 CSCL 22B

There is currently no single Space Station configuration which is accepted as a baseline. However, the latest approach is toward symmetry in both geometry and mass distribution. This minimizes aerodynamic and gravity gradient torques. Solar arrays and radiators drive the configuration strongly. One axis of the solar arrays needs to be perpendicular to the orbit plane, and the geometric and principal axis should remain common along this axis to minimize secular torques. The need for both inertial and earth-fixed modes drives the structure of the Station toward a disk-like shape in the orbital plane. Author

N84-12235*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE BOEING FLYWHEEL STUDY

R. R. RICE In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 71-76 Dec. 1983 refs Avail: NTIS HC A10/MF A01 CSCL 10C

The major features of the history of the Boeing flywheel were studied. The analysis of the regenerative fuel cell was started as an outgrowth of the original Boeing study of the Space Operations Center, and was completed in November 1982 with the publication of the final report number D180-27160-1. The current flywheel effort attempts to study the integrated flywheel using the same ground rules that were used on the fuel cell study. Author

N84-12236*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SPACE STATION CONTROL REQUIREMENTS AND FLYWHEEL SYSTEM WEIGHTS FOR COMBINED MOMENTUM AND ENERGY STORAGE

F. M. ELAM In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 77-92 Dec. 1983 refs

Avail: NTIS HC A10/MF A01 CSCL 10C

The specifications of the flywheel system for momentum storage and vehicle torquing are somewhat dependent upon the attitude control requirements of the space station in orbit. As a ground rule, the flywheel system will be sized large enough to provide all attitude maneuvers, if practical, to avoid or minimize turning on the reaction control system (RCS). The RCS, whenever used, expels expensive mass and tends to contaminate optical surfaces of the vehicle. The vehicle rate and acceleration specifications of 0.10 deg/sec and 0.01 deg/square sec are tentative, and may be reduced if lesser values are more practical for flywheel design. For local vertical attitude hold, the average attitude error should be zero, and not the classical 1 degree, since control moment gyro (CMG) gimbal angles provide an exact reference feedback for gravity gradient momentum. Docking presents a problem for docking transients and attitude alignment which will require use of the RCS. Author

₩84-12238*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. ATTITUDE CONTROL IPACS TECHNOLOGY

CONSIDERATIONS

L. BRANDON /n NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 99-104 Dec. 1983

Avail: NTIS HC A10/MF A01 CSCL 22B Larger facilities or the Space Station and its evolutionary

versions are considered for the control bandwidth which will evolve to lower values, probably in the 0.01 to 0.1 hertz range. An integrated power attitude control systems (IPACS) unit that incorporates conventional mechanical bearings to have a bandwidth of 4-10 hertz is expected. If the IPACS unit incorporates the advanced technology magnetic bearing, a bandwidth of 1.2 hertz is expected. It is found that for the Space Station or even the Space Platform, either of the above IPACS concepts are adequate. E.A.K.

N84-12243*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ADVANCED CONTROL AND POWER SYSTEM (ACAPS) TECHNOLOGY PROGRAM

C. R. KECKLER and N. J. GROOM In its Integrated Flywheel Technol., 1983 p 141-156 Dec. 1983 refs

Avail: NTIS HC A10/MF A01 CSCL 22B

The advanced control and power system (ACAPS) program is to establish the technology necessary to satisfy space station and related large space structures requirements for efficient, reliable, and cost effective energy storage and attitude control. Technology advances in the area of integrated flywheel systems capable of performing the dual functions of energy storage and attitude control are outlined. FAK

N84-12245*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

IPACS GUIDANCE NAVIGATION AND CONTROL SYSTEM CONSIDERATIONS AND TEST ACTIVITIES

H. J. BUCHANAN In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 165-168 Dec. 1983 Avail: NTIS HC A10/MF A01 CSCL 17G

The MSFC facility proposed for the Space Station Attitude Control Simulator which consists of a large three degree of freedom table driven by computer controlled hydraulic actuators designed to give high bandwidth and extremely fine control through large angles is outlined. The facility includes star and solar simulators providing collimated light with the spectral content and intensity typical of Earth orbit. E.A.K.

N84-13608*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STABILITY, VIBRATION AND PASSIVE DAMPING OF PARTIALLY RESTRAINED IMPERFECT COLUMNS

Z. RAZZAQ, R. T. VOLAND, H. G. BUSH, and M. M. MIKULAS, JR. Oct. 1983 38 p refs (NASA-TM-85697; NAS 1.15:85697) Avail: NTIS HC A03/MF

A01 CSCL 20K

A theoretical and experimental study of slender tubular columns for possible use in space structures is conducted in the presence of partial rotational end restraints. Explicit formulas are derived for computing the buckling load and the lowest natural frequency of perfectly straight uniform elastic members with rotational end restraints possessing linear moment-rotation characteristics. An exact solution in the form of a transcendental equation, and a numerical solution using second-order finite-differences are also presented. The presence of an initial imperfection is also incorporated into the numerical procedure. Vibration tests are conducted on an imperfect tubular steel member in the absence of an axial load. A damping concept consisting of a string-mass assembly is explored. Three passive damping configurations involving combinations of three lead shots were investigated. The three lead shot configurations provided considerably greater damping than the single lead shot. Author

N84-14235 California Univ., Los Angeles.

ACTIVE CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES Ph.D. Thesis

M. K. MACKAY 1983 260 p

Avail: Univ. Microfilms Order No. DA8314665

The control of a large flexible space structure using a finite number of controls and observations is considered. The control problem is formulated as an optimal stochastic regulator. Various assumptions are made concerning the natural damping in the system. This leads to semigroup representations for the open loop system which are uniformly exponentially stable and compact, uniformly exponentially stable and noncompact, strongly stable, and unitary (no natural damping). New sufficient conditions are given for the existence of a solution to the control problem for the strongly stable and unitary cases. The solution to the control problem is obtained in terms of the compensator, i.e., the optimal linear operator mapping the observations to the control. Both time domain and frequency domain representations for the compensator are given and its modal approximation is studied. The general theory is applied to a space structure modeled as a rigid central body with two flexible appendages (cantilevered beams).

Dissert. Abstr.

N84-14546# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

EXPERIMENTAL STUDY OF ACTIVE VIBRATION CONTROL Annual Report, 15 Mar. 1982 - 14 Mar. 1983

W. L. HALLAUER, JR. 15 Apr. 1983 11 p (Contract AF-AFOSR-0217-82; AF PROJ. 2307)

(AD-A133818; AFOSR-83-0855TR) Avail: NTIS HCA02/MFA01 CSCL 20K

Control system hardware, including velocity sensors, force actuators, and analog circuitry, has been designed, fabricated, calibrated, and tested in operation. Active vibration control in the forms of direct-velocity-feedback control and modal-space control has been implemented on a dynamically uncomplicated beam-cable structure, and theorectical simulations of the structure-control dynamics have been completed. Either correlation between experiment and theory has been satisfactory, or the reasons for unsatisfactory correlation have become clear so that corrections can be made in the future. A dynamically complicated, variable-geometry plane grid structure intended for control experiments has been built and analyzed experimentally and theoretically for its modes of vibration. The initial versions of both the actual structure and its theorectical model was unsatisfactory in some respects, and necessary improvements are almost completed at this writing. Finally, the tasks of subcontractor HR Textron are almost completed. They consist of a study of the techniques known as component cost analysis and modal cost analysis and a preliminary study of issues involved in the testing of active vibration control systems of full-size satellite structures, most specifically whether testing should be conducted on the ground or in orbit. Author (GRA)

N84-15181# TRW Space Technology Labs., Redondo Beach, Calif.

FOURTEEN (ACTIVE CONTROL OF ACOSS SPACE STRUCTURES) Final Technical Report, 23 Jun. 1981 - 30 Oct. 1982

R. J. BENHABIB, H. K. FLASHNER, and F. C. TUNG Mar. 1983 260 p

(Contract F30602-81-C-0194: DARPA ORDER 3654: AF PROJ. Č654)

(AD-A133411; RADC-TR-83-51) Avail: NTIS HCA12/MFA01 CSCL 22B

ACOSS Fourteen is one of a series of studies for the development of a unified structural dynamics and control technology base to support future development of large space systems. The major emphasis in these studies in the past has been on generic control law development for active vibration suppression. The emphasis is now shifting towards hardware development and experimental verification of the technology. ACOSS Fourteen studies the definition, design and plan for an on-orbit. Shuttle-based Proof of Concept demonstration and stability enduring designs which extend previous designs and treat noncolocated actuator-sensor control systems, while remaining insensitive to modal truncation and inaccurate structural models.

Author (GRA)

Dornier-Werke G.m.b.H., Friedrichshafen (West N84-15182# Germany).

STUDY ON DAMPING REPRESENTATION RELATED TO SPACECRAFT STRUCTURAL DESIGN Final Report E. HILBRANDT Paris ESA Feb. 1983 210 p refs (Contract ESTEC-4435/80/NL-AK(SC))

(EMSB-18/83; ESA-CR(P)-1770) Avail: NTIS HC A10/MF A01 Damping representation models for spacecraft dynamic response analysis, and system damping prediction methods were

analyzed. Results show that the only suitable damping model is the viscous damping model. For response analysis with adapted modal viscous damping values the response of a structure may be predicted with adequate accuracy if a derived coupling criteria is not violated. Otherwise the response should be predicted with a corrective method or the exact analysis with complex eigenmodes. Damping prediction methods for system damping from substructure damping are far more sensitive to the damping characteristics of the substructures than response analysis methods. Because of damping coupling effects nonproportional damping characteristics have to be incorporated in these system damping prediction methods. Damping estimation methods are not adequate for damping prediction; system identification must be applied. Differences between random and harmonic test methods are treated and system identification with random response data is discussed. Author (ESA)

N84-15840 Rensselaer Polytechnic Inst., Troy, N. Y. DIRECT MULTIVARIABLE MODEL REFERENCE ADAPTIVE CONTROL WITH APPLICATIONS TO LARGE STRUCTURAL SYSTEMS Ph.D. Thesis

I. BAR-KANA 1983 253 p Avail: Univ. Microfilms Order No. DA8321179

The need for adaptive control of any system arises because of ignorance of the systems internal structure and critical parameter values, as well as changing control regimes. A large scale system is substantially more susceptible to these problems. Although considerable progress has been made in designing Model Reference adaptive controllers for unknown single input single output control systems, little progress has been made toward extension of these ideas to the multi-input multi-output (multivariable) case. Furthermore, most adaptive control procedures need the order of the (assumably unknown) controlled plant and use a reference model of the same order as the plant for implementation of the adaptive algorithm. Direct Multivariable Model Reference Adaptive Control (DMMRAC) procedures which do not require explicit parameter identification or a reference model of the same order as the plant seem to be especially attractive for the control of large structural systems. However, in the past they were shown to only be feasible for systems which satisfy the strictly positive realness condition. Dissert. Abstr.

N84-16056*# Alabama Univ., Huntsville. Dept. of Aerospace Engineering.

FINITE ELEMENT ANALYSIS OF A DEPLOYABLE SPACE STRUCTURE

G. E. WEEKS In its Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program 24 p Dec. 1983 refs Avail: NTIS HC A99/MF A01 CSCL 20K

The dynamic characteristics of the Solar Array Flight Experiment (SAFE) structure during deployment and retraction are investigated. The SAFE structure consists of a deployable mast with an attached solar blanket designed with accordion type folds to permit packaging in a small volume. The planar form of the blanket geometry during deployment is maintained by a blanket tension/guidewire system. Structurally, the mast is modeled as an Euler beam column with inplane and out of plane bending and finite torsional stiffness. For out of plane motion, the blanket is modeled as a distributed mass uniformly supported by the three quidewires. For inplane motion the blanket displacements are assumed to vary linearly from the mast base to the mast tip. The mathematical model uses a virtual work formulation, required because the axial loading on the mast is nonconservative, combined with assumed beam modes to derive the differential equations of motion. Consideration of the time dependent boundary conditions results in an infinite set of ODE with time dependent coefficients. Finally, correlation of mast tip accelerations to mast base bending moments for specified modal motions are indicated. M.G.

N84-16232# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SENSITIVITY ANALYSIS OF THE INFLUENCE OF THE FLEXIBILITY OF SOLAR PANELS ON THE ATTITUDE DYNAMICS OF ARTIFICIAL SATELLITES [ANALISE DE SENSITIVIDADE DA INFLUENCIA DA FLEXIBILIDADE DE APENDICES SOBRE A DINAMICA DA ATITUDE DE SATELITES ARTIFICIAIS]

D. L. FERREIRA, P. T. D. M. LOURENCAO, and O. M. NETO Jun. 1983 12 p refs In PORTUGUESE; ENGLISH summary Presented at the 7th Brazil. Mech. Eng. Conf., COBEM 83, Uberlandia, Minas Gerais, 13-16 Dec. 1983

(INPE-2763-PRE/337) Avail: NTIS HC A02/MF A01

The motion of a spin-stabilized satellite, having two flexible solar panels was studied. The equations of motion are attained using the Lagrangian formalism and the assumed modes method. The influence of the flexibility is studied using the eigenvalue and eigenvector sensitivity. The pole allocation technique is used to minimize the effects of elasticity on the rigid body motion.

Author

N84-16246*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.

DIGITAL CONTROL SYSTEM FOR SPACE STRUCTURAL DAMPERS Semiannual Progress Report

J. K. HAVILAND Jan. 1984 27 p refs

(Contract NAG1-349)

(NASA-CR-175355; NAS 1.26:175355; UVA/52824/MAE84/101) Avail: NTIS HC A03/MF A01 CSCL 22B

A recently developed concept for a damper was improved by adding a small taper to the proof-mass, and using a proximeter to determine position. Also, an experimental damper was built using a three-inch stroke in place of the standard one-inch stroke. The analog controller initially used was replaced by an independent digital controller slaved to a TRS-80 Model I computer, which also serves as a highly effective, low-cost development system. An overall system concept for the use of proof-mass dampers is presented. A.R.H.

N84-16248*# Massachusetts Inst. of Tech., Cambridge. Dept. of Aeronautics and Astronautics.

RELIABILITY ISSUES IN ACTIVE CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES Semiannual Status Report, 16 May - 15 Nov. 1983

W. E. VANDERVELDE 23 Nov. 1983 8 p

(Contract NAG1-126)

(NASA-CR-175341; NAS 1.26:175341) Avail: NTIS HC A02/MF A01 CSCL 22B

The unreliability of control system components was investigated in our attempt to deal with that problem. This matter is of concern in large space structure control because of the large number of components required to achieve specified performance in some situations, and the long operating period required between maintenance visits. The detection and isolation of component failures during system operation, and algorithms for reconfiguring control systems following detection and isolation of a failure were emphasized. S.L.

N84-16249*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THERMALLY INDUCED SPIN RATE RIPPLE ON SPACECRAFT WITH LONG RADIAL APPENDAGES

J. V. FEDOR Aug. 1983 29 p refs

(NASA-TM-85058; NAS 1.15:85058) Avail: NTIS HC A03/MF A01 CSCL 22B

A thermally induced spin rate ripple hypothesis is proposed to explain the spin rate anomaly observed on ISEE-B. It involves the two radial 14.5 meter beryllium copper tape ribbons going in and out of the spacecraft hub shadow. A thermal lag time constant is applied to the thermally induced ribbon displacements which perturb the spin rate. It is inferred that the averaged thermally induced ribbon displacements are coupled to the ribbon angular motion. A possible exponential build up of the inplane motion of the ribbon which in turn causes the spin rate ripple, ultimately limited by damping in the ribbon and spacecraft is shown. It is indicated that qualitative increase in the oscillation period and the thermal lag is fundamental for the period increase. found that numerical parameter values required to agree with in orbit initial exponential build up are reasonable; those required for the ripple period are somewhat extreme. E.A.K.

N84-17227*# Rockwell International Corp., Downey, Calif. Shuttle Integration and Satellite Systems Div. A DEPLOYABLE STRUCTURE AND SOLAR ARRAY CONTROLS

EXPERIMENT FOR STEP

T. S. NISHIMOTO *In* NASA. Langley Research Center STEP Expt. Requirements p 211-220 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

A candidate configuration for a controls experiment on the Space Technology Experiments Platform (STEP) is described. The elements of the experiment are the mast, the solar array, and an articulation module between the two. The characteristic dimensions are very compatible for integration on a pallet such a STEP's proposed configuration. The controls' objective would be the measurement of orbiter interaction as well as the system identification of the appendages. The flight experiment configuration would also provide a test bed for various active vibration controls concepts. The instrumentation being considered would measure accelerations, strains, displacements, and temperatures. The deployable mast has eight elements defining a structural bay. Uniaxial measurements would be required to define loads at a cross section of the structure. Displacements due to thermal distortion of the mast and the local state of the solar concentrator may be measured by an optical ranging technique from the orbiter aft flight deck. M.G.

N84-17228*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

VIBRATION ISOLATION TECHNOLOGY EXPERIMENT

C. R. KECKLER In its STEP Expt. Requirements p 221-230 Jan. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 22B

The objectives of the vibration isolation technology experiment are to demonstrate the viability of the magnetic suspension technology in providing the isolation of large structures elements from the external environment and to quantify the degree of isolation provided by this system. The approach proposed for this experiment is to mount a six-degrees-of-freedom magnetic bearing suspension system at the free end of a shuttle-attached flexible structure such as MAST. The disturbance generator, located on top of the isolation system, will be energized at selected and broadband frequencies to simulate a typical spacecraft vibration environment. Sensors located on the isolation system and the flexible structures element will be used to quantify the degree of isolation provided by this system. M.G.

N84-17229*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

INTEGRATED POWER/ATTITUDE CONTROL SYSTEM (IPACS) TECHNOLOGY EXPERIMENT

C. R. KECKLER *In its* STEP Expt. Requirements p 231-240 Jan. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 22B

An experiment is proposed that will perform the tasks associated with the control and energy storage/power generation functions attendant to space operations. It was shown in past studies that the integration of these functions into one system can result in significant weight, volume, and cost savings. The Integrated Power/Attitude Control System (IPACS) concept is discussed. During orbit day, power is derived from the solar cell arrays and, after appropriate conditioning, is used to operate the spacecraft subsystems, including the control system. In conventional approaches, a part of the collected solar energy is stored in a bank of batteries to permit operation of the vehicle's systems during orbit night. In the IPACS concept, the solar energy is stored in the spinning flywheels of the control system in the form of kinetic energy. During orbit night, the wheels are despun and, through the use of a wheel-shaft mounted generator, power is generated for the onboard subsystems. Operating these flywheels over a 50-percent speed variation permits the extraction of 75 percent of the stored energy while at the same time preserving 50 percent of the momentum capacity for control of the vehicle. Batteries can therefore be eliminated and significant weight and volume savings realized. R.J.F.

N84-17230*# General Electric Co., Philadelphia, Pa. Space Systems Div.

INVESTIGATION OF ARTICULATED PANEL DYNAMICS

C. V. STAHLE, JR. In NASA. Langley Research Center STEP Expt. Requirements p 241-255 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

An articulated panel dynamics experiment to evaluate present analysis and ground test methods as well as damping effectiveness is proposed. The experiment uses an existing panel design which was extensively analyzed and tested. These data provide a firm basis for evaluating the adequacy of panel analysis and ground test methodology. The key issues for future large space structure panel designs are addressed: the critical launch transient and vibroacoustic loading; the deployment analysis adequacy including air and gravitational effects; and the orbital resonant frequencies and mode shapes of deployed panel assemblies. By using an existing mature design that was thoroughly tested, the effort can focus on correlation of actual flight results with existing predictions. A second panel assembly incorporating passive damping is proposed to provide a direct measure of damped panel benefits that can be obtained. These benefits include: reduced launch loads and responses; and highly damped deployed modes. Existing space-qualified viscoelastic epoxy, in combination with composite materials or an alternate more effective damping material, will be used. R.J.F.

N84-17241# Institut National de Recherche d'Informatique et d'Automatique, Rocquencourt (France).

VALIDATION METHODS FOR MATHEMATICAL MODELS OF FLEXIBLE SATELLITE DYNAMICS Final Report [METHODES DE VALIDATION DES MODELES MATHEMATIQUES EN DYNAMIQUE DES SATELLITES NON RIGIDES]

C. A. DARMON Paris ESA 1983 303 p refs In FRENCH (Contract ESTEC-2991/76/NL-AK(SC))

(ESA-CR(P)-1794) Avail: NTIS HC A14/MF A01

The linear equations of the dynamics of a rotating or three axis stabilized satellite are analyzed, using a second order Lagrange, a frequential, modal and a variable state model. Satellite sensor equations are solved. It is shown that satellite nonvibration modes are not observed by accelerometers and gyrometers. A fast Fourier transformation nonparametric method which identifies system order is presented. Parameter identification conditions for a second order model are established, and a maximum likelihood estimate algorithm for model parameters is described. An algorithm which identifies modal vectors and frequencies which intervene in the mode model as state variables, and second order model matrices for each observable mode is shown. Author (ESA)

N84-17251*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

INVESTIGATION OF ELECTRODYNAMIC STABILIZATION AND CONTROL OF LONG ORBITING TETHERS Final Report, 13 Sep. 1982 - 12 Sep. 1983

G. COLOMBO (Padova Univ., Italy) and D. ARNOLD Jan. 1984 159 p refs

(Contract NAS8-35036)

(NASA-CR-170972; NAS 1.26:170972) Avail: NTIS HC A08/MF A01 CSCL 22B

The state-of-the-art in tether modelling among participants in the Tethered Satellite System (TSS) Program, the slack tether and its behavior, and certain advanced applications of the tether to problems in orbital mechanics are identified. The features and applications of the TSS software set are reviewed. Modelling the slack tether analytically with as many as 50 mass points and the application of this new model to a study of the behavior of a broken tether near the Shuttle are described. A reel control algorithm developed by SAO and examples of its use are described, including an example which also demonstrates the use of the tether in transferring a heavy payload from a low-orbiting Shuttle to a high circular orbit. Capture of a low-orbiting payload by a Space Station in high circular orbit is described. Energy transfer within a dumbbell-type spacecraft by cyclical reeling operations or gravitational effects on the natural elasticity of the connecting tether, it is shown, can circularize the orbit of the spacecraft.

N.W.

N84-18262*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics. CONTROL OF LARGE FLEXIBLE SPACECRAFT BY THE INDEPENDENT MODAL-SPACE CONTROL METHOD Interim

Report L. MEIROVITCH and J. SHENAR Washington NASA Jan. 1984 212 p refs

(Contract NAG1-225)

(NASA-CR-3760; NAS 1.26:3760) Avail: NTIS HC A10/MF A01 CSCL 22B

The problem of control of a large-order flexible structure in the form of a plate-like lattice by the Independent Modal-Space Control (IMSC) method is presented. The equations of motion are first transformed to the modal space, thus obtaining internal (plant) decoupling of the system. Then, the control laws are designed in the modal space for each mode separately, so that the modal equations of motion are rendered externally (controller) decoupled. This complete decoupling applies both to rigid-body modes and elastic modes. The application of linear optimal control, in conjunction with a quadratic performance index, is first reviewed. A solution for high-order systems is proposed here by the IMSC method, whereby the problem is reduced to a number of modal minimum-fuel problems for the controlled modes. Author

N84-18281*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

ATTITUDE, CONTROL AND STABILIZATION

B. G. MORAIS *In* NASA. Langley Research Center Space Station Technol., 1983 p 41-60 Feb. 1984

Avail: NTIS HC A09/MF A01 CSCL 22B

In the area of control, several problems can arise during the evolution of the space station. These incude: 1) the use of multiple or articulated flexible bodies; 2) the need for distributed cntrol for maneuvering and maintaining altitude; 3) hierarchical control to automate and manage control systems; 4) structual control (from the standpoint of appendage stamping; isolation, and possible figure control); 5) cntrol position and orientation for component modules during construction (an evolutionary requirement); 6) control during docking and undocking operations; and 7) the normal requirements for stablity and control during systems operations. In addition, there are a number of key technology concerns, such as significant landing modes which tend to be closely spaced and distributed widely, distributed sensors and actuators which are collecated, and the wide distribution of landing modes that must be reduced from a dimensional standpoint. Author

N84-18311# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

ACOSS ELEVEN (ACTIVE CONTROL OF SPACE STRUCTURES), VOLUME 1 Interim Report, Apr. - Nov. 1982

E. FOGEL, D. R. HEGG, H. MCCLAMROCH, and J. C. LIN Griffiss AFB, N.Y. RADC Jul. 1983 140 p 2 Vol.

(Contract F30602-81-C-0180; AF PROJ. C655)

(AD-A135675; CSDL-R-1598-VOL-1; RADC-TR-83-158-VOL-1)

Avail: NTIS HC A07/MF A01 CSCL 22A

This volume documents the progress made in four principal areas during this reporting period: (1) The difficulties encountered in the Large Space Structure (LSS) system identification were studied. Focusing on the high-resolution identification problem, a procedure for identifying lightly damped, closely spaced modes is derived; (2) Two approaches to the incorporation of actuator.

dynamics and the role of actuator transducers in LSS vibration control were explored; (3) A modal dashpot/modal spring control design is presented; and (4) A controlled experiment for the ACOSS design is proposed in which each principal element in the overall synthesis process is systematically examined. Author (GRA)

N84-18312# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

ACOSS ELEVEN (ACTIVE CONTROL OF SPACE STRUCTURES), VOLUME 2 Interim Report, Jun. - Nov. 1982

T. H. BROOKS and D. ANDING Griffiss AFB, N.Y. RADC Jul 1983 148 p 2 Vol.

(Contract F30602-81-C-0180; AF PROJ. C655)

(AD-A135676; CSDL-R-1598-VOL-2; RADC-TR-83-158-VOL-2) Avail: NTIS HC A07/MF A01 CSCL 22A

In analysis and simulation of Space-based Surveillance System Performance, a key variable is the scene/sensor interaction, under subcontract to CSDL, Photon Research Associates has developed a software package capable of generating and manipulating terrestrial scene data sets as a function of major surveillance system and mission parameters. This report documents the details of this simulation, called Genesis, which has now been incorporated into the Draper Integrated Simulations. Author (GRA)

N84-18313# Air Force Academy, Colo.

SCALE MODEL TESTING FOR CONTROL SYSTEM PARAMETERS OF LARGE STRUCTURES Final Report, Aug. 1982 - Aug. 1983

R. T. EVANS, B. J. SIMMONS, S. M. BROWN, D. A. ERCHINGER, and M. E. MATHEWS Oct. 1983 35 p

(Contract AF PROJ. 2308)

(AD-A135652; FJSRL-TR-83-0011) Avail: NTIS HC A03/MF A01 CSCL 22B

The premise is made that as an alternate to or enhancement to finite element analysis of a large complex structure, scale model tests can provide useful parameters for control system design. The objective is to minimize risks associated with expensive construction of large complex space structures by better predictions of the associated structural dynamics. This report covers construction of scale models, and comparison of scale model parameters to the full size structure. A comparison of the results obtained for three scale models yields general relationships that can be applied to future large complex structure development and to a conclusion that structural characteristics pertaining to control system parameters can be determined from scale model tests. GRA

N84-18987# California Univ., Los Angeles. Dept. of System Science.

RESEARCH ON BOUNDARY FEEDBACK AND CONTROL THEORIES, 1978 - 1983 Final Report, 2 Jan. 1982 - 31 Mar. 1983

A. V. BALAKRISHNAN Mar. 1983 16 p

(Contract AF-AFOSR-3550-78; AF PROJ. 2304)

(AD-A136531; AFOSR-83-1240TR) Avail: NTIS HC A02/MF A01 CSCL 12A

During the period of this grant, topics investigated included: nonlinear white noise theory; stabilization of distributed parameter systems by boundary feedback; system modeling and identification; control of flexible flight vehicles; random fields, filtering and estimation; control of randomly varying systems; and control of large space structures. Thirty technical papers were produced with titles including: active control of airfoils in unsteady aerodynamics; identification of aircraft parameters in turbulence with nonrational spectra; Aircraft performance modelling, theory and some preliminary results; and active control of large flexible space structures. GRA N84-19383# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CAPTURE OF SATELLITE STABILIZED BY GRAVITY GRADIENT WITH A FLEXIBLE MAST DURING AND AFTER DEPLOYMENT [ANALISE DO PROBLEMA DE CAPTURA DE UM SATELITE ESTABILIZADO POR GRADIENTE DE GRAVIDADE COM MASTRO FLEXIVEL DURANTE E APOS A FASE DE ESTICAMENTO]

D. L. FERREIRA, P. T. D. M. LOURENCAO, and S. A. TAVARES May 1983 11 p refs in PORTUGUESE; ENGLISH summary Presented at the 7th Brazilian Congr. of Mech. Engr., COBEM 83, Uberlandia, Brazil, 13-16 Dec. 1983

(INPE-2749-PRE/325) Avail: NTIS HC A02/MF A01

The capture of the nominal equilibrium position of a gravity gradient stabilized satellite with flexible and extensible appendages is considered. The initial conditions, for which the capture is possible, are studied noting that there is a large variation in the parameters such as deployment velocity center of massa positions, etc. The objective is to evaluate the influence of the boom flexibility on the librational movement of the rigid body. The study is based on the Lagrangena formulation and on the method of assumed modes. Author

N84-19392*# Bendix Corp., Teterboro, N.J. Guidance Systems Div.

MODULAR DESIGN ATTITUDE CONTROL SYSTEM Final Report

F. D. CHICHESTER 24 Jan. 1984 71 p refs (Contract NAS8-33979)

(NASA-CR-170996; NAS 1.26:170996) Avail: NTIS HC A04/MF A01 CSCL 22B

The problem of applying modular attitude control to a rigid body-flexible suspension model of a flexible spacecraft with some state variables inaccessible was addressed by developing a sequence of single axis models and generating a series of reduced state linear observers of minimum order to reconstruct those scalar state variables that were inaccessible. The specific single axis models treated consisted of two, three and four rigid bodies, respectively, interconnected by a flexible shaft passing through the mass centers of the bodies. Reduced state linear observers of all orders up to one less than the total number of scalar state variables were generated for each of the three single axis models cited. Author

N84-19394*# Avco Systems Div., Lowell, Mass.

MAINTENANCE AND ÓPERATIONAL ENHANCEMENT OF THE FLEXIBLE SPACECRAFT DYNAMICS PROGRAM Final Report 9 Sep. 1983 38 p refs

(Contract NAS5-27466)

(NASA-CR-175211; NAS 1.26:175211) Avail: NTIS HC A03/MF A01 CSCL 22B

The modifications and additions made to the Flexible Spacecraft Dynamics (FSD) Program under contract NAS5-27466 are described. The principal addition to the program was the capability to simulate a two axis gimble platform despin control system using the vibration damper degree of freedom for the azimuth gimble. The details of the modifications made to the FSD Program are presented. Modifications to existing subroutines are briefly described and a detailed description of new subroutines is given. In addition, the program variables in new labelled COMMON blocks are described in detail. New input symbols for the FSD Program are described.

N84-19464# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DECENTRALIZED CONTROL OF A LARGE SPACE STRUCTURE USING DIRECT OUTPUT FEEDBACK M.S. Thesis

D. V. THYFAULT Dec. 1983 140 p

(AD-A136781; AFIT/GA/AA/83D-8) Avail: NTIS HC A07/MF A01 CSCL 12A

Direct output feedback control methods are used to develop a multiple-input multiple-output controller. The controller is then applied to the Charles Stark Draper Laboratory 2 (CSDL 2) model.

05 STRUCTURAL DYNAMICS AND CONTROL

The CSDL 2 model is a sophisticated optical space structure representative of large flexible space structures. This model consists of 59 nodes and 23 lumped masses. The beam elements are fully connected and may support axial, transverse, and torsional deformations. NASTRAN is employed to generate modal approximations of the model as well as the mode shapes and frequencies of the resulting modes. Of the numerous modes available for the model, only the first 36 modes are utilized and implemented in the controller. The control problem is formulated in state space form and direct output feedback is implemented. The state is represented as modal amplitudes and rates. System outputs are obtained by rate sensors and control is applied by point force actuators.

N84-19465# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE EFFECT OF MASS AND STIFFNESS CHANGES ON THE DAMPING FACTOR IN A LARGE SPACE STRUCTURE AS REPRESENTED BY THE CSDL 2 MODEL M.S. Thesis

D. E. OLSEN Dec. 1983 132 p

(AD-A136984; AFIT/GSO/AA/83D-2) Avail: NTIS HC A07/MF A01 CSCL 22B

This investigation was undertaken to determine the sensitivity of the damping factor in a large space structure (LSS) to small changes in nonstructural mass and structural element stiffness. Revision 3 of the ACOSS 2 model, developed by the Charles Stark Drapes Laboratory, Inc. (CSDL), was used as the model of the LSS. Various combinations of the mirror masses in this large space telescope were varied by up to 10%, selected structural elements were stiffened by increasing their cross-sectional areas by 10 and 50%, and, finally, two structural elements in the middle of the telescope were stiffened to represent the addition of a lumped mass located away from the control system sensors and actuators. A control system of 21 collocated sensors and actuators, positioned at the top and bottom of the telescope, was used in this analysis. The analysis was accomplished using NASTRAN for the finite element analysis, and, after selecting certain vibration modes for further study, the complex conjugate pairs used to determine the damping factors were calculated. The results indicate that the damping factors for the CSDL model are quite sensitive to small perturbations and that it is very difficult to predict the effect that a perturbation to the model will have on the damping factors. GRA

N84-19900# Concordia Univ., Montreal (Quebec). Dept. of Mechanical Engineering.

DYNAMIC BEHAVIOUR OF A SATELLITE ANTENNA STRUCTURE IN RANDOM VIBRATION ENVIRONMENT

V. K. JHA (SPAR Aerospace Ltd.), T. S. SANDAR, and R. B. BHAT *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., part 3 p 91-103 May 1983 refs

Avail: SVIC, Code 5804, Naval Research Lab., Washington, D.C. 20375 CSCL 20K

Satellite antenna structures are often subjected to random excitations with power spectra densities varying in an arbitrary manner in the frequency domain. A mathematical model for effectively describing such excitations is proposed in order to compute the dynamic response of the antenna structure. The mathematical model of the excitation is developed analytically by enveloping the profile of the power spectral densities by linear segments of varying slopes. The validity of the proposed mathematical model is experimentally verified. The dynamic response of the satellite antenna structure is obtained using the proposed mathematical model for the excitation. The finite element program SPAR was used as the main frame for this dynamic response analysis. The eigenvalues and mode shapes along with displacements and stresses for the antenna structure subjected to random excitations encountered during normal operation are presented, employing the proposed mathematical model for the excitations. M.G.

N84-20625*# Bendix Corp., Teterboro, N.J. Guidance Systems Div.

EXHIBIT D MODULAR DESIGN ATTITUDE CONTROL SYSTEM STUDY Progress Report, Jan. - Feb. 1984

F. CHICHESTER Feb. 1984 69 p refs

(Contract NAS8-33979)

(NASA-CR-170993; NAS 1.26:170993) Avail: NTIS HC A04/MF A01 CSCL 22B

A dynamically equivalent four body approximation of the NASTRAN finite element model supplied for hybrid deployable truss to support the digital computer simulation of the ten body model of the flexible space platform that incorporates the four body truss model were investigated. Coefficients for sensitivity of state variables of the linearized model of the three axes rotational dynamics of the prototype flexible spacecraft were generated with respect to the model's parameters. Software changes required to accomodate addition of another rigid body to the five body model of the rotational dynamics of the prototype flexible spacecraft were evaluated.

N84-20627*# Howard Univ., Washington, D. C. Dept. of Mechanical Engineering.

ENVIRONMENTAL EFFECTS ON THE DYNAMICS AND CONTROL OF AN ORBITING LARGE FLEXIBLE ANTENNA SYSTEM

R. KRISHNA and P. M. BAINUM 1984 10 p refs Proposed for Presentation at the 35th Intern. Astronautical Congr., Lausanne, Switzerland, 7 - 13 Oct. 1984 (Contract NSG-1414)

(NASA-CR-175448; NAS 1.26:175448) Avail: NTIS HC A02/MF A01 CSCL 22B

Solar radiation pressure on the vibrating antenna structure, temperature gradients induced by solar heating, and stabilizing gravity-gradient torques were considered when the linear regulator theory was used to obtain orientation and shape control of a hoop/column antenna system being considered for the land mobile satellite system. A finite element model of the antenna system which includes all six rigid modes and seven flexible modes was used. Results show that the environmental disturbances affect only the rigid modes of the structure. The effect of solar radiation pressure interacting with the vibrating system is smaller than the solar radiation pressure acting on the thermally deformed structure. To reduce control effort in order to maintain shape and orientation, thermal deformations must be minimized in the preliminary design of the system. A.R.H.

N84-20880*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STATIC AND DYNAMIC STRUCTURAL-SENSITIVITY DERIVATIVE CALCULATIONS IN THE FINITE-ELEMENT-BASED ENGINEERING ANALYSIS LANGUAGE (EAL) SYSTEM C. J. CAMARDA and H. M. ADELMAN Mar. 1984 80 p refs

(NASA-TM-85743; L-15659; NAS 1.15:85743) Avail: NTIS HC A05/MF A01 CSCL 20K

The implementation of static and dynamic structural-sensitivity derivative calculations in a general purpose, finite-element computer program denoted the Engineering Analysis Language (EAL) System is described. Derivatives are calculated with respect to structural parameters, specifically, member sectional properties including thicknesses, cross-sectional areas, and moments of inertia. Derivatives are obtained for displacements, stresses, vibration frequencies and mode shapes, and buckling loads and mode shapes. Three methods for calculating derivatives are implemented (analytical, semianalytical, and finite differences), and comparisons of computer time and accuracy are made. Results are presented for four examples: a swept wing, a box beam, a stiffened cylinder with a cutout, and a space radiometer-antenna truss. Author N84-21172# Stevens inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.

TIME DOMAIN ANALYSIS AND SYNTHESIS OF ROBUST CONTROLLERS FOR LARGE SCALE LOG (LINEAR QUADRATIC GAUSSIAN) REGULATORS Final Report, 1 Sep. 1982 - 31 Aug. 1983

R. K. YEDAVALLI, R. N. SHANBHAG, and J. IRUDAYASAMY 31 Aug. 1983 56 p

(Contract AF-83-0139; AF PROJ. 2304)

(AD-A137760: AFOSR-84-0040TR) Avail: NTIS HC A04/MF A01 CSCL 12A

The aspect of robustness for linear multivariable systems is analyzed in time domain. Both stability robustness and performance robustness are combinedly considered to meet stability and performance requirements. First a stability robustness condition in time domain (in terms of eigenvalues) is presented and examples are given which indicate that the proposed robustness condition is less conservative then the corresponding frequency domain condition as well as another recently proposed time domain condition, both given in terms of singular values. Next a technique is presented to further reduce the conservatism of the proposed condition. A design algorithm that incorporates both stability robustness and performance robustness into the design procedure suggested in the summer faculty program report, is modified with the help of new definitions of robustness indices. Computer software to implement the algorithm is presented along with simple examples to illustrate the concepts. Based on the experience gained by the minigrant research, areas of future research are recommended. Author (GRA)

N84-21604# European Space Agency, Paris (France). DERIVATION AND COMBINATION OF IMPEDANCE MATRICES FOR FLEXIBLE SATELLITES

E. CRELLIN (ESTEC, Noorwidik, Netherlands) and F. JANSSENS (ESTEC, Noorwidjk, Netherlands) Nov. 1983 107 p refs (ESA-STR-209; ISSN-0379-4067) Avail: NTIS HC A06/MF A01

The concept of the impedance matrix of a dynamical system is presented as a tool for the study of the small vibrations about equilibrium of a satellite with flexible appendages (attitude dynamics). A method which avoids the derivation of the equations of motion of the global system and does not require discretization of the flexible appendage a priori is developed. The impedance of the global system enables the study of the attitude dynamics and it can be constructed, in a systematic way, from the subsystem impedances. Impedances for typical subsystems of spinning satellites are derived. The method of combination of the subsystem impedances is used to derive global system impedances for GEOS, ISPM, ISEE-B, ESRO-4 and IMP-J satellites. Author (ESA)

N84-21611# Consulenze Generali Roma (Italy).

STUDY ON SYNTHESIS AND CHARACTERIZATION OF LARGE SPACE SYSTEMS, PHASE 2. PART 2: PROPOSALS FOR ADDITIONS, MODIFICATIONS AND NEW ANALYTICAL **METHODS, VOLUME 1 Final Report**

C. ARDUINI and U. PONZI Paris ESA Dec. 1982 360 p refs 5 Vol.

(Contract ESTEC-4348/80/NL-AK(SC))

(ESA-CR(P)-1779-VOL-3) Avail: NTIS HC A16/MF A01 For large space structure design, solution of the dynamic problems of the periodic structures by cyclosymmetric technique is discussed. Computing radiation forces by adapting thermal design verification softwares is considered. Simplified models and computational schemes for the aerodynamic load are outlined. Finite element formulations for tensioned members are evaluated.

N84-21612# Consulenze Generali Roma (Italv).

THE SOLUTION OF THE DYNAMIC PROBLEM OF THE PERIODIC STRUCTURES BY CYCLOSYMMETRIC TECHNIQUE **Final Report**

C. ARDUINI In its Study on Syn. and Characterization of Large Space Systems, Phase 2. Part 2: Proposals for Additions, Modifications and New Anal. Methods, Vol. 1 p 13-168 Dec. 1982 refs

Avail: NTIS HC A16/MF A01

The cyclosymmetric approach is advocated for the large space problem. structure eigenvalue The method treats noncyclosymmetric systems as perturbations of a basic cyclosymmetric system. Noncyclosymmetry is assumed to reside in the boundary conditions only. The original set of equations is reduced to a formally cyclosymmetric system by including all the deviations in the load vector (F). All the unknowns are obtained as functions of F, but since F also depends on the unknowns, the solution is really a reformulation of the problem. System cyclosymmetry is estimated a posteriori by comparing its modal shapes to those of the cyclosymmetric boundary conditions. The method is particularly good for higher frequency modes, but also gives good results for frequencies as low as the fundamental, and for any number of bays. It can be applied to multisymmetric systems. Author (ESA)

06

ELECTRONICS

Includes techniques for power and data distribution, antenna RF performance analysis, communications systems, and spacecraft charging effects.

A84-10016#

SPACE STATION DATA MANAGEMENT - A SYSTEM EVOLVING FROM CHANGING REQUIREMENTS AND A DYNAMIC TECHNOLOGY BASE

W. C. MOSLEY (General Electric Co., Space Systems Div., Valley Forge, PA) IN: Computers in Aerospace Conference, 4th, Hartford, CT, October 24-26, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983. p. 101-109.

(AIAA PAPER 83-2338)

An assessment is made of the data management system requirements, and consequent architectural properties, of a prospective Space Station data system. These requirements are shaped by such factors as an operational lifetime that will span several generations of technology, and the ability to accomodate evolutionary growth. The architectural features that must be emphasized include modularity, to achieve functional autonomy, flexibility of application, testability, transparency of technological modification, and standardization. It is noted that software verification and validation tools offer the greatest potential return on investment of any of the data management system technology areas in which accelerated development can be undertaken. Generally, it is judged that the technology base for the initial configuration of the Space Station data system is currently available. O.C.

A84-10025#

VOICE INTERACTIVE SYSTEM FOR AIDING AND DOCUMENTATION OF SPACE-BASED TASKS

V. RILEY and R. VESTEWIG (Honeywell Systems and Research Center, Minneapolis, MN) IN: Computers in Aerospace Conference, 4th, Hartford, CT, October 24-26, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p. 171-177.

(AIAA PAPER 83-2355)

The application of a voice-interactive maintenance-aiding device (VIMAD) to the performance assembly and maintenance tasks in space is considered. The problems presented by the complexity of the tasks to be performed, by the crew limitations of space missions, by the space environment in general, and by the further restrictions of extravehicular activities are reviewed. VIMAD has been developed for ground use and comprises a helmet-mounted, hand-held, or full-size portable display unit linked by RF or cable to a computer or microcomputer controlling the presentation of video or audio information. User command is by voice or portable keyboard, and the instructions and diagrams are stored on random-access video and audio disks. The modifications in software and hardware which might be needed to adapt VIMAD to space use are discussed, taking the need for task documentation into account, and the advantages and feasibility of a VIMAD-type system are demonstrated. T.K.

A84-10396#

EXPERIMENT DATA COMMUNICATIONS (48 MBIT/S) BETWEEN SPACELAB, THE SPACE SHUTTLE AND THE GROUND

R. J. SELG (ESA, Spacelab Sustaining Engineering Div., Cocoa Beach, FL) and G. A. WEIJERS (ESA, Spacelab Sustaining Engineering Div., Noordwijk, Netherlands) ESA Bulletin (ISSN 0376-4265), no. 35, Aug. 1983, p. 34-39.

Tests have been performed at Johnson Space Center in Houston to verify the end-to-end data-transmission performance of the NASA Space Transportation System's high-rate data downlink (48 Mbit/s) with the European Spacelab multiplexing and demultiplexing equipment to be used at the link's input and output. The aims of the tests were to check equipment compatibility and the overall performance of the link and to establish operational procedures and constraints in time for the first Spacelab flight.

Author

A84-11816*# National Aeronautics and Space Administration, Washington, D. C.

HIGH CAPACITY POWER SYSTEMS FOR SPACE

J. P. MULLIN and J. H. AMBRUS (NASA, Space Energy Conversion Office, Washington, DC) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 5 p.

(IAF PAPER 83-421)

Candidate high-power supply systems for future space missions are discussed. Solar cells, particularly made from GaAs materials, are projected to be amenable large arrays that will have a 10 yr lifetime with a 15 percent efficiency at the end. Concentrator arrays using GaAs cells could furnish over 200 W/sq m with 100 suns irradiance. Different battery systems, other than the present low-power NiCd storage systems, will be required, and could be either fuel cell systems or NiH2 batteries. The flywheel also offers promise, especially if integrated within the attitude control system. Solar thermal systems are also possible, featuring SiGe thermocouples, or boron alloys or rare earth calcogenides in thermoelectric generators or thermionic converters equipped with alkali metal elements. Mechanical systems, notably the Brayton cycle engine, offer multihundredwatt performance and higher, with at least 3.5 yr lifetimes. Experimentation is still needed to characterize the power supply interaction with the spacecraft environment and to design efficient and long-lasting radiators if heat engines are implemented. M.S.K.

A84-11817#

PHOTOVOLTAIC SOLAR ARRAYS LEADING TO A CANDIDATE SPACE POWER SYSTEM IN THE REGIME BEYOND 100 KW

W. WESTPHAL and J. RATH (Telefunken AG, Wedel, West Germany) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 27 p.

(IAF PAPER 83-422)

Design and technology considerations for a solar array power supply for the manned space station are discussed. The system would provide up to 100 kW peak and 40 kW continuous if batteries are provided. Currently unanswered problems are the interactions between the array and the station or platform, expansion to 260 kW output, stowage in the Shuttle for launch, and the deployment scenario. Choices will be made between concentrator and panel configurations, the structural materials, and the concentrator designs. Modular units are favored if retraction of the array is not a factor. It is noted that the solar array is preferred to nuclear turboelectric configurations for the 100 kW space station power supply. M.S.K.

A84-11823#

MANAGEMENT OF THE RADIOLINK OF THE SOLAR SAIL SPACECRAFT BY RADIO-AMATEURS

J. Y. PRADO, A. PERRET, and J. VILLAEYS (Union pour la Promotion de la Propulsion Photonique, Venerque, Haute-Garonne, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 4 p.

(IAF PAPER 83-447)

The progress of the technical studies being performed as a prelude to the construction of solar sail vehicles for a race to the moon is assessed. The designs of the sail are guided by the necessity of making them very large and very light, as well as of reflective materials. Attention is being given to the optimized control of the sails in order to configure the trajectory and gain or lose speed as needed. The manufacture and launch of a solar sail is projected to cost \$2.5-5 million, and is planned to reach operation by 1986-87. The sails will be constructed of aluminized plastic films a few microns thick. Three sails can be launched in three separate modules in the lower part of the Ariane 3 or 4 fairing and placed in near-GEO by a kick motor. Ground control will guide the unfurling of the sails, which will be equipped to telemeter attitude data. Each sail will weigh about 170 kg, and commands will be issued at amateur radio wavelengths. M.S.K.

A84-13521#

EVALUATION OF BUS IMPEDANCE ON THE SPOT MULTIMISSION PLATFORM

A. CAPEL (ESA, Earth Observation Programme Office, Toulouse, France) and A. BARNABA (Centre National d'Etudes Spatiales, Toulouse, France) ESA Journal (ISSN 0379-2285), vol. 7, no. 3, 1983, p. 277-298. refs

A numerical model for the performance of a boost-type regulator for solar-array voltage regulation through shunting excess energy into dissipative elements or shorting the array strings is presented. Equations and variable waveforms which define static operation are described and a dynamic model is configured using the current-injection principle. The resulting small-signal equivalent model is tested against operation of a breadboard model and verified, and further confirmed in comparison with the unit in the SPOT power system. Note is taken of the bus impedance in the three boost sections of the SPOT power circuitry. Attention is also given to the effect of batteries wired in parallel to the user load. M.S.K.

A84-15623

NTC '82; NATIONAL TELESYSTEMS CONFERENCE, GALVESTON, TX, NOVEMBER 7-10, 1982, CONFERENCE RECORD

Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1982, 515 p.

Topics of interest in the aerospace and electronic systems fields, such as space communications and digital avionics, are explored. Attention is given to digital avionic analysis and design, and to 30/20 GHz technology advances. Land mobile satellite system design concepts and technologies are discussed, as are communications, microwaves, and tracking systems for space, launch vehicles for communications satellites, and civil and military applications of the GPS. Optical communications potentialities, theory, and technologies are examined, and consideration is devoted to robotics, image coding advances, and advanced concepts in communications. The DBS system is described, together with computer simulations of telecommunication systems, systems, and linearization remote sensing of satellite

communication. Offshore communications are investigated, as are optical processing of RF signals, communications and tracking for the Shuttle, and potential design and performance features of a space station. M.S.K.

A84-15639*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SPACE STATION COMMUNICATIONS AND TRACKING EQUIPMENT MANAGEMENT/CONTROL SYSTEM

M. H. KAPELL and J. W. SEYL (NASA, Johnson Space Center, Houston, TX) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B2.1.1-B2.1.8.

Design details of a communications and tracking (C and T) local area network and the distribution system requirements for the prospective space station are described. The hardware will be constructed of LRUs, including those for baseband, RF, and antenna subsystems. It is noted that the C and T equipment must be routed throughout the station to accommodate growth of the station. Configurations of the C and T modules will therefore be dependent on the function of the space station module where they are located. A block diagram is provided of a sample C and T hardware distribution configuration. A topology and protocol will be needed to accommodate new terminals, wide bandwidths, bidirectional message transmission, and distributed functioning Consideration will be given to collisions occurring in the data transmission channels. M.S.K.

A84-15640* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COMMUNICATIONS, TRACKING, AND DOCKING ON THE SPACE STATION

H. O. ERWIN (NASA, Johnson Space Center, Houston, TX), M. H. CODEN, and F. W. SCHOLL (Codenoll Technology Corp., New York, NY) IN: NTC '82; National Telesystems Conference, Galveston, TX; November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B2.2.1-B2.2.5.

Many of the communications, tracking, and docking functions on a large manned orbiting Space Station - one that is modular and made of metal - will have to be performed by optical systems out of necessity. This paper discusses four practical approaches accomplishing Space Station functions using optical to communications technology. It also provides the results of preliminary experiments involved in the design of particular systems. Major operational factors considered in each system design include: (a) electromagnetic interference problems, (b) data bandwidth requirements, (c) zero-gravity operations, (d) free-space operations, (e) data security, and (f) modular expansion of the Space Station structure. The technologies discussed are the following: (a) local infrared communications, (b) optical tracking and docking techniques, (c) long distance free space optical communications, and (d) local area optical networks. Author

A84-15641

MULTIBEAM PHASED ARRAYS - APPLICATION TO SOC/FREE-FLYER COMMUNICATION SYSTEM

J. S. RICE and J. H. OTT (Novar Electronics Corp., Barberton, OH) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B2.3.1-B2.3.5.

Features of a multibeam design for control and communications between a NASA space station and up to 10 free-flying platforms are described. Performance demands permit high gain narrow beams at long range and low gain wide beams at short range. Interferometric phase control would form the transmit and receive beams based on measurements made by the free-flyers using reference signals beamed from no more than three locations on the space station's phased array. Nonlinear polarization is expected, and multiple antennas will be included on the station to prevent signal blocking. Calculations for the phased array are presented, and monolithic phased array technology is noted to fail to meet a need for multiaccess capabilities. M.S.K.

A84-15642*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APPLICATION OF BEAM POWER TECHNOLOGY TO A SPACE STATION

G. D. ARNDT and J. H. SUDDATH (NASA, Johnson Space Center, Houston, TX) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B2.4.1-B2.4.5. refs

The feasibility and performance parameters for beam microwave power supplies from a space station to nearby orbiting satellites are examined. A 5.8 GHz transmission frequency is found suitable for beaming 1-10 kW over a distance of 1-10 km. The antenna could have a 15 m diameter, a 64 kW output, provide uniform illumination, and have a retrodirective phase control system. A LEO to ground demonstration project is described, involving power levels of 0.0025 mW/sq cm and yielding 202 W at a 100 x 100 m rectenna. M.S.K.

A84-15643* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

A COMMUNICATIONS SYSTEM CONCEPTUAL DESIGN FOR A LOW EARTH ORBITING MANNED SPACE STATION

K. TU (Lockheed Engineering and Management Services Co., Inc., Houston, TX), W. E. TEASDALE, and R. J. ZIMMERMAN (NASA, Johnson Space Center, Houston, TX) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. B2.5.1-B2.5.19.

The results of a NASA study on the design of the communications system for a space station RF communications system are reported. The system requirements, ground rules, and assumptions are detailed, together with the overall configuration, the relay satellite links, and the forward and return links. The operational modes are surveyed for voice and data transmission performances, as well as links to unmanned orbital transfer vehicles. Tradeoff studies are yet to be performed for system growth, video data compression, multiaccess communications, optical or conventional functioning, and the necessary antenna systems.

A84-15671

AUTONOMOUS NAVIGATION OF GEOSYNCHRONOUS SATELLITES USING THE NAVSTAR GLOBAL POSITIONING SYSTEM

P. JORGENSEN (Aerospace Corp. El Segundo, CA) IN: NTC'82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. D2.3.1-D2.3.6.

Special problems arise in connection with the navigation of geosynchronous satellites using the Navstar/Global Positioning System (GPS). A user's set on a geosynchronous satellite, unlike the near earth user, can never perform the required measurements to four GPS satellites simultaneously. The present investigation is concerned with the consequences of this situation for the navigation of the geosynchronous satellites. It s found that despite the limited visibility of Navstar/GPS satellites to user satellites at geosynchronous altitude, GPS can provide autonomous navigation of geosynchronous satellites with an accuracy of the order of 100 m. G.R.

NARROW MULTIBEAM SATELLITE GROUND STATION ANTENNA EMPLOYING A LINEAR ARRAY WITH A GEOSYNCHRONOUS ARC COVERAGE OF 60 DEG. II -ANTENNA DESIGN

M. J. GANS and N. AMITAY (Bell Radio Research Laboratory, Holmdel, NJ) IEEE Transactions on Antennas and Propagation (ISSN 0018-926X), vol. AP-31, Nov. 1983, p. 966-972. refs

A dually polarized narrow (less than 0.5 deg) beam antenna which provides a geosynchronous arc coverage of 60 deg is proposed and analyzed. To track the geosynchronous arc accurately, the properly oriented antenna produces a conically scanned beam by means of a linear array of feed horns with bias ccut apertures illuminating a pair of parabolic cylinder reflectors in an imaging arrangement. This design, with reduced size array and singly curved reflectors, is relatively simple to construct. Calculations for a 0.35 deg beamwidth Ku band earth station antenna show a 0.05 deg pointing accuracy with scan loss due to aberrations less than 1 dB and little pattern degradation throughout the scan region. For multiple beam capability, a Rotman lens is proposed and analyzed as a means of exciting the feed array. It allows communication with multiple satellites spaced as close as 1 deg. Author

A84-18025*# Systems Science and Software, La Jolla, Calif. PLASMA SHEATH STRUCTURE SURROUNDING A LARGE POWERED SPACECRAFT

M. J. MANDELL, G. A. JONGEWARD, and I. KATZ (System, Science and Software, La Jolla, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 5 p. refs

(Contract NAS3-23058)

(AIAA PAPER 84-0329)

Various factors determining the floating potential of a highly biased (about 4-kV) spacecraft in low earth orbit are discussed. While the common rule of thumb (90 percent negative; 10 percent positive) is usually a good guide, different biasing and grounding patterns can lead to high positive potentials. The NASCAP/LEO code can be used to predict spacecraft floating potential for complex three-dimensional spacecraft. Author

A84-18394*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A PROGRAMMABLE POWER PROCESSOR FOR HIGH POWER SPACE APPLICATIONS

J. R. LANIER, JR., J. R. GRAVES, R. E. KAPUSTKA, and J. R. BUSH, JR. (NASA, Marshall Space Flight Center, Huntsville, AL) IN: PESC '82; Annual Power Electronics Specialists Conference, 13th, Cambridge, MA, June 14-17, 1982, Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 331-340. refs

A Programmable Power Processor (P3) has been developed for application in future large space power systems. The P3 is capable of operation over a wide range of input voltage (26 to 375 Vdc) and output voltage (24 to 180 Vdc). The peak output power capability is 18 kW (180 V at 100 A). The output characteristics of the P3 can be programmed to any voltage and/or current level within the limits of the processor and may be controlled as a function of internal or external parameters. Seven breadboard P3s and one 'flight-type' engineering model P3 have been built and tested both individually and in electrical power systems. The programmable feature allows the P3 to be used in a variety of applications by changing the output characteristics. Test results, including efficiency at various input/output combinations, transient response, and output impedance, are presented.

A84-19169

SAMPLED DATA CONTROL OF LARGE SPACE STRUCTURES USING CONSTANT GAIN VELOCITY FEEDBACK - A NEGATIVE VIEW

N. H. MCCLAMROCH (Michigan, University, Ann Arbor, MI) IN: Conference on Decision and Control, 21st, Orlando, FL, December 8-10, 1982, Proceedings. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1982, p. 1279, 1280.

A framework is developed for sampled data control of large space structures, in terms of discrete time recursive equations in second order form. This framework is used to analyze the simplest control scheme where the loop is closed using constant gain output velocity feedback. It is shown that the closed loop is stable if the feedback gain is positive definite and not too large, and if the output velocity feedback is properly specified. Properties of such a stabilizing controller establish the advantage of analog control of the form considered. Author

A84-20583

POTENTIAL OF MINICOMPUTER-ARRAY PROCESSOR SYSTEM FOR NONLINEAR FINITE-ELEMENT ANALYSIS

G. A. STROHKORB and A. K. NOOR (George Washington University, Hampton, VA) Computers and Structures (ISSN 0045-7949), vol. 18, no. 4, 1984, p. 703-718. refs

The potential of using a minicomputer/array-processor system for the efficient solution of large-scale, nonlinear, finite-element problems is studied. A Prime 750 is used as the host computer, and a software simulator residing on the Prime is employed to assess the performance of the Floating Point Systems AP-120B array processor. Major hardware characteristics of the system such as virtual memory and parallel and pipeline processing are reviewed, and the interplay between various hardware components is examined. Effective use of the minicomputer/array-processor system for nonlinear analysis requires the following: (1) proper selection of the computational procedure and the capability to vectorize the numerical algorithms; (2) reduction of input-output operations; and (3) overlapping host and array-processor operations. A detailed discussion is given of techniques to accomplish each of these tasks. Two benchmark problems with 1715 and 3230 degrees of freedom, respectively, are selected to measure the anticipated gain in speed obtained by using the proposed algorithms on the array processor. Previously announced in STAR as N83-27259 SL

A84-20647

IMPROVED ORBIT UTILIZATION USING AUXILIARY FEEDS IN EXISTING EARTH TERMINALS

J. ARNBAK, M. H. A. J. HERBEN, and R. A. C. M. VAN SPAENDONK (Eindhoven, Technische Hogeschool, Eindhoven, Netherlands) Space Communication and Broadcasting (ISSN 0167-9368), vol. 1, Dec. 1983, p. 405-416. refs

While geostationary orbit crowding has begun to restrict further development of the satellite communications bands, and the investment in existing earth terminals discourages antenna replacements for the achievement of lower sidelobe envelopes, the E-W stationkeeping tolerance was suffciently tightened in 1979 to make feasible the coordination of two potentially interfering satellite networks through specific sidelobe reductions at the appropriate earth terminals. This may be achieved by a simple retrofit of these terminals which are found to constrain orbit occupancy. Attention is presently given to the state of interferometric sidelobe suppression by auxillary feeds in double-reflector antenna systems, in view of feed geometry, orbital spacing between satellites, required excitation levels, and system bandwidth. O.C.

DIELECTRIC CHARGING IN SPACE - GROUND TEST DATA AND MODEL VERIFICATION

V. W. PINE, B. L. BEERS, and S. T. IVES (Beers Associates, Inc., Reston, VA) (IEEE, U.S. Defense Nuclear Agency, NASA, et al., Annual Conference on Nuclear and Space Radiation Effects, Gattinburg, TN, July 18-21, 1983) IEEE Transactions on Nuclear Science (ISSN 0018-9499), vol. NS-30, Dec. 1983, p. 4290-4295. refs

A computational model of the charging of dielectrics by electron irradiation has been verified by comparison with ground-based test data. Recent improvements to the model are described briefly. Model calculations are compared with a variety of ground-based test data. The test data span a range of electron energies, from a few keV to beyond 1 MeV. Several experimental configurations are examined. Agreement between computational and experimental results is good. Author

A84-22958* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NEW DIRECTIONS IN SOLAR ARRAY DEVELOPMENT

J. SCOTT-MONCK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 7-12. NASA-supported research. refs

A broad overview is presented of current and near-term solar array technology that could be suitable for space use. Particular consideration is given to such advanced concepts as high power arrays, concentrator arrays, and ultrathin solar cell arrays. It is concluded that if such ambitious concepts as geosynchronous space platforms, orbital space stations, and alternate forms of propulsion are realized, the type of new technology described in this paper may find acceptance for space. B.J.

A84-22959

TECHNOLOGY COMPONENTS OF SOLAR ARRAYS FOR SPACE PLATFORMS

K. BOGUS (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 13-20. refs

It is noted that the European Space Photovoltaics Program responds to the near-future needs of space platform missions. The chosen approach is characterized by emphasis on silicon-cell optimization, development of long-life contact systems, and commonality for different applications. Space platform concepts in the framework of the European space program are categorized into four classes containing near-term missions and follow-up generations: retrievable LEO platforms; long-life LEO platforms for earth observation and astronomy; power module systems; and geostationary telecommunication platforms. The requirements on the solar array subsystem in each of these classes are identified, leading to a definition of PV technology development requirements. Current space PV technology activities in Europe which respond to these requirements are discussed, and future space platform applications are examined. **B.I**

A84-22961* Lockheed Missiles and Space Co., Sunnyvale, Calif.

SOLAR ARRAY SHUTTLE FLIGHT EXPERIMENT - HARDWARE DEVELOPMENT AND TESTING

R. V. ELMS (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA), H. C. HILL, and L. E. YOUNG (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 25-30.

(Contract NAS8-31352)

This paper reports on the fabrication and ground testing of (a) a large area, light-weight, flexible substrate developmental solar

array wing that has been built for NASA-MSFC and of (b) the supporting structure and data acquisition system (DAS) which, with the wing, will be flown in the Shuttle as an experiment in 1984. The experiment will verify the dynamics, thermodynamic, and electrical performance predictions of the array wing and will demonstrate the structural capability of the array wing for Orbiter launch and re-entry environments. The experiment hardware verification program was designed to minimize costs and risk of experiment performance degradation while maintaining Shuttle and crew safety. The previous full-scale wing hardware tests included an extension mast water table test and wing testing for random vibration, thermal vacuum, and acoustic environments. The results of these tests were used to define wing design modifications and to scope the test program for the experiment hardware. Author

A84-22962

TECHNICAL ASPECTS OF THE INTELSAT V SOLAR ARRAY

H. E. POLLARD and W. R. BARON (Ford Aerospace and Communications Corp., Palo Alto, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 31-35.

The Intelsat V solar array is the largest rigid solar array used for a commercial communication satellite. This paper describes salient technology applications of the electrical design, development and manufacture of the Intelsat V solar array. The circuits including cells, interconnects and wiring are being assembled using solderless welding techniques; the first solar array of this size to do so. Special welding process controls are described including monitor of electrical pulse, resistance and head pressure which provide the quality control to assure satisfactory welds. With the extensive use of solderless cells, various techniques were employed to ensure humidity resistance. The use of the Scanning Auger Microprobe as well as X-ray fluorescence for Palladium measurements are summarized. The electrical and environmental test program for the project is reviewed.

A84-22963* Lockheed Missiles and Space Co., Sunnyvale, Calif.

NEW COMPONENT DEVELOPMENT FOR MULTI-100 KW LOW-COST SOLAR ARRAY APPLICATIONS

G. J. PACK and J. A. MANN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 36-38. Research supported by the Lockheed Missiles and Space Co.

(Contract NAS8-32981)

Studies of the cost and performance of flexible arrays have shown that the most dramatic reductions in the \$/Watt figure of merit are achieved by increasing performance. An examination of those properties that contribute to array performance indicated areas where radical changes in current design practice and philosophy would result in significant cost and performance impacts. To take advantage of the predicted cost reductions, modules were fabricated and tested that had ultra-thin superstrates as a load carrying member and large area dielectric wraparound (DWA), gridded back surface and copper contacted solar cells. Author

A84-22979* Applied Solar Energy Corp., City of Industry, Calif. LARGE AREA, LOW COST SPACE SOLAR CELLS

J. KUKULKA and P. A. ILES (Applied Solar Energy Corp., City of Industry, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 146-149.

(Contract NAS9-16440)

This paper describes cost effective production-ready space solar cells which can meet the requirements for use on the Space Shuttle and other large space missions. Actual yield and performance data for these cells, as well as cost comparisons between these and standard space cells are included. Author

MECHANICAL WRAPAROUND CONTACTED CELL FOR LOW COST SPACE ARRAYS

N. MARDESICH, D. JOSLIN, and D. MICHAELS (Spectrolab, Inc., Sylmar, CA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 160-163.

The paper presents the advantages, performance, reliability and cost of a mechanical wraparound contact on a large area solar cell. The wraparound contact consists of a silver ribbon laminated to the metallization on the back of a solar cell with an insulating acrylic-Kapton-acrylic sandwich and wrapped around the edge to the N+ metallization and welded. The wraparound contact can increase the cell cost by approximately 20 percent, which must be offset by the panel assembly savings. Author

A84-22997#

PREDICTION OF SOLAR CELL PERFORMANCE IN SPACE

R. L. STATLER and D. H. WALKER (U.S. Navy, Naval Research Laboratory, Washington, DC) **IN: Photovoltaic Specialists** Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 301-306. Navy-supported research.

Predicting solar array performance with a high degree of accuracy is of critical importance to the success of space missions. This calculation is influenced by a large number of variables and parameters. Consequently, the accurate prediction becomes very difficult and safety margins must be assigned because of unknown factors relating to incomplete description of the behavior of the materials and components in the solar array. This paper discusses two factors which are important in such predictions. The first is a description of the gradual deterioration of the optical transmissivity of the coverglass and its adhesive layer, using data derived from the solar cell experiment on the Naval Research Laboratory NTS-2 satellite. The magnitude of this effect is shown through the interpretation of satellite data. The second factor is temperature enhanced radiation damage which was observed during radiation experiments at low dose rates on silicon solar cells. The observed radiation damage is shown to be strongly dependent on the temperature of the silicon cells during irradiation. The magnitude of this effect is shown in its influence on the interpretation of satellite data. Author

A84-25306#

MSAT MOBILE COMMUNICATION DEMONSTRATION SATELLITE SYSTEM AND BUS TRADEOFF CONSIDERATIONS R. D. CASWELL (Department of Communications, Communications Research Centre, Ottawa, Canada) and A. M. KIDD (Spar Aerospace, Ltd., Montreal, Canada) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 450-458. refs (AIAA PAPER 84-0751)

A84-26516#

RADIATION CHARACTERISTICS OF ARRAY ANTENNAS WITH DISTURBED **APERTURE** COVERAGE [STRAHLUNGSCHARAKTERISTIK VON ARRAY-ANTENNEN MIT GESTOERTER APERTURBELEGUNG]

E. FLOERY and W. RIEDLER (Graz, Technische Universitaet, Graz, Austria) (International Union of Radio Science and Gesellschaft, Gemeinsame Nachrichtentechnische Tagung, Kleinheubach, West Germany, Oct. 3-7, 1983) Kleinheubacher Berichte (ISSN 0343-5725), vol. 27, 1984, p. 243-252. In German. Research supported by the Fonds zur Foerderung der wissenschaftlichen Forschung. refs A numerical simulation of the effect of disturbances in the

ideal aperture coverage of phased array antennas on the radiation geometry is presented. The microwave radiation energy distribution in the near-earth region provides an important criterion for determining the energy threshold value of ionospheric modification and for fixing error tolerances. The simulation method is based on discretizing the aperture so that the geometric form and the energy distribution of the sending antenna can assume arbitrary profiles. C.D

A84-28067

CHARACTERISTICS OF THE MICROPROCESSOR IMPLEMENTATION OF ALGORITHMS FOR THE PROCESSING OF RADIO SIGNALS AND NOISE IN LARGE ANTENNA ARRAYS MIKROPROTSESSORNOI REALIZATSII [OSOBENNOSTI ALGORITMOV OBRABOTKI RADIOSIGNALOV I POMEKH V BOL'SHIKH ANTENNYKH RESHETKAKH]

V. V. POPOVSKII and E. I. GLUSHANKOV Radioelektronika (ISSN 0021-3470), vol. 27, March 1984, p. 51-53. In Russian. refs

A84-29861

TELECOMMUNICATION SYSTEMS FOR LARGE-SCALE SPACE MANUFACTURING ACTIVITY

D. OLMSTEAD (Stanford University, Stanford, CA) and M. A. ROTHBLATT (Schnader, Harrison, Segal and Lewis, Washington, DC) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 157-175.

(AAS PAPER 83-216)

Telecommunication systems for large-scale manufacturing activity are analyzed in terms of probable requirements, available frequency resources and desired network architecture. Separate analysis is provided for space manufacturing activity in earth orbit and in deep space. The paper suggests various design alternatives for meeting dispersed space communications requirements and considers interface options with terrestrial networks. The paper recommends adoption of a TDMA-based architecture and suggests spectrum allocation priorities for intersatellite and space operation radio services. Author

N84-12233*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SPACE STATION ENERGY SIZING

R. R. RICE In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 57-62 Dec. 1 Avail: NTIS HC A10/MF A01 CSCL 22B Dec. 1983

A general schematic for a space station power system is described. The major items of interest in the power system are the solar array, transfer devices, energy storage, and conversion equipment. Each item will have losses associated with it and must be utilized in any sizing study, and can be used as a checklist for itemizing the various system components. Author

National Aeronautics and Space Administration. N84-12246*# Goddard Space Flight Center, Greenbelt, Md.

ASSESSMENT OF POTENTIAL FOR BATTERIES IN SPACE APPLICATIONS

F. E. FORD In NASA. Langley Research Center Integrated Flywheel Technol., 1983 p 171-174 Dec. 1983 Avail: NTIS HC A10/MF A01 CSCL 10C

Different battery technologies for energy storage in space missions were examined. One of the best ways of the possibilities of high energy density batteries were determined by looking at more conventional batteries (i.e., lead-acid, nickel-cadmium, nickel-hydrogen, etc.). The theoretical specific energy density for state of the art batteries and the usable energy density for a reasonable life expectancy are outlined. The most mature of these couples is lead acid, which achieves nearly 20% of its theoretical capacity. The nickel-cadmium couple, has matured to where the active capacity is 17% of its theoretical capacity. The achievements are used to measure the practicality of more advanced batteries and to estimate what is needed for future high power space E.A.K. systems.

N84-12634*# TRW Space Technology Labs., Redondo Beach, Calif. Power Sources Engineering Dept.

STUDY OF MULTI-KILOWATT SOLAR ARRAYS FOR EARTH ORBIT APPLICATIONS Final Report, 19 Nov. 1980 - 30 Jun. 1983

R. E. PATTERSON 15 Oct. 1983 200 p refs (Contract NAS8-34131)

(NASA-CR-170939; NAS 1.26:170939; REPT-38172-6001-UE-00) Avail: NTIS HC A09/MF A01 CSCL 10A

A miniaturized Cassegrainian concentrator (MCC) solar array concept is being developed with the objective of significantly reducing the recurring cost of multikilowatt solar arrays. The desired cost reduction is obtained as a result of using very small high efficiency solar cells in conjuction with low cost optics. The MCC single element concept incident slar radiation is reflected rom a primary parabolic reflector to a secondary hyperbolic reflector and finally to a 4 millimeter diameter solar cell. A light catcher cone is used to improve off axis performance. The solar cell is mounted to a heat fin. An element is approximately 13 millimeters thick which permits efficient launch stowage of the concentrator system panels without complex optical component deployments or retractions. The MCC elements are packed in bays within graphite epoxy frames and are electrically connected into appropriate series-parallel circuits. A MCC sngle element with a 21 sq cm entrance aperture and a 20 efficient, 0.25 sq cm gallium arsenide solar cell has the same power output as 30 sq cm of 11-percent efficiency (at 68 C) silicon solar cells. S.C.L.

N84-12653# Istituto di Ricerca e Tecnologia per lo Studio del Plasma Nello Spazio, Frascati (Italy).

ORBITING WIRE AS A DYNAMO: AUXILIARY POWER POSSIBILITIES FOR SPACE PLATFORMS

G. MASTRANTONIO Mar. 1983 12 p refs Sponsored by CNR

(IFSI-83-3) Avail: NTIS HC A02/MF A01

A technique to short circuit the electric field set up by the Earth's magnetic field in an orbiting metal wire, so that energy can be extracted is described. Useful powers of 3 kw for wire length 1 km, 4 mm in diameter and for external load equal to the wire resistance are predicted. By varying the wire length as well as its cross-section low-voltage, high current (and vice-versa) needs can be met. Author (ESA)

N84-14394# General Research Corp., Santa Barbara, Calif. RF SYSTEMS IN SPACE. VOLUME 2: SPACE-BASED RADAR ANALYSES Final Technical Report

A. V. MRSTIK, D. BESTE, R. J. BARTEK, and P. M. PAZICK Griffiss AFB, N.Y. RADC Apr. 1983 213 p (Contract F30602-81-C-0119; AF PROJ. 4506) (AD-A133735; RADC-TR-83-91-VOL-2) Avail: NTIS

HCA10/MFA01 CSCL 17I

The main objective of this effort was to develop a computer based analytical capability for simulating the RF performance of large space-based radar (SBR) systems. The model is capable of simulating corporate and space fed aperture. The model also can simulate multibeam feeds, cluster/point feeds, corporate feed and various aperture distributions. The simulation is capable of accepting Draper Labs structural data and antenna current data from Atlantic Research Corporation's (ARC) First Approximation Methods (FAM) and Higher Approximation Methods (HAM) models. In addition there is a routine to input various apertures surface distortions which causes the elements in the arrays to be displaced from the ideal location on a planar lattice. There were analyses looking at calibration/compensation techniques for large aperture space radars. Passive, space fed lens SBR designs were investigated. The survivability of an SBR system was analyzed. The design of ground based SBR validation experiments for large aperture SBR concepts were investigated. SBR designs were investigated for ground target detection. GRA

N84-14395# General Research Corp., Santa Barbara, Calif. RF SYSTEMS IN SPACE. VOLUME 1: SPACE ANTENNAS FREQUENCY (SARF) SIMULATION Final Technical Report A. C. LUDWIG, J. R. FREEMAN, and J. D. CAPP Griffiss AFB, N.Y. RADC Apr. 1983 253 p (Contract F30602-81-C-0119; AF PROJ. 4506) (AD-A133734; RADC-TR-83-91-VOL-1) Avail: NTIS HCA12/MFA01 CSCL 171

The main objective of this effort was to develop a computer based analytical capability for simulating the RF performance of large space-based radar (SBR) systems. The model is capable of simulating corporate and space fed aperture. The model also can simulate multibeam feeds, cluster/point feeds, corporate feed and various aperture distributions. The simulation is capable of accepting Draper Labs structural data and antenna current data from Atlantic Research Corporation's (ARC) First Approximation Methods (FAM) and Higher Approximation Methods (HAM) models. In addition there is a routine to input various apertures surface distortions which causes the elements in the array to be displaced from the ideal location on a planar lattice. These were analyses looking at calibration/compensation techniques for large aperture space radars. Passive, space fed lens SBR designs were investigated. The survivability of an SBR system was analyzed. The design of ground based SBR validation experiments for large aperture SBR concepts were investigated. SBR designs were investigated for ground target detection. GRA

N84-14761# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

MODERN SOFTWARE DEVELOPMENT TOOLS IN SPACE PROJECTS ON THE EXAMPLE OF A SPACELAB EXPERIMENT

O. NEFF, R. SCHMIDT, and H. J. SCHNEIDER In ESA Software Eng. p 257-259 Aug. 1983

Avail: NTIS HC A13/MF A01

The life cycle of the software for a Spacelab experiment is outlined. Typical software requirements for spacecraft experiments, and software development tools used in this project are presented. The program design language; the real time language PEARL for programming; and a powerful debugging system, which can also be used for test and operation of the complete experiment are described. An implementation of the compiler and real time operating system, resulting in very efficient object code is demonstrated. Author (ESA)

N84-15386# Fondazione Ugo Bordoni, Rome (Italy).

THE SMALL TRANSMITTER RECEIVER STATIONS IN THE SIRIO EXPERIMENT [LE PICCOLE STAZIONI RICETRASMITTENTI NELL'ESPERIMENTO SIRIO]

P. LOMBARDI, P. MIGLIORINI, and E. SAGGESE (Telespazio S.p.A.) Oct. 1982 12 p In ITALIAN Submitted for publication

(FUB-50-1982) Avail: NTIS HC A02/MF A01

Experiments related to the utilization of 3m antenna transmitter receiver stations are discussed. The stations can transmit or receive via the Sirio satellite either 64 k bit/sec or 2.048 Mbit/sec data rates from or to similar stations or large antenna (17m) stations. System operation was tested using large antenna transmitters and small antenna receivers. With clear sky conditions a 0.000001 error rate is feasible. The influence of rain events with alternations of the order on up to 12 dB is discussed. Author (ESA)

N84-15970 Colorado State Univ., Fort Collins.

CURRENT COLLECTION FROM THE SPACE PLASMA THROUGH DEFECTS IN HIGH VOLTAGE SOLAR ARRAY INSULATION Ph.D. Thesis

R. P. STILLWELL 1983 129 p

Avail: Univ. Microfilms Order No. DA8317838

For spacecraft operation in the near earth environment, solar cell arrays constitute the major source of reliable long-term power. Optimization of mass and power efficiency results in a general requirement for high voltage solar arrays. The space plasma environment, though, can result in large currents being collected

06 ELECTRONICS

by exposed solar cells. The solution of a protective covering of transparent insulation is not a complete solution, inasmuch as defects in the insulation result in anomalously large currents being collected through the defects. Tests simulating the electron collection from small defects in an insulation have shown that there are two major collection modes. The first mode involves current enhancement by means of a surface phenomenon involving the surrounding insulator. In the second mode the current collecton material, in addition to the surface enhancement of the first mode.

Dissert. Abstr.

N84-16247*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RADIATING DIPOLE MODEL OF INTERFERENCE INDUCED IN SPACECRAFT CIRCUITRY BY SURFACE DISCHARGES

R. N. METZ (Colby College) Jan. 1984 7 p refs (NASA-TP-2240; E-1775; NAS 1.60:2240) Avail: NTIS HC A02/MF A01 CSCL 22B

Spacecraft in geosynchronous orbit can be charged electrically to high voltages by interaction with the space plasma. Differential charging of spacecraft surfaces leads to arc and blowoff discharging. The discharges are thought to upset interior, computer-level circuitry. In addition to capacitive or electrostatic effects, significant inductive and less significant radiative effects of these discharges exist and can be modeled in a dipole approximation. Flight measurements suggest source frequencies of 5 to 50 MHz. Laboratory tests indicate source current strengths of several amperes. Electrical and magnetic fields at distances of many centimeters from such sources can be as large as tens of volts per meter and meter squared, respectively. Estimates of field attenuation by spacecraft walls and structures suggest that interior fields may be appreciable if electromagnetic shielding is much thinner than about 0.025 mm (1 mil). Pickup of such fields by wires and cables interconnecting circuit components could be a source of interference signals of several volts amplitude. Author

N84-17224*# General Dynamics Corp., San Diego, Calif. PHOTOVOLTAIC CONCENTRATOR POINTING DYNAMICS AND PLASMA INTERACTION STUDY

T. G. STERN *In* NASA. Langley Research Center STEP Expt. Requirements p 177-184 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 201

The objectives of this experiment are to use the Space Technology Experiments Platform (STEP) system to demonstrate the viability of concentrator photovoltaic arrays by: (1) configuring a deployable mast on the STEP pallet with concentrator mass models and some active photovoltaic modules; (2) measuring the array pointing dynamics under normal rotation as well as disturbance conditions; (3) performing an array plasma interaction experiment to determine the steady-state plasma losses under various voltage conditions; and (4) providing active distributed control of the support truss to determine the improvement in dynamic response. Experiment approach and test control and instrumentation are described. M.G.

N84-17235*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ADAPTIVE MICROWAVE REFLECTOR

J. W. GOSLEE *In its* STEP Expt. Requirements p 325-331 Jan. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 20N

As an interim step in going to the 100-meter reflector that was evaluated, a 5-meter reflector is proposed to test the electrostatic concept under space conditions. Some of the issues which require the space environment for evaluation are the following questions: Can deployment of a box ring structure with a thin film reflector attached be manually deployed? In the absence of humidity, can a 0.3-mil aluminized Kapton film reflector be formed by the electrostatic process suitable for antenna applications? Can the photogrammetric process be used to evaluate the reflector surface with pictures taken from the payload handling station? Can the space charging effect be evaluated with the 5-meter reflector attached to the Shuttle? Does the outgassing of moisture from 0.3-mil Kapton film affect its reflector capability? A box ring truss support structure and an automatic sequence deployment system are discussed. R.J.F.

N84-17236*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MICROWAVE REFLECTOR CHARACTERIZATION USING SIMPLE INSTRUMENTS IN EVA

J. W. GOSLEE In its STEP Expt. Requirements p 333-338 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 20N

An antenna with rigid panels which can be measured under ground conditions, carried to space in a packaged condition, deployed into a form similar to the Earth-measured one, measured under space conditions, restowed, and brought back to Earth so that the original measurements can be verified is the type being proposed for this experiment. The antenna chosen will be measured under ground conditions, carried aloft, deployed into its antenna shape, lifted by the remote manipulator system to a position where it can be sighted by two astronauts at the two theodolites, and held there until the surface characterization can be completed. An alternate method would be to use photogrammetry and take pictures of the surface from the payload handling station. After the surface characterization is completed, the antenna will be folded and restowed into the Shuttle bay for return to Earth. The surface characterization will be repeated on Earth after its return for verification both of the original measurement taken on Earth and the measurement taken in space. B.J.F.

N84-17254# Aerospace Corp., Los Angeles, Calif. A REVIEW OF SCATHA SATELLITE RESULTS: CHARGING AND DISCHARGING

J. F. FENNELL, H. C. KOONS, M. S. LEUNG, and P. F. MIZERA In ESA Spacecraft/Plasma Interactions and their Influence on Field and Particle Meas. p 3-11 Nov. 1983 refs (Contract AF-F04701-82-C-0083)

Avail: NTIS HC A10/MF A01

Results from the SCATHA satellite charging monitors and discharge detectors are summarized. The data show that surface charging, near synchronous altitudes, occurs preferentially in the midnight to local morning sectors. Evidence for bulk charging by energetic electrons is also observed. Material charging data show that there is a marked increase in bulk conductivity of solar-illuminated Kapton with exposure time in the space vacuum. Teflon accumulates a permanent charge which slowly increases with time. A quartz cloth material charges to higher than expected levels. Statistical analysis of the surface charging and the resultant discharges and noise generation shows a close association with each other. Discharges are ascribed to possible bulk charging. The signal amplitudes of the discharge signal is shown.

Author (ESA)

N84-17269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE ROLE OF POTENTIAL BARRIER FORMATION IN SPACECRAFT CHARGING

C. K. PURVIS *In* ESA Spacecraft/Plasma Interactions and their influence on Field and Particle Meas. p 115-124 Nov. 1983 refs. Previously announced as N83-35005

Avail: NTIS HC A10/MF A01 CSCL 22B

The role of potential barrier formation in spacecraft charging at geosynchronous orbit is discussed. Sudden dramatic shifts in structure potential at eclipse entry and exit, and in response to injections of hot plasma during eclipse do not indicate the magnitude of differential charging. All daylight charging and some long-term eclipse charging is barrier dominated. Shaded or low yield surfaces charge negatively, forming vacuum potential barriers which suppress emission of photoelectrons and secondary electrons, causing the spacecraft to charge negatively. This process, which is configuration and material dependent, limits the magnitude of insulator-negative differential charging to values substantially lower than supposed, and allows the possibility of insulator-positive differential charging. Discharges are less energetic and more localized than supposed. If the spacecraft changes its potential when electrons are emitted in a discharge, then when the structure is driven positive, electron emission should cease. Author (ESA)

N84-17431*# LinCom Corp., Los Angeles, Calif.

USER MANUAL OF THE CATSS SYSTEM (VERSION 1.0) COMMUNICATION ANALYSIS TOOL FOR SPACE STATION Interim Report

C. S. TSANG, Y. T. SU, and W. C. LINDSEY Nov. 1983 45 p (Contract NAS9-16868)

(NASA-CR-171728; NAS 1.26:171728; TR-1183-8314) Avail: NTIS HC A03/MF A01 CSCL 17B

The Communication Analysis Tool for the Space Station (CATSS) is a FORTRAN language software package capable of predicting the communications links performance for the Space Station (SS) communication and tracking (C & T) system. An interactive software package was currently developed to run on the DEC/VAX computers. The CATSS models and evaluates the various C & T links of the SS, which includes the modulation schemes such as Binary-Phase-Shift-Keying (BPSK), BPSK with Direct Sequence Spread Spectrum (PN/BPSK), and M-ary Frequency-Shift-Keying with Frequency Hopping (FH/MFSK). Optical Space Communication link is also included. CATSS is a C & T system engineering tool used to predict and analyze the system performance for different link environment. Identification of system weaknesses is achieved through evaluation of performance with varying system parameters. System tradeoff for different values of system parameters are made based on the performance prediction. Author

N84-17436*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.

AIRBORNE ANTENNA PATTERN CALCULATIONS Final Report, 1 Nov. 1982 - 31 Oct. 1983

A. B. BAGHERIAN and R. R. MIELKE Dec. 1983 106 p refs (Contract NSG-1655)

(NASA-CR-173284; NAS 1.26:173284) Avail: NTIS HC A06/MF A01 CSCL 20N

Use of calculation program START and modeling program P 3D to produce radiation patterns of antennas mounted on a space station is discussed. Basic components of two space stations in the early design stage are simulated and radiation patterns for antennas mounted on the modules are presented. Author

N84-17931# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

SELECTION OF NOISY SENSORS AND ACTUATORS FOR REGULATION OF LINEAR SYSTEMS Ph.D. Thesis

M. L. DELORENZO Aug. 1983 254 p

(AD-A135442; AFIT/CI/NR-83-59D) Avail: NTIS HC A12/MF A01 CSCL 12A

This research has developed and tested an algorithm which aids the controls engineer in placing sensors and actuators in a linear system to best achieve a set of variance specifications on the outputs and inputs of the system. The term best achieve has been defined to be the sensor and actuator configuration which enables a controller to do either of the following: Meet the input specifications while minimizing a sum of output variances normalized by their specification (i.e. input-constrained solution), or meet the output specifications while minimizing a sum of input variances normalized by their specification (i.e., output-constrained solution). The approach taken to solve this sensor and actuator selection (SAS) problem was to use LQG (Linear Quadratic Gaussian) theory to specify a structure for the controller, and then develop an algorithm (SASLQG) that places sensors and actuators in this controller structure to achieve either the input-constrained or output-constrained solution. The main advantage of this approach is the mathematical ease which LQG theory addresses variance constraints, and the main disadvantage

is that there may be other controller structures which do better. GRA

N84-18458# Contraves Corp., Zurich (Switzerland). Dept. EKR. SPACE TELESCOPE: SOLAR ARRAY PRIMARY DEVELOPMENT MECHANISM

A. VEIT and D. CHANDLER In ESA First European Space Mech. and Tribology Symp. p 27-34 Dec. 1983

Avail: NTIS HC A10/MF A01

A Primary Deployment Mechanism (PDM) powered by redundant stepper motors was developed for the primary deploy and stow operations of the Space Telescope solar array. The mechanism locks the array boom in the deployed position and releases the boom at the end of mission for restowing before capture and Earth return via space shuttle. Due to a continual growth in the design load of the PDM, the system exhibited instabilities. A redesign introduced a planetary gear train between the motors and the primary lever arms. This results in a very stable system, allowing for increase in system load if required. Three flight models were successfully tested. Acceptance testing, besides ambient operational tests, included vibration and thermal vacuum tests with operational testing being included in the thermal vacuum environment. Author (ESA)

N84-18532# National Telecommunications and Information Administration, Annapolis, Md.

ASSESSMENT OF SATELLITE POWER FLUX-DENSITY LIMITS IN THE 2025-2300 MHZ FREQUENCY RANGE, PART 1 A. FARRAR Oct. 1983 67 p refs

(PB84-129402; NTIA/REPT-83-135) Avail: NTIS HC A04/MF A01 CSCL 17B

An assessment of the line-of-sight (LOS) power flux-density (pfd) limits for satellites operating in the 2025-2300 MHz frequency range was conducted. Two computer models were used in the analysis. Modifications to these models were suggested in order to enhance their accuracy in the evaluation of the pfd limits in this and other shared bands. Distinctions were made between the satellites in geostationary satellite orbit and those in nongeostationary orbits. Two different sets of limits were calculated, one for the satellites in the geostationary satellite orbit and the other for the satellites in nongeostationary satellite orbits. These limits were calculated using the technical characteristics of equipment in the 2025-2300 MHz frequency range. The preliminary calculations using the existing computer models indicate that the pfd limits for the satellites operating in this frequency range may be relaxed.

N84-19382*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPACELAB DATA PROCESSING FACILITY

1983 27 p refs Original document contains color illustrations (NASA-TM-85556; NAS 1.15:85556) Avail: NTIS HC A03/MF A01 CSCL 14B

The Spacelab Data Processing Facility (SDPF) processes, monitors, and accounts for the payload data from Spacelab and other Shuttle missions and forwards relevant data to various user facilities worldwide. The SLDPF is divided into the Spacelab Input Processing System (SIPS) and the Spacelab Output Processing System (SOPS). The SIPS division demultiplexes, synchronizes, time tags, quality checks, accounts for the data, and formats the data onto tapes. The SOPS division further edits, blocks, formats, and records the data on tape for shipment to users. User experiments must conform to the Spacelab's onboard High Rate Multiplexer (HRM) format for maximum process ability. Audio, analog, instrumentation, high density, experiment data, input/output data, quality control and accounting, and experimental channel tapes along with a variety of spacelab ancillary tapes are provided to the user by SLDPF. M.A.C.

N84-19463# Air Force Geophysics Lab., Hanscom AFB, Mass. SHEATH IONIZATION MODEL OF BEAM EMISSIONS FROM LARGE SPACECRAFTS

S. T. LAI, H. A. COHEN, K. H. BHAVNANI (Radex, Inc.), and M. F. TAUTZ (Radex, Inc.) 30 Dec. 1983 14 p Presented at the Spacecraft Environ. Interactions Technol. Conf., Colorado Springs, 4-6 Oct. 1983

(Contract AF PROJ. 7661)

(AD-A137181; AFGL-TR-83-0331) Avail: NTIS HC A02/MF A01 CSCL 22A

An analytical model of the charging of a spacecraft emitting electron and ion beams has been applied to the case of large spacecraft. In this model, ionization occurs in the sheath due to the return current. Charge neutralization of spherical space charge flow is examined by solving analytical equations numerically. Parametric studies of potential large spacecraft are performed. As in the case of small spacecraft, the ions created in the sheath by the returning current play a large role in determining spacecraft potential. Author (GRA)

N84-21781# Mission Research Corp., Santa Barbara, Calif. THE EFFECTS OF APERTURE ANTENNAS AFTER SIGNAL PROPAGATION THROUGH ANISOTROPIC IONIZED MEDIA D. L. KNEPP 1 Mar. 1983 76 p

(Contract DNA001-81-C-0006; S99-QAXH)

(AD-A138286; AD-E301332; MRC-R-744; DNA-TR-81-254) Avail: NTIS HC A05/MF A01 CSCL 20N

Because of the large ranges involved, a space based search and track radar requires a large aperture antenna to increase the energy collected and to create a narrow beam for accurate angle measurements and for resistance to localized jammers. This report gives the effects of such an antenna on measurements of received power, decorrelation time (or distance), mean time delay, time delay jitter and coherence bandwidth after propagation of the radar signal through a strongly disturbed transionospheric propagation channel. It is shown that aperture averaging can reduce observed signal power, increase observed decorrelation time and can be a significant factor in reducing the time delay jitter observed at the antenna output. As part of this analysis an analytic solution is obtained for the two-position, two-frequency mutual coherence function for spherical wave propagation in the strong scatter limit. Transmitter and receiver are located in free-space on opposite sides of a thick slab containing anisotropic electron density irregularities that are elongated in the direction parallel to the magnetic field. The orientation of the magnetic result is used to determine the effect of an antenna aperture as a function of geometry relative to the magnetic field. GRA

07

ADVANCED MATERIALS

Includes matrix composites, polyimide films, thermal control coatings, bonding agents, antenna components, manufacturing techniques, and space environmental effects on materials.

A84-10949*# Monsanto Research Corp., St. Louis, Mo. EROSION OF MYLAR AND PROTECTION BY THIN METAL FILMS

P. FRAUNDORF (Monsanto Research Center, St. Louis, Mo), D. LINDSTROM, S. SANDFORD, P. SWAN, R. WALKER, E. ZINNER (Washington University, St. Louis, MO), and N. PAILER (Max-Planck-Institut fuer Kernphysik, Heidelberg, West Germany) IN: Shuttle Environment and Operations Meeting, Washington, DC, October 31-November 2, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p. 131-137. refs

(Contract NAGW-122)

(AIAA PAPER 83-2636)

Mylar strips, 2.5 microns thick, uncoated and coated with 50A, 100A and 200A of AI, Pd, and Au/Pd were exposed on STS-5 in order to measure the erosion of mylar and to test means of protecting thin plastic foils commonly used for space experiments in low earth orbit. Analysis by optical microscopy, SEM and STEM investigation, EDX measurements, FTIR spectroscopy and weight loss measurements showed that while up to 75 percent of the uncoated mylar was eroded during exposure, thin coatings of the above metals can protect mylar for integrated oxygen-fluxes of at least 10 to the 21st atoms/sq cm. Author

A84-17108

NEW FABRIC STRUCTURES OF CARBON FIBER

A. NISHIMURA, N. UEDA, and H. S. MATSUDA (Toray Industries, Inc., Otsu, Shiga, Japan) IN: Materials and processes - Continuing innovations; Proceedings of the Twenty-eighth National SAMPE Symposium and Exhibition, Anaheim, CA, April 12-14, 1983. Azusa, CA; Society for the Advancement of Material and Process Engineering, 1983, p. 71-88.

Carbon fiber fabric has been increasingly used as a reinforcing intermediate material in the fields of aircraft and aerospace materials that require high performance; and is becoming one of the basic reinforcing materials for composites. A drawback of conventional fabric, however, is in lower transfer ratio of the properties to those of the composites. This is a result of carbon fiber bend (crimp), caused by the alternate crossing of warp and weft yarns which induce stress concentration. In order to solve the problem, a new fabric structure, that is, bi-directional noncrimp carbo fiber fabrics have been developed. In this paper, attention is given to test results obtained from extensive studies of noncrimp fabrics; that is, optimum design of fabric construction and effect of the construction to mechanical properties. The carbon fiber investigated includes the newly developed high strain type having more than 1.7 percent ultimate strain. Author

A84-17120

FIELD REPAIR OF GRAPHITE EPOXY SKIN PANELS ON THE SPACESHIP COLUMBIA

W. A. HENRY (Rockwell International Corp., Space Transportation and Systems Group, Downey, CA) IN: Materials and processes -Continuing innovations; Proceedings of the Twenty-eighth National SAMPE Symposium and Exhibition, Anaheim, CA, April 12-14, 1983 . Azusa, CA, Society for the Advancement of Material and Process Engineering, 1983, p. 249-257.

Prior to and during the first four test flights of the spaceship Columbia, structural deficiencies as well as flight damages to the aft propulsion subsystem orbital maneuvering and reaction control subsystems pods graphite epoxy (G/ep) skin panels were strengthened and repaired with beefup straps and doublers bonded in place at Kennedy Space Center. This is a delineation of the structural modifications and double repairs made on these skin panels. It includes a discussion of failure causes and descriptions, inspections, development of bonding techniques and procedures, installation of beefups and repair doublers, and bonding procedure modifications resulting from problems encountered in the field. It highlights the evolution of the procedure from that developed in the laboratory to modifications made in the field to eliminate problems encountered during field installation of beefups and repairs. The beefup and repair procedures developed in the laboratory and modified in the field prior to and during the early flights of Columbia have become the standard procedures for all OMS/RCS pod field repairs. Author

A84-17151

ADVANCED COMPOSITE ANTENNA REFLECTORS FOR COMMUNICATIONS SATELLITES

R. N. GOUNDER, C. F. SHU, and B. D. JACOBS (RCA, Astro Electronics Div., Princeton, NJ) IN: Materials and processes -Continuing innovations; Proceedings of the Twenty-eighth National SAMPE Symposium and Exhibition, Anaheim, CA, April 12-14, 1983 Azusa, CA, Society for the Advancement of Material and Process Engineering, 1983, p. 678-686.

This paper discusses advanced composites applications to communications antenna reflectors used on RCA-built satellites. Various types of reflector systems and their specific materials and structures requirements are reviewed. The mechanical design, analysis, and test results for the different types of advanced composite reflectors are presented. The specific problems associated with deployable, frequency-reuse, gridded Kevlar reflectors and large, deployable, high-frequency graphite reflectors are discussed in greater detail. Novel design concepts for the control of thermal distortions in deployable, composite reflectors are presented.

A84-17174

USING THE OUTGASSING TEST TO SCREEN MATERIALS FOR CONTAMINATION POTENTIAL

R. MOSS (Ford Aerospace and Communications Corp., Western Development Laboratories Div., Palo Alto, CA) IN: Materials and processes - Continuing innovations; Proceedings of the Twenty-eighth National SAMPE Symposium and Exhibition, Anaheim, CA, April 12-14, 1983 Azusa, CA, Society for the Advancement of Material and Process Engineering, 1983, p. 1045-1056. refs

The standard outgassing test method, ASTM E-595, and the apparatus used are described, and results of internal and round robin inter-laboratory tests are reviewed. It is shown that the ASTM E-595 outgassing test is an accurate, reproducible method for screening organic materials for contamination. Normal acceptance levels of 1.0 percent TML and 0.10 percent VCM are realistic for the initial screening of materials. More than 90 percent of materials can be expected to clearly pass or fail the 1.0 and 0.10 percent limits. Round robin tests confirm that different laboratories testing the same material can expect the same accept/reject results. The test is not operator sensitive.

A84-17200

CRACKED INNER LAYER FOIL IN HIGH-DENSITY MULTILAYER PRINTED WIRING BOARDS

G. R. PAUL (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: Materials and processes - Continuing innovations; Proceedings of the Twenty-eighth National SAMPE Symposium and Exhibition, Anaheim, CA, April 12-14, 1983 . Azusa, CA, Society for the Advancement of Material and Process Engineering, 1983, p. 1399-1405. refs

A study has been undertaken to establish why foil cracks occur at the internal foil planes of multilayer boards (MLBs) fabricated with standard 1- and 2-oz electrodeposited (ED) copper foil. The foil cracking was observed during the testing of high-density MLBs and following the thermal stress requirements similar to MIL-P-55110C, but at 500 F. Metallographic analysis indicated that layers one and two and/or nine and ten of a typical 10-layer MLB were most susceptible to thermal shock damage. Test panels were fabricated using standard ED clad material for comparison to laminate with high-temperature elongation (HTE) copper foil. The test panels were subjected to process variations throughout the stages of fabrication to determine the failure mechanism. Author

A84-17768

MATERIALS AND CONSTRUCTION TECHNIQUES FOR LARGE SPACECRAFT STRUCTURES [WERKSTOFFE UND BAUWEISEN GROSSER RAUMFAHRTSTRUKTUREN]

W. HARTUNG (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Strukturmechanik, Brunswick, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), vol. 40, Nov. 1983, p. 26-29. In German.

The current status of DFVLR research on CFRP materials and designs for large structures (such as a communications platform) to be built from modular subassemblies in orbit is reviewed. The pilot studies assume a platform lifetime of 10-20 yr and use slender, thin-walled profiled bars as primary construction elements. Thermal cyclic tests show that epoxide-resin CFRP elements maintain tensile strength at 80 percent or better after 3480 cycles but suffer some loss of stiffness. Exposure during 27 h to an electron-radiation dose greater than that predicted for the platform lifetime produces no detrimental effect on CFRP performance. Overall, the applicability of CFRP to these structures has been confirmed. Since the structural designs themselves cannot be effectively tested on earth, modal survey tests using new software (incorporating phase-resonance and phase-separation phenomena) and mathematical simulations of the larger structures are being developed. T.K.

A84-18159#

REACTIONS OF HIGH VELOCITY ATOMIC OXYGEN WITH CARBON

G. S. ARNOLD and D. R. PEPLINSKI (Aerospace Corp., Chemistry and Physics Laboratory, El Segundo, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 6 p. Research supported by the Aerospace Corp. refs

(AIAA PAPER 84-0549)

A spacecraft in low earth orbit experiences bombardment by fast oxygen atoms by virtue of its own orbital velocity. Direct, dramatic observations on the Space Shuttle, as well as indirect evidence from a number of Space Division and NASA spacecraft. have revealed some of the effects which this bombardment can produce. The high velocity at which atoms strike surfaces on orbit has resulted in gas-solid chemistry not observed in the thermal interactions of oxygen atoms with surfaces and has apparently accelerated the rates of some more familiar processes. The phenomenology of oxygen atom collisions with surfaces is completely unstudied at these high collision velocities (2-8 km/sec). This paper discusses the reactions between oxygen atoms and carbon films at collision velocities of 3.5 km/sec. It is found that there is no apparent translational energy enhancement of reaction probability at this collision velocity. Results are compared to on-orbit rates. Author

A84-19912*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LOW EARTH ORBIT ATOMIC OXYGEN EFFECTS ON SURFACES

L. J. LEGER, J. T. VISENTINE, and J. F. KUMINECZ (NASA, Johnson Space Center, Houston, TX) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 9 p. refs

(AIAA PAPER 84-0548)

Significant effects have been observed on surfaces in the Shuttle Orbiter payload bay and on some experiments due to exposure to the LEO environment. These effects, which are predominantly manifested as surface recession and therefore mass loss, appear to arise from oxidation from exposure to atomic oxygen, the major LEO component. Rates of interaction were measured on two experiments for a large group of materials and specifically for thin organic films, and are in the range of 2-3 x 10

to the 24th cu cm/atom. These rates are large enough to present significant problems for solar arrays which use similar thin films for solar-cell support. Author

A84-20682* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIMULATED SPACE RADIATION EFFECTS ON DIELECTRICS AND COATINGS

F. L. BOUQUET, A. PHILLIPS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA), and D. A. RUSSELL (Boeing Radiation Effects Laboratory, Seattle, WA) (IEEE, U.S. Defense Nuclear Agency, NASA, et al., Annual Conference on Nuclear and Space Radiation Effects, Gatlinburg, TN, July 18-21, 1983) IEEE Transactions on Nuclear Science (ISSN 0018-9499), vol. NS-30, Dec. 1983, p. 4090-4093. NASA-supported research. refs

Simulation tests of space radiation have been performed for specific organic and inorganic materials. The test results for fifteen materials exposed to protons and five exposed to electrons are presented. Author

A84-21775

THE EFFECT OF PRESSURE AND TEMPERATURE ON TIME-DEPENDENT CHANGES IN **GRAPHITE/EPOXY** COMPOSITES BELOW THE GLASS TRANSITION

J. MIJOVIC and R. C. LIANG (New York, Polytechnic Institute, Brooklyn, NY) Polymer Engineering and Science (ISSN 0032-3888), vol. 24, no. 1, Jan. 1984, p. 57-66. refs (Contract NSF MEA-81-20211)

Effects of pressure and temperature on time-dependent changes in physical/mechanical properties of graphite/epoxy composites were investigated. Samples were cut from the eight-ply-thick laminates of commercially used composites, post-cured, and then guenched to environments of various temperature and pressure. Time-dependent changes in their properties were analyzed by thermal and thermomechanical (dynamic mechanical) measurements. An increase in the glass-transition temperature was found to occur as a function of time. The rate of this process was enhanced by an increase in temperature and/or a decrease in pressure. An explanation was offered in terms of types and mechanisms of molecular events that occur in the glassy state. Time-dependent decrease in free volume (and enthalpy) takes place but is not the sole mechanism responsible for the observed increase in T(g). After a certain period of time (which depends on T and P of the environment), additional crosslinking appears to take place. Author

A84-24501

FRACTURE MECHANICS OF CERAMICS. VOLUME 5 - SURFACE FLAWS, STATISTICS, AND WICROCRACKING

R. C. BRADT, ED. (Pennsylvania State University, University Park, PA), A. G. EVANS, ED. (California, University, Berkeley, CA), D. P. H. HASSELMAN, ED. (Virginia Polytechnic Institute and State University, Blacksburg, VA), and F. F. LANGE, ED. (Rockwell International Science Center, Thousand Oaks, CA) New York, Plenum Press, 1983, 706 p.

Among the topics discussed are interface crack extension with friction, the indentation fracture toughness of brittle materials with Palmouist cracks, the surface and subsurface fracture of alpha-SiC single crystals, brittle material deformation and cracking during temperature scratching, ceramic material high reliability assessment, a probabilistic framework for structural design, the measurement and implications of the stress corrosion limit, a universal materials function for subcritical crack extension, and the fracture of piezoelectric materials. Also discussed are the fracture statistics of multiple flaw distributions, reliability improvements for hot pressed silicon nitride, ceramic microcracking mechanisms, statistical aspects of grain boundary cracking in ceramics and rocks, the fracture behavior of glass matrix/glass particle composites, and limitations and challenges found in the application of fracture mechanics to ceramics. O.C.

A84-24508

ASSESSMENT OF RELIABILITY OF CERAMIC MATERIALS

J. E. RITTER, JR. (Massachusetts, University, Amherst, MA) IN: Fracture mechanics of ceramics. Volume 5 - Surface flaws, statistics, and microcracking . New York, Plenum Press, 1983, p. 227-251. refs

The reliability analysis of ceramic components must take into account the variability and time-dependency of strength. The techniques and concepts of fracture mechanics can be used for purposes of design to estimate the allowable stress and expected lifetime of a component in service. This is accomplished by estimating the initial crack size in the material and the time required for the crack to grow from its initial size to a final critical size. The application of fracture mechanics theory appropriate for carrying out a reliability analysis is reviewed and successful applications of this theory are discussed. Limitations of the theory and methods for overcoming these limitations are then presented. Author

A84-28242

SIC-REINFORCED-ALUMINUM ALLOYS FOR AEROSPACE APPLICATIONS

B. J. MACLEAN and M. S. MISRA (Martin Marietta Aerospace, Denver, CO) IN: Mechanical behavior of metal-matrix composites: Proceedings of the Symposium, Dallas, TX, February 16-18, 1982 . Warrendale, PA, The Metallurgical Society of AIME, 1983, p. 301-320.

The aluminum alloys 6061 and 2024, reinforced with SiC whiskers or particulates, were tested for tensile, fatigue, impact toughness, and thermal expansion properties. Substantial improvements in modulus, strength, and fatigue resistance were observed when compared to the metal-matrix composite's wrought alloy counterpart. Depending on the degree of hot-working, elastic moduli on the order of 18 x 10 to the 6th psi (124 GPa) are possible with tensile strengths of greater than 70,000 psi (480 MPa). Enhanced strength and stiffness evolve at the expense of elongation and impact toughness. Microstructure and fractography reveal the relation between reinforcement/matrix homogeneity and isotropy of properties. The coefficient of thermal expansion is seen to decrease from a nominal value of 13 x 10 to the -6th in./in. F to 8 x 10 to the -6th in./in. F. Author

A84-28458* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

EVALUATION OF SPACECRAFT MATERIALS AND PROCESSES FOR OPTICAL DEGRADATION POTENTIAL

T. ODONNELL (California Institute of Technology, Jet Propulsion Laboratory, Applied Mechanics Technology Section, Pasadena, IN: Spacecraft contamination environment; Proceedings of CA) the Meeting, Arlington, VA, May 4-6, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 65-71. refs

(Contract JPL-955426)

A Wide Field Planetary Camera instrument with wide wavelength sensitive Charged Coupled Device detectors has been designed and built for employment in space. The contamination potential of the spacecraft hardware is determined by the outgassing characteristics of the selected materials and the effect of the performed processing procedures. An investigation was conducted to provide for more selective material screening with respect to contamination potential and to develop an optical effects data base. In the investigation, a series of thermogravimetric, residual gas, Micro-Volatile Condensible Material (VCM), and Vacuum Optical Degradation tests were performed. The results of the Micro-VCM testing of four epoxy adhesive systems are presented in tables. G.R.

A84-28553* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ELECTRICALLY CONDUCTIVE BLACK OPTICAL PAINT

M. M. BIRNBAUM, E. C. METZLER, and E. L. CLELAND (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Scattering in optical materials; Proceedings of the Meeting, San Diego, CA, August 25-27, 1982. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 60-70. NASA-supported research. refs

An electrically conductive flat black paint has been developed for use on the Galileo spacecraft which will orbit Jupiter in the late 1980s. The paint, designed for equipment operating in high-energy radiation fields, has multipurpose functions. Its electrical conductivity keeps differential charging of the spacecraft external surfaces and equipment to a minimum, preventing the buildup of electrostatic fields and arcing. Its flat black aspect minimizes the effects of stray light and unwanted reflectances, when used in optical instruments and on sunshades. Its blackness is suitable, also, for thermal control, when the paint is put on spacecraft surfaces. The paint has good adherence properties, as measured by tape tests, when applied properly to a surface. The electrically conductive paint which was developed has the following characteristics: an electrical resistivity of 5 x 10 to the 7th ohms per square; a visual light total reflectance of approximately 5 percent; an infrared reflectance of 0.13 measured over a spectrum from 10 to the (-5.5) power to 0.001 meter; a solar absorptivity, alpha-s, of 0.93, and a thermal emissivity, epsilon, of 0.87, resulting in an alpha-s/epsilon of 1.07. The formula for making the paint and the process for applying it are described. Author

A84-28900

EFFECT OF TEMPERATURE, MOISTURE AND RADIATION EXPOSURES ON COMPOSITE MECHANICAL PROPERTIES

V. F. MAZZIO (General Electric Co., Space Div., Valley Forge, PA) and G. HUBER (Cincinnati Testing Laboratories, Inc., Cincinnati, OH) SAMPE Journal (ISSN 0091-1062), vol. 20, Mar.-Apr. 1984, p. 14, 15, 18 (4 ff.).

(Contract F33615-79-C-5114)

A program was conducted to determine the effects of electron beam radiation, moisture, and temperature exposure on the mechanical properties of advanced composites. The composite graphite/epoxy materials systems evaluated were three (P-75-S/CE339, GY70/X30, and T300/934) and one Kevlar/epoxy system (Kevlar 49/5209). The environmental conditions evaluated were three levels of radiation exposure (between 3 x 10 to the 8th and 3 x 10 to the 9th rads), moisture saturation at 90 percent R.H. and 160 F, and combined moisture and space environmental exposure. High and low dose rate exposure of PS75-S/CE339 resulted in improved properties due to postcuring effects. Kevlar 49/5209 showed no apparent effects from radiation when compared with baseline properties. P75-S/CE339 tensile specimens exposed to combined moisture and space environment and tested at elevated temperature showed a decrease in modulus and strength; Kevlar 49/5209 showed a slight reduction in tensile properties. V.L.

A84-29101#

A VARIATIONAL THEOREM FOR THE VISCOELASTODYNAMIC ANALYSIS OF HIGH-SPEED LINKAGE MACHINERY FABRICATED FROM COMPOSITE MATERIALS

B. S. THOMPSON (Michigan State University, East Lansing, MI) and C. K. SUNG American Society of Mechanical Engineers, Design and Production Engineering Technical Conference, Dearborn, MI, Sept. 11-14, 1983. 7 p. refs (Contract NSF MEA-82-16777)

(ASME PAPER 83-DET-6)

The dynamic analysis of high-speed linkage machinery fabricated from viscoelastic composite materials requires the construction of appropriate equations of motion and boundary conditions for the members of the mechanism. In order to establish these equations, a variational theorem is presented herein by considering the motion of a continuum having dynamic viscoelastic deformations superimposed on a general rigid-body motion. The theorem is written in the Stieltjes convolution notation, and variations in displacement, velocity, stress and strain yield the appropriate characteristic equations. A finite element analysis based on the theorem is presented for flexible four bar linkages constructed from graphite-epoxy laminates, and the results are compared with experimental data. Author

A84-29565#

HIGHER TEMPERATURE COMPOSITE JOINTS SURVIVE ELIMINATION TESTS

V. WIGOTSKY Aerospace America (ISSN 0740-722X), vol. 22, Feb. 1984, p. 32, 35.

Design and preliminary test results for four types of graphite/polyimide joints for aerospace vehicles are discussed. Different designs of joints made from Celion 3000 and 6000/PMR-15 graphite in a polyimide matrix over a polyimide/fiberglass honeycomb core were subjected to temperatures ranging from -250 to 600 F to reveal information about laminate net tension strength, the relative worth of separately bonded or cocured doublers, and the importance of bonding attachment angles to the joint. In static tests it was discovered that one bolted design type had cover failures outside the joint area at an average of 97 percent of the design requirements; and a sandwiched, straight joint design type was dropped because of difficulties in bonding its parts together. Diagrams are presented which describe the different design types in detail. I.H.

A84-29572#

GRAPHITE/POLYIMIDE JOINTS EXTEND TEMPERATURE LIMITS

V. WIGOTSKY Aerospace America (ISSN 0740-722X), vol. 22, March 1984, p. 29-31.

After extensive testing, an American aerospace company has found four graphite/polyimide joint designs for which the 350 F temperature limit of epoxy-matrix could be raised to 550 F. The bonded and bolted joints are designed for loads encountered by control surfaces of advanced aerospace vehicles. However, there are certain problems because static and fatigue testing revealed a wide variation in failure loads and modes among different specimens. The reasons for these variations are discussed, taking into account deficiencies in gripping of the test specimen, the shelf life of resin, and the role of the nadic ester. G.R.

W84-11220*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SURFACE ANALYSIS OF GRAPHITE FIBER REINFORCED POLYIMIDE COMPOSITES

D. L. MESSICK (Virginia Polytechnic Inst. and State Univ., Blacksburg), D. J. PROGAR, and J. P. WIGHTMAN Oct. 1983 21 p refs Presented at the 15th Natl. SAMPE Tech. Conf., Cincinnati, 4-6 Oct. 1983

(Contract NAG1-248)

(NASA-TM-85700; NAS 1.15:85700) Avail: NTIS HC A02/MF A01 CSCL 11D

Several techniques have been used to establish the effect of different surface pretreatments on graphite-polyimide composites. Composites were prepared from Celion 6000 graphite fibers and the polyimide LARC-160. Pretreatments included mechanical abrasion, chemical etching and light irradiation. Scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS) were used in the analysis. Contact angle of five different liquids of varying surface tensions were measured on the composites. SEM results showed polymer-rich peaks and polymer-poor valleys conforming to the pattern of the release cloth used durng fabrication. Mechanically treated and light irradiated samples showed varying degrees of polymer peak removal, with some degradation down to the graphite fibers. Minimal changes in surface topography were observed on concentrations of surface fluorine even after pretreatment. The light irradiation pretreatment was most effective at reducing surface fluorine concentrations whereas chemical pretreatment was the least effective. Critical surface

tensions correlated directly with the surface fluorine to carbon ratios as calculated from XPS. Author

N84-11595*# Martin Marietta Corp., Denver, Colo. EVALUATION AND PREDICTION OF LONG-TERM ENVIRONMENTAL EFFECTS OF NONMETALLIC MATERIALS, **SECOND PHASE Final Report**

Sep. 1983 46 p refs

(Contract NAS8-33578)

(NASA-CR-170915; NAS 1.26:170915; MCR-83-643) Avail: NTIS HC A03/MF A01 CSCL 13B

Changes in the functional properties of a number of nonmetallic materials were evaluated experimentally as a function of simulated space environments and to use such data to develop models for accelerated test methods useful for predicting such behavioral changes. The effects of changed particle irradiations on candidate space materials are evaluated. NW.

N84-16037*# Mississippi State Univ., State College. Dept. of Chemical Engineering.

AN EVALUATION OF TECHROLL SEAL FLEXIBLE JOINT MATERIAL

W. B. HALL In Alabama Univ. Res. Rept.: 1983 NASA/ASEE Summer Faculty Fellowship Program 18 p Dec. 1983

Avail: NTIS HC A99/MF A01 CSCL 11A This study evaluated the materials utilized in the flexible joint for possible failure modes. Studies undertaken included effect of temperature on the strength of the system, effect of fatigue on the strength of the system, thermogravimetric analysis, thermochemical analysis, differential scanning calorimeter analysis, dynamic mechanical analysis, and peel test. These studies indicate that if the joint failed due to a materials deficiency, the most likely mode was excessive temperature in the joint. In addition, the joint material is susceptible to fatigue damage which could have been a contributing factor. B.W.

N84-17217*# Dayton Univ., Ohio. Research Inst.

THE EFFECTS OF THE SPACE ENVIRONMENT ON DAMPING MATERIALS AND DAMPING DESIGNS ON FLEXIBLE STRUCTURES

M. F. KLUESENER In NASA. Langley Research Center STEP Expt. Requirements p 79-102 Jan. 1984 Avail: NTIS HC A15/MF A01 CSCL 20K Jan. 1984 refs

The effects of space environments on damping materials and damping designs on flexible structures were investigated. The following items were examined: damping of flexible spacecraft appendages; composite loss factor (n sub s) vs. time in high vacuum for damped test beams and damping of flexible structures. The STEP experiments show inherent damping of flexible structures in space effective possible damping design configurations for space structures, effects of passively damped components on the system loss factor of flexible structures and the effect of space environment on properties of damping materials. E.A.K.

N84-17253# European Space Agency, Paris (France). SPACECRAFT/PLASMA INTERACTIONS THEIR AND INFLUENCE ON FIELD AND PARTICLE MEASUREMENTS

A. PEDERSEN, ed., D. GUYENNE, ed., and J. HUNT, ed. Nov. Proc. of 17th ESLAB Symp., Noordwijk, 1983 217 p refs Netherlands, 13-16 Sep. 1983

(ESA-SP-198; ISSN-0379-6566) Avail: NTIS HC A10/MF A01; ESA, Paris FF 140 Member States, AU, CN and NO (+20% others)

The effect of spacecraft-plasma interactions on plasma and electric field measurements was discussed, using results from Voyager, SCATHA, ISEE, and GEOS satellite missions, and space shuttle flights. Spacecraft charging and impact ionization during Halley's comet flyby missions were considered. Means of controlling spacecraft surface potentials were examined.

N84-17293*# Rensselaer Polytechnic Inst., Troy, N. Y. **COMPOSITE STRUCTURAL MATERIALS Semiannual Progress** Report, 30 Apr. - 30 Sep. 1983

G. S. ANSELL, R. G. LOEWY, and S. E. WIBERLEY Dec. 1983 190 p

(Contract NGL-33-018-003)

(NASA-CR-173259; NAS 1.26:173259; SAPR-45) Avail: NTIS HC A09/MF A01 CSCL 11D

Progress and plans are reported for investigations of: (1) the mechanical properties of high performance carbon fibers; (2) fatigue in composite materials; (3) moisture and temperature effects on the mechanical properties of graphite-epoxy laminates; (4) the theory of inhomogeneous swelling in epoxy resin; (5) numerical studies of the micromechanics of composite fracture; (6) free edge failures of composite laminates; (7) analysis of unbalanced laminates; (8) compact lug design; (9) quantification of Saint-Venant's principles for a general prismatic member; (10) variation of resin properties through the thickness of cured samples; and (11) the wing fuselage ensemble of the RP-1 and RP-2 sailplanes. A.R.H.

N84-18416# Erno Raumfahrttechnik G.m.b.H., Bremen (West

Germany). Structures Dept. INTEGRITY CONTROL OF CARBON FIBER REINFORCED PLASTICS STRUCTURAL ELEMENTS, PHASE 1 REPORT W. H. PAUL and D. WAGNER Paris ESA 8 Apr. 1983 342

p refs

(Contract ESA-4442/80/NL-AK(SC))

(TB-TS-11-01/82-A; ESA-CR(P)-1778) Avail: NTIS HC A15/MF À01

An integrity control program for CFRP structural elements, to avoid catastrophic failures due to propagation of defects and imperfections inherent in FRPs is established. Based upon the experience with fracture control of elements made from homogeneous materials, the control logic applicable to safety relevant elements is determined and consequences in application through all project phases are considered. Problems in defining adequate acceptance/rejection criteria for quality assurance are identified, given the difficulties in determination of local inter and intra laminary stresses at notches and defects. The phenomenological approach to relate damage propagation under operational conditions to initial gross stresses cannot describe the real process: cracking, especially delamination, results in a significant change of stresses in individual layers. A tranfer matrix analytical method is proposed. Author (ESA)

N84-21290*# Perkin-Elmer Corp., Danbury, Conn. Space Science Div.

OPTICAL COATING IN SPACE Final Report

A. N. BUNNER 27 Oct. 1983 83 p refs

(Contract NASW-3753)

(NASA-CR-175441; NAS 1.26:175441; ER-591; REPT-2983-81) Avail: NTIS HC A05/MF A01 CSCL 20F

A technological appraisal of the steps required to approach the goal of in-situ optical coating, cleaning and re-coating the optical elements of a remote telescope in space is reported. Emphasis is placed on the high ultraviolet throughput that a telescope using bare aluminum mirrors would offer. A preliminary design is suggested for an Orbital Coating Laboratory to answer basic technical questions. Author

Fulmer Research Inst. Ltd., Stoke Poges N84-21675# (England).

REVIEW REPORT OF THE THIRD YEAR'S ACTIVITIES ON THE STUDY SURVEY OF ADVANCED MATERIALS

D. P. BASHFORD Paris ESA 14 Sep. 1983 12 p (Contract ESA-4389/80/NL-AK(SC))

(R878; ESA-CR(P)-1838) Avail: NTIS HC A02/MF A01

Mechanical test methods applicable to carbon fiber reinforced plastics (CFRP) were investigated. Moisture absorption and residual stresses in CFRP were studied. Epoxy resins suitable for space structure applications as matrices for fiber reinforced composites were examined. Author (ESA)

ASSEMBLY CONCEPTS

Includes automated manipulator techniques, EVA, robot assembly, teleoperators, and equipment installation.

A83-44602

CANADARM AND THE SPACE SHUTTLE

B. A. AIKENHEAD (National Aeronautical Establishment, Ottawa, Canada), R. G. DANIELL, and F. M. DAVIS (SPAR Aerospace, Ltd., Toronto, Canada) Journal of Vacuum Science and Technology A (ISSN 0734-2101), vol. 1, Apr.-June 1983, pt. 1, p. 126-132. Research supported by the National Research Council of Canada.

The remote manipulator system designed for the Space Shuttle is discussed. The system requirements and environment are summarized, and the manipulator arm assembly and its installation in the Orbiter, the joint assemblies, the end effector, and the wrist roll joint are discussed. The system uses brushless dc servomotors to drive the six joints and the end effector in a variety of control modes which provide both manual and automatic control of the arm functions. Allowances made for the vacuum environment are addressed, and proof of compliance with requirements is considered. C.D.

A84-10070*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A SYSTEM FOR INTELLIGENT TELEOPERATION RESEARCH N. E. ORLANDO (NASA, Langley Research Center, Hampton, VA) American Institute of Aeronautics and Astronautics, Computers in Aerospace Conference, 4th, Hartford, CT, Oct. 24-26,

1983. 7 p. refs (AIAA PAPER 83-2376)

The Automation Technology Branch of NASA Langley Research Center is developing a research capability in the field of artificial intelligence, particularly as applicable in teleoperator/robotics development for remote space operations. As a testbed for experimentation in these areas, a system concept has been developed and is being implemented. This system termed DAISIE (Distributed Artificially Intelligent System for Interacting with the Environment), interfaces the key processes of perception, reasoning, and manipulation by linking hardware sensors and manipulators to a modular artificial intelligence (AI) software system in a hierarchical control structure. Verification experiments have been performed: one experiment used a blocksworld database and planner embedded in the DAISIE system to intelligently manipulate a simple physical environment; the other experiment implemented a joint-space collision avoidance algorithm. Continued system development is planned. Author

A84-11935

SIMULATION OF THE MOTION OF A SHUTTLE-ATTACHED FLEXIBLE MANIPULATOR ARM

R. A. MILLER, W. R. GRAHAM, and F. R. VIGNERON (Department of Communications, Ottawa, Canada) IN: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3 . Montreal, International Association for Mathematics and Computers in Simulation, 1983, p. 225-227.

An overview of the Shuttle's Remote Manipulator Control System is presented, followed by a description of a two-joint, two-link model of the arm used to study its flexible behavior. Two methods of modelling link flexibility are formulated. Non real-time and real-time simulations are described, and conclusions regarding the arm's flexible behavior and the simulation methodology are presented. Author A84-15667* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

KNOWLEDGE BASED SYSTEMS FOR INTELLIGENT ROBOTICS

N. S. RAJARAM (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, Inc., 1982, p. D1.1.1-D1.1.4. refs

(Contract NAS9-15800)

It is pointed out that the construction of large space platforms, such as space stations, has to be carried out in the outer space environment. As it is extremely expensive to support human workers in space for large periods, the only feasible solution appears to be related to the development and deployment of highly capable robots for most of the tasks. Robots for space applications will have to possess characteristics which are very different from those needed by robots in industry. The present investigation is concerned with the needs of space robotics and the technologies which can be of assistance to meet these needs, giving particular attention to knowledge bases. 'Intelligent' robots are required for the solution of arising problems. The collection of facts and rules needed for accomplishing such solutions form the 'knowledge base' of the system. G.R.

A84-21486

THE SHUTTLE REMOTE MANIPULATOR SYSTEM: CANADARM - A ROBOT ARM IN SPACE

C. G. J. WAGNER-BARTAK (Spar Aerospace, Ltd., Mississauga, Ontario, Canada) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 131-142.

The diversity of automated tasks required by the Space Shuttle has prompted critical consideration of both artificial intelligence and the man/machine relationship, resulting in the development of the Shuttle's Remote Manipulator System (RMS). This system provides interactive computer and human control, so that either can possess executive system management. For the 'astroworker', the RMS constitutes a dextrous cybernetic system that electronically and mechanically increases physical strength, sensory perception, and dimensions of reach. It is the first generation of space-based robotic manipulators that will eventually become the workhorses of space-based industrialization. Attention is given to the development status of the RMS, as well as the extrapolation of its technology to future orbital robotics for manufacturing, auxiliary power source deployment, and platform construction in solar power conversion projects. O.C.

A84-22336#

REMOTE MANIPULATORS IN SPACE

P. S. MATTHEWS, B. R. HILL (Spar Aerospace, Ltd., Remote Manipulator Systems Div., Toronto, Canada), and C. G. WAGNER-BARTAK IN: Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983. New York, American Society of Mechanical Engineers, 1983, p. 101-112.

The role of manipulators in space and the major design challenges of the current Remote Manipulator System (RMS) are treated. The RMS, operated by both man-in-the-loop and preprogrammed control, manipulates a maximum 30,000 kg payload, 18.3 m in length and 4.5 m in diameter. End point accuracy is in the order of + or -5 cm and + or -1 deg when automatically controlled and better than + or -1.1/2 cm when operator controlled. RMS functions discussed include the future deployment of on-orbit, Shuttle tended platforms such as Eureca and Leasecraft, where robotic technology will exploit the constant microgravity environment for manufacturing processes. In the future, control systems will only be provided with tasks; manipulators will effect obstacle-avoiding, automatic interfacing of tools and spacecraft with fully sensate hands that include force and visual/proximity sensing. C.M.

A84-22337#

AUTOMATION, ROBOTICS, AND MACHINE INTELLIGENCE SYSTEMS (ARAMIS) IN SPACE MANUFACTURING

D. G. STUART (MIT, Cambridge, MA) IN: Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 . New York, American Society of Mechanical Engineers, 1983, p. 113-126. refs

Two studies are reviewed, one on the design of a space manufacturing facility (SMF), and the other on automation, robotics, and machine intelligence systems (ARAMIS) for space applications. The overall design of the SMF is described, as well as examples of space-specific production processes and equipment. A systematic method to evaluate ARAMIS options for tasks in space is presented. Promising ARAMIS options are described for mechanical actuation tasks, monitoring and control tasks, decision and planning tasks, and fault diagnosis and handling tasks.

Author

A84-25484* Honeywell, Inc., Clearwater, Fla. MANIPULATOR INTERACTIVE DESIGN WITH INTERCONNECTED FLEXIBLE ELEMENTS

R. P. SINGH (Honeywell, Inc., Clearwater, FL) and P. W. LIKINS (Lehigh University, Bethlehem, PA) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 2. New York, Institute of Electrical and Electronics Engineers, 1983, p. 505-512. NASA-sponsored research. refs

This paper describes the development of an analysis tool for the interactive design of control systems for manipulators and similar electro-mechanical systems amenable to representation as structures in a topological chain. The chain consists of a series of elastic bodies subject to small deformations and arbitrary displacements. The bodies are connected by hinges which permit kinematic constraints, control, or relative motion with six degrees of freedom. The equations of motion for the chain configuration are derived via Kane's method, extended for application to interconnected flexible bodies with time-varying boundary conditions. A corresponding set of modal coordinates has been selected. The motion equations are imbedded within a simulation that transforms the vector-dyadic equations into scalar form for numerical integration. The simulation also includes a linear, time-invariant controler specified in transfer function format and a set of sensors and actuators that interface between the structure and controller. The simulation is driven by an interactive set-up program resulting in an easy-to-use analysis tool. Author

A84-25531

DYNAMICS OF NONRIGID ARTICULATED ROBOT LINKAGES R. P. JUDD and D. R. FALKENBURG (Oakland University, Rochester, MI) IN: American Control Conference, San Francisco, CA, June 22-24, 1983, Proceedings. Volume 3. New York, Institute of Electrical and Electronics Engineers, 1983, p. 1045-1049. refs

This paper presents the kinematic and dynamic analysis of an n-link manipulator with flexible members. The deformation of a link from its rigid body position is modeled by a homogeneous transformation. The dynamic equations are obtained using an Euler-Lagrange formulation. These equations are compared to those describing a rigid link mechanism. Author

A84-25828

STUDY OF ARTIFICIAL INTELLIGENCE TECHNIQUES -REALIZATION OF A HIGHLY AUTONOMOUS EXPERIMENTAL ROBOT SYSTEM [CONTRIBUTION AL'ETUDE DE TECHNIQUES D'INTELLIGENCE ARTIFICIELLE - REALISATION D'UN SYSTEME ROBOTIQUE EXPERIMENTAL AGRANDE AUTONOMIE]

A. LANUSSE Toulouse III, Universite, Docteur-Ingenieur Thesis, 1983, 179 p. In French. refs

Artificial intelligence research is conducted to develop a robotized assembly system capable of implementing short or long production series with small variations. A flexible multirobot multisensor assembly cell is defined and realized. Integration of software programs effects the development of the NNS system.

The methodology can easily be transferred to more complex problems in the future. The applications of artificial intelligence techniques in diagnosis and treatment of robot system failures are examined, including decision systems, production systems, and logical-proof systems. Finally, existing plan-synthesis methods are examined in detail and an algorithm that generalizes the NOAH system is proposed. C.M.

A84-28523* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NASA RESEARCH IN TELEOPERATION AND ROBOTICS

A. J. MEINTEL, JR. (NASA, Langley Research Center, Automation Technology Branch, Hampton, VA) and R. L. LARSEN (NASA, Computer Science and Electronics Office, Washington, DC) IN: Robotics and industrial inspection; Proceedings of the Meeting, San Diego, CA, August 24-27, 1982. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 22-30. refs

Increased automation is necessary in future NASA missions. Drivers for automation include constrained funding and physical resources as well as mission capabilities not achievable through conventional means. The application of emerging technology in manipulators and machine intelligence will enable the development of robotic devices remotely commanded by human operators to increase man's productivity in space. The Office of Aeronautics and Space Technology (OAST) has established a program for research in teleoperation and robotics. The program's near-term focus is a Remote Orbital Servicing System (ROSS). The longer range goals include: (1) basic research in autonomous operations, (2) human factors research on the man-machine interface to remote systems, and (3) system integration and analysis of advanced concepts. This paper reviews the current NASA research and technology and considers future work needed to meet the OAST goals. Author

A84-28541

APPLICATION OF LASER INTERFEROMETRY TO ROBOTICS

R. H. ANDERSON, C. W. GILLARD, and C.-C. HUANG (Lockheed Missiles and Space Co., Inc., Space Systems Div., Sunnyvale, CA) IN: Robotics and industrial inspection; Proceedings of the Meeting, San Diego, CA, August 24-27, 1982. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 207-213. refs

The application of a two-color CO2 laser system and a HeNe phase modulated system to the positioning and control of robots is discussed. The CO2 laser system has a 0.03 micron precision for aligning optical elements, and the HeNe phase modulated system has a 25 micron precision for measuring and controlling large antennas. If incorporated into robotics, laser metrology would permit unsophisticated robots (unaffected by temperature or stress) to perform high-precision work. The recommended primary distance measuring system for robotics is the multichannel interferometer in *i*addition to a modulated subcarrier for absolute distance measurement updates. Other recommendations include beam relay by stationary and tracking mirrors, and a retroreflector target attached to the robot as close as possible to the tool. C.M.

A84-44183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ON MODELING DILUTION JET FLOWFIELDS

J. D. HOLDEMAN (NASA, Lewis Research Center, Cleveland, OH) and R. SRINIVASAN (Garrett Turbine Engine Co., Phoenix, AZ) AIAA, SAE, and ASME, Joint Propulsion Conference, 20th, Cincinnati, OH, June 11-13, 1984. 13 p. Previously announced in STAR as N84-25713. refs

(AIAA PAPER 84-1379)

This paper compares temperature field measurements from selected experiments on a single row, and opposed rows, of jets injected into a ducted crossflow with profiles calculated using an empirical model based on assumed vertical profile similarity and superposition, and distributions calculated with a 3-D elliptic code using a standard K-E turbulence model. The empirical model predictions are very good within the range of the generating experiments, and the numerical model results, although exhibiting too little mixing, correctly describe the effects of the principal flow and geometric variables. Author

N84-10582*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.

SPACE APPLICATIONS OF AUTOMATION, ROBOTICS AND MACHINE INTELLIGENCE SYSTEMS (ARAMIS). VOLUME 3, PHASE 2: EXECUTIVE SUMMARY Final Report

D. L. AKIN, M. L. MINSKY, E. D. THIEL, and C. R. KURTZMAN Washington NASA Oct. 1983 42 p refs (Contract NAS8-34381)

(NASA-CR-3736; NAS 1.26:3736; SSL-32-83-VOL-3-PHASE-2) Avail: NTIS HC A03/MF A01 CSCL 05H

The field of telepresence is defined, and overviews of those capabilities that are now available, and those that will be required to support a NASA telepresence effort are provided. Investigation of NASA's plans and goals with regard to telepresence, extensive literature search for materials relating to relevant technologies, a description of these technologies and their state of the art, and projections for advances in these technologies are included. Several space projects are examined in detail to determine what capabilities are required of a telepresence system in order to accomplish various tasks, such as servicing and assembly. The key operational and technological areas are identified, conclusions and recommendations are made for further research, and an example developmental program leading to an operational telepresence servicer is presented.

N84-10583*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.

SPACE APPLICATIONS OF AUTOMATION, ROBOTICS AND MACHINE INTELLIGENCE SYSTEMS (ARAMIS), PHASE 2. VOLUME 1: TELEPRESENCE TECHNOLOGY BASE DEVELOPMENT Final Report

D. L. AKIN, M. L. MINSKY, E. D. THIEL, and C. R. KURTZMAN Oct. 1983 106 ρ refs

(Contract NAS8-34381)

(NASA-CR-3734; NAS 1.26:3734; SSL-30-83) Avail: NTIS HC A06/MF A01 CSCL 05H

The field of telepresence is defined, and overviews of those capabilities that are now available, and those that will be required to support a NASA telepresence effort are provided. Investigation of NASA's plans and goals with regard to telepresence, extensive literature search for materials relating to relevant technologies, a description of these technologies and their state of the art, and projections for advances in these technologies over the next decade are included. Several space projects are examined in detail to determine what capabilities are required of a telepresence system in order to accomplish various tasks, such as servicing and assembly. The key operational and technological areas are identified, conclusions and recommendations are made for further research, and an example developmental program is presented, leading to an operational telepresence servicer.

N84-10584*# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.

SPACE APPLICATIONS OF AUTOMATION, ROBOTICS AND MACHINE INTELLIGENCE SYSTEMS (ARAMIS), PHASE 2. VOLUME 2: TELEPRESENCE PROJECT APPLICATIONS Final Report

D. L. AKIN, M. L. MINSKY, E. D. THIEL, and C. R. KURTZMAN Washington NASA Oct. 1983 116 p refs

(Contract NAS8-34381)

(NASA-CR-3735; NAS 1.26;3735; SSL-31-83) Avail: NTIS HC A06/MF A01 CSCL 05H

The field of telepresence is defined and overviews of those capabilities that are now available, and those that will be required to support a NASA telepresence effort are provided. Investigation of NASA' plans and goals with regard to telepresence, extensive literature search for materials relating to relevant technologies, a description of these technologies and their state of the art, and

projections for advances in these technologies over the next decade are included. Author

N84-11761*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SELF-LOCKING TELESCOPING MANIPULATOR ARM Patent Application

M. F. NESMITH, inventor (to NASA) 30 Sep. 1983 14 p (NASA-CASE-MFS-25906-1; US-PATENT-APPL-SN-537757) Avail: NTIS HC A02/MF A01 CSCL 05H

A telescoping manipulator arm and pivotable finger assembly are disclosed. The telescoping arm assembly includes a generally T-shaped arm having three outwardly extending fingers guided on the grooved roller guides to compensate for environmental variations. The pivotable finger assembly includes four pivoting fingers. Arcuate teeth are formed on the ends of the fingers. A rack having teeth on four sides meshes with each one of the fingers. One surface of the rack includes teeth along its entire surface which mesh with teeth of the finger. The teeth at the remote end of the rack engage teeth of a gear wheel. NASA

N84-13208*# Essex Corp., Huntsville, Ala.

ANALYSIS OF LARGE SPACE STRUCTURES ASSEMBLY: MAN/MACHINE ASSEMBLY ANALYSIS Final Report Washington NASA Dec. 1983 172 p refs

(Contract NAS8-32989)

(NASA-CR-3751; NAS 1.26:3751; H-83-03) Avail: NTIS HC A08/MF A01 CSCL 22A

Procedures for analyzing large space structures assembly via three primary modes: manual, remote and automated are outlined. Data bases on each of the assembly modes and a general data base on the shuttle capabilities to support structures assembly are presented. Task element times and structure assembly component costs are given to provide a basis for determining the comparative economics of assembly alternatives. The lessons learned from simulations of space structures assembly are detailed. Author

N84-16250*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SYNCHRONOUSLY DEPLOYABLE TRUSS STRUCTURE Patent Application

H. G. BUSH, M. M. MIKULAS, JR., and R. E. WALLSOM, inventors (to NASA) (Kentron International, Inc., Hampton, Va.) 30 Nov. 1983 15 p

(NASA-CASE-LAR-13117-1; US-PATENT-APPL-SN-556512) Avail: NTIS HC A02/MF A01 CSCL 22B

A collapsible-expandable truss structure is disclosed which includes two space surface truss layers with an attached core layer. The surface truss layers are composed of several linear struts arranged in multiple triangular configurations. Each linear strut is hinged at its center and hingedly connected at each end to a nodular joint. A passive spring serves as the expansion force to move the folded struts from a stowed collapsed position to a deployed operative final truss configuration. A damper controls the rate of spring expansion for synchronized deployment of the truss as the folded configuration is released for deployment by restraint belts that synchronously extend under the control of motor driven spools. NASA

N84-16807# Naval Academy, Annapolis, Md. Dept. of Weapons and Systems Engineering.

STABILITY ENHANCEMENT OF A FLEXIBLE ROBOT MANIPULATOR Final Report, 1982 - 1983

T. D. LOOKE 24 Jun. 1983 115 p

(AD-A134185; USNA-TSPR-126) Avail: NTIS HC A06/MF A01 CSCL 12A

A computer software programming technique was developed to compensate a highly oscillatory robot system controlled by a bang-bang input. The assumptions that the system was linear and had lumped parameter characteristics allowed a fifth order, simplified dynamic model to be derived. Analysis using frequency response methods led to further simplification of the model to a third order system. Based on the third order model, a technique was developed which would compensate the system with a form of deadbeat control. Simulation of the model driven by the compensated bang-bang input verified the deadbeat response. The technique was implemented on an 8080-based microcomputer system which controlled the input. Actual system response to the compensated input was observed to be essentially free of the undesirable oscillatory motions, thus yielding an apparently rigid system. Author (GRA)

N84-17219*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ERECTABLE BEAM EXPERIMENT

W. L. HEARD, JR. In its STEP Expt. Requirements p 121-134 Jan. 1984

Avail: NTIS HC A15/MF A01 CSCL 22B

The erectable beam applicability to the MAST/STEP experiment is summarized. High manual assembly rates were demonstrated in neutral buoyancy tests and it is suggested that use of an erectable beam would eliminate extension/retraction complexity associated with deployable beams. The erectable beam assembly aid is easily adaptable to general truss configurations and structural appendages could be accommodated with the use of actuators. The ACCESS flight experiment precedes MAST by 2 to 3 years and will provide mature, space proven assembly/disassembly technology on which to base the MAST experiment. E.A.K.

N84-20175*# Stanford Univ., Calif.

PRECISE CONTROL OF FLEXIBLE MANIPULATORS Semiannual Progress Report

R. H. CANNON, JR. Mar. 1984 36 p refs

(Contract NAG1-322)

(NASA-CR-175389; NAS 1.26:175389) Avail: NTIS HC A03/MF A01 CSCL 05H

Experimental apparatus were developed for physically testing control systems for pointing flexible structures, such as limber spacecraft, for the case that control actuators cannot be collocated with sensors. Structural damping ratios are less than 0.003, each basic configuration of sensor/actuator noncollocation is available, and inertias can be halved or doubled abruptly during control maneuvers, thereby imposing, in particular, a sudden reversal in the plant's pole-zero sequence. First experimental results are presented, including stable control with both collocation and noncollocation. Author

N84-20316# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.

RECURSIVE LAGRANGIAN DYNAMICS OF FLEXIBLE MANIPULATOR ARMS VIA TRANSFORMATION MATRICES Interim Technical Report

W. J. BOOK Dec. 1983 28 p

(AD-A137345; CMU-RI-TR-83-23) Avail: NTIS HC A03/MF A01 CSCL 12A

Improving the performance of most engineering systems requires the ability to model the system's behavior with improved accuracy. The evolution of the mechanical arm from teleoperator and crane to present day industrial and space robots and large space manipulators is no exception. Initial simple kinematic and dynamic models are no longer adequate to improve performance in the most critical applications. Both the mechanical system and control system require improved models for design simulation. Proposed new control algorithms require dynamic models for control calculation. Planning and programming activities as well as man-in-the-loop simulation also require accurate models of the arms. Accuracy is usually acquired at some cost. The application of mechanical arms to economically sensitive endeavors in industry and space also gives incentive to improve the efficiency of the formulation and simulation of dynamic models. Control algorithms and man-in-the-loop simulation require real time calculation of dynamic behavior. Formulation of the dynamics in an easy to understand conceptual approach is also important if maximum use of the results is to be obtained. The nonlinear equations of motion for flexible manipulator arms consisting of rotary joints connecting two flexible links are developed. Kinematics of both the rotary joint motion and the link deformation are described by 4x4 transformation matrices. The link deflection is assumed small so that the link transformation can be composed of summations of assumed link shapes. The resulting equations are presented as scalar and 4x4 matrix operations ready for programming.

Author (GRA)

N84-20626*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CONSTRUCTION CONCEPT FOR ERECTING AN OFFSET-FED ANTENNA

M. D. RHODES Mar. 1984 20 p refs

(NASA-TM-85774; NAS 1.15:85774) Avail: NTIS HC A02/MF A01 CSCL 22B

A design concept for the construction of an offset-fed antenna is discussed. Antennas of this type are of interest for space applications because the configuration eliminates the effects of feed and feed-support blockage. The proposed construction concept is developed around the assembly of a stiff truss substructure by pressure-suited astronauts operating in extravehicular activity (EVA) assisted by a mobile platform that moves along the structure to position the astronauts at joint locations where they can latch members in place. Construction can be accomplished from the shuttle cargo bay in the course of a normal flight or from a space station platform. The concepts demonstrates the versatility of machine assisted manned assembly and is only one of many potential applications. Author

N84-20857*# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

FEASIBILITY OF REMOTELY MANIPULATED WELDING IN SPACE. A STEP IN THE DEVELOPMENT OF NOVEL JOINING TECHNOLOGIES Final Report

K. 'MASUBUCHI, J. E. AGAPAKIS, A. DEBICCARI, and C. VONALT Sep. 1983 260 p refs

(Contract NASW-3740)

(NASA-CR-175437; NÁS 1.26:175437) Avail: NTIS HC A12/MF A01 CSCL 131

In order to establish permanent human presence in space technologies of constructing and repairing space stations and other space structures must be developed. Most construction jobs are performed on earth and the fabricated modules will then be delivered to space by the Space Shuttle. Only limited final assembly jobs, which are primarily mechanical fastening, will be performed on site in space. Such fabrication plans, however, limit the designs of these structures, because each module must fit inside the transport vehicle and must withstand launching stresses which are considerably high. Large-scale utilization of space necessitates more extensive construction work on site. Furthermore, continuous operations of space stations and other structures require maintenance and repairs of structural components as well as of tools and equipment on these space structures. Metal joining technologies, and especially high-quality welding, in space need Author developing.

PROPULSION

Includes propulsion concepts and designs utilizing solar sailing, solar electric, ion, and low thrust chemical concepts.

A84-13397#

A PARAMETRIC STUDY OF SPACE TRANSFER-PROPULSION STAGES

V. R. LARSON, P. E. COFFMAN (Rockwell International Corp., Rocketdyne Div., Canoga Park, CA), A. FABRIZI, and G. BAIOCCHI (BPD Difesa-Spazio, Colleferro, Italy) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 44 p. Research supported by the European Space Agency, Rockwell International Corp., and Universitadi Roma.

(IAF PAPER 83-401)

Surveys of commercial spacecraft activities and future geosynchronous earth orbit (GEO) satellite requirements suggest that a spacecraft propulsion system that provides the perigee burn for a broad range of future commercial satellites would have an excellent market potential. The efforts in this direction reported here followed two approaches. The first concentrated on the feasibility and the payload capabilities that could be provided by an upper propulsion system assembled essentially from off-the-shelf components and subsystems. The second approach considers the benefits that could be achieved by using major subsystems specifically tailored for the application. The results obtained thus far indicate that attractive UPS configurations can be defined with either approach.

A84-16116

A FUTURE SOLAR ORBITAL TRANSFER VEHICLE CONCEPT

C. F. GARTRELL (General Research Corp., McLean, VA) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-19, Sept. 1983, p. 704-710. refs

The limiting payload performance of any transfer vehicle is determined by the exhaust velocity of the propellant and the mass characteristics of the transfer vehicle. The theoretical specific impulse limit of liquid oxygen/liquid hydrogen systems is about 560 s, while specific impulses obtained in practice are about 460 s. However, a much greater value for the specific impulse can be produced by making use of the direct heating of low atomic number gases. It is pointed out that in the innerplanet environment the sun offers a convenient source of thermal energy. The present investigation is concerned with a solar orbital transfer vehicle (SOTV) which utilizes a 100 m diameter concentrator system to provide the approximately 10 MW of thermal power needed to obtain a nominal thrust level of 2780 N. G.R.

A84-18141*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

VERTICAL ASCENT FROM EARTH TO GEOSYNCHRONOUS ORBIT

J. A. MARTIN (NASA, Langley Research Center, Space Systems Div., Hampton, VA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 11 p. refs

(AIAA PAPER 84-0509)

The concept of ascending vertically from the equator on earth to the point in geosynchronous orbit directly above was investigated. The gravity losses were found to be so great that vertical ascent is not practical with only chemical-rocket propulsion. With laser propulsion, propellant requirements with vertical ascent are reduced and might allow the use of single-stage vehicles from earth to geosynchronous orbit. Combined or composite chemical and laser propulsion is shown to be useful. A gravity ladder suspended from geosynchronous orbit part of the distance to earth is shown to reduce the vehicle propulsion requirements. Author

A84-21484

TRANSPORTATION - OPTIONS AND HIGH PAYOFF CHOICES M. W. HUNTER, II (Lockheed Missiles and Space Co., Inc., Palo Alto, CA) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 99-117. refs

In recent years, nonrocket ideas have proliferated. Various electromagnetic acceleration schemes, energy transfer by laser from power stations to accelerating vehicles, and momentum transfer devices consisting of structures of vast proportions have been suggested. It is a complex array of possibilities, many of which potentially apply from low earth orbit to interstellar propulsion. This paper relies on the simple relations between energy and momentum which are fundamental to the various possible space propulsion systems. Energy transmission by new techniques, such as a laser power station, and the various limitations on its conversion to momentum are covered. Momentum storage and direct momentum transfer are also treated.

A84-21485

AN ELECTRIC PROPULSION TRANSPORTATION SYSTEM FROM LOW-EARTH ORBIT TO GEOSTATIONARY ORBIT UTILIZING BEAMED MICROWAVE POWER

W. C. BROWN (Raytheon Co., Microwave Power Transmission Dept., Waltham, MA) and P. E. GLASER (Arthur D. Little, Inc., Cambridge, MA) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 119-129. refs

An electric propulsion transportation system from low-earth orbit to geostationary orbit that is based upon microwave power transmission technology derived from studies of the Solar Power Satellite is described. The ion engines in the transportation vehicle are supplied with d.c. electrical power that is obtained from a microwave rectenna on the vehicle that collects and rectifies power from a microwave beam originating from a transmitter located on the earth near its equator. As the transportation vehicle passes over the transmitter on each revolution, it receives power first at low duty cycle and then rapidly at longer duty cycle as it gains in altitude. The paper contains estimates of transit times from low-earth orbit to geostationary orbit and estimates of transportation costs for a typical scenario. These estimates indicate acceptable transit times to geostationary orbit and costs that are much less than existing chemical propulsion methods. Author

A84-22980* Spire Corp., Bedford, Mass. LARGE AREA SPACE SOLAR CELL ASSEMBLIES

M. J. NOWLAN and M. B. SPITZER (Spire Corp., Bedford, MA) IN: Photovoltaic Specialists Conference, 16th, San Diego, CA, September 27-30, 1982, Conference Record . New York, Institute of Electrical and Electronics Engineers, 1982, p. 150-155. refs (Contract NAS3-22236)

Results of the development of a 34.3 sq cm space solar cell and integral glass cover are presented. Average AM(0) cell efficiency is 14 percent. The cell design includes a high performance back surface reflector yielding a thermal alpha of approximately 0.66. A novel process is described which integrates cell fabrication and encapsulation thereby achieving a reduction of encapsulation cost. Test results indicate the potential of this new technology. Author

A84-24980#

HIGHLY EFFICIENT, VERY LOW-THRUST TRANSFER TO GEOSYNCHRONOUS ORBIT - EXACT AND APPROXIMATE SOLUTIONS

D. C. REDDING Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Mar.-Apr. 1984, p. 141-147.

Previously cited in issue 19, p. 2988, Accession no. A83-39400

A84-24981#

OPTIMAL LOW-THRUST TRANSFERS TO SYNCHRONOUS ORBIT

J. V. BREAKWELL (Stanford University, Stanford, CA) and D. C. REDDING Journal of Guidance, Control, and Dynamics (ISSN 0731-5090), vol. 7, Mar.-Apr. 1984, p. 148-155. refs

The general problem of circle-to-circle transfer is examined for chemical rocket spacecraft, following Lawden's 'primer vector' theory. Impulsive and near-impulsive transfers are analyzed to predict initial conditions for low-thrust transfers. A computer solution of the low-thrust problem is described. Results are presented for the low earth orbit to geosynchronous orbit case, showing behavior of the optimal thrust direction, and developing transfer efficiency figures for a range of acceleration limits. Both fixed-thrust and fixed-acceleration propulsion systems are considered. The effect of multiple burns is discussed. Robbins's approximation for gravity loss is shown to be good for a large class of maneuvers. Author

A84-25292#

A STANDARDIZED PROPULSION MODULE FOR FUTURE COMMUNICATIONS SATELLITES IN THE 2000 TO 3000 KG CLASS

H. KELLERMEIER, D. E. KOELLE (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany), and R. BARBERA (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 345-353.

(AIAA PAPER 84-0727)

Applications of a propulsion module in the 2500 kg range are examined. Propulsion module technology in Europe is reviewed and the goals of the Orbital Propulsion Module Study conducted for ESA in 1983 are outlined. Propulsion systems investigated by the study for three types of missions are compared: (1) the GEO insertion of an AR 44 L payload, (2) the GTO-GEO transfer of a Shuttle-launched spacecraft of three tons maximum, and (3) the LEO raising of a three-to-five ton spacecraft from the 300 km Shuttle orbit to some 1000 km with a moderate plane change. Four major propulsion system alternatives are compared to each other in terms of GEO payload and mission cost: a satellite-integrated unified system, an attached unified propulsion module, a separable propulsion module, and an autonomous propulsion vehicle/stage. A conceptual definition of two different propulsion modules resulting from the study is presented and discussed. CD

A84-25293# UTILIZATION OF ELECTRIC PROPULSION FOR COMMUNICATION SATELLITES

PH. SAINT-AUBERT (Matra SA, Toulouse, France), D. VALENTIAN (SocieteEuropeenne de Propulsion, Vernon, Eure, France), and W. BERRY (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 354-364. refs (AIAA PAPER 84-0729)

The advantages and drawbacks of utilizing an electric propulsion system for the station-keeping of future telecommunication satellites are reviewed and analyzed. Two propulsion systems presently under development in Europe are used as reference systems: The FEEP concept, where liquid caesium is ionized under the field emission principle, and the RIT 10 concept, where the ionization depends on radio frequency excitation of a gas. A mission analysis is presented, and the optimization of the propulsion system parameters using a solar array alone or combining an array with on-board batteries, is discussed.

A84-25294#

WHY DON'T WE USE ION PROPULSION?

R. SPERBER (GTE Satellite Corp., Stamford, CT) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 365-375. refs (AIAA PAPER 84-0730)

Ion propulsion systems are compared with conventional catalytic and electrically augmented hydrazine systems and the potential for incorporation of ion propulsion into today's Delta spacecraft is discussed. Battery-powered ion propulsion systems tend to be more massive than electrically augmented hydrazine systems because of the large fixed masses of additional batteries required. Solar array power appears to be preferable for ion-propelled spacecraft. For commercial use, ion propulsion will have to satisfy technical problems with respect to life, contamination, RF noise, and integration of the system into real spacecraft. Technical and political approaches to these problems are suggested. C.D.

A84-25344

INTERSTELLAR SOLAR SAILING - CONSIDERATION OF REAL AND PROJECTED SAIL MATERIALS

G. L. MATLOFF (Pratt Institute, Brooklyn, NY) British Interplanetary Society, Journal (Interstellar Studies) (ISSN 0007-084X), vol. 37, March 1984, p. 135-141. refs

The relevant theory of real partially transmitting films is developed. Interstellar missions using 'real' beryllium and aluminium solar sails 5-30 nm thick are investigated, as is a mission using a projected 10 nm composite sail. Analysis indicates that optimized performance projections for these sails do not vary appreciably from previous calculations for an idealized 90 percent reflective sail with an area/mass thickness of 6 x 0.00001 kg/m sq and an emissivity of 0.5. Substantial performance improvement is possible if a perforated sail is used in place of a hyper-thin, flat, metallic or composite sheet. The theory of two types of optical filters that might be relevant in the consideration of perforated solar sails, although not entirely adequate in the visual spectral region, is reviewed and discussed.

A84-27443#

ROUNDTRIP INTERSTELLAR TRAVEL USING LASER-PUSHED LIGHTSAILS

R. L. FORWARD (Hughes Research Laboratories, Malibu, CA) Journal of Spacecraft and Rockets (ISSN 0022-4560), vol. 21, Mar.-Apr. 1984, p. 187-195. refs

Design concepts for large lightsail spacecraft powered by solar-pumped lasers and capable of high-speed interstellar travel are proposed. Major components of the systems include circular thin-Al-film sails (optimum thickness about 16 nm for 650-nm radiation), powerful solar-driven CW-laser arrays with a 1000-km diameter in earth or solar orbit, and 1000-km-diameter Fresnel zone lenses to focus the laser beam. A fly-by mission to Alpha Centauri (with a 65-GW laser system, a 3.6-km-diameter sail, a maximum speed of 0.11 c, and a travel time of about 40 yr), a /one-way rendezvous mission to Alpha Cen (7.2 TW, 100 km, 0.21 c, 36 yr; deceleration phase 26 TW, 30 km, 5 yr), and a manned return mission to Epsilon Eridani (43 PW, 1000 km, 0.5 c, 51 yr earth time or 46 yr crew-aging time, including 5 yr for exploration) are described and illustrated with drawings. T.K.

A84-29869

MAKING THE HIGH FRONTIER HIGHLY VISIBLE WITH A SOLAR SAIL RACE TO THE MOON

G. PIGNOLET (Centre National d'Études Spatiales; Union pour la Promotion de la Propulsion Photonique, Toulouse, France) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983. San Diego, CA, Univelt, Inc., 1983, p. 249-257. refs (AAS PAPER 83-226)

It is felt that for too many people space and the possibilities it offers remain too remote. It is difficult for the public to distinguish between science fiction and potential reality. What makes the difference is experience, sensory experience, and this is related directly to the structure of the human brain. It is thought that a race to the moon between several small solar sails could attract the attention to the reality of space. The sails would remain visible from the surface of the earth and could provide sustained interest for the world-wide public. The costs of such a race are also discussed.

N84-11206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. RESISTOJET PROPULSION FOR LARGE SPACECRAFT

SYSTEMS

M. J. MIRTICH 1982 32 p refs Presented at the 16th Intern. Elec. Propulsion Conf., New Orleans, 17-19 Nov. 1982; sponsored by AIAA, the Japan Soc. for Aeron. and Space Sci., and Deutsche Gesselschaft fur Luft-und Raumfarhrt

(NASA-TM-83489; E-1813; NAS 1.15:83489) Avail: NTIS HC A03/MF A01 CSCL 21H

Resistojet propulsion systems have characteristics that are ideally suited for the on-orbit and primary propulsion requirements of large spacecraft systems. These characteristics which offer advantages over other forms of propulsion are reviewed and presented. The feasibility of resistojets were demonstrated in space whereas only a limited number of ground life tests were performed. The major technology issues associated with these ground tests are evaluated. The past performance of resistojets is summarized and, looks into the present day technology status is reviewed. The material criteria, along with possible concepts, needed to attain high performance resistojets are presented. S.L.

N84-12226*# Boeing Aerospace Co., Seattle, Wash.

STUDY OF AUXILIARY PROPULSION REQUIREMENTS FOR LARGE SPACE SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY

W. W. SMITH and G. W. MACHLES Sep. 1983 22 p (Contract NAS3-23248)

(NASA-CR-168193-VOL-1; NAS 1.26:168193-VOL-1;

D180-27728-1) Avail: NTIS HC A02/MF A01 CSCL 21H

An insight into auxiliary propulsion systems (APS) requirements for large space systems (LSS) launchable by a single shuttle is presented. In an effort to scope the APS requirements for LSS, a set of generic LSSs were defined. For each generic LSS class a specific structural configuration, representative of that most likely to serve the needs of the 1980's and 1990's was defined. The environmental disturbance forces and torques which would be acting on each specific structural configuration in LEO and GEO orbits were then determined. Auxiliary propulsion requirements were determined as a function of: generic class specific configuration, size and openness of structure, orbit, angle of orientation, correction frequency, duty cycle, number and location of thrusters and direction of thrusters and APS/LSS interactions. The results of this analysis were used to define the APS characteristics of: (1) number and distribution of thrusters. (2) thruster modulation. (3) thrust level, (4) mission energy requirements, (5) total APS mass component breakdown, and (6) state of the art adequacy/deficiency. S.L.

N84-13218*# Boeing Aerospace Co., Seattle, Wash. STUDY OF AUXILIARY PROPULSION REQUIREMENTS FOR LARGE SPACE SYSTEMS, VOLUME 2 Final Report

W. W. SMITH and G. W. MACHLES Sep. 1983 305 p refs (Contract NAS3-23248)

(NASA-CR-168193-VOL-2; NAS 1.26:168193-VOL-2;

D180-27728-2) Avail: NTIS HC A14/MF A01 CSCL 21H

A range of single shuttle launched large space systems were identified and characterized including a NASTRAN and loading dynamics analysis. The disturbance environment, characterization of thrust level and APS mass requirements, and a study of APS/LSS interactions were analyzed. State-of-the-art capabilities for chemical and ion propulsion were compared with the generated propulsion requirements to assess the state-of-the-art limitations and benefits of enhancing current technology. Author N84-19474# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DISCONTINUOUS LOW THRUST ORBIT TRANSFER M.S. Thesis

J. R. CASS, JR. Dec. 1983 64 p

(AD-A136908; AFIT/GA/AA/83D-1) Avail: NTIS HC A04/MF A01 CSCL 21C

This paper examines the use of discontinuous low thrust for orbital transfers between two non-coplanar, circular orbits. The vehicle is assumed to be a solar-powered, ion rocket that cannot operate when it is within the Earth's shadow. Two timescales are used to derive a minimum fuel trajectory. The fast timescale solution maximizes a change in inclination when given a change in semi-major axis for a single orbit. The slow timescale solution combines fast timescale results to obtain the minimum fuel trajectory. Results are presented for three specific transfers requiring varying amounts of shadow penetration. It is shown that the fuel penalty caused by discontinuous thrust is small. However, there can be a moderate increase in total trip time if the time within the shadow is large. Author (GRA)

10

GENERAL

Includes either state-of-the-art or advanced technology which may apply to Large Space Systems and does not fit within the previous categories. Publications of conferences, seminars, and workshops are covered in this area.

A84-10024*# National Aeronautics and Space Administration, Washington, D. C.

SPACE STATION AUTONOMY REQUIREMENTS

J. L. ANDERSON (NASA, Washington, DC) IN: Computers in Aerospace Conference, 4th, Hartford, CT, October 24-26, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1983, p. 164-170.

(AIAA PAPER 83-2352)

Several concepts of autonomy have emerged from space station technology and mission studies. Unifying these concepts is important to enabling the needs for and requirements of autonomous systems for a space station to be explored. One purpose of autonomy related to a space station is to offload routine, demonstrated, precisely specifiable tasks and functions from humans to machines in order to increase habitability, increase human-machine system productivity, or to decrease operational costs. Defining incremental roles, functions, and technical capabilities for autonomy leads to identification of computing systems technologies needed to enable various degrees of autonomy. Author

A84-10066*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DATA SYSTEM ARCHITECTURE CONSIDERATIONS FOR A SPACE STATION

E. B. CONNELL (NASA, Goddard Space Flight Center, Data Systems Technology Office, Greenbelt, MD) IN: Computers in Aerospace Conference, 4th, Hartford, CT, October 24-26, 1983, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1983, p. 472-477.

(AIAA PAPER 83-2346)

The functions that a space station could serve are outlined and details of the data systems requirements are discussed. The data system design will be guided by an overall space systems plan, and will feature distributed, layered architecture, user friendliness, hierarchical control, technology transparency, standard interfaces, and automated engineering tools. The station would begin with a limited core capability and evolve to serve functions defined thereafter. The automation of the engineering tools will be necessary to permit an optimized, minimized crew to control all functions of the space station, while at the same time freeing the crew from being actively involved in maintaining the nominal life support functions of the equipment. One major criterion is that the software must be error free, while another is adaptibility to changing space station configurations and demands. M.S.K.

A84-10883

SPACE APPLICATIONS AT THE CROSSROADS; PROCEEDINGS OF THE TWENTY-FIRST GODDARD MEMORIAL SYMPOSIUM, GREENBELT, MD, MARCH 24, 25, 1983

J. H. MCELROY, ED. and E. L. HEACOCK, ED. (NOAA, Washington, DC) Symposium sponsored by AAS, AIAA, American Society for Aerospace Education, et al. San Diego, CA, Univelt, Inc. (Science and Technology Series. Volume 55), 1983, 308 p.

NASA's accomplishments in space exploration in the quarter century since NASA was formed are reviewed and the directions that could be taken in the near future are examined. The increases in spacefaring capabilities that were gained in the interval covering the Mercury program to near-operational status for the STS are discussed, as are the historical, current, and future NASA aeronautical research programs. Comparisons are made between the data available from the multispectral scanner and the thematic mapper on board Landsat-4, particularly for land cover/use applications. Attention is given to promising avenues for new classification schemes for the enhanced spectral range of the thematic mapper. D.H.K.

A84-10965*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LAUNCH PROCESSING FOR SPACELAB 1

R. O. MCBRAYER (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Shuttle Environment and Operations Meeting, Washington, DC, October 31-November 2, 1983, Collection of Technical Papers . New York, American Institute of Aeronautics and Astronautics,

1983, p. 228-233.

(AIAA PAPER 83-2622)

The final integration of Spacelab payloads with the Shuttle is described. Attention is given to launch processing planning, schedules, quality control, and problem reports and configuration maintenance. Also covered are the integration and checkout of individual and combined experiments, mounting the end cones, attachment of the transfer tunnel, and inclusion of an extra experiments pallet. The entire Spacelab module was subjected to a full systems simulation before deliverance to the Orbiter bay. Modular parts that were transferred from building-to-building were placed in sealed containers filled with a purged atmosphere during transport. M.S.K.

A84-11719#

SPACE LOGISTICS

D. S. EDGECOMBE, C. O. COOGAN, and R. R. TESTER (Battelle Columbus Laboratories, Columbus, OH) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 9 p.

(IAF PAPER 83-24)

Features of logistics for space missions are discussed with an eye to existing trends and possible improvements. The thrust of space programs is shifting from exploration to exploitation of near-earth space, either through expansion of existing satellite capabilities or construction of a series of space stations. Payload dimensions and operating equipment are moving toward standardization, in proven electronic components and in size to fit the Shuttle bay. Space stations and on-orbit servicing by the Orbiter would extend the lifetimes of satellites while also encouraging greater standardization of parts. A need then arises to stockpile parts which may be subject to obsolescence because the assemby lines will have closed. The defense systems practice of front-end logistics analysis assimilates factors which impinge on the desired degree of readiness and the ability to sustain operations over a long time period. All components are analyzed for their criticality and reliability to identify the logistics areas which are feasible to alter, particularly for characterizing the parts and materials which

64

must be available in storage from the beginning, a project such as a space station. M.S.K.

A84-11722#

ESA SPACE STATION ACTIVITIES

J. COLLET and G. PETERS (ESA, Directorate of Space Transportation Systems, Paris, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 9 p. refs (IAF PAPER 83-30)

Current ESA space-station planning is surveyed, focusing on the studies comprising the Long-Term Space-Transportation Preparatory Programme. The present Spacelab, Ariane-2, 3, and 4, and European Retrievable Carrier (Eureca) projects are reviewed, and the need for a European launch capability beyond Ariane-4, a European space infrastructure, and continued cooperation with NASA is defined. User needs in the life sciences, material sciences, space science, remote sensing, communications, and industry are described. Proposed ESA contributions to space-station design include Spacelab-based habitation, logistics, and laboratory modules; Eureca-based solar arrays and heat-pipe radiators; and new designs for an orbital maneuvering vehicle (modular and integrated versions are illustrated). The prospects for ESA/NASA cooperation in the space-station project are considered in terms of political, economic, and technological factors. D.G.

A84-11723#

OVERVIEW OF SPACE STATION OPERATIONS

W. C. SCHNEIDER (Computer Sciences Corp., Falls Church, VA) and J. H. DISHER International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 7 p.

(IAF PAPER 83-38)

Current planning and development for space-station operations in the 1990's are summarized. The system elements (habitat, power/utility module, multiple-docking/berthing module, logistics module, discipline-oriented modules, teleoperator maneuvering system, remote manipulation system, and ground support) and capabilities (experiments, satellite service, upper-stage basing and servicing, structural fabrication or assembly, and operation of tethered satellites) are characterized. It is shown that a station in a 450-km, 28.5-deg-inclined circular orbit with crew exchange and resupply every 90-120 days could fulfill these requirements with an initial crew of 6-8 and mature-phase crew of 20-24. Launch and support by the Space Shuttle are assumed. Consideration is given to data-management, mission-control, and operational safety factors. The findings are illustrated with tables and graphs. D.G.

A84-11727#

EUROPEAN UTILISATION ASPECTS FOR A SPACE STATION

W. LEY and H. SAX (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, West Germany) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 8 p. Research supported by the European Space Agency.

(IAF PAPER 83-54)

The results of an ESA study on the payloads and benefits of European participation in a NASA space station are reported. Analyses and guestionnaires were prepared of mission candidates in material sciences and processes, life sciences, space science applications and technology, and new space utilization fields. European hardware contributions to a space station were projected as logistics, hangar, and experiments modules, as well as retrievable free-flying platforms that would carry material sciences, biology, space sciences, and earth observation instrumentation. The usefulness of a manned presence for the space-based materials, life sciences, and space technologies is concluded valid, especially with regard to operations on a space station. The space station would be, in fact, a complement to present unmanned European space missions, and the human presence is essential for constructing and maintaining larger, more complex apparatus in space. M.S.K.

A84-11728#

SPACE STATION - A CANADIAN PERSPECTIVE

K. H. DOETSCH (National Aeronautical Establishment, Ottawa, International Astronautical Federation, International Canada) Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 16 p.

(IAF PAPER 83-55)

Canada's potential role in the development and operation of a space-station infra-structure is discussed, reporting the results of a survey of industrial, university, and government users and/or suppliers conducted in 1982-1983, in response to a NASA request. Interest is found in applications from the fields of remote sensing, communications, materials processing, science, technology, medicine, and biology; while Canadian industry could contribute to aspects as space construction and maintenance, such large-solar-array design, flexible-structure design and control, and sensor-system development. It is suggested that most Canadian needs can be served by a combination of polar-orbit platforms for remote sensing, a low-inclination, low-earth-orbit, permanently or intermittently manned research and development laboratory, and a local-orbit maneuvering vehicle to assemble and service them. A block diagram of space infrastructures and graphs of the survey responses are provided. T.K.

A84-11737#

AN OVERVIEW OF THE INSTITUTIONAL AND REGULATORY ASPECTS AND THEIR IMPACT ON SYSTEM DESIGN

F. M. GALANTE (Eutelsat, Paris, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 11 p. (IAF PAPER 83-82)

Attention is given to international regulations that are applicable to geostationary orbit use by fixed satellite service systems, with a view to the means currently available for the reduction of potential interference to acceptable levels through a system-coordination process. This coordination process may result in either a reduction of the capacity of the planned system, or in a reduction of service quality. It is noted that if the interference environment is taken into consideration at the time of a given system's planning, rather than at the coordination stage, it may be possible to achieve a system optimization that will reduce the negative economic impact of coordination. Ó.C.

A84-11739#

COMMERCIAL COMMUNICATIONS SATELLITE MARKET AND **TECHNOLOGY IN THE 90'S**

R. T. FILEP (Communications 21 Corp., Redondo Beach, CA) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 6 p. refs (IAF PAPER 83-86)

A description is presented of a user requirement study which was conducted during the fall of 1982 to determine possible commercial communications missions for a low-earth orbit space station under consideration for the 1990s. The study included a review of the literature on large space structures for communications. The survey returns were grouped into four categories, taking into account missions relating to testing, space communications technology, scientific research priorities and suggestions for cost savings in space, and communications traffic growth. In discussions regarding the space station, of considerable interest to many of the participants was the concept of the space station as a 'service station-in-the-sky'. Some interest was expressed in a low-earth orbit communications satellite. G.R.

A84-11753#

UTILISATION OF THE EUROPEAN RETRIEVAL CARRIER EURECA FOR LIFE SCIENCE RESEARCH

G. SEIBERT (ESA, Paris, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983, IAF Paper 83-169. 9 p.

The design features, mission profiles, and functions of the EURECA free flying platform, to be launched from the Orbiter into a 500 km orbit, then return for retrieval at a later date, are described.

The 2.2 m spacecraft will weigh about 3.5 tons, feature a 400 N thruster and propellant sufficient for a 400 m/sec velocity change, and interface with the Orbiter RMS arm. The missions will support biology, exobiology, and materials processing experiments. The first mission will carry a protein crystallization experiment to provide protein crystals for X ray diffraction studies, botany experiments to determine the effect of gravity on plant growth, an experiment to determine the long-term effect of space radiation on biological materials, and the protection afforded biological materials by shielding equipment. The EURECA platform will maintain orbit for six months before lowering orbit for a passive capture by the Orbiter. <u> М</u>SК

A84-11773#

FAIRCHILD THE LEASECRAFT SYSTEM COMMERCIALLY-OPERATED PLATFORM FOR SCIENCE AND **BUSINESS IN SPACE**

B. RAAB (Fairchild Space Co., Germantown, MD) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 10 p.

(IAF PAPER 83-232)

Design features and mission profiles for the Leasecraft free-flying platforms are described. The Leasecraft would use multimission modular spacecraft (MMS) configured for launch by the Shuttle, transfer to 28.5 deg polar sunsynchronous inclination orbits, and return for later retrieval with the RMS arm, changeout and replacement of the payload, and return to the sunsynchronous orbit. The Leasecraft would have two optional solar power panels, an attitude control subsystem, a special function module, and a TDRSS antenna, as well as a propulsion subsystem that would also be refueled during Orbiter rendezvous. Payloads would be categorized as primary or secondary, with the former claiming priority on the spacecraft attitude, mission modes, and revisit intervals. An example of a primary mission would be the Advanced X-ray Astrophysics Facility, while secondary paylods could include materials processing experiments and search and rescue transponders. Primary services are expected to cost \$2-4 million/month, while secondary services run \$0.5-1 million/month. M.S.K.

A84-11779#

NATURAL SELECTION OF STELLAR CIVILIZATIONS BY THE LIMITS OF GROWTH

M. D. PAPAGIANNIS (Boston University, Boston, MA) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 9 p. refs (IAF PAPER 83-272)

Evolution occurs in any system that possesses degrees of freedom to allow the appearance of new entities and constraints to select a few of them to become part of the system which in this manner continues to evolve. The limits of growth in a finite system, which will be imposed on all stellar civilizations by the colossal distances that separate the stars, will become the constraint that will affect the natural selection of these civilizations. Those that will manage to overcome their innate tendencies toward continuous material growth and replace them with non-material goals will be the only ones to survive this crisis. As a result the entire galaxy in a cosmically short period will become populated by stable, highly ethical and spiritual civilizations. Author

A84-11787#

ANALYTICAL MODEL OF THE EVOLUTION OF ORBIT PARAMETERS OF A QUASI GEOSTATIONARY SATELLITE

P. LEGENDRE (Centre National d'Etudes Spatiales, Toulouse, France) International Astronautical Federation, International Astronautical Congress, 34th, Budapest, Hungary, Oct. 10-15, 1983. 9 p. refs

(IAF PAPER 83-316)

The MASQ analytical model describing the evolution of the orbit parameters of a geostationary satellite maintained within a narrow window (0.1 deg) in longitude and latitude is examined. The method used in developing the model involves expanding the perturbation functions in adapted orbit parameters and incorporating

them in the Lagrange equations. The model is a secular evolution model with sums of periodical terms; the periods are extensively variable and come under four different categories. The model is shown to be sufficiently accurate to maintain geostationary satellites in station and requires less computational effort than numerical methods VI

A84-11938* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SIMULATION OF THE GALILEO SPACECRAFT AXIAL -**DELTA-V ALGORITHM**

J. M. LONGUSKI (California Institute of Technology, Jet Propulsion Laboratory, Guidance and Control Section, Pasadena, CA) 1N: World Congress on System Simulation and Scientific Computation, 10th, Montreal, Canada, August 8-13, 1982, Proceedings. Volume 3. Montreal. International Association for Mathematics and Computers in Simulation, 1983, p. 236-238. refs

(Contract NAS7-100)

Preliminary results are presented from the analysis of the Galileo spacecraft axial delta-V algorithm. The Galileo spacecraft is a dual spin interplanetary spacecraft which will study the four Galilean moons of Jupiter as well as the Jovian environment and atmosphere. In order to achieve orbit about Jupiter and accurately deliver the probe to the planet's upper atmosphere, the Galileo spacecraft must be capable of performing many trajectory corrections or delta-V maneuvers. Twelve 10 Newton thrusters and one 400 Newton engine are utilized for this purpose. There are many maneuver modes and control algorithms available to the spacecraft. In this paper only the analysis of the axial delta-V algorithm will be discussed. The analysis consists of two parts: an analytic study and a simulation study. The analytic results are based on rigid body dynamics, while the simulation includes the first order effect of the flexible magnetometer boom and nutation damper. The simulation utilizes a program developed at JPL which allows flexible body effects to be simulated by modeling a collection of rigid bodies attached together by hinges, springs and dampers. In this preliminary study of the Galileo only two rigid bodies were used in the simulation, but many more can and will be used in the final tests. In this analysis, the algorithm appears to be working correctly and the analytic and simulation results agree very well.

Author

A84-13376#

THE SPACELAB TEST PROGRAM

J. K. VON DER LIPPE (Messerschmitt-Boelkow-Blohm GmbH; Raumfahrttechnik GmbH, Bremen, West Germany) AIAA, AHS, IES, SETP, SFTE, and DGLR, Flight Testing Conference, 2nd, Las Vegas, NV, Nov. 16-18, 1983. 12 p.

(AIAA PAPER 83-2685)

The design features, program organization, and tests of the Spacelab are described. Spacelab provides a shirtsleeve environment for LEO missions lasting up to 30 days. The design is modular and can accommodate up to three pallets as well as the pressurized vessel, with all components staying mounted in the Orbiter bay. ESA provides design, development, and manufacturing, as well as the instrument pointing system, the first flight payload package, and post-delivery support until after the second flight. NASA will purchase a second Spacelab, supply verification instrumentation for the hardware during the first two flights, and will construct the Spacelab tunnel. The final product was constructed after complete testing of subsystem component, and no environmental testing was performed on a complete system. Actual full system tests covered the initial power-up, interfaces, EM compatibility, noise, off-gassing, leaks, mass properties, and software. M.S.K.

A84-13901#

SPACELAB'S DEVELOPMENT

M. BIGNIER (ESA, Paris, France) ESA Bulletin (ISSN 0376-4265), no. 36, Nov. 1983, p. 6-11.

Significant events in the international cooperation between ESA members and NASA in the development of Spacelab are outlined. The agreement to develop Spacelab in Europe was formalized in

a MOU between NASA and ESRO in 1972, and was followed by configuration studies in both Europe and the U.S. It was decided in 1973 that ESA would build the hardware and turn it over to NASA, which would fly Spacelab on the Shuttle and buy a second Spacelab manned module. Once delivered, all responsibility for Spacelab would be transferred to NASA. A total of 10 European countries participated in the design, construction, and testing, performed by a project team of 100 engineers and 40 industrial companies. Design reviews were performed until 1981, in concert with hardware development of both Spacelab and pallets. The Eureca free-flying platform is being developed as a follow-on project, and studies are being conducted for activities in the future. such as participation in a space station. MSK

A84-14586* Jet Propulsion Lab., California Inst. of Tech., Pasadena

LARGE DEPLOYABLE REFLECTOR (LDR) - A CONCEPT FOR AN ORBITING SUBMILLIMETER-INFRARED TELESCOPE FOR **THE 1990S**

P. N. SWANSON, S. GULKIS, T. B. H. KULPER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA), and M. KIYA (NASA, Ames Research Center, Moffett Field, CA) Optical Engineering (ISSN 0091-3286), vol. 22, Nov.-Dec. 1983, p. 725-731. NASA-supported research. refs

The history and background of the Large Deployable Reflector (LDR) are reviewed. The results of the June 1982 Asilomar (CA) workshop are incorporated into the LDR science objectives and telescope concept. The areas where the LDR may have the greatest scientific impact are in the study of star formation and planetary systems in the own and nearby galaxies and in cosmological studies of the structure and evolution of the early universe. The observational requirements for these and other scientific studies give rise to a set of telescope functional requirements. These, in turn, are satisfied by an LDR configuration which is a Cassegrain design with a 20 m diameter, actively controlled, segmented, primary reflector, diffraction limited at a wavelength of 30 to 50 microns. Technical challenges in the LDR development include construction of high tolerance mirror segments, surface figure measurement, figure control, vibration control, pointing, cryogenics, and coherent detectors. Project status and future plans for the LDR are discussed. Author

A84-14764

SPACEFLIGHT TO 2000 - INTERAVIA LOOKS FORWARD FROM THE PRESENT

C. BULLOCH Interavia (ISSN 0020-5168), vol. 38, Nov. 1983, p. 1185-1192.

NASA and ESA space missions and technologies to the year 2000 are discussed, together with economic and political factors impinging on the space activities. International cooperation is essential for projects costing upwards of \$10 billion, with one driving force being that nations must participate in space programs or lose any technological competitiveness they could generate internally due to the cutting edge qualities of space technologies. Telecommunications will continually expand, with the STS remaining the largest booster vehicle. ESA may develop a launcher for LEO applications, and use a lifting body first stage. Improved durability is planned for the Shuttle main engines, as are thrust augmentation and ceramic-lined chambers. Over 100 missions have been identified for a space station, and a range of orbit transfer vehicles is being developed for a variety of applications. One spin-off from space programs will be advances in computer technology because of current data rates from remote sensing satellites, the need for a high level of artificial intelligence on a space station, and remotely controlled devices such as free-flying repair platforms. D.H.K.

A84-15092

MISSION TO MARS - THE CASE FOR A SETTLEMENT

C. STOKER (Colorado, University, Boulder, CO) and C. P. MCKAY Technology Review (ISSN 0040-1692), vol. 86, Nov.-Dec. 1983, p. 27-30, 35-37.

Scenarios and motivations for exploration, settlement, and exploitation of Mars are explored. Mars has an atmosphere that contains enough oxygen to extract breathing gases, and the soil is mineralogically rich in elements suitable for the manufacture of construction materials, fuels, and soil for growing plants. The location of Mars also serves as a gateway to the asteroids, which may be mined for raw materials. The Martian moons, Deimos and Phobos, are candidates for the development of asteroid mining techniques. The water supply on Mars consists of a 0.3 percent atmospheric concentration, the polar caps, and the potential for a deeply penetrating permafrost that extends to the lower latitudes. NASA has a design for a Mars mapper satellite that could locate the ground-frost areas of the entire planet. Ion-drive and solar-sail propulsive systems could provide power for the trip to Mars after the spacecraft have been assembled in earth orbit. The round-trip journey, plus landing, experimentation, and exploration, would last more than 2.5 yr. A larger data base is still needed to predict the health effects of the long journey in microgravity, isolation, and in exposure to occasional solar flare radiation. MSK

A84-15161

MAN IN SPACE - AN OVERVIEW

O. G. GAZENKO (Ministerstvo Zdravookhraneniia SSSR, Institut Mediko-Biologicheskikh Problem, Moscow, USSR) Aviation, Space, and Environmental Medicine (ISSN 0095-0562), vol. 54, Section II, Dec. 1983, p. S3-S5.

The effects of the space environment on humans are reviewed in the light of 22 years of experience, and the implications for future space-colonized projects are considered. The primary factors discussed are cosmic radiation and weightlessness. While operations near the earth are shown to expose crew members to only minimal amounts of radiation, interplanetary voyages will involve exposure to relativistic androns which could affect vital brain centers. Weightlessness brings numerous complications related to changes in the afferent nervous system, the cardiovascular system, and the loading of the musculoskeletal system which could well induce evolutionary changes in space colonists ('El Greco-type' humans in solar-system colonies or new species of the Homo denus in Galactic colonies). The risk factors for current spacecraft crew members are shown to be comparable to those encountered by test pilots or professional boxers. T.K.

A84-15189#

GLOBAL IMPLICATIONS OF SPACE ACTIVITIES: AN AIAA/ASPEN INSTITUTE ASSESSMENT

New York, American Institute of Aeronautics and Astronautics, 1983, 7 p.

The impact of space technology on six areas of global impact was assessed by the AIAA and representatives of government. industry, and educational organizations in June 1983. Attention was given to percussions that would be felt in science, third world participation in space applications, space station policy, military activities. remote sensing, and technology transfer. Recommendations were developed that included continuance of the NASA Advanced Communications Technology program, facilitating an open-door policy for remote-sensing data, governmental sponsorship of meetings between representatives of space-faring nations, encouragement of international participation by scientists in the planning stages of a space station, and efforts by the U.S. to benefit from the technologies of other countries in planning future space stations. Continued open dissemination of nonclassified technological literature in the U.S. is also advised, as are increased efforts to negotiate weapons bans for space, separation of military and civilian space activities, and persevering attention to the needs of developing countries in space policy. M.S.K.

A84-15321

FINANCING LARGE SPACE PROJECTS [LE FINANCEMENT DES GRANDS PROJETS SPATIAUX] M. E. LEVY (Paris, Bangue Nationale, Paris, France) IN:

M. E. LEVY (Paris, Banque Nationale, Paris, France) IN: Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings. Toulouse, Cepadues-Editions, 1983, p. 609-623. In French.

The arrangement possible for financing large space projects are explored, together with various projects which can be undertaken. The scale of financing is noted to be on the order already experienced with petroleum, nuclear, natural gas production and utilization facilities, the Airbus program, and international gas pipelines. The projects depend on volume, time to operatinal status, the novelty, international aspect, and the risks. Participants in the venture comprise the promoter, the financiers, the public authorities, and the clients. Financing plans include normal credit channels, taking into account the associated risks and necessary advances for capitalization, loans, credit-leasing arrangements, and through concessions. Proposed and operational projects for which the financing is necessary include the Ariane, the SPOT satellite, Spacelab, DBS satellites, and astronomical satellites. M.S.K.

A84-15381

DEVELOPING THE SPACE FRONTIER; PROCEEDINGS OF THE TWENTY-NINTH ANNUAL CONFERENCE, HOUSTON, TX, OCTOBER 25-27, 1982

A. NAUMANN, ED. and G. ALEXANDER, ED. (Lockheed Engineering and Management Services Co., Inc., Houston, TX) Conference sponsored by the American Astronautical Society and American Institute of Aeronautics and Astronautics. San Diego, CA, Univelt, Inc., 1983, 434 p. Projects which are planned, under development, in design, or

are being carried out as parts of the U.S. space program are discussed. Factors influencing the articulation of a U.S. space policy are examined from political, military, scientific, NASA, and civilian viewpoints. Private sector participation in space activities is explored in terms of remote sensing, the development of low-cost spacecraft, and cooperative agreements among companies to fund space ventures. The implementation of government space development programs by government agencies is described, together with financial and business participation in space. Areas requiring technological advance to commence space construction are delineated, covering propulsion, power sources, commercial needs, and data management systems. Economic, political, and social impediments and supports for space activities are assessed, as is progress in utilization and expansion of the capabilities of the STS. Finally, the suitability of the Shuttle as a base for development of the space frontier is examined. No individual items are abstracted in this volume M.S.K.

A84-17026

COLLOQUIUM ON THE LAW OF OUTER SPACE, 25TH, PARIS, FRANCE, SEPTEMBER 27-OCTOBER 2, 1982, PROCEEDINGS Colloquium sponsored by the International Astronautical Federation. New York, American Institute of Aeronautics and Astronautics, 1983, 352 p.

International law aspects of outer space are addressed. The topics considered include: legal aspects of protection of the earth and outer space environment, legal aspects of the peaceful use of outer space in the light of Article IV of the 1967 Outer Space Treaty, determination of applicable law to living and working in outer space, and legal aspects of direct broadcast satellites.

C.D.

A84-17054#

JURISPRUDENTIAL PHILOSOPHIES OF THE ART OF LIVING IN SPACE THE TRANSNATIONAL IMPERATIVE

P. M. STERNS and L. I. TENNEN IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 187-202. refs

(IAF PAPER 82-IISL-38)

The parameters to be considered in determining the law applicable to living and working in space are examined. In addition, traditional jurisprudential philosophies are analyzed in terms of their rationale and policy considerations in the context of a space settlement. It is demonstrated that a jurisprudential philosophy which transcends national legal structures will be necessary for the continued existence of a space settlement. Such a philosophy will promote the interests and policies of all the participants in a space settlement, in times of dispute as well as in times of peaceful coexistence. V.L.

A84-17057#

DETERMINATION OF APPLICABLE LAW TO LIVING AND WORKING IN OUTER SPACE

L. FEKETE IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 221, 222. refs

(IAF PAPER 82-IISL-44)

The international space law as it applies to national and international space crews is discussed. The subjects of space law are always states and never physical persons. States are obliged to see to it that their nationals conduct space activities in accordance with international law. Space stations are under the jurisdiction of the state on whose registry the station is launched into outer space. The law of the jurisdictional state applies to the crew. Where the crew is an international one, the various states participating in the undertaking may agree between themselves as to the applicable law. C.D.

A84-17058#

DETERMINATION OF APPLICABLE LAW TO LIVING AND WORKING IN SPACE

H. DESAUSSURE (Akron, University, Akron, OH) and P. HAANAPPEL (McGill University, Montreal, Canada) IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 223-228. refs (IAF PAPER 82-IISL-45)

The existing body of international space law does not contain a comprehensive set of rules dealing with living and working in outer space. In developing such a set of rules the international legal community can either follow a substantive law approach or a conflicts approach. This paper will deal with two recent developments in U.S. domestic law which are relevant to the subject of living and working in space; first, a U.S. District Court decision on property and privacy law as affected by remote sensing from the airspace; secondly, U.S. legislation giving U.S. courts criminal jurisdiction over launched spacecraft and personnel on board. Both developments will be discussed and put into an international context.

A84-17074#

THE SOLAR POWER SATELLITE - A PROGRAMME FOR DEVELOPMENT AID

R. C. MEINER IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 343-346.

It is pointed out that there are essentially four types of foreign aid. These types include the transfer of knowledge, the transfer of materials, the transfer of funds, and the provision of preferential agreements. A great number of studies have been conducted to assess the pros and cons of a Solar Power Satellite System (SPSS). According to many, the most difficult problems which have to be solved in connection with such a project are related to environmental, societal, political, and institutional aspects. The present investigation is concerned with the initiation of a gradual, phased approach toward a Solar Power Satellite (SPS). Phase I of such an approach would involve the set-up of an organization and the allocation of studies. The building of photovoltaic farms and of an SPS pilot project would occur during the second phase, while development and deployment of a full SPSS would take place during the third phase. The developments are to be financed under foreign aid. G.R.

A84-17075#

ENERGY FROM SPACE - LEGAL IMPLICATIONS OF THE USE OF THE GEOSTATIONARY ORBIT

S. GOROVE IN: Colloquium of the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 347-349.

The provisions of international and treaty law governing the use of geostationary orbits (GEO) and the communications spectrum associated with them are reviewed. The questions raised are considered especially important in the light of plans for solar-power satellites in GEO. The claims of national sovereignty over portions of the GEO by equatorial nations in the Bogota Declaration of 1976 have been rejected, and the Outer Space Treaty of 1967 provides for free exploration and use of space. The frequency-assignment resolutions of the successive WARC meetings (1971, 1973, 1977, and 1979) on space telecommunications have also concerned themselves with GEO, and call for 'equitable access' to GEO 'in practice'. Such provisions are interpreted to mean that nations can demand access to GEO slots or communications channels only when they possess the technical capability to use them; no 'sharing in the benefits' (as stipulated in the Moon Agreement) is required. The need for more carefully defined criteria and the establishment of priorities for future GEO use is stressed. T.K.

A84-17076#

CONSEQUENCES OF TRANSMISSION OF SOLAR ENERGY FROM OUTER SPACE

A. A. COCCA IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 351-353.

The possible physical effects of MW, laser, or mirror-type SPS transmissions and their legal implications are considered. The bioeffects of the transmitted radiation and the atmospheric effects of transmission and of launcher-effluent injection (heating and ionospheric depletion) are examined, and the political aspects of receiver siting (near the equator for GEO solar systems) are indicated. The occupation of large portions of the MW band for SPS transmission and more generalized detrimental effects of SPS on space and terrestrial communications systems are explored, and the provisions of the Space Treaty, the Liability Convention, and (proposed) WARC Radio Regulations are discussed. Since no specific regulations on the use of solar energy have been adopted, a set of twelve basic tenets is proposed. The definition of solar energy and the GEO as nonappropriable parts of the 'common heritage of mankind' and the establishment of international organs (including a compulsory tribunal) to enforce the liability of SPS operators for ensuing damages and the fair sharing of soar resources are urged. T.K.

A84-17077#

LEGAL ASPECTS OF SOLAR POWER SATELLITES IMPACT ON THE ENVIRONMENT

I. H. PH. DIEDERIKS-VERSCHOOR IN: Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings . New York, American Institute of Aeronautics and Astronautics, 1983, p. 355-363. refs

There are three sources of the impact. The first has to do with the terrestrial operations connected with the construction of the launching site, the space vehicles, the satellites themselves, and the receiving installations. The second concerns the transport operations of the space vehicles carrying the satellites, and the third the transmission of the solar energy back to earth. The overall impact will comprise the biological effects of electromagnetic radiation, the atmospheric effects of radiation and launch effluents, and the environmental effects of land requirements and the siting of launch facilities and ground-based energy receivers. The rules of space law that form the legal framework for this situation are set forth. A rudimentary foundation for protection of the environment does exist, thanks mainly to the Space treaty of 1967. The absence in current space law of any rule making it mandatory for states to act in such a way as to preclude any possibility of contaminating the environment is decried. C.R.

A84-17762

THE GERMAN SPACELAB MISSION D1 [DIE DEUTSCHE SPACELAB-MISSION D1]

N. KIEHNE and H. STEIMLE (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), vol. 40, Nov. 1983, p. 2-4. In German.

The goals, planning, and organization of the 7-day German Spacelab mission (D1) planned (in cooperation with NASA and ESA) for mid-1985 are reviewed, with a focus on the roles played by the DFVLR. The scientific payload components are listed in a table, and the biomedical, materials-science and processing, communications, and navigation experiments are characterized. DFVLR is responsible for choosing the experiments to be performed, developing and building the apparatus, integration of the payload in the FRG, operational control of the mission, and management of the program. Preparations are underway for the training of the ground personnel and the mission and payload specialists with a Spacelab simulator, and for staging operations in cooperation with NASA to facilitate the integration of the D1 payload into the STS. DFVLR project management is under the supervision of a joint committee comprising both DFVLR and the FRG Science and Technology Ministry. A block diagram of the organizational structure is provided. T.K.

A84-17763

OPERATIONAL PLANNING, SIMULATION, AND PERFORMANCE OF THE GERMAN SPACELAB MISSION D1 [OPERATIONELLE PLANUNG, SIMULATION UND AUSFUEHRUNG DER DEUTSCHEN SPACELAB-MISSION D1]

H. J. PANITZ (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), vol. 40, Nov. 1983, p. 5-10. In German.

The current status of DFVLR preparations and planning for the 7-day German Spacelab mission (D1) planned for June, 1985, is reviewed, emphasizing operational rather than hardware aspects. The development of crew activity plans and operating procedures for the 100 scientific experiments, the selection and training of the two mission specialists and two payload specialists (using the Spacelab simulator being completed at Cologne), and the organization of the ground-support and communications systems are discussed. Drawings, block diagrams, and a sample activity plan are included. T.K.

A84-19850

SPACE STATIONS - A KEY TO SOCIO-ECONOMIC BENEFITS FROM SPACE?

J. M. LOGSDON Earth-Oriented Applications of Space Technology (ISSN 0277-4488), vol. 3, no. 3-4, 1983, p. 219-225. refs

The way that the idea for a space station has evolved is traced. It was first proposed as a means for preparing for manned planetary exploration. By 1966, however, it was concluded that such a station would be used instead for broadbased research and development programs in science and technology. In the latter part of the 1970s there was again a change, with the station now seen as an operations center for constructing and maintaining space systems. Research was no longer to be the primary goal. At the present time, however, research is again being put forward as the rationale. It is believed that if the goals and benefits of the station are specified too precisely, there may be insufficient interest and support. The project should be approached as a long-term investment, one that will enable the U.S. to continue making progress in space. It is also believed that the efforts that the Soviet Union is making in this area should serve as an impetus to U.S. efforts. C.R.

A84-21344

PROJECT SPACE STATION - PLANS FOR A PERMANENT MANNED SPACE CENTER

B. OLEARY (Science Applications, Inc., Pasadena, CA) Harrisburg, PA, Stackpole Books, 1983, 174 p. refs

Plans and possibilities for a U.S. space station are discussed, and some visions of the human role in space at the turn of the century are presented. The Soviet role in space, the militarization of space, the building of a space station from tinkermodules, and the use of space stations for industry, communications, and space travel are addressed. The possibility of mining precious metals in asteroids is considered. Space station architecture, the construction of factories and hotels in space, commerce and homesteading in space, and space careers are discussed. C.D.

A84-21476

ENERGY FROM SPACE; PROCEEDINGS OF THE SYMPOSIUM ON SOLAR ENERGY FROM SPACE, VIENNA, AUSTRIA, AUGUST 9-21, 1982

J. W. FREEMAN, ED. (Rice University, Houston, TX) Symposium sponsored by the United Nations. Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, 192 p.

Aspects of solar power generation in space are considered. The subjects discussed include: a vision of future energy from space; solar power satellite concept for utilization of energy from space; the institutional challenge of solar power satellites; system study of the solar power satellite concept; market potential and possible limitations for satellite solar power stations; financing a solar power satellite project; and European questions related to satellite power systems. Also addressed are: options and high payoff choices for transportation; an electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beamed microwave power; the Canadarm robot arm of the Shuttle Remote Manipulator System; an early experimental solar power satellite; power economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation stations; and space solar power in perspective. CD

A84-21477

ENERGY FROM SPACE - A VISION OF THE FUTURE

P. JANKOWITSCH (Austrian National Assembly Parliament, Vienna, Austria) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 3-10.

The SPS is one of the most promising nonpolluting power generation options which could contribute to meeting global energy demands in the 21st century. With proper organization and foresight, the nations of the world may one day collaborate in establishing a satellite solar power system to resolve their energy needs. Intelsat and Inmarsat have emerged to provide exciting examples of the feasibility of such international efforts. The implications of SPS deployment are international in scope. An SPS would use outer space and radio frequency spectrum resources that are within the international domain. SPS would be subject to the present legal regime governing activities in outer space which encompasses two international organizations and three treaties. Author

A84-21478

EVOLUTION OF THE SOLAR POWER SATELLITE CONCEPT -THE UTILIZATION OF ENERGY FROM SPACE

P. E. GLASER (Arthur D. Little, Inc., Cambridge, MA) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 11-21. refs

The utilization of the inexhaustible resources available in space is discussed with emphasis on solar energy conversion in orbit for use on earth. The rationale for the solar power satellite (SPS) as a potential global energy supply option is presented, and the evolution of this concept since 1968 is traced. Alternative concepts for obtaining energy from space are also reviewed. The factors favoring the development of the SPS are highlighted, including projected dramatic increases in global electrical generating capacity. Environmental impacts and societal effects with emphasis on international participation in an SPS program are considered and the SPS is compared with alternative energy conversion methods. The international implications of the SPS are underlined and the common interests of both developed and developing nations in the development of the SPS as a 21st century option are recognized. The steps towards implementation of the SPS option are outlined in the context of achieving the inevitable transition to renewable sources of energy. Author

A84-21479

SOLAR POWER SATELLITES - THE INSTITUTIONAL CHALLENGE

J. M. LOGSDON (George Washington University, Washington, DC) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 23-29.

The tasks of designing, financing, developing, and operating a solar power satellite (SPS) system would be as much organizational and institutional in character as they are technical and economic. The institutional character of a proposed SPS would be an issue of interest to almost all countries of the world, because the supply of large quantities of baseload of electricity by the SPS would have global political and economic impact. This investigation has the objective to provide some information regarding questions of organization and management of such a SPS, giving attention to the point that similar (although far from identical) institutional challenges have been solved. Thus, the International Telecommunications Satellite Organization (Intelsat) is discussed as an example. The reasons for the success of Intelsat are considered along with the limits to the Intelsat model, and the global context for SPS development. G.R.

A84-21480* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex. A SYSTEM STUDY OF THE SOLAR POWER SATELLITE

A SYSTEM STUDY OF THE SOLAR POWER SATELLITE Concept

R. O. PILAND (NASA, Johnson Space Center, Houston, TX) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 35-47.

The paper summarizes a system study of the solar power satellite (SPS) concept which was conducted in the 1977-1980 time period. The system study was sponsored by the U.S. Department of Energy and the National Aeronautics and Space Administration as part of an SPS Concept Development and Evaluation Program. A reference system, developed during the study is described. The reference system was subsequently used as a basis for environmental, economic, and societal assessments. The reference system was recognized as probably not being an optimized approach. A number of alternate approaches which were studied in less depth are also described. The paper concludes with a number of observations regarding the SPS concept, and the pertinence of ongoing space technology, development, and flight programs to various aspects of the concept. Author

MARKET POTENTIAL AND POSSIBLE LIMITATIONS FOR SATELLITE SOLAR POWER STATIONS

M. J. CLAVERIE and A. P. DUPAS (CNRS, Paris, France) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 49-59. refs

A84-21482

FINANCING A SOLAR POWER SATELLITE PROJECT

C. A. S. FAWCETT (Morgan Grenfell and Co., Ltd., London, England) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 71-77.

It is pointed out that the solar power satellite project constitutes a unique financial challenge because is represents the first attempt to exploit extraterrestrial sources commercially. This project is to make electricity available to all nations from sources which are outside the claim of any nation. This transnational character of the project and, in addition, the magnitude of the project costs, point to the desirability and the need for international funding. A technique known as 'project financing' has been developed in the world's financial community specifically for the purpose of funding such very large ventures. Attention is given to details of project financing, the completion risk, the completion agreement, the economic risk (technological risk), aspects of equity, questions regarding the debt, and the United Nations revolving fund for natural resources exploration. G.R.

A84-21483

EUROPEAN QUESTIONS RELATED TO SATELITE POWER SYSTEMS

D. KASSING (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 87-97. refs

A number of problems which have been identified in recent European studies related to satellite power systems are addressed. Based on energy demand and supply projections for Europe, developed by the International Institute for Applied Systems Analysis, the potential of power satellites in a future energy mix is discussed. A few major constraints are presented which may restrict power transmission to European receiving sites, e.g., orbital limitations, siting problems of the ground station, and economic and institutional issues. Conceptual designs for the structure of ground receiving stations located offshore near the European coastlines are described.

A84-21487

SPACE STATION - AN EARLY EXPERIMENTAL SOLAR POWER SATELLITE

M. NAGATOMO (Tokyo University, Tokyo, Japan) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 143-154. refs

The Solar Power Satellite (SPS) is a typical macroengineering problem encompassing technical, social, and economic problems with many potential solutions, among which choices must be made. The 'macrophasing' project management concept presently introduced features a central facility for each of the several phases which will serve as an experimental facility, demonstrating milestone achievements for each of the major SPS development problems. The first phase will feature an orbital space station that is to be built within one decade. This dedicated space station may, after furnishing valuable construction platform for the larger (subscale) models of the prospective SPS which constitute the second phase. The third and last phase will emphasize economic evaluation of the system. O.C.

A84-21488

POWER-ECONOMICAL CONSIDERATIONS FOR THE INTEGRATION OF TERRESTRIAL AND EXTRATERRESTRIAL SOLAR GENERATORS INTO EXISTING POWER GENERATION SYSTEMS

I. B. STOY (Rheinisch-Westfaelisches Elektrizitaetswerk AG, Essen, West Germany) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 155-167.

A84-21489

SPACE SOLAR POWER IN PERSPECTIVE

G. R. WOODCOCK (Boeing Aerospace Co., Seattle, WA) (United Nations, Symposium on Solar Energy from Space, Vienna, Austria, Aug. 9-21, 1982) Space Solar Power Review (ISSN 0191-9067), vol. 4, no. 1-2, 1983, p. 169-181. refs

When the solar power satellite (SPS) concept was introduced in 1968. it quickly became regarded as a fanciful idea which would not work. The claims made by early critics were mainly related to the assumed inefficiency of microwave power transmission, the problems concerning the construction and control of the required large space structures, the astronomical cost of space transportation, and the energy needed for delivery of the SPS to orbit. However, a number of studies and developments occurring at the time the criticisms were being leveled and afterwards showed that many of the claims made by the critics were not true. The present investigation synopsizes current knowledge of the SPS concept and reviews new circumstances not considered in evaluations conducted in 1980 and 1981. The technical challenges are examined along with environmental issues, the 'reference system' created by DOE-NASA studies, cost issues, new developments, and needs for further research. GR.

A84-21497

MANNED PLANETARY MISSIONS?

R. C. PARKINSON (British Aerospace PLC, Dynamics Group, Stevenage, Herts., England) Spaceflight (ISSN 0038-6340), vol. 26, Feb. 1984, p. 50-52.

Manned planetary missions, mistakenly criticized as glamour projects, are shown to be more effective, more attractive and less costly than unmanned missions; NASA is shown to outspend ESA in both project types. The complexity of a manned mission increases its information capturing ability and eliminates the need for multiple unmanned missions. Manned space activities will reduce costs with the proposed manned Space Station, which would serve as a transportation node to geosynchronous flight. The reusable Orbit Transfer Vehicle with large payload capability would move spacecraft to high orbit while decreasing the overall launching cost to approximately \$11 million per ton. In conclusion manned missions (e.g., to Mars and Jupiter) in coordination with robots to maximize data collection are suggested. C.M.

A84-21499

MANKIND'S INTERSTELLAR FUTURE

A. R. MARTIN Spaceflight (ISSN 0038-6340), vol. 26, Feb. 1984, p. 76-79.

Results of a questionnaire, based on the Delphi method, and dealing with space predictions are presented. The results project mankind as a stellar civilization by the end of the 21st century. The questionnaires, answered by 15 individuals connected with space aspects, provide median dates and interquartile ranges for 11 space missions including the first manned mission to the Jupiter system (2029), the use of solar system natural resources (2040), and the mission colonization of an extrasolar planet (2260). A scenario forecast depicts humans as having landed on Phobos and Deimos by 2005 and the establishment of L-5 colonies by 2075.

A84-21720

SPACE 1991

D. VELUPILLAI Flight International (ISSN 0015-3710), vol. 125, Jan. 21, 1984, p. 163-165.

NASA's plans for a space station by 1991 are discussed. The space station, with a 500-km-high circular orbit inclined at 28.5 deg, is to be continuously manned, a staging post to higher orbits, a satellite service center, and a platform for science and industry. It will comprise several reparable and evolvable modules and unmanned independent platforms, will have a 60 kW power capability, and will possess an open-loop life-support system for its rotating crew of six to eight people. An eventual self-sufficient colony is intended. Differences from the Space Shuttle will be the station's electronic pilotage and distributed computer architecture with microprocessors controlling each task. Initial cost is estimated at \$8,000 million spread over five years. Industry contracts are to be awarded for preliminary design of major elements, and international cooperation is indicated.

A84-22327

MANUFACTURING IN SPACE; PROCEEDINGS OF THE WINTER ANNUAL MEETING, BOSTON, MA, NOVEMBER 13-18, 1983 L. KOPS, ED. (McGill University, Montreal, Canada) Meeting

sponsored by the American Society of Mechanical Engineers. New York, American Society of Mechanical Engineers (Production Engineering Symposia Series. PED Volume 11), 1983, 223 p.

Processes, facilities, and issues related to manufacturing in outer space are addressed. The subjects discussed include: NASA, European, and Japanese projects on materials processing in space: gravitational effects in dendritic growth; space research impact on semiconductor crystal growth technology; simulation prior to space manufacturing; hardware for materials processing in space; containerless science and technologies; a low orbit satellite manufacturing facility; remote manipulators in space; automation, robotics, and machine intelligence systems in space manufacturing. Also considered are: manufacturing space systems in space; electrophoresis operations in space; rationale for commercial activities in space; Space Shuttle, private enterprise, and intellectual properties in space manufacturing; manufacturers' liability for space products; economics and profitability of space manufacturing; and international cooperation and competition in materials processing in space. CD

A84-22338#

MANUFACTURING SPACE SYSTEMS IN SPACE

G. R. WOODOOCK (Boeing, Kent Space Center, Kent, WA) IN: Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 . New York, American Society of Mechanical Engineers, 1983, p. 127-137.

It is pointed out that the strongest motivator for developing the initial steps in space manufacturing technology is the opportunity afforded by the Space Shuttle to repair or maintain spacecraft in low earth orbit. The steps that will be followed in the repair of the Solar Max spacecraft are outlined. Even though this is a repair rather than a manufacturing mission, the steps to be carried out are similar to those that could be used for manufacturing in space. The use of EVA astronauts to simplify deployment mechanism design is then discussed, noting that the astronauts can readily remove launch retention fixtures, unfold a deployable device, and install braces or pip-pins to place and lock an appendage into its mission-operational position. This can eliminate complex electromechanical drives and sequencers and, in many instances, provide a much stiffer structure in the process. A description is then given of the manufacturing processes foreseen for the space station. C.R.

A84-22341*# National Aeronautics and Space Administration, Washington, D. C.

SPACE SHUTTLE, PRIVATE ENTERPRISE AND INTELLECTUAL PROPERTIES IN THE CONTEXT OF SPACE MANUFACTURING S. N. HOSENBALL and R. F. KEMPF (NASA, Washington, DC) IN: Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983. New York, American Society of Mechanical Engineers, 1983, p. 149-160.

It is a national policy to make the capabilities of the Space Transportat ion System available to a wide range of potential users. This includes its availability as a space manufacturing facility for commercial activities, which may be carried out on a reimbursable basis or as a joint endeavor with NASA, but with substantial private investment. In any high risk, long lead-time research and development activity directed towards commercialization, the protection afforded the results of the research and development under the laws relating to intellectual property rights may provide an important incentive for private investment. The paper reviews NASA's policies and practices for the protection of privately-established intellectual property rights involved in STS use, with particular emphasis on reimbursable launch agreements and joint endeavor agreements.

A84-22862#

A CYLINDRICAL NEAR-FIELD TEST FACILITY FOR LARGE SATELLITE ANTENNAS

C.-P. FISCHER (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) European Microwave Conference, 13th, Nuernberg, West Germany, Sept. 5-9, 1983, Paper. 6 p. refs (MBB-UR-628-83-OE)

Recent developments in satellite antenna technology have the objective to achieve a more economical frequency spectrum utilization for improved communication capacity. The approach utilized in the implementation of this objective involves the employment of a narrow antenna beamwidth and frequency reuse. Large reflectors will be needed along with high frequencies (up to 40 GHz presently), low side lobe levels, excellent polarization purity, and high beam pointing accuracy. Spacecraft antennas will be implemented as deployable reflector antennas with multifeed systems and antenna fine pointing mechanism built with carbon-fiber-reinforced plastic structures. Suitable approaches for testing the antennas are discussed. It is found that near-field testing provides major advantages over far-field testing in the considered case. Attention is given to the principles of cylindrical near-field testing, the required instrumentation and the software, and test results. G.R.

A84-23440* Chicago Univ., III.

PYROELECTRIC MATERIALS AS ELECTRONIC PULSE DETECTORS OF ULTRAHEAVY NUCLEI

J. A. SIMPSON and A. J. TUZZOLINO (Chicago, University, Chicago, IL) Physical Review Letters (ISSN 0031-9007), vol. 52, Feb. 20, 1984, p. 601-604. refs

(Contract NGL-14-001-006; NGL-14-001-258)

The design and testing of ultraheavy-nucleus pulse detectors based on pyroelectric materials are reported, extending the preliminary findings of Tuzzolino (1983) and Simpson and Tuzzolino (1983). Uranium-ion beams of about 240 MeV/u are detected by a 39.5-micron-thick Si detector, degraded to about 175 MeV/u by Al absorbers, and then strike 700-micron-thick polyvinylidene fluoride or 1000-micron-thick LiTaO3 pyroelectric samples. Both detector systems are connected to a coincidence circuit via charge-sensitive preamplifiers, shaping amplifiers with 30-microsec effective time constants, and electronic discriminators. Sample spectra are shown, and the pulse heights measured are found to agree with theoretical calculations to within a factor of about 2. The response of the pyroelectric materials is found to be unaffected by exposure to about 10 Mrad of 2-7-MeV/u heavy ion radiation. With further study and improvement of the detection sensitivity, devices of this type could be applied to large-area space measurements of low ultraheavy-ion fluxes. T.K.

SPACE STATION: POLICY, PLANNING AND UTILIZATION; PROCEEDINGS OF THE SYMPOSIUM, ARLINGTON, VA, JULY 18-20, 1983

M. GERARD, ED. and P. W. EDWARDS, ED. (American Institute of Aeronautics and Astronautics, New York, NY) Symposium sponsored by the American Institute of Aeronautics and Astronautics and NASA. New York, American Institute of Aeronautics and Astronautics, 1983, 221 p.

The design, technology, and applications of the proposed Space Station (SS) are examined in contributions and discussions from the AIAA/NASA Symposium on the Space Station held on July 18-20, 1983. The role of man in space, the history of SS concepts, and the requirements of scientists, engineers, and commercial users are reviewed. Discussion is included on military space activities; the Solar Maximum Repair Mission; the role of the SS in earth sciences, life sciences, astronomy and astrophysics, and solar physics; pharmaceutical manufacturing on the SS, satellite and platform maintenance and repair from the SS; international utilization of the SS; SS architectures and user concerns; the SS as an element of the total space-system architecture; productivity on an evolutionary SS, SS information and communications systems; and environmental-control and life-support systems for the SS. T.K.

A84-24627*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE ROLE OF MAN IN SPACE

J. R. LOUSMA (NASA, Johnson Space Center, Houston, TX) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983. New York, American Institute of Aeronautics and Astronautics, 1983, p. 7-13.

The roles played by astronauts in space missions are discussed using illustrations from the Spacelab and STS experience, and the implications for the proposed space station are considered. Man's ability to perform successfully for relatively long periods in space is demonstrated, and capabilities in manipulation, EVA, equipment repair and compensation for equipment failure, earth observation, astronomy of sun and stars, and laboratory experimentation are characterized and illustrated with photographs. Space station activities planned include repairs (like that of the Solar Maximum Satellite), maintenance (of the Space Telescope), and construction and involve the use of a manned maneuvering unit, a teleoperator maneuvering system, and/or a manned or unmanned OTV. T.K.

A84-24629#

USE OF SPACE STATION FOR SCIENCE

T. M. DONAHUE (National Academy of Sciences, Washington, DC) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 33-35.

Scientific goals for the next 15 years in astronomy and astrophysics, earth sciences, planetary exploration, and solar and space physics are surveyed; the requirements of space missions to attain them are listed; and the ability of the proposed space station to fulfill the requirements is analyzed. The need for GEO, deep-space, high-inclination-orbit, and free-flyer capabilities in addition to a manned station in LEO at 28.5-deg inclination is identified: the manned station would serve primarily to service, launch, or even construct unmanned science vehicles which could serve the scientific needs better than experiments forcefully adapted to the station itself. T.K.

A84-24631#

THE ROLE OF SPACE STATION IN EARTH SCIENCES

L. R. GREENWOOD (Fairchild Space Co., Germantown, MD) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 66-72. refs

Space-station or space-platform characteristics and technologies required or desirable for future research in

upper-atmosphere studies, global atmospheric chemistry, meteorology, and climatology are examined, summarizing the findings of a summer (1982) study by the Earth's Environment Panel of the National Research Council Space Applications Board. Capabilities discussed include deployment of large numbers of sensors, high-inclination-orbit options, frequent recalibration and intercalibration with satellites, introduction of new or larger lidar and microwave observatories, and repair and maintenance of instruments and cooled detectors. Earth-science missions are found to require only intermittent manned presence for maintenance and calibration or for construction of large platforms for transfer to GEO.

A84-24632#

ROLE OF A SPACE STATION IN PHARMACEUTICAL MANUFACTURING

J. T. ROSE (McDonnell Douglas Astronautics Co., St. Louis, MO) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 79-84.

The impact of the proposed space station on the commercial manufacture of pharmaceuticals is discussed, with a focus on the prototype program (using electrophoresis) being developed by McDonnell Douglas in cooperation with the Ortho Pharmaceutical Corporation and NASA. The commercial organization of the program is outlined, and the successful production tests carried out with the STS are briefly described and illustrated with photographs and drawings. First test flight of a production-scale prototype is planned for 1985, to be followed by an unmanned-free-flyer program and/or manned production on the space station. The economic advantages of the manned mode are seen in ease of maintenance. lower transportation costs (raw materials and products only rather than whole vehicles or modules), and more rapid development of new products.

A84-24635#

NATIONAL SECURITY IMPLICATIONS OF A U.S. SPACE STATION

C. W. COOK (USAF, Washington, DC) IN: Space Station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 145-157.

The use of the proposed space station for military missions is discussed. The current military role in space is characterized (unmanned communications and surveillance satellites), the DOD manned programs of the past are reviewed, and current projects in cooperation with NASA (manned-spaceflight-engineer program, space test program, and space biotechnology program) are examined. While DOD interest in further research on man's roles and capabilities in space remains high, and while the potential of a space station (e.g., for repairing or maintaining unmanned satellites on orbit) will continue to receive close attention, no military missions requiring a manned space station or justifying DOD financing have been identified. A more evolutionary approach using an extended STS and perhaps a space-based TMS is favored. T.K.

A84-24636#

SPACE STATION COMMUNICATIONS

C. L. CUCCIA (Ford Aerospace and Communications Corp., Palo Alto, CA) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 182-188.

A concise history of the various types of communications that have been used in low-earth-orbit vehicles and form the basis of the various types of communications and communication requirements that can be realized in space-station developments over the next decade is presented. The Space Shuttle can be assumed to be a prototype space station in the tradition of Apollo and Spacelab. Shuttle operations require earth-to-ground support communications, EVA communications, internal communications,

and communications to and from other spacecraft (TDRS) and free-flying vehicles for experiments (SPAS-01). These basic communication requirements will expand to the point where the man-computer alliance in the space station will transform the station into a space communications and computer center capable of providing data processing and storage in association with ground-based distributed processing along the growing terrestrial ISDN global digital highway. The space station will also provide unique means to obtain data and information from one part of the earth or space and transport them to another point on earth.

Author

A84-24637#

ENVIRONMENTAL CONTROL AND LIFE SUPPORT (ECLS) **DESIGN OPTIMIZATION APPROACH**

H. F. BROSE (United Technologies Corp., Hamilton Standard Div., Windsor Locks, CT) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 189-194.

The design of environmental-control and life-support (ECLS) systems for the proposed space station is discussed. Design constraints imposed by the overall station concept include crew size and tour of duty, evolutionary vs. integral development, power concept, orbit-keeping and ACS concept, and EVA requirements. The design process involves selecting the station scenario or range of scenarios to be realized, setting the ECLS standards, reviewing concepts capable of meeting these standards, performing payback analysis, and selecting the technologies using specific criteria. Basic, intermediate, and growth versions of a station ECLS system are presented in block diagrams and characterized. A flexible design approach applicable to different scenarios is т.к. recommended.

A84-25251

COMMUNICATION SATELLITE SYSTEMS CONFERENCE, 10TH, ORLANDO, FL, MARCH 19-22, 1984, TECHNICAL PAPERS

Conference sponsored by the American Institute of Aeronautics and Astronautics. New York, American Institute of Aeronautics and Astronautics, 1984, 753 p.

Topics are discussed which are related to satellite communications in Latin America, the efficient use of the geostationary orbit, spacecraft antennas, direct broadcast systems, communication networks, earth stations, Ka-band systems and hardware, mobile systems, launch system developments, and satellite evaluation and test. Other subjects considered are concerned with Direct Broadcast Satellite (DBS) home terminals, regional and international systems, geostationary platforms and clusters, signal processing systems and technology, domestic systems, propagation effects, advanced spacecraft bus technology, military systems, systems availability and cost, and transponder components, taking into account low power devices and power amplifiers. Attention is given to a low cost communications satellite for developing countries, approaches for optimizing communications satellite reliability, and digital technologies and systems for geostationary orbit satellites. G.R.

A84-25253#

REDUCED DOMESTIC SATELLITE ORBIT SPACING

G. L. SHARP (Federal Communications Commission, Washington, IN: Communication Satellite Systems Conference, 10th, DC) Orlando, FL, March 19-22, 1984, Technical Papers . New York. American Institute of Aeronautics and Astronautics, 1984, p. 7-17. refs

(AIAA PAPER 84-0652)

The demand for services provided by communications satellites in geostationary orbit is growing, and problems arise with respect to the required increase in capacity. One approach for providing such an increase involves the employment of more satellites operating at smaller orbital spacings. The present investigation is concerned with the results of technical studies conducted by the Federal Communications Commission (FCC) to determine the feasibility of reducing orbital spacings between U.S. 'domestic fixed satellites' (domsats). Attention is given to details regarding the usable orbital arc, an adjacent satellite interference model, antenna sidelobe patterns, a single entry analysis, a 4/6 GHz aggregate analysis, results for the 4/6 GHz bands, results for the 12/14 GHz bands, data services, voice services, video reception, and high power spot beams. G.R.

A84-25254#

TIME PHASED INTRODUCTION OF ADVANCED TECHNOLOGIES - ITS IMPACT ON ORBIT/SPECTRUM CONSERVATION

D. TONG (Hughes Aircraft Co., El Segundo, CA) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 18-26. refs (AIAA PAPER 84-0653)

It is pointed out that technical factors influence both the number of spacecraft which can occupy the geostationary orbit with acceptable interference, and the amount of traffic which each spacecraft can carry. These factors are not static, but in a state of continuous evolution. It is suggested that the most practical procedure would involve the introduction of new technical standards in stages over an extended period of time. The present investigation has the objective to examine some of the foreseen improvements in spacecraft and transmission technologies. Orbit conservation technologies are considered, taking into account spacecraft antenna improvements, earth station antenna improvements, and transponder technologies. Attention is given to telephony and record traffic-analog, telephony and record traffic-digital, analog television, and digital television. It is found that a number of techniques exist which can significantly increase the capacity of the geostationary orbit. G.R.

A84-25281#

GEO SPACE PLATFORM ECONOMICS - IMPACT OF CONCEPT, SIZE, LAUNCH MODE AND LIFETIME

D. E. KOELLE (Messerschmitt-Boelkow-Blohm GmbH; ERNO Raumfahrttechnik GmbH, Ottobrunn, West Germany) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 241-248. refs (AIAA PAPER 84-0704)

The design of GEO communications platforms is examined from an economic perspective. The historical and projected growth of satellite services and spacecraft mass and capability is traced, and the concepts proposed for large conventional satellites, platforms with integrated transfer propulsion, modular platform assemblies, and large man-tended stations with service and repair are reviewed. Spacecraft and launch costs are evaluated, taking the impact of design lifetime into account. A decrease in per-channel space-segment costs is predicted for larger satellites and platforms. Graphs and tables of the numerical results and drawings of proposed systems are included. T.K.

A84-25304#

DIGITAL TECHNOLOGIES AND SYSTEMS FOR GEOSTATIONARY ORBIT SATELLITES

R. PETERS (International Telecommunications Satellite Organization, Washington, DC), R. RIEGER, and A. STANLEY (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 432-439. refs (AIAA PAPER 84-0749)

Power consumption, speed, and radiation resistance of bipolar and CMOS technologies are reviewed for their suitability for use in geosynchronous orbit satellites. Results of Intelsat sponsored radiation tests on five complete microprocessor systems, plus RAMs and PROMs, representing several different bipolar and CMOS techniques, are discussed with other recent test data. Radiation hardened CMOS devices proved quite radiation resistant, had low power consumption and very low soft error rates, making them well suited for satellite applications. Finally, future trends of integrated circuits, including speed, power consumption and reliability are analyzed. Author

A84-25309#

THE SPACE VAN AND ITS POTENTIAL IMPACT ON THE DESIGN OF COMMUNICATIONS SATELLITES

L. CORMIER (TranSpace, Inc., Washington, DC) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers New York, American Institute of Aeronautics and Astronautics, 1984, p. 476-481. (AIAA 84-0758)

This paper outlines the impact that much lower transportation costs might have on the design of communications satellites. The first portion of the paper describes a launch vehicle, the 'Space Van,' which is fully reusable and promises to reduce transportation costs to synchronous orbit by a factor of between two and ten or more, depending upon the total tonnage transported. Such a reduction in transportation costs should be a powerful stimulus to new approaches to the design of communications satellites. The paper concludes with an outline of some concepts for these new design approaches. Author

A84-25318#

COMPUTER TOOLS FOR OPTIMIZING ORBIT USE

T. MIZUNO, Y. ITO, and T. MURATANI (Kokusai Denshin Denwa Co., Ltd., Research and Development Laboratories, Tokyo, Japan) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 549-557.

(AIAA PAPER 84-0651)

The ORBIT-II orbit-spacing-optimization program for GEO communications satellites is characterized and demonstrated. The problems inherent in current orbit-management (OM) techniques are discussed; the methods proposed to improve OM are surveyed (earth and satellite antenna characteristics, positioning flexibility, transmission efficiency, and interference criteria); and the possible administrative (WARC) approaches to OM are reviewed. The ORBIT-II program represents a tool capable of optimizing both positions and beam patterns, with world-map visualization of the results. Sample problems involving both a priori planning and the phased introduction of orbit-conservation measures and including as many as 94 satellites are calculated, and maps and tables of service-arc constraints are shown.

A84-25319*# National Aeronautics and Space Administration, Washington, D. C.

LESSONS LEARNED DURING THE FIRST YEAR OF THE TDRSS

R. O. ALLER and L. M. ROBINSON (NASA, Washington, DC) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 558-564. (AIAA PAPER 84-0687)

The Tracking and Data Relay Satellite System (TDRSS) is the National Aeronautics and Space Administration's (NASA) newest capability for tracking and communicating with NASA's low-earth orbiting scientific and operational satellites. This support will eventually be provided through three identical satellites in geosynchronous orbit. They will relay data through a single ground station located in New Mexico. This paper discusses both the overall TDRSS concept and NASA's experience to date with the first of the three relay satellites on station. Author

A84-25327#

DEVELOPMENT TRENDS IN EUROPE ON SATELLITE CLUSTERS AND GEOSTATIONARY PLATFORMS

U. RENNER (ESA, Communication Satellites Dept., Noordwijk, Netherlands) and J. NAUCK (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) IN: Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1984, p. 622-628. refs

(AIAA PAPER 84-0703)

ESA development programs for advanced GEO communications satellites or platforms are surveyed. The ongoing concentration of space-communications traffic in the European region is evaluated, and a gradual transition from the current Eutalsat deployment (one 9-channel satellite in each of three orbital positions) to a configuration combining string-of-pearls clusters of medium-size (18-channel) national satellites and large international platforms is predicted. The technology of clustering and platform assembly in space, including TV observation of neighbor satellites, rendezvous, and mechanical docking in LEO and/or GEO, is discussed. Various proposed vehicles and configurations are illustrated with drawings, and the ESA efforts currently underway or planned (e.g., in-orbit experiments using EURECA) are characterized.

A84-28576

SYSTEMS CONSIDERATIONS IN MOSAIC FOCAL PLANES

K. P. WHITE, III (Aerospace Corp., Los Angeles, CA) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 68-74. refs

Two key reasons for pursuing the development of mosaic focal planes are reviewed and it is shown that rapid frame repetition rate is the only requirement that can be solved no other way than through mosaic focal planes. With the view that spaceborne mosaic focal plane sensors are necessarily 'smart sensors' requiring a lot of onboard processing just to function, it is pointed out that various artificial intelligence techniques may be the most appropriate to incorporate in the data processing. Finally, a novel mosaic focal plane design is proposed, termed a virtual mosaic focal plane, in response to other system constraints. Author

A84-28579

COORDINATE TRANSFORMATION ASSEMBLY

C.-C. HUANG and J. BARNEY (Lockheed Missiles and Space Co., Inc., Space Systems Div., Sunnyvale, CA) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 88-97.

The coordinate transformation assembly (CTA) is a noncontact electrooptical device conceived to link the angular coordinates between two remote platforms to a high degree of accuracy. The CTA is, therefore, highly desirable in cases in which the coordinates of one point have to be relayed around corners or over a number of obstacles to another point. It has been demonstrated that the CTA can be employed to measure slight angular shifts in the position of structures such as those inherent in the cargo of large spacecraft. The theoretical basis of CTA operation is discussed, taking into account the roll coordinate, and pitch and yaw coordinates. Attention is given to the transmitter and receiver used in a laboratory setup. G.R.

A84-28975#

WITH THE SPACE SHUTTLE TOWARDS SPACE INDUSTRIALIZATION [MIT DER RAUMFAEHRE 'SPACE SHUTTLE' ZUR WELTRAUM-INDUSTRIALISIERUNG]

J. VON PUTTKAMER IN: Annual report of the Frankfurt Physics Union during the period Jan. 1, 1980 to Dec. 31, 1980, the 155th year of the Union (Jahresbericht des physikalischen Vereins zu Frankfurt am Main fuer die Zeit vom 1.1.1980 bis zum 31.12.1980, 155. Vereinsjahr). Frankfurt am Main, Physikalischer Verein, 1982, p. 47-67. In German.

The space transportation vehicle, 'Space Shuttle', introduces an entirely new era for astronautics. The new era is concerned with the operational, almost routinewise, utilization of the cosmic environment for humanity. The key to this development is the lowering of transportation costs by making use of a space transportation system which is more economical than the one-way launch vehicles of the past. Space industrialization can provide access to the new world of space and utilize it for the common good of mankind. Attention is given to details regarding the Space Transportation System and plans for its utilization, the usable characteristics of outer space, the aims of space industrialization, products 'Made in Space', solar energy made available for terrestrial applications with the aid of geostationary satellites, and the 'humanization' of space. G.R.

A84-29063* Case Western Reserve Univ., Cleveland, Ohio. GRAVITATIONAL BIOLOGY ON THE SPACE STATION

J. R. KEEFE (Case Western Reserve University, Cleveland, OH) and A. D. KRIKORIAN (New York, State University, Stony Brook, NY) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 25 p. NASA-supported research. refs (SAE PAPER 831133)

The current status of gravitational biology is summarized, future areas of required basic research in earth-based and spaceflight projects are presented, and potential applications of gravitational biology on a space station are demonstrated. Topics covered include vertebrate reproduction, prenatal/postnatal development, a review of plant space experiments, the facilities needed for growing plants, gravimorphogenesis, thigmomorphogenesis, centrifuges, maintaining a vivarium, tissue culture, and artificial human organ generation. It is proposed that space stations carrying out these types of long-term research be called the National Space Research Facility. C.M.

A84-29126

U.S. NATIONAL CONGRESS OF APPLIED MECHANICS, 9TH, CORNELL UNIVERSITY, ITHACA, NY, JUNE 21-25, 1982, PROCEEDINGS

Congress supported by NSF, U.S. Navy, U.S. Army, et al. New York, American Society of Mechanical Engineers, 1982, 526 p.

Various topics in applied mathematics are addressed. The subjects discussed include: two-phase flow, nonlinear fracture mechanics, tribology, interfacial fluid mechanics, mechanical behavior of composite materials, large motions of systems containing flexible bodies, geophysical fluid dynamics, structural reliability and damage assessment, electromagnetoelastic interactions, flows in materials processing, qualitative theory of dynamical systems, and mechanics of energy technology. C.D.

A84-29656#

THE RESIDUAL GRAVITATIONAL FIELD OF ORBITAL SPACE STATIONS [UEBER DAS RESTSCHWEREFELD IN ORBITALEN RAUMSTATIONEN]

W. KNABE (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 16 p. In German. refs

(DGLR PAPER 83-089)

The gravitational field within an orbiting space station and its influence on freely moving bodies in the station are investigated analytically. The field is shown to have a tensorial character, and this finding is extended by analogy from Newtonian to modern gravitational theory. The station is thus characterized as a freely falling inertial laboratory. Current gradiometric techniques for measuring the residual field are reviewed, and an alternative method theoretically applicable at near-zero gravity is proposed.

T.K.

A84-29657#

MICROGRAVITY CONDITIONS ON ORBITAL PLATFORMS [MIKROGRAVITATIONS-BEDINGUNGEN ORBITALER PLATTFORMEN]

D. EILERS (ERNO Raumfahrttechnik GmbH, Bremen, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 20 p. In German. ESA-sponsored research. refs

(DGLR PAPER 83-90)

The design of orbital platforms to provide undisturbed microgravity environments for experiments and manufacturing processes is discussed, with a focus on the European Retrievable Carrier (Eureca), a platform carrying a wide variety of payloads for a 6-month mission in a 500-km orbit (with release and retrieval by the STS at 300 km). The microgravity requirements of the Eureca experiments are analyzed, and limits of 0.00001 g in the 0.01-1-Hz frequency range, from 0.00001 to 0.001 g in the 1-100-Hz range, and about 0.001 Hz at higher frequencies are proposed. The verification methods currently employed in the Eureca design process are characterized and illustrated. The natural phenomena affecting the microgravity environment (primarily residual atmosphere and gravitational gradients) and the effects of the platform systems (AOCS, thermal circulation, power supply, and data processing) and payloads are evaluated, and the allowable contributions of the subsystems to the microgravity 'budget' are presented in a table. T.K.

A84-29658#

THE ATTITUDE AND ORBIT CONTROL SYSTEM FOR EURECA [DAS BAHN- UND LAGEREGELUNGSSYSTEM FUER EURECA] G. LIPPNER and H. BAUER (Dornier System GmbH, Friedrichshafen, West Germany) Deutsche Gesellschaft fuer Luftund Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 6 p. In German.

(DGLR PAPER 83-091)

The development of an AOCS for the European Retrievable Carrier (Eureca) is reported.. The AOCS is designed to perform the transfer maneuver to a 500-km orbit after Eureca is released from the cargo bay of the STS, maintain attitude and orbit during the operational phase (about 6 months for the first flight), and return Eureca to the STS orbit for retrieval. Major components include sun and earth sensors; accelerometer; gyros; magnetic, N2, and hydrazine positioning systems (the latter for orbit transfer); and control electronics. The AOCS design is modular, using the modular attitude control system (MACS) bus to insure flexibility for future Eureca modifications. The development of the AOCS enters the C/D phase in June, 1984, with delivery of the first flight unit for system integration planned for April, 1986. Drawings, flow charts, block diagrams, and tables of hardware parameters are provided. T.K.

A84-29852* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SPACE MANUFACTURING 1983; PROCEEDINGS OF THE SIXTH CONFERENCE, PRINCETON UNIVERSITY, PRINCETON, NJ, MAY 9-12, 1983

J. D. BURKE, ED. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) and A. S. WHITT, ED. (Space Studies Institute, Princeton, NJ) Conference sponsored by Princeton University, American Astronautical Society, and Space Studies Institute. San Diego, CA, Univelt, Inc., 1983, 495 p.

General topics are biomedical and social sciences, space stations and habitats, space manufacturing, international and legal considerations, materials resources and processing, accelerators and asteroids, and space economics. Among the papers presented, consideration is given to the evolution of man as an explorer; whether people, robots, or hybrids should operate a space station; electrophoresis experiments in space; the emerging government regulation of American space entrepeneurs; the extraction and purification of iron-group and precious metals from asteroidal feedstocks; the construction, testing, and design comparison to computer simulation fo the Mass-Driver III; and the international competition in commercial aerospace markets. C.M.

A84-29854

PROBABLE MISSIONS AND TRANSPORTATION SCENARIOS TO USE REGENERATIVE LIFE SUPPORT SYSTEMS

T. VINOPAL, E. GUSTAN, and R. OLSON (Boeing Aerospace Corp., Seattle, WA) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983. San Diego, CA, Univelt, Inc., 1983, p. 27-43. refs (AAS PAPER 83-201)

Six missions that could benefit from a controlled ecological life support system type system are described along with their transportation and cost analyses: the Leo Low Inclination, the Leo High Inclination, the 6 X GEO, the Lunar Base, the Asteroid Base, and the Mars Surface Exploration. Each transportation analysis consists of a trajectory analysis to determine the travel route, and a vehicle analysis to determine the most efficient rocket or group of rockets for the mission. Life support systems discussed involve three materials supply methods: (1) storing materials on board at launch time for the entire mission, (2) periodically resupplying materials through waste recycling. Finally, cost estimates are provided for each mission on a per kilogram basis. C.M.

A84-29855

SPACE STATIONS - THE NEXT STEP IN SPACE?

J. M. LOGSDON IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983. San Diego, CA, Univelt, Inc., 1983, p. 45-57. refs (AAS PAPER 83-202)

This paper explores the question of whether a space station is the appropriate next major step in the U.S. space program. It briefly traces past space station proposals, then reviews the kind of forces affecting a possible decision within the next few years to proceed with a space station. The station is viewed as an investment opportunity which makes best sense if the United States is likely to pursue an active space program in coming decades. Author

A84-29856

UNDERSTANDING SPACE SETTLEMENTS AS HUMAN SYSTEMS

F. WHITE (Human Systems, Inc., Newton, MA) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 59-84. refs

(AAS PAPER 83-204)

A unified approach to the development of space settlements is discussed using as a framework Human Systems Theory. Human systems as general systems are examined, and it is illustrated that the human mind, interacting with its environment, conceives of physical technologies to serve a need within the human system. The importance of human technologies interface and the development of a vision or purpose are demonstrated by three examples of companies that became successful human systems. In addition, pitfalls of North American colonies at Jamestown, Plymouth, and Massachusetts Bay are examined to alert space settlement planners. It is maintained that a successful human system requires a vision that supports the dynamic balance of the physical, conceptual, and spiritual technologies of that system. Finally, a proposal for a research program designed to generate more knowledge about human systems for space applications is proposed. C.M.

A84-29857

A PROGRAM TO DEVELOP EFFICIENT MANNED OPERATIONS IN SPACE

R. KLINE (Grumman Aerospace Corp., Bethpage, NY) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983. San Diego, CA, Univelt, Inc., 1983, p. 107-118.

(AAS PAPER 83-207)

The evolutionary development of man's activities in space is reviewed, and a program which combines man and machine for

expanding on-orbit operations is discussed. The space station and its general mission areas are covered: a National Space Test Facility, a Transportation Harbor, Satellite Servicing, and an Observatory. It is noted that as space missions change, the astronaut's tasks will expand to include tests set-up, data reduction, stage assembly, fueling operations, service, and repair. The man-machine interface will change simultaneously with developments in robotics, artificial intelligence, and telepresence. Also examined are future manned and unmanned space stations in geosynchronous and hi-energy orbits. It is recommended that to use man efficiently in space, Shuttle Orbiter flights be used to develop space operational equipment, as well as demonstrate the equipment's applications to commercial, scientific, and defense communities. C.M.

A84-29865

MAJOR CONCERNS OF PRIVATE ENTERPRISE REGARDING RECENT DEVELOPMENTS IN SPACE LAW

S. GOROVE (Mississippi, University, University, MS) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 199-208. refs

(AAS PAPER 83-221)

This presentation starts out by recalling one of the early concerns of private enterprise regarding the legitimacy of its activities in outer space. The discussion moves on to a consideration of some of the major concerns that have arisen in view of recent developments in space law. Among them are: (1) unresolved issues pertaining to the use of the geostationary orbit; (2) similar issues regarding the exploitation of the moon and other celestial bodies: (3) concerns about the international implications of direct television broadcasting by satellites; (4) misgivings about the adequacy of legal protection against damage, harm or interference which may occur in outer space; and, finally, (5) concerns about the state of governmental regulatory procedures. Author

A84-29866* National Aeronautics and Space Administration, Washington, D. C.

INTERNATIONAL ASPECTS OF COMMERCIAL SPACE ACTIVITIES

K. S. PEDERSEN (NASA, International Affairs Div., Washington, IN: Space manufacturing 1983; Proceedings of the Sixth DC) Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 209-217. (AAS PAPER 83-222)

Attention is given to problems in international cooperation that will arise if NASA proceeds with a Space Station. The rise in space budgets in many countries is cited as an indication of the growing importance being placed on space activities. It is also pointed out that these nations are emphasizing areas which hold promise for eventual commercial payoff. Developing countries are also paying greater attention to space. As part of the European Space Agency's development program, it is underwriting the development of up to six multiuser facilities dedicated to microgravity research; these include furnaces and thermostats for processing metallurgical samples and for crystal growth and botanical investigations. Competition from Europe is seen as a spur to efficiency. Attention is also given to the question whether international cooperation will interfere with research carried out by the US for military purposes. C.R.

A84-29868

A LEGAL CHARTER FOR NON-GOVERNMENTAL SPACE INDUSTRIALIZATION

M. A. ROTHBLATT (Schnader, Harrison, Segal and Lewis, Washington, DC) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 229-247. refs

(AAS PAPER 83-225)

Maximum and minimum legal bounds for the exercise of state supervision and authorization of nongovernmental activity in outer space are specified. Legal limits are given in both international and United States law. It is shown that both existing United States law and current regulation theory mandate a minimum exercise of state supervision and authorization for a defined class of space industrialiation activities and that they specify supervisory and control responsibilities. This class of activity, together with the supervisory and control responsibilities, is outlined. Statutory language is suggested pursuant to which firms will receive legal charters to engage in a broad class of space development activity. On the basis of existing space law treaties and other fundamental principles of international law, it is shown that state exercise of supervision and authorization may range from state operation of all space activity to state responsibility for all space activity.

C.R.

A84-29883

INTERNATIONAL COMPETITION IN COMMERCIAL **AEROSPACE MARKETS**

A. M. DEERING (Johnson and Higgins, New York, NY) and W. A. GOOD (Earth Space Transport Systems Corp., New York, NY) IN: Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton, NJ, May 9-12, 1983 . San Diego, CA, Univelt, Inc., 1983, p. 421-430. refs

(AAS PAPER 83-244)

The U.S. has not approached the subject of space commerce in a way which takes the best advantage of its competitive free enterprise system. Many lessons can be learned by closely examining the relationship between government and entrepreneurs in the early days of air commerce. A review of recent international trends in commercial space technology shows that the U.S. is not maintaining the technological leadership to which it is committed due to a suboptimal government/industry relationship vis a vis other industrialized nations. Author

N84-10174*# Martin Marietta Corp., Denver, Colo. **MOLECULAR CONTAMINATION MATH MODEL SUPPORT Final** Report

R. WELLS 30 Sep. 1983 97 p refs

(Contract NAS8-34945)

(NASA-CR-170899; NAS 1.26:170899; MCR-83-640) Avail:

NTIS HC A05/MF A01 CSCL 22B The operation and features of a preprocessor for the Shuttle/Payload Contamination Evaluation Program Version 2) are described. A preliminary preprocessor for SPACE 2 is developed. Further refinements and enhancements of the preprocessor to insure complete user friendly operation, are recommended. N.W.

N84-10179# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

LARGE SPACE INSTRUMENTATION TO MEASURE THE INTERACTION BETWEEN SPACE STRUCTURES AND THE ENVIRONMENT Final Report, 1 Oct. 1981 - 30 Sep. 1982 C. I. MENG Dec. 1982 21 p

(Contract MIPR-FY7121-82-00007; AF PROJ. 7661)

(AD-A129990; AFGL-TR-83-0059) Avail: NTIS HC A02/MF A01 ČSCL 14B

The major effort at the Applied Physics Laboratory of the Johns Hopkins University while participating in the Air Force Geophysics Laboratory's planning of the polar orbiting space shuttle payload definition is to provide necessary information on the polar region space environment and suggestions on the various measurements of the interaction between the space structure and the environment. During the first phase, the effort was concentrated on the polar region space environment, and results of the investigation were presented to the first meeting of the IMPS Definition Phase at JPL. During the second phase of the program, the major effort was on the investigation of possible instrumentation to perform measurements of the interaction between space structures and the environment. Four measurements and their instrumentation were conceived and suggested to the IMPS Definition Team. These Author (GRA) are summarized here.

10 GENERAL

National Aeronautics and Space Administration. N84-12228*# Langley Research Center, Hampton, Va.

INTEGRATED FLYWHEEL TECHNOLOGY, 1983

C. R. KECKLER, ed., G. E. RODRIGUEZ, ed. (NASA. Goddard Space Flight Center), and N. J. GROOM, ed. Washington Dec. 1983 205 p refs Workshop held in Greenbelt, Md., 2-3 Aug. 1983

(NASA-CP-2290; L-15707; NAS 1.55:2290) Avail: NTIS HC A10/MF A01 CSCL 10C

Topics of discussion included: technology assessment of the integrated flywheel systems, potential of system concepts, identification of critical areas needing development and, to scope and define an appropriate program for coordinated activity.

N84-14752# CAP Sogeti Logiciel, Toulouse (France). Space Branch.

SOFTWARE PRODUCTION IN A LARGE SPACE PROJECT: THE SPOT MISSION CENTER

V. T. KHANG In ESA Software Eng. p 185-190 Aug. 1983 refs

Avail: NTIS HC A13/MF A01

The MULTIPRO software workbench used to manage the software production of a team of up to 20 engineers on the SPOT (French satellite) is described. The software runs on CDC Cybers or the SEMS Solaris 16. Software tools were developed for the firmware of the terminals, a librarian and a document generator. A detailed analysis language, not part of the workbench, is used on the Cyber as required by quality assurance. Author (ESA)

N84-16075*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SIGNIFICANT SCIENTIFIC AND TECHNICAL RESULTS AT MARSHAL SPACE FLIGHT CENTER Annual Report for 1983 Nov. 1983 83 p refs

(NASA-TM-82562; NAS 1.15:82562) Avail: NTIS HC A05/MF A01 CSCL 05B

Research programs in atmospheric science, materials processing in space, and space sciences as well as technology programs in space power, materials processes, and space structures are discussed. Author

N84-16097*# Essex Corp., Huntsville, Ala. SPACE TELESCOPE Final Report

E. C. PRUETT, K. B. ROBERTSON, C. N. VANVALKENBURG, and W. REED 13 Sep. 1983 34 p

(Contract NAS8-33272)

(NASA-CR-170948; NAS 1.26:170948; H-83-06) Avail: NTIS HC A03/MF A01 CSCL 03A

Space telescope drawings, mockup drawings, space support equipment, and Spacelab experiment hardware are discussed.

N.W.

N84-16242*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

STS-9: ORBITAL WORKSHOP SPACELAB TO FLY ON NINTH SHUTTLE MISSION

Oct. 1983 8 p

(NASA-TM-85497; KSC-231-83; NAS 1.15:85497) Avail: NTIS HC A02/MF A01 CSCL 22A

The first non-astronants are discussed. Spacelab is described. Spacelab objectives, Spacelab 1 investigations, atmospheric physics and Earth observations, space plasma physics, solar physics and astronomy, material sciences and technology development, and life sciences are discussed. N.W.

N84-16420*# National Aeronautics and Space Administration, Washington, D. C.

THE US SPACE STATION: POTENTIAL BASE FOR A SPACEBORNE MICROWAVE FACILITY

D. MCCONNELL In JPL Spaceborne Imaging Radar Symp. p 144-156 1 Jul. 1983

Avail: NTIS HC A08/MF A01 CSCL 22B

Concepts for a U.S. space station were studied to achieve the full potential of the Space Shuttle and to provide a more permanent presence in space. The space station study is summarized in the following questions: Given a space station in orbit in the 1990's, how should it best be used to achieve science and applications objectives important at that time? To achieve those objectives, of what elements should the station be comprised and how should the elements be configured and equipped. These questions are addressed. E.A.K.

N84-16677# Technische Univ., Darmstadt (West Germany). Inst. of Physical Geodesy.

GEODETIC ASPECTS OF ESA PROJECTS, STUDIES AND INVESTIGATIONS

E. GROTEN In Technische Univ. Geodesy and Global Geodyn. p 429-438 1982 refs

Avail: NTIS HC A02/MF A01

Some of the various ESA projects which are of basic interest to the advancement of modern geodesy are considered. Besides projects also studies and investigations sponsored by ESA or carried out in ESA-offices and at ESA-facilities are mentioned. References are given where more detailed information can be found. Author

N84-16991*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

INTERPRETATION STS-3/PLASMA OF DIAGNOSTICS PACKAGE RESULTS IN TERMS OF LARGE SPACE STRUCTURE PLASMA INTERACTIONS Semiannual Technical Progress Report, 10 Jul. 1983 - 25 Jan. 1984

W. S. KURTH 27 Jan. 1984 19 p (Contract NAG3-449)

(NASA-CR-173266: NAS 1.26:173266) Avail: NTIS HC A02/MF A01 CSCL 201

The Plasma Diagnostics Package, which was flown aboard STS-3 recorded various chemical releases from the Orbiter. Changes in the plasma environment were observed to occur during Flash Evaporator System (FES) releases, water dumps and maneuvering thruster operations. During flash evaporator operations, broadband Orbiter-generated electro-static noise is enhanced and plasma density irregularity (delta n/N) is observed to increase by as much as 4 times and is strongly peaked below 6 Hz. In the case of water dumps, background electrostatic noise is enhanced or suppressed depending on frequency and Delta N/N is also seen to increase by as much as 4 times. Various changes in the plasma environment are effected by primary and vernier thruster operations. In addition, thruster activity stimulates electrostatic noise with a spectrum which is most intense at frequencies below 10 kHz. Author

N84-17050# La Jolla Inst., Calif.

IDENTIFICATION OF NEW POTENTIAL SCIENTIFIC AND TECHNOLOGY AREAS FOR DOD APPLICATION. SUMMARY OF ACTIVITIES Final Technical Report, 2 Aug. 1982 - 2 Aug. 1983

2 Aug. 1983 301 p

(Contract MDA903-82-C-0376; ARPA ORDER 3710)

(AD-A134372; LJI-LJ-83-252) Avail: NTIS HC A14/MF A01 CSCL 05A

Document reports on highlights of this year's program, including laser propagation in the atmosphere, laser beam clean-up in Raman amplifiers, X-ray laser research, utilization of the external tanks of the Space Shuttle, and the Status of Solid State materials suitable for high power lasers. GRA

N84-17223*# Department of Communications, Ottawa (Ontario). Space Technology and Applications Branch.

CANADIAN ATTITUDE SENSING EXPERIMENTAL PACKAGE (CASEP)

A. H. REYNAUD In NASA. Langley Research Center STEP Expt. Requirements p 165-176 Jan. 1984 refs Avail: NTIS HC A15/MF A01 CSCL 22B

The Canadian Attitude Sensing Experiment Package (CASEP) was designed to demonstrate and verify the operation of an attitude sensing subsystem prior to committing its use on an operational mission. Data telemetry/recording requirements, power and physical requirements, and mission requirements of the experiment package are defined. M.G.

N84-18315# European Space Agency, Paris (France). SPACELAB DATA BOOK

N. LONGDON, comp. and J. HUNT, ed. Sep. 1983 127 p Original contains color illustrations

(ESA-BR-14; ISSN-0250-1589) Avail: NTIS HC A02/MF A01

The Spacelab program is outlined. Crew training, functions, and accommodation are described. Safety factors; accommodation for experiments; structural design; the Igloo; command and data management subsystem; electrical power distribution; environment control; and the transfer tunnel are described. Ground operations; ground support; mission operations; and possible developments are outlined. Author (ESA)

N84-19371*# Stanford Telecommunications, Inc., McLean, Va. STUDY OF A TRACKING AND DATA ACQUISITION SYSTEM FOR THE 1990'S. VOLUME 3: TDAS COMMUNICATION MISSION MODEL Draft Final Report

T. MCCREARY 31 May 1983 122 p refs Prepared in cooperation with Space Communications Co., Gaithersburg, Md. (Contract NAS5-26546)

(NASA-CR-175195; NAS 1.26:175195; STI/E-TR-25066-VOL-3) Avail: NTIS HC A06/MF A01 CSCL 22A

A parametric description of the communication channels required between the user spacecraft to be supported and the user ground data systems is developed. Scenarios of mission models, which reflect a range of free flyers vs space platform usage as well as levels of NASA activity and potential support for military missions, and potential channel requirements which identify: (1) bounds on TDAS forward and return link data communication demand, and (2) the additional demand for providing navigation/tracking support are covered. Author

N84-19429# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

THE COMPLEMENTARY ROLES OF EXISTING AND ADVANCED ENVIRONMENTAL, THERMAL CONTROL AND LIFE SUPPORT TECHNOLOGY FOR SPACE STATIONS

A. I. SKOOG and H. F. BROSE (Hamilton Standard, Windsor Locks, Conn.) *In* ESA Environ. and Thermal Control Systems for Space Vehicles p 281-288 Dec. 1983 refs

Avail: NTIS HC A25/MF A01

The role of existing technology, especially Shuttle and Spacelab equipment, and the evolution to incorporation of advanced hardware in a closed loop environmental thermal control and life support (ETCLS) system are discussed. Analyses of regenerative and closed loop systems performed during Space Operations Center, Manned Space Platform, Space Station and Spacelab programs are reviewed. Cabin atmosphere, hygiene, water management, and galley requirements are considered. It is concluded that a considerable amount of existing ETCLS equipment can be used for space stations. Author (ESA) N84-20605*# Engineering and Economics Research, Inc., Vienna, Va.

AN ATTACHED PAYLOAD OPERATIONS CENTER (APOC) AT THE GODDARD SPACE FLIGHT CENTER (GSFC), VOLUME 1 Final Report

7 Dec. 1983 101 p 2 Vol.

(Contract NAS5-26962)

(NASA-CR-175160; NAS 1.26:175160) Avail: NTIS HC A06/MF A01 CSCL 14B

A management overview of the Attached Payload Operations Center (APOC) functional requirements and design are presented. The rationale for developing the APOC concept and the assumptions utilized are presented. A summary of the concept complete with major functional areas and associated data flows is provided. The attributes of this concept are formalized and the necessary resources needed for its development and operation presented. S.L.

N84-20613# Committee on Commerce, Science, and Transportation (U. S. Senate). CIVIL SPACE STATION

Washington GPO 1984 91 p refs Hearing before the Subcomm. on Sci., Technol. and Space of the Comm. on Com., Sci. and Transportation, 98th Congr., 1st Sess., 15 Nov. 1983 (S-REPT-98-523; GPO-29-426) Avail: Subcommittee on Science, Technology and Space

How present uses of space can be extended and how other capabilities can be developed that have a unique applicability to a permanent presence in space are issues explored. Existing alternatives for accomplishing the nation's objectives in space are examined and the advantages and disadvantages of each are considered. Private sector involvement, the possibility of international cooperation, and the functions and concepts for a mixture of manned and unmanned elements are discussed.

A.R.H.

N84-20617*# Lockheed Aircraft Corp., Burbank, Calif. ON-ORBIT SPACECRAFT/STAGE SERVICING DURING STS LIFE CYCLE Final Report

27 Jan. 1984 140 p refs

(Contract NAS9-15800)

(NASA-CR-171775; NÁS 1.26:171775; LMSC-D931673) Avail: NTIS HC A07/MF A01 CSCL 22B

A comprehensive and repesentative set of shuttle payloads was identified for shuttle and space station servicing missions. The classes of servicing functions were determined and the general servicing support required for the set of referenced spacecraft was allocated. A candidtate strawman space station was depicted from a synthesis of space station concepts derived from NASA space station architecture studies done by eight contractors. The shuttle servicing hardware and kits were identified and their applicability in transitioning servicing capability to the space station was evaluated. A.R.H.

N84-21145# Massachusetts Inst. of Tech., Cambridge. IMPLEMENTATION OF MACLISP ON A LARGE ADDRESS SPACE COMPUTER Final Report

J. MOSES 21 Dec. 1983 4 p (Contract DE-AC02-79ER-10357)

(DE84-005042; DOE/ER-10357/1) Avail: NTIS HC A02/MF A01

This is a belated final report on the implementation of NIL the New Implementation of LISP. Work on this project began in 1978 and is still continuing. The original timetable for the project two years - slipped badly. Over four years were used to get a working version ready for distribution. At this point over 130 copies of the NIL System were distributed and many of the users find it superior to all available alternatives on the DEC VAX. In that sense the project was quite successful.

N84-21437*# Terra-Mar, Mountain View, Calif. ALTERNATIVE STRATEGIES FOR SPACE STATION FINANCING

D. C. WALKLET and A. T. HEENAN 1 Sep. 1983 33 p refs (Contract NASW-3750)

(NASA-CR-175412; NAS 1.26:175412) Avail: NTIS HC A03/MF A01 CSCL 05C

The attributes of the proposed space station program are oriented toward research activities and technologies which generate long term benefits for mankind. Unless such technologies are deemed of national interest and thus are government funded, they must stand on their own in the market place. Therefore, the objectives of a United States space station should be based on commercial criteria; otherwise, such a project attracts no long term funding. There is encouraging evidence that some potential space station activities should generate revenues from shuttle related projects within the decade. Materials processing concepts as well as remote sensing indicate substantial potential. Futhermore, the economics and thus the commercial feasibility of such projects will be improved by the operating efficiencies available with an ongoing space station program. BG

N84-21440# Committee on Appropriations (U. S. Senate).

DEPARTMENT OF HOUSING URBAN AND DEVELOPMENT-INDEPENDENT AGENCIES APPROPRIATIONS FOR 1984: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

In its Dept. of Housing and Urban Develop., and Certain Independent Agencies Appropriations, 1984, Pt. 2 p 1133-1387 1984

Avail: Comm. on Appropriations

Research and development activities in the areas of space transportation systems, space stations, space scence, technology utilization, aeronautical research and technology, space research, energy technology, space tracking and data systems and construction of facilities are summarized. Achievements of the past year were also summarized. B.G.

N84-21441# Committee on Science and Technology (U. S. House)

AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR FISCAL **YEAR** 1985

Washington GPO 1984 222 p Presented in accompaniment to H.R. 5154 to the Comm. on Sci. and Technol., 98th Congr., 2d Sess., 21 Mar. 1984

(H-REPT-98-629; GPO-31-451) Avail: US Capitol, House **Document Room**

The Committee on Science and Technology recommends passage of the funding appropriations bill to NASA for research and development, space flight, control and data communications. construction of facilities, and program management. Principal areas of activity in space transportation capability relate to Spacelab, high altitude satellite orbit placement, payload operations, and advanced programs study and evaluation. The completion of the fleet of shuttle orbiters along with mission preparation and control contribute to the fulfillment of the Space Transportation System. The advanced systems program performs studies and aids development of improved capabilities in tracking and data systems for new missions and to improve cost effectiveness and reliability for overall support of the spaceflight missions. The research and program management appropriation funds the performance and management of research, technology, and test activities at NASA installations along with the planning, and support of contractor research and development in aeronautical and space research.

M.A.C.

N84-21442# Committee on Science and Technology (U. S. House).

REVIEW OF THE NATIONAL AERONAUTICS AND SPACE ACT OF 1958

Washington GPO 1984 410 p Hearings before the Subcomm. on Space Sci. and Appl. of the Comm. on Sci. and Technol., 98th Congr., 1st Sess., 18, 19, 25, 26 Oct. 1983

(GPO-28-915) Avail: Subcommittee on Space Science and Applications

Whether the policy objectives contained in the National Aeronautics and Space Act of 1958 adequately reflect the direction and scope of NASA's future is explored including whether NASA's ability to keep pace with changes in the space program is in any way limited by the agency's charter. Major trends which are significantly changing the nature of the civilian space program discussed include space commercialization, increased emphasis on national security, and international cooperation and competition. A.R.H.

N84-21443# Committee on Commerce, Science, and Transportation (U. S. Senate).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1985

Washington GPO 1984 21 p H.R. 5154 enacted into law by the 92nd Congr., 2d Sess., 28 Mar. 1984

Avail: US Capitol, House Document Room

Appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes are authorized. The provisions of the bill are presented. SI.

N84-21444# Committee on Science and Technology (U. S. House).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1985

Washington GPO 1984 22 p A bill, H.R. 5154, referred to the Comm. on Sci. and Technol., 98th Congr., 2d Sess., 15 Mar. 1984

(H-REPT-98-629) Avail: US Capitol, House Document Room

Appropriations are authorized to the National Aeronautics and Space Administratin for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes. The provisions of the bill are presented. SL

N84-21590# European Space Agency, Paris (France). INTRODUCTION TO GEOSTATIONARY ORBITS

E. M. SOOP (ESOC, Darmstadt, West Germany) and W. R. BURKE, ed. Nov. 1983 148 p refs (ESA-SP-1053; ISSN-0379-6566) Avail: NTIS HC A07/MF A01

The laws governing spacecraft motion in geostationary orbit, and the orders of magnitude of perturbing effects on the orbit are discussed. Orbital maneuvers, perturbed orbits, in orbit control, eclipse effects, stationkeeping, and orbit determination are introduced. Author (ESA)

N84-21592*# Rockwell International Corp., Downey, Calif. Space **Operations** Center.

SHUTTLE INTERACTION STUDY Quarterly Review 3 Sep. 1980 86 p

(Contract NAS9-16153)

(NASA-CR-173400; NAS 1.26:173400; PD80-55; QR-1) Avail: NTIS HC A05/MF A01 CSCL 14B

The role of the Space Operations Center (SOC) as it effects the missions of the space shuttle was analyzed. Graphic representation of space shuttle docking procedures with attention to the docking module was presented. Other topics included extravehicular activity options, space station evaluation, space logistics of the SOC, equipment interfacing, and SOC buildup scenarios. M.A.C.

N84-21593*# Rockwell International Corp., Downey, Calif. Space Operations Center.

SHUTTER INTERACTION STUDY EXTENSION Monthly Progress Report, 6 Oct. - 6 Nov. 1981

Oct. 1981 14 p

(Contract NAS9-16153)

(NASA-CR-173401; NAS 1.26:173401; MPR-3) Avail: NTIS HC A02/MF A01 CSCL 14B

Plans for space shuttle missions as they effect the Space Operation Center (SOC) were examined. Shuttle fleet utilization, traffic analysis, SOC assembly operations, SOC propellant storage, and flight support facilities were studied with cost estimates, and completion schedules included. M.A.C.

N84-21594*# Rockwell International Corp., Downey, Calif. Space Operations Center.

SHUTTLE INTERACTION STUDY EXTENSION Final Review Feb. 1982 257 p

(Contract NAS9-16153)

(NASA-CR-173398; NAS 1.26:173398; PD82-1A) Avail: NTIS HC A12/MF A01 CSCL 14B

The following areas of Space Shuttle technology were discussed: variable altitude strategy, spacecraft servicing, propellant storage, orbiter plume impingement, space based design, mating (docking and berthing), shuttle fleet utilization, and mission/traffic model. B.G.

N84-21595*# Rockwell International Corp., Downey, Calif. Space Operations Center.

SHUTTER INTERACTION STUDY Monthly Progress Report, 19 Sep. - 24 Oct. 1980

Oct. 1980 68 p

(Contract NAS9-16153)

(NASA-CR-173402; NAS 1.26:173402; MPR-3) Avail: NTIS HC A04/MF A01 CSCL 14B

The deployment, transport, and exchange procedures for the SOC logistics module and for logistics modules/cradles envisioned to support both the flight support facilities operation and the space construction operation were developed. The use of a holding and positioning aid device was determined to be the most desirable arrangement for the parking/holding of the modules during this exchange operation. The capability/feasibility of transporting eight crew members in the orbiter to and from the SOC was analyzed. Two arrangements were defined for this operation: (1) with the airlock in the orbiter cabin, and (2) with no airlock in the cabin.

Author

N84-21596*# Rockwell International Corp., Downey, Calif. Space Operations/Integration and Satellite Systems Div.

SHUTTLE INTERACTION STUDY EXTENSION Midterm Review 15 Oct. 1981 160 p

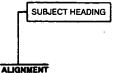
(Contract NAS9-16153)

(NASA-CR-173403; NAS 1.26:173403; PD81-20A) Avail: NTIS HC A08/MF A01 CSCL 14B

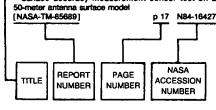
The implications of using the Shuttle with the SOC were analyzed, including constraints that the Shuttle places upon the SOC design. All the considerations involved in the use of the shuttle as a part of the SOC concept were identified. Author

JANUARY 1985

Typical Subject Index Listing



Surface accuracy measurement sensor test on a



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

ACCURACY		
Surface accuracy measurement 50-meter antenna surface model	senso	r test on a
INASA-TM-856891	n 17	N84-16427
ACTIVE CONTROL	P 17	1104-10427
Active control of large flexible space	struct	ures
		N84-14235
Experimental study of active vibration	n cont	rol
[AD-A133818]	p 38	N84-14546
ACOSS Fourteen (Active Control of	Space	Structures)
[AD-A133411]	p 38	N84-15181
ACOSS eleven (Active Control Of	Space	Structures),
volume 1		
[AD-A135675]	- ·-	N84-18311
ACOSS eleven (Active Control Of	Space	Structures),
volume 2		
[AD-A135676]	p 41	N84-18312
ACTUATORS		
On the number and placement		
On the number and placement independent modal space control	- for la	arge flexible
On the number and placement independent modal space control spacecraft	– for la p 34	arge flexible A84-24990
On the number and placement independent modal space control spacecraft The dynamics and control of tar	– for la p 34	arge flexible A84-24990
On the number and placement independent modal space control spacecraft The dynamics and control of lan structures, 6	-forla p34 geflex	arge flexible A84-24990 kible space
On the number and placement independent modal space control spacecraft The dynamics and control of tar structures, 6 [NASA-CR-174450]	– for la p 34 ge fleo p 36	AB4-24990 AB4-24990 Kible space N84-10173
On the number and placement independent modal space control spacecraft The dynamics and control of lar structures, 6 [NASA-CR-174450] Actuator placement considerations	-forla p34 geflex p36 forth	Arge flexible A84-24990 kible space N84-10173 e control of
On the number and placement independent modal space control spacecraft The dynamics and control of tar structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures	- for la p 34 ge flex p 36 for th p 20	Arge flexible A84-24990 (ible space N84-10173 e control of N84-11199
On the number and placement independent modal space control – spacecraft The dynamics and control of lan structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and	p 34 ge flex p 36 for the p 20 l cont	Arge flexible A84-24990 kible space N84-10173 e control of N84-11199 trol system
On the number and placement independent modal space control – spacecraft The dynamics and control of lan structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities	p 34 ge flex p 36 for the p 20 l cont p 37	Arge flexible A84-24990 kible space N84-10173 e control of N84-11199 trol system N84-12245
On the number and placement independent modal space control spacecraft The dynamics and control of lar structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratio	- for la p 34 ge flex p 36 for th p 20 l cont p 37 en cont	Arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 trol system N84-12245 rol
On the number and placement independent modal space control spacecraft The dynamics and control of lan structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratic (AD-A133818)	- for la p 34 ge flex p 36 for the p 20 l cont p 37 en cont p 38	Arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 trol system N84-12245 rol
On the number and placement independent modal space control spacecraft The dynamics and control of lar structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratio	- for la p 34 ge flex p 36 for th p 20 l cont p 37 m cont p 38 ccture	Arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 trol system N84-12245 rol
On the number and placement independent modal space control – spacecraft The dynamics and control of lan structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratic [AD-A133818] Synchronously deployable truss stru	p 36 p 36 for the p 20 l conti p 37 in conti p 38 icture p 59	arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 rol system N84-12245 rol N84-14546 N84-16250
On the number and placement independent modal space control spacecraft The dynamics and control of lar structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratic (AD-A133818) Synchronously deployable truss stru [NASA-CASE-LAR-13117-1] Selection of noisy sensors and actu of linear systems large space struct	- for la p 34 ge flex p 36 for the p 20 l conti p 37 in conti p 38 cture p 59 ators fit tures	arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 rol system N84-12245 rol N84-14546 N84-16250 or regulation
On the number and placement independent modal space control spacecraft The dynamics and control of tar structures, 6 [NASA-CR-174450] Actuator placement considerations large space structures IPACS guidance navigation and considerations and test activities Experimental study of active vibratic [AD-A133818] Synchronously deployable truss stru [NASA-CASE-LAR-13117-1] Selection of noisy sensors and actu	- for la p 34 ge flex p 36 for the p 20 l conti p 37 in conti p 38 conti p 38 conti p 59 ators fit tures p 51	arge flexible A84-24990 (ible space N84-10173 e control of N84-11199 rol system N84-12245 rol N84-14546 N84-16250

Precise control of flexible manipulators p 60 N84-20175 [NASA-CR-175389]

ADAPTIVE CONTROL The spatial order reduction problem adaptive control of distributed parameters	eter sys	tems
Multivariable direct adaptive control of time-varying commands Some applications of direct adaptiv structural systems Direct multivariable model reference with applications to large structural systems	p 33 ve cont p 34 æ adap	A84-19118 rol to large A84-25496
ADAPTIVE FILTERS		
Characteristics of the microprocess of algorithms for the processing of radii in large antenna arrays ADHESION TESTS Electrically conductive black optical	p 48	
AERODYNAMIC CONFIGURATIONS	p 55	A84-28553
STEP mechanical systems AERODYNAMIC HEATING	p 8	
Thermal control of tethered satellite i aerodynamic mission AERODYNAMIC LOADS		N84-19444
Simplified models and computation		emes of the
aerodynamic load - large space stru	p 28	N84-21614
AERODYNAMIC STABILITY Research on boundary feedback as	nd cont	rol theories,
1978 - 1983 [AD-A136531]	p 41	N84-18987
AERODYNAMICS STEP mechanical systems	р 8	N84-17213
AEROELASTICITY Aggregate models for distributed		
with applications to flexible air and sp	acecraf p 31	t A84-11945
Aeroelastic stability and response weapons	of flexi	ble tactical
[AIAA PAPER 84-0392] AERONAUTICAL ENGINEERING	p 32	A84-18060
Research and technology, 1983 [NASA-TM-85702] AEROSPACE ENGINEERING	p 7	N84-12026
Vibration characteristics of self- columns for use in space		ding stayed A84-21237
Higher temperature composite joints tests		
Graphite/polyimide joints extend ter	mperatu	ıre limits
Research and technology, 1983 [NASA-TM-85702]	p 55	
	n 7	N84-12026
AEROSPACE ENVIRONMENTS	p 7	
AEROSPACE ENVIRONMENTS Canadarm and the Space Shuttle	p 57	A83-44602
AEROSPACE ENVIRONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments	p 57 p 67 Platfo	A83-44602 A84-15161 rm (STEP)
AÉROSPACE ENVIRONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environments	p57 p67 Platfo p8 ment c	A83-44602 A84-15161 rm (STEP) N84-17212 on damping
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environ materials and damping designs on fle	p 57 p 67 Platfo p 8 ment o xible str p 56	A83-44602 A84-15161 rm (STEP) N84-17212 on damping nuctures N84-17217
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environ materials and damping designs on flee Environmental effects on the dynau an orbiting large flexible antenna syst	p 57 p 67 Platfo p 8 ment o xible str p 56 mics an em '	A83-44602 A84-15161 rm (STEP) N84-17212 on damping ructures N84-17217 dd control of
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on fle: Environmental effects on the dynai an orbiting large flexible antenna syst [NASA-CR-175448] AEROSPACE INDUSTRY	p 57 p 67 Platfo p 8 ment o xible str p 56 mics an em ' p 42	A83-44602 A84-15161 rm (STEP) N84-17212 In damping nuctures N84-17217 d control of N84-20627
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on fle Environmental effects on the dynau an orbiting large flexible antenna syst [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project	p 57 p 67 Platfo p 8 ment o xible str p 56 mics an em ' p 42	A83-44602 A84-15161 rm (STEP) N84-17212 on damping uctures N84-17217 d control of N84-20627 see on Space -14, 1982,
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on flex Environmental effects on the dynai an orbiting large flexible antenna syste [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project Technology, Toulouse, France, M	p 57 p 67 Platto p 8 ment o xible stu p 56 mics an em p 42 s; Cours May 3 p 2	A83-44602 A84-15161 rm (STEP) N84-17212 on damping nuctures N84-17217 dd control of N84-20627 se on Space -14, 1882, A84-15301
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on fle: Environmental effects on the dynai an orbiting large flexible antenna syst [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project Technology, Toulouse, France, I Proceedings Human organization and	p 57 p 67 Platfo p 8 ment o xible str p 56 mics as p 42 s; Courra May 3 p 2 spac p 2	A83-44602 A84-15161 rm (STEP) N84-17212 on damping nuctures N84-17217 d control of N84-20627 se on Space -14, 1982, A84-15301 a84-15303
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on fle Environmental effects on the dynau an orbiting large flexible antenna syst [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management	p 57 p 67 Platto p 8 ment o xible str p 56 mics an em p 42 s; Cours May 3 p 2 space p 2 vace p 2 vace inc	A83-44602 A84-15161 rm (STEP) N84-17212 nn damping ructures N84-17217 d control of N84-20627 se on Space -14, 1982, A84-15301 be project A84-15303 ojects A84-15304
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on flex Environmental effects on the dynau an orbiting large flexible antenna syste [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project Technology, Toulouse, France, M Proceedings Human organization — and management The contract — management for sp	p 57 p 67 Platto p 8 mics an em 56 mics an em 2 p 42 space p 2 space p 2 space p 2 space p 2 space p 2 space p 2 space p 2 space p 2 space p 2	A83-44602 A84-15161 rm (STEP) N84-17212 on damping nuctures N84-17217 d control of N84-20627 se on Space -14, 1982, A84-15301 ae project A84-15304 Justry A84-15305
AÉROSPACE ENVIŘONMENTS Canadarm and the Space Shuttle Man in space - An overview Space Technology Experiments overview The effects of the space environi materials and damping designs on fle Environmental effects on the dynau an orbiting large flexible antenna syste [NASA-CR-175448] AEROSPACE INDUSTRY Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management The contract management for sp The progression of projects in sp Management of large space projects	p 57 Platfo P8 ment o xible str p 56 mics an am p 42 s; Courr May 3 p 2 space p 2 sace inc p 2 sace inc p 2 sace inc p 2 sace inc p 2	A83-44602 A84-15161 rm (STEP) N84-17212 nn damping ructures N84-17217 dd control of N84-20627 se on Space -14, 1982, A84-15301 ze project A84-15303 ojects A84-15304 dustry A84-15305 y assurance A84-15310

Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303

AEROSPACE SCIENCES		
Developing the space frontier; Pro	ceed	ings of the
Twenty-ninth Annual Conference, Hou		
25-27, 1982	p 67	A84-15381
STEP Experiment Requirements		
[NASA-CP-2294]	p 7	N84-17211
Space Technology Experiments	Platfo	
overview	p 8	N84-17212
AEROSPACE SYSTEMS	40	10-1-11212
		Cabination
NTC '82; National Telesystems Confe		
TX, November 7-10, 1982, Conference		
		A84-15623
Project space station - Plans for a p		
space center Book		A84-21344
AEROSPACE TECHNOLOGY TRANSFE		
Space applications at the crossroad		
the Twenty-first Goddard Memorial Sym		
MD, March 24, 25, 1983	p 64	A84-10883
NASA priority technologies	-	
[IAF PAPER 83-345]		A84-11793
Global implications of space activities		
Institute Assessment - Book	p 67	A84-15189
STEP Experiment Requirements	_	
[NASA-CP-2294]	р7	N84-17211
STEP experiment integration	p 8	N84-17215
Deployable beam flight experiment (
	р8	N84-17218
AIRBORNE/SPACEBORNE COMPUTER		
Space station data management -		
from changing requirements and a d	ynamic	technology
base		
[AIAA PAPER 83-2338]	p 43	A84-10016
Space station autonomy requiremen	ts	
[AIAA PAPER 83-2352]	p 63	A84-10024
A voice interactive system for aiding a	and do	cumentation
of space-based tasks		
[AIAA PAPER 83-2355]	p 43	A84-10025
Space station communications	p 73	A84-24636
AIRCRAFT CONSTRUCTION MATERIA		
Research and technology, 1983		
[NASA-TM-85702]	p 7	N84-12026
Composite structural materials	μ.	104 12020
[NASA-CR-173259]	p 56	N84-17293
AIRCRAFT CONTROL	p 00	1104 11200
Aggregate models for distributed p	arame	ter systems
with applications to flexible air and spa		
with applications to house as and spe		A84-11945
ALGORITHMS	p 31	A04-11045
		ortaining to
Algorithms and computational aspe		
Algorithms and computational aspe block diagonal dominance method		
Algorithms and computational aspe	s for	design of
Algorithms and computational aspe block diagonal dominance method decentralized feedback compensation	s for p 15	design of A84-19108
Algorithms and computational aspe block diagonal dominance method decentralized feedback compensation Direct multivariable model referenc	s for p15 eadaq	design of A84-19108
Algorithms and computational aspe block diagonal dominance method decentralized feedback compensation	s for p 15 e adap stems	design of A84-19108 ptive control
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model referenc with applications to large structural sys	s for p 15 e adaj stems p 38	design of A84-19108 ptive control N84-15840
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques	s for p 15 e adaj stems p 38	design of A84-19108 ptive control N84-15840
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model referenc with applications to large structural syst Spline-based estimation techniques elliptic distributed systems	p 15 e adap stems p 38 for pa	design of A84-19108 ptive control N84-15840 arameters in
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439]	p 15 e adau stems p 38 for pa p 9	design of A84-19108 otive control N84-15840 arameters in N84-17947
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of	p 15 e adag stems p 38 for pa p 9 of robus	design of A84-19108 ptive control N84-15840 arameters in N84-17947 st controllers
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu	p 15 e adag stems p 38 for pa p 9 of robus	design of A84-19108 ptive control N84-15840 arameters in N84-17947 st controllers
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators	s for p 15 e adap stems p 38 for pa for pa p 9 of robus adratic	design of A84-19108 ptive control N84-15840 arameters in N84-17947 st controllers Gaussian)
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760]	s for p 15 e adap stems p 38 for pa for pa p 9 of robus adratic	design of A84-19108 ptive control N84-15840 arameters in N84-17947 st controllers
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators	s for p 15 e adap stems p 38 for pa for pa p 9 of robus adratic	design of A84-19108 ptive control N84-15840 arameters in N84-17947 st controllers Gaussian)
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement	s for p 15 e adag stems p 38 for pa p 9 of robus adratic p 43	design of A84-19108 bitive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172
Algorithms and computational aspe- block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural sys Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qui regulators [AD-A137760] ALIGNMENT	s for p 15 e adag stems p 38 for pa p 9 of robus adratic p 43	design of A84-19108 bitive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689]	s for p 15 e adap stems p 38 for pa for pa of robus adratic p 43 senso	design of A84-19108 bitive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS	s for p 15 e adag stems p 38 for pa for pa of robus adratic p 43 senso p 17	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689]	s for p 15 e adap stems p 38 for pa for pa of robus adratic p 43 senso	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS	s for p 15 e adag stems p 38 for pa for pa of robus adratic p 43 senso p 17	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 ir test on a N84-16427
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Our regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys	s for p 15 e ada stems p 38 for pa p 38 for pa p 43 senso p 17 for	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-atuminum alloys applications	s for p 15 e adap stems p 38 for pa p 38 for pa p 43 senso p 17 for p 54	design of A84-19108 brive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 in test on a N84-16427 aerospace A84-28242
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiG-reinforced-aluminum alloys applications ALUMINUM OXIDES	s for p 15 e adapters p 38 for pa for pa adratic p 43 senso p 17 for p 54 materi	design of A84-19108 brive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 in test on a N84-16427 aerospace A84-28242
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiG-reinforced-aluminum alloys applications ALUMINUM OXIDES	s for p 15 e adapters p 38 for pa for pa adratic p 43 senso p 17 for p 54 materi	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace A84-28242 als
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural sys Spline-based estimation techniques etliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-atuminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic	s for p 15 e aday stems p 38 for p3 for p3 of robu: adratic p 43 senso p 17 for p 54 materii p 54	design of A84-19108 brive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 in test on a N84-16427 aerospace A84-28242 als A84-24508
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatib	s for p 15 e adaqu stems p 38 for pa adratic p 43 senso p 17 for p 54 c asser	design of A84-19108 bive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace A84-28242 als A84-24508 mbly of shear
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatit and compression loaded anisotrop	s for p 15 e adaa stems p 38 for p p 9 f robus adratic p 43 senso p 17 for p 54 for p 54 c asser c asser c asser c asser c asser c asser c asser c asser c adaa senso	design of A84-19108 bive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace A84-28242 als A84-24508 mbly of shear
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatib	s for p 15 e adaa stems p 38 for p p 9 f robus adratic p 43 senso p 17 for p 54 for p 54 c asser c asser c asser c asser c asser c asser c asser c asser c adaa senso	design of A84-19108 brive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-21172 aerospace A84-28242 als A84-24508 mbly of shear ites with an
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatia and compression loaded anisotrog arbitrary supporting structure ANTENNA ARRAYS	s for p 15 e ada stems p 38 for p p 9 of robus adratic p 43 senso p 17 for p 54 c asser p 54 c asser p 54 c asser p 23	design of A84-19108 bive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace A84-28242 als A84-24508 mbly of shear ites with an A84-14050
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qui regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatii and compression loaded anisotrog arbitrary supporting structure ANTENNA ARRAYS Radiation characteristics of arra	s for p 15 e ada stems p 38 for p g 9 p 16 robu: adratic p 43 senso p 17 for p 54 for p 54 casser p 54 casser p 54 casser p 54 g 9 g 3 g 9 g 3 g 9 g 15 g 15 g 15 g 15 g 15 g 15 g 15 g 15	design of A84-19108 bitve control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-216427 aerospace A84-28242 als A84-24508 mbly of shear tes with an A84-14050 ennas with
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LQG (Linear Qu regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiG-reinforced-aluminum alloys applications ALUMINUM ALLOYS SiG-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatit and compression loaded anisotroj arbitrary supporting structure ANTENNA ARRAYS Radiation characteristics of arra disturbed aperture coverage	s for p 15 e ada stems p 38 for p 9 for p 9 for p 9 for p 9 for p 9 senso p 43 senso p 43 senso p 17 for p 54 c assenso p 54 senso p 54 senso p 15 senso p 55 senso p	design of A84-19108 btive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 or test on a N84-21172 or test on a N84-21172 or test on a N84-26576 A84-28242 als A84-24508 nbby of shear tites with an A84-14050 ennas with A84-26516
Algorithms and computational aspet block diagonal dominance method decentralized feedback compensation Direct multivariable model reference with applications to large structural syst Spline-based estimation techniques elliptic distributed systems [NASA-TM-85439] Time domain analysis and synthesis of for large scale LOG (Linear Qui regulators [AD-A137760] ALIGNMENT Surface accuracy measurement 50-meter antenna surface model [NASA-TM-85689] ALUMINUM ALLOYS SiC-reinforced-aluminum alloys applications ALUMINUM OXIDES Assessment of reliability of ceramic ANISOTROPIC PLATES Buckling and vibration of any prismatii and compression loaded anisotrog arbitrary supporting structure ANTENNA ARRAYS Radiation characteristics of arra	s for p 15 e adaa stems p 38 for p p 9 for p p 9 for p p 43 senso p 43 senso p 43 for p 54 for p 54 c assers p 54 c assers p 54 c assers p 23 y ant p 48 sor in for p 48 sor in for in for p 54 c assers p 23 y ant p 48 sor in for in for p 48 sor in for in for p 54 c assers p 23 c assers p 48 sor in for in for p 54 c assers p 55 c assers p	design of A84-19108 brive control N84-15840 arameters in N84-17947 st controllers Gaussian) N84-21172 r test on a N84-16427 aerospace A84-28242 als A84-24508 mbly of shear ttes with an A84-14050 ennas with A84-26516 olementation

p 48 A84-28067

in large antenna arrays

ANTENNA DESIGN

Technology requirements for large flexible space
structures
[IAF PAPER 83-404] p 2 A84-11811
A hardware demonstration of control for a flexible
offset-feed antenna p 31 A84-13321
An advanced generation land mobile satellite system
and its critical technologies p 3 A84-15634 Dynamics and control of a large space antenna
p 32 A84-17361
Narrow multibeam satellite ground station antenna
employing a linear array with a geosynchronous arc
coverage of 60 deg. II - Antenna design
p 46 A84-17743
A deployable 30/20 GHz multibeam offset antenna [AIAA PAPER 84-0658] p 20 A84-25258
Unfurlable offset antenna design for multipurpose
applications
[AIAA PAPER 84-0659] p 16 A84-25259
Land-mobile communications satellite system design [AIAA PAPER 84-0753] p 5 A84-25308
[AIAA PAPER 84-0753] p 5 A84-25308 Use of electromagnetic models in the optimal control
of large space antennas p 35 A84-25552
Study on large, ultralight long-life structures in space,
phase 2C
[TM-EKR3] p 17 N84-17284
Construction concept for erecting an offset-fed
antenna [NASA-TM-85774] p 60 N84-20626
[NASA-TM-85774] p 60 N84-20626 Geometric modeling of large space antenna
deployment p 22 N84-22225
ANTENNA FEEDS
Improved orbit utilization using auxiliary feeds in existing
earth terminals p 46 A84-20647
ANTENNA RADIATION PATTERNS
Narrow multibeam satellite ground station antenna
employing a linear array with a geosynchronous arc
coverage of 60 deg. II - Antenna design p 46 A84-17743
A cylindrical near-field test facility for large satellite
antennas
[MBB-UR-628-83-OE] p 72 A84-22862
C P at 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Radiation characteristics of array antennas with
disturbed aperture coverage p 48 A84-26516
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS p 51 N84-17436 The dynamics and control of large flexible space structures, 6 p 36 N84-10173 APERTURES p 36 N84-10173 The diffects of aperture antennas after signal propagation through anisotropic ionized media p 52 N84-21781
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21411 National Aeronautics and Space Administration
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS p 51 N84-17436 Anttenna pattern calculations [InASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [INASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985-[H-REPT-98-629] p 80 N84-21441
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APEROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration fr fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21443
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APEROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25255
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 60 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 [H-REPT-98-629] p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES A review of SCATHA satellite results: Charging and
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25255 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APEROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 60 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25255 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 ARCHITECTURE Architectural options and development issues p 4 A84-24633 Space station needs, attributes and architectural options
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 60 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 ARCHITECTURE Architectural options and development issues p 4 A84-24633 Space station needs, attributes and architectural options study. Volume 3: Requirements
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25255 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 ARCHITECTURE Architectural options and development issues p 4 A84-24633 Space station needs, attributes and architectural options study. Volume 3: Requirements [NASA-CR-173332] p 10 N84-18267
disturbed aperture coverage p 48 A84-26516 Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 ANTENNAS The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173 APERTURES The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 APPROPRIATIONS Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 60 N84-21441 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21444 APPROXIMATION Approximations method for space frame synthesis p 19 A84-10141 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Parameter identification in continuum models p 16 A84-25525 ARC DISCHARGES A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 ARCHITECTURE Architectural options and development issues p 4 A84-24633 Space station needs, attributes and architectural options study. Volume 3: Requirements

technology and programmatics [NASA-CR-173331] p 10 N84-18268 Space station needs attributes and architectural options

study. Final executive review [NASA-CR-173335] p 10 N84-18269

Space station needs, attributes and architectural options study. Final review executive summary briefing [NASA-CR-173674] p 10 N84-18272 Space station needs, attributes and architectural

options. Volume 1: Executive summary NASA [NASA-CR-172792] p 12 N84-18292

- Space station data management A system evolving from changing requirements and a dynamic technology base [AIAA PAPER 83-2338] p 43 A84-10016
- Space station autonomy requirements [AIAA PAPER 83-2352] p 63 A84-10024 Data system architecture considerations for a space station
- [AIAA PAPER 83-2346]
 p 63
 A84-10066

 Attitude, control and stabilization
 p 40
 N84-18281

 Data management
 p 12
 N84-18287
- ARRAYS Potential of minicomputer-array processor system for
- nonlinear finite-element analysis p 46 A84-20583 ARTIFICIAL INTELLIGENCE A system for intelligent teleoperation research
- [AIAA PAPER 83-2376] p 57 A84-10070 Knowledge based systems for intelligent robotics p 57 A84-15667
- Automation, Robotics, and Machine Intelligence Systems (ARAMIS) in space manufacturing p 58 A84-22337
- Study of artificial intelligence techniques Realization of a highly autonomous experimental robot system ----French thesis p 58 A84-25828 ARTIFICIAL SATELLITES
- Servicing vehicle for satellites and platforms in low earth orbits
- [DGLR PAPER 83-102] p 6 A84-29666 ASCENT PROPULSION SYSTEMS
- A parametric study of space transfer-propulsion stages ____
- [IAF PAPER 83-401] p 61 A84-13397 Vertical ascent from earth to geosynchronous orbit [AIAA PAPER 84-0509] p 61 A84-18111 ASSEMBLING
- Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies [NASA-CR-175437] p 60 N84-20857 ASTEROIDS
- The Tiros-based asteroid mission p 2 A84-14762 ASTRODYNAMICS
- A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 Analytical model of the evolution of orbit parameters of a quasi geostationary satellite
- [IAF PAPER 83-316] p 65 A84-11787 Dynamics and control of a deformable gyrostat, utilizing continuum vehicle modes p 31 A84-12488
- On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854
- Attitude stability for the yaw-wheel class of orbiting gyrostats p 33 A84-19675 Transient dynamics during the orbiter based deployment of flexible members
- [AIAA PAPER 84-0061] p 34 A84-21285 A simulator to study dynamic interaction of the Space Shuttle on-orbit flight control system with deployed flexible payloads p 35 A84-26717
- ASTRONAUT MANEUVERING EQUIPMENT Construction concept for erecting an offset-fed antenna
- [NASA-TM-85774] p 60 N84-20626 ASTRONAUT PERFORMANCE
- A definition of STS accommodations for attached payloads [NASA-CR-172223] p 17 N84-10114
- [NASA-CR-172223] ASTRONAUT TRAINING
- Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763 ASTRONAUTS
- The role of man in space p 72 A84-24627 ASTRONOMICAL TELESCOPES
- Coherent arrays of separate optical telescopes in space project Trio p 3 A84-15363 ATMOSPHERIC CHEMISTRY
- The role of space station in earth sciences p 72 A84-24631 Significant scientific and technical results at Marshal
- Space Flight Center [NASA-TM-82562] p 78 N84-16075
- ATMOSPHERIC PHYSICS The role of space station in earth sciences
- p 72 A84-24631 Significant scientific and technical results at Marshal Space Flight Center [NASA-TM-82562] p 78 N84-16075
- [NASA-TM-82562] p 78 N84-16075 ATOMIC COLLISIONS
- Reactions of high velocity atomic oxygen with carbon [AIAA PAPER 84-0549] p 53 A84-18159 ATTITUDE CONTROL
- Science platform and attitude subsystem in-flight calibration for the Galileo spacecraft p 32 A84-17355

On the number and placement of actuators for independent modal space control --- for large flexible spacecraft p 34 Å84-24990 The attitude and orbit control system for Eureca [DGLR PAPER 83-091] p 76 A84-29658 Control of flexible spacecraft by optimal model illowing p 36 N84-12222 following Integrated Flywheel Technology, 1983 p 78 N84-12228 [NASA-CP-2290] Space station control requirements and flywheel system weights for combined momentum and energy storage p 37 N84-12236 IPACS attitude control technology considerations p 37 N84-12238 Advanced Control and Power System (ACAPS) p 37 N84-12243 technology program guidance navigation and control system IPACS considerations and test activities p 37 N84-12245 Exhibit D modular design attitude control system study [NASA-CR-170993] p 42 N84-20625 ATTITUDE GYROS Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 AUTOMATIC CONTROL Deployable beam flight experiment (MAST) p 8 N84-17218 AUTOMATIC FLIGHT CONTROL The attitude and orbit control system for Eureca [DGLR PAPER 83-091] p 76 A84-29658 AUTOMATION Robotics, and Machine Intelligence Automation. Systems (ARAMIS) in space manufacturing p 58 A84-22337 AUTONOMY Space station autonomy requirements [AIAA PAPER 83-2352] p 63 A84-10024 AUXILIARY POWER SOURCES Orbiting wire as a dynamo: Auxiliary power possibilities for space platforms [IFSI-83-3] p 49 N84-12653 **AUXILIARY PROPULSION** Study of auxiliary propulsion requirements for large space systems, volume 2 [NASA-CR-168193-VOL-2] p 63 N84-13218 AVIONICS NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record p 44 A84-15623 A definition of STS accommodations for attached pavloads [NASA-CR-172223] p 17 N84-10114 В BALL BEARINGS Thermal conductance and torque of thin section four-point contact ball bearings in vacuum [ESA-ESTL-54] p 25 N84-15562 BANDWIDTH IPACS attitude control technology considerations p 37 N84-12238 BARRIER LAYERS The role of potential barrier formation in spacecraft p 50 N84-17269 charging BEAM LEADS Deployable beam flight experiment (MAST) p 8 N84-17218 p 60 N84-17219 Erectable beam experiment BEAMS (RADIATION) Application of beam power technology to a space ation p 45 A84-15642 station BEAMS (SUPPORTS) Control structure interactions in large space structures Analysis using energy approach --- for constant and pulsed p 35 A84-27934 thrusters The development of a composite beam building machine for on-site construction of large space structures p 20 A84-29862 [AAS PAPER 83-217] p 60 N84-17219 Erectable beam experiment The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Component mode synthesis and large deflection vibrations of complex structures -- beams and trusses [NASA-CR-173338] p 21 N84-18680 p 21 N84-18680 BEHAVIOR The flexural behavior of PACSAT (passive communication satellite) in orbit p 36 N84-11195 [AD-A131406] BENDING The flexural behavior PACSAT (passive of communication satellite) in orbit [AD-A131406] p 36 N84-11195

BINARY CODES

Sodium heat transfer system modeling

p 25 N84-16509 [DE84-002051] BINARY SYSTEMS (MATERIALS)

Recent and planned developments at the Goddard Space Flight Center in thermal control technology p 26 N84-19402

BIOASTRONAUTICS

Man in space - An overview p 67 A84-15161 Integrated water management system - Description and est results - for Space Station waste water processing [SAE PAPER 831111] p 6 A84-29046

Gravitational biology on the space station [SAE PAPER 831133] p 75 p 75 A84-29063

BIOCHEMISTRY

The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station p 14 N84-20610 [NASA-CR-175436]

BIOLOGICAL EFFECTS

Gravitational biology on the space station [SAE PAPER 831133] p 75 p 75 A84-29063 BODY KINEMATICS

Manipulator interactive design with interconnected flexible elements p 58 A84-25484

BOOMS (EQUIPMENT)

Large space instrumentation to measure the interaction between space structures and the environment p 77 N84-10179 [AD-A129990]

BOUNDARY LAYERS

Research on boundary feedback and control theories, 1978 - 1983

[AD-A136531] p 41 N84-18987 BROADCASTING

The Franco-German DBS program 'TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 A84-25260 BUCKLING

Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure p 23 A84-14050 Stability, vibration and passive damping of partially restrained imperfect columns

[NASA-TM-85697] p 37 N84-13608 BUS CONDUCTORS

Evaluation of bus impedance on the SPOT multimission platform p 44 A84-13521 BYPASSES

Evaluation of bus impedance on the SPOT multimission platform p 44 A84-13521

С

CALIBRATING

Science platform and attitude subsystem in-flight calibration for the Galileo spacecraft p 32 A84-17355 CANADIAN SPACE PROGRAMS

Space station - A Canadian perspective

[IAF PAPER 83-55] p 65 A84-11728 MSAT mobile communication demonstration satellite system and bus tradeoff considerations

[AIAA PAPER 84-0751] p 48 A84-25306 CARBON

Reactions of high velocity atomic oxygen with carbon [AIAA PAPER 84-0549] p 53 A84-18159 CARBON DIOXIDE CONCENTRATION

Electrochemical and steam-desorbed amine CO2 concentration Subsystem comparison --- for oxygen recovery on Space Station [SAE PAPER 831120]

p 6 A84-29054 CARBON DIOXIDE LASERS

Application of laser interferometry to robotics p 58 A84-28541

CARBON FIBER REINFORCED PLASTICS Thermo-mechanical behaviour of CFRP tubes for space structures

p 22 A84-11814 [IAF PAPER 83-417]

- Materials and construction techniques for large pacecraft structures p 53 A84-17768 spacecraft structures Integrity control of carbon fiber reinforced plastics structural elements, phase 1 report ---SDACE
- applications p 56 N84-18416 [TB-TS-11-01/82-A] Review report of the third year's activities on the study
- survey of advanced materials for spacecraft and launch vehicles (R878) p 56 N84-21675

CARBON FIBERS New fabric structures of carbon fiber

	p 52	A84-17108
Composite structural materials		
[NASA-CR-173259]	p 56	N84-17293

CASSEGRAIN OPTICS

Study of multi-kilowatt solar arrays for Earth orbit applications

[NASA-CR-170939] p 49 N84-12634 CELESTIAL MECHANICS

Introduction to geostationary orbits [ESA-SP-1053] p 80 N84-21590 CENTER OF MASS

Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic rods p 35 A84-26977 CENTRAL ELECTRONIC MANAGEMENT SYSTEM

p 73 A84-24636 Space station communications CERAMICS

Fracture mechanics of ceramics. Volume 5 - Surface flaws, statistics, and microcracking p 54 A84-24501 Assessment of reliability of ceramic materials

p 54 A84-24508 CHARGED PARTICLES

Spacecraft/plasma interactions and their influence on field and particle measurements --- conferences

p 56 N84-17253 [ESA-SP-198] CIRCULAR ORBITS

Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728

Optimal low-thrust transfers to synchronous orbit

p 62 A84-24981 Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic p 35 A84-26977 rods

CLIMATOLOGY The role of space station in earth sciences

p 72 A84-24631 CLOSED ECOLOGICAL SYSTEMS

Systems engineering aspects of a preliminary conceptual design of the space station environmental control and life support system

[SAE PAPER 831109] p 5 A84-29044 Electrochemical and steam-desorbed amine CO2 concentration Subsystem comparison --- for oxygen recovery on Space Station

p 6 A84-29054 [SAE PAPER 831120] Phase change water recovery techniques - Vapor compression distillation and thermoelectric/membrane concepts --- from waste water as part of Space Station life support system

[SAE PAPER 831122] p 6 A84-29056 The complementary roles of existing and advanced environmental, thermal control and life support technology p 79 N84-19429 for space stations CMOS

Digital technologies and systems for geostationary orbit satellites

[AIAA PAPER 84-0749] p 74 A84-25304 COATINGS

Simulated space radiation effects on dielectrics and coatinos p 54 A84-20682 CODING

Implementation of MACLISP on a large address space computer

[DE84-005042] p 79 N84-21145 COLUMNS (SUPPORTS)

Vibration characteristics of self-expanding stayed p 34 A84-21237 columns for use in space Stability, vibration and passive damping of partially

restrained imperfect columns [NASA-TM-85697] p 37 N84-13608

COMBINED STRESS Instability analysis of space trusses

p 32 , A84-16885 COMMERCIAL SPACECRAFT

Leasecraft - An innovative space vehicle p 5 A84-27945

Reusable commercial space processing platforms AAS PAPER 83-208] p 7 A84-29858 [AAS PAPER 83-208]

Space Station needs, attributes and architectural options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites [NASA-CR-173314] p 13 N84-18298

COMMONALITY

Space Station needs, attributes and architectural options. Volume 2, book 2, part 1: Mission implementation concepts (NASA-CR-1733161 p 13 N84-18300

COMMUNICATION EQUIPMENT

A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 COMMUNICATION NETWORKS

Space station communications and tracking equipment management/control system p 45 A84-15639 p 73 A84-24636 Space station communications Telecommunication systems for large-scale space

manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 COMMUNICATION SATELLITES

Application of a common reflector configuration to a multimission satellite of the 90's

COMPOSITE MATERIALS

p 1 A84-11731 [IAF PAPER 83-60] Commercial communications satellite market and

technology in the 90's [IAF PAPER 83-86] p 65 A84-11739

NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record p 44 A84-15623

- An advanced generation land mobile satellite system and its critical technologies Advanced composite p 3 A84-15634 reflectors for
- antenna communications satellites p 53 A84-17151 Improved orbit utilization using auxiliary feeds in existing
- earth terminals p 46 A84-20647

Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers p 73 A84-25251

Reduced domestic satellite orbit spacing IAA PAPER 84-0652] p 73 A84-25253 [AIAA PAPER 84-0652]

Time phased introduction of advanced technologies -Its impact on orbit/spectrum conservation

p 74 A84-25254 [AIAA PAPER 84-0653] A deployable 30/20 GHz multibeam offset antenna

p 20 A84-25258 [AIAA PAPER 84-0658] Unfurlable offset antenna design for multipurpose applications

p 16 A84-25259 [AIAA PAPER 84-0659] GEO space platform economics - Impact of concept, size, launch mode and lifetime

p 74 A84-25281 [AIAA PAPER 84-0704] Tele-X - The first step in a satellite communications

system for the Nordic countries p 4 A84-25287 module for future [AIAA PAPER 84-0713]

A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class p 62 A84-25292 [AIAA PAPER 84-0727] Utilization of electric propulsion for communication

satellites p 62 A84-25293 [AIAA PAPER 84-0729]

Why don't we use ion propulsion? [AIAA PAPER 84-0730] p 62 A84-25294

The space van and its potential impact on the design of communications satellites

[AIAA 84-0758] p 74 A84-25309 Computer tools for optimizing orbit use

p 74 A84-25318 [AIAA PAPER 84-0651] NASA's geostationary communications platform program

[AIAA PAPER 84-0702] p 5 A84-25326 Development trends in Europe on satellite clusters and geostationary platforms [AIAA PAPER 84-0703]

The flexural behavior of PACSAT (passive

Space Station needs, attributes and architectural

VASA-CR-173314] p 13 N84-18298 Design and development of an advanced solar array

BAe reaction wheels for Olympus — Olympus elecommunication satellite p 17 N84-18475

Assessment of satellite power flux-density limits in the

Heat pipes for the L-SAT communications module

A Variable Conductance Heat Pipe (VCHP) radiator

The thermal design of L-SAT large telecommunication

Algorithms and computational aspects pertaining to

Implementation of MACLISP on a large address space

Multivariable direct adaptive control for a general class f time-varying commands p 33 A84-19118

Reliability issues in active control of large flexible space

Tests and prediction of composite material viscoelastic

Effect of temperature, moisture and radiation exposures

on composite mechanical properties p 55 A84-28900

block diagonal dominance methods for design of

system for communications payloads p 27 N84-19406

options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites

communication satellite) in orbit

telecommunication satellite

2025-2300 MHz frequency range, part 1

decentralized feedback compensation

[AD-A131406]

[NASA-CR-173314]

drive mechanism

[P884-129402]

radiators

satellite

COMPILERS

structures

COMPENSATORS

computer [DE84-005042]

COMPLEX SYSTEMS

[NASA-CR-175341]

COMPOSITE MATERIALS

[IAF PAPER 83-418]

behaviour for large space structure

of time-varying commands COMPONENT RELIABILITY

p 75 A84-25327

p 36 N84-11195

p 17 N84-18457

p 51 N84-18532

p 26 N84-19405

p 27 N84-19414

p 15 A84-19108

p 79 N84-21145

p 39 N84-16248

p 30 A84-11815

A-3

COMPOSITE STRUCTURES

Composite structural materials p 56 N84-17293 [NASA-CR-173259] COMPOSITE STRUCTURES Thermal control of tubular composite structures in space p 22 A84-10440 environment

reflectors for composite Advanced antenna p 53 A84-17151 communications satellites The development of a composite beam building machine for on-site construction of large space structures p 20 A84-29862 [AAS PAPER 83-217]

COMPUTATION Mathematical synthesization of complex structures

p 19 N84-22224 COMPUTATIONAL FLUID DYNAMICS

Modular design attitude control system [NASA-CR-170996] p

p 41 N84-19392 COMPUTER AIDED DESIGN

Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an p 23 A84-14050 arbitrary supporting structure Spacecraft thermal design using interactive graphics [AIAA PAPER 84-0143] p 23 A84-17910 Algorithms and computational aspects pertaining to block diagonal dominance methods for design of decentralized feedback compensation

p 15 A84-19108 Matrix(X) - Application to large space structure control design problems p 16 A84-19129 Potential of minicomputer-array processor system for p 46 A84-20583 nonlinear finite-element analysis

Computer tools for optimizing orbit use p 74 A84-25318 [AIAA PAPER 84-0651]

Manipulator interactive design with interconnected flexible elements p 58 A84-25484 Thermal analysis research applicable to space station

technology needs [NASA-TM-84658] p 25 N84-15426

Computer aided synthesis of a satellite antenna structure with probabilistic constraints p 21 N84-19899 p 21 N84-19899 Computer-Aided Geometry Modeling

[NASA-CP-2272] p 18 N84-22179 Mathematical synthesization of complex structures p 19 N84-22224

space Geometric modeling of large antenna p 22 N84-22225 deployment

COMPUTER AIDED MANUFACTURING Study of artificial intelligence techniques - Realization of a highly autonomous experimental robot system ---French thesis p 58 A84-25828

COMPUTER GRAPHICS

Spacecraft thermal design using interactive graphics [AIAA PAPER 84-0143] p 23 A84-17910 Computer-Aided Geometry Modeling

[NASA-CP-2272] D 18 N84-22179 Mathematical synthesization of complex structures p 19 N84-22224

Geometric modeling of large space antenna p 22 N84-22225 deployment COMPUTER PROGRAMS

A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887

Highly efficient, very low-thrust transfer to geosynchronous orbit - Exact and approximate solutions p 61 A84-24980

On modeling dilution jet flowfields [AIAA PAPER 84-1379] p 58 A84-44183 A definition of STS accommodations for attached navioads.

[NASA-CR-172223] p 17 N84-10114 Control of flexible spacecraft by optimal model p 36 N84-12222 following Software quality assurance Spacelab experience and future trends p 17 N84-14759 Stability enhancement of a flexible robot manipulator [AD-A134185] p 59 N84-16807 Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering Analysis Language (EAL) system [NASA-TM-85743] p 42 N84-20880 Interactive geometry modeling of space station

p 18 N84-22191 conceptual designs COMPUTER SYSTEMS DESIGN Space station autonomy requirements

p 63 A84-10024 [AIAA PAPER 83-2352] COMPUTER SYSTEMS PROGRAMS

Software quality assurance Spacelab experience and future trends p 17 N84-14759 IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber

p 26 N84-19400 Computing the radiation pressure forces by adapting thermal design verification softwares -- large space p 28 N84-21613 structures

Simplified models and computational schemes of the aerodynamic load -- large space structures p 28 N84-21614

COMPUTER TECHNIQUES Data system architecture considerations for a space

- station [AIAA PAPER 83-2346] p 63 A84-10066
- Optimal low-thrust transfers to synchronous orbit p 62 A84-24981 Sodium heat transfer system modeling
- [DE84-002051] p 25 N84-16509 Space Station needs, attributes and architectural options: Summary briefing

[NASA-CR-173328] p 10 N84-18271 COMPUTERIZED SIMULATION

- Some aspects of simulation studies in spacecraft p 15 A84-11930 dynamics Dielectric charging in space - Ground test data and model verification D 47 A84-20709
- ACOSS eleven (Active Control Of Space Structures), volume 2 [AD-A135676] p 41 N84-18312
- CONDUCTIVE HEAT TRANSFER
- Radiation-conduction interaction in large space structures [AIAA PAPER 84-0144] p 23 A84-17911
- A Variable Conductance Heat Pipe (VCHP) radiate system for communications payloads p 27 N84-19406 CONFERENCES
- Space applications at the crossroads; Proceedings of the Twenty-first Goddard Memorial Symposium, Greenbelt, MD, March 24, 25, 1983 p 64 A84-10883 Management of large space projects; Course on Space
- Technology, Toulouse, France, May 3-14, 1982, Proceedings p 2 A84-15301 Proceedings
- Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381
- NTC '82; National Telesystems Conference, Galveston,

TX, November 7-10, 1982, Conference Record p 44 A84-15623

Colloquium on the Law of Outer Space, 25th, Paris, France, September 27-October 2, 1982, Proceedings p 67 A84-17026

- Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 p 71 A84-22327
- Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, p 72 A84-24626 1983
- Communication Satellite Systems Conference, 10th, Orlando, FL, March 19-22, 1984, Technical Papers p 73 A84-25251
- U.S. National Congress of Applied Mechanics, 9th, Cornell University, Ithaca, NY, June 21-25, 1982, Proceedings p 75 A84-29126 Space manufacturing 1983; Proceedings of the Sixth
- Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Integrated Flywheel Technology, 1983
- p 78 N84-12228 [NASA-CP-22901 STEP Experiment Requirements
- p 7 N84-17211 [NASA-CP-2294] Spacecraft/plasma interactions and their influence on field and particle measurements --- conferences
- p 56 N84-17253 [ESA-SP-198] Environmental and thermal control systems for space ehicles -- conferences p 26 N84-19396 [ESA-SP-200]
- Sheath ionization model of beam emissions from large spacecrafts
- (AD-A1371811 p 52 N84-19463 Computer-Aided Geometry Modeling p 18 N84-22179
- [NASA-CP-2272] CONGRESSIONAL REPORTS
- NASA's space station activities
- [GPO-27-393] p 7 N84-14234 National Aeronautics and Space Administration Act, 1985 p 9 N84-18116 Civil space station [S-REPT-98-523] p 79 N84-20613 Department of and Urban Housing Development-independent agencies appropriations for 1984: National Aeronautics and Space Administration p 80 N84-21440

Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441

- Review of the National Aeronautics and Space Act of 1958
- [GPO-28-915] p 80 N84-21442 National Aeronautics Administration Space and Authorization Act, 1985 National Aeronautics and p 80 N84-21443 Space Administration Authorization Act, 1985 (H-REPT-98-629) p 80 N84-21444

CONSTRAINTS

- Stability, vibration and passive damping of partially restrained imperfect columns p 37 N84-13608 [NASA-TM-85697]
- p 11 N84-18278 Systems/operations technology CONSTRUCTION Authorizing appropriations to the National Aeronautics
- and Space Administration for fiscal year 1985 p 80 N84-21441 [H-REPT-98-629]
- Operational modules for space station constructio p 21 N84-21608 [NASA-TM-85772] CONTINUUM MECHANICS
- Parameter identification in continuum models p 16 A84-25525
- CONTRACT MANAGEMENT The contract --- management for space projects
- p 2 A84-15304 CONTRACT NEGOTIATION
 - The contract --- management for space projects p 2 A84-15304
 - CONTRACTS
 - The contract --- management for space projects p 2 A84-15304 CONTROL

The effects of the space environment on damping materials and damping designs on flexible structures p 56 N84-17217 Scale model testing for control system parameters of

- large structures [AD-A135652] p 41 N84-18313
- CONTROL CONFIGURED VEHICLES The Toysat structural control experiment --- for large p 31 A84-13320 flexible space structure
- Sampled data control of large space structures using constant gain velocity feedback - A negative view
- p 46 A84-19169 Some applications of direct adaptive control to large p 34 A84-25496 structural systems
- Control structure interactions in large space structures Analysis using energy approach --- for constant and pulsed thrusters p 35 A84-27934
- CONTROL EQUIPMENT Digital control system for space structural dampers
- p 39 N84-16246 [NASA-CR-1753551 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 CONTROL SIMULATION
- Hardware simulation of spacecraft dynamics and p 30 A84-11932 control
- A flexible structure controller design method using mode residualization and output feedback - for Large Flexible p 32 A84-17369 Space System
- CONTROL STABILITY
- Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian)
- regulators [AD-A137760] p 43 N84-21172
- CONTROL SURFACES Research on boundary feedback and control theories, 1978 - 1983

[AD-A136531] p 41 N84-18987

- CONTROL THEORY Dynamics and control of a large space antenna p 32 A84-17361
- Multivariable direct adaptive control for a general class time-varying commands p 33 A84-19118 of time-varving commands
- A large space structure benchmark problem ACOSS p 33 A84-19127 Model No. 2 Number crunching on the ACOSS Model No. 2
- p 33 A84-19128
- Matrix(X) Application to large space structure control p 16 A84-19129 design problems
 - Some applications of direct adaptive control to large
- structural systems p 34 A84-25496 Controllability and observability criteria for multivariable
- p 35 A84-25516 linear second-order models The dynamics and control of large flexible space
- structures, 6 [NASA-CR-174450]
- ASA-CR-174450] p 36 N84-10173 Control of flexible spacecraft by optimal model illowing p 36 N84-12222 following
- IPACS attitude control technology considerations p 37 N84-12238 Study on synthesis and characterization of large space

systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2

A degree of controllability definition - Fundamental

Controllability and observability criteria for multivariable

Environmental effects on the dynamics and control of

concepts and application to modal systems

an orbiting large flexible antenna system [NASA-CR-175448] p

p 29 N84-21616

p 34 A84-24991

p 35 A84-25516

p 42 N84-20627

[ESA-CR(P)-1779-VOL-4]

linear second-order models

CONTROLLABILITY

CONTROLLERS Dynamics and control of a large space antenna p 32 A84-17361 Selection of noisy sensors and actuators for regulation of linear systems --- large space structures [AD-A1354421 p 51 N84-17931 Decentralized control of a large space structure using direct output feedback [AD-A136781] p 41 N84-19464 CONVECTION Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents INASA-TM-775341 p 26 N84-18576 COOLING SYSTEMS Thermofluidynamics of heat pipes p 27 N84-19423 Design and manufacturing of a heat rejection system for advanced thermal control --- spacecraft and or payloa coolina p 27 N84-19434 COORDINATE TRANSFORMATIONS Coordinate transformation assembly --- for space platform angular coordinate linking p 75 A84-28579 COORDINATES Computer-Aided Geometry Modeling [NASA-CP-2272] p 18 N84-22179 COPPER Cracked inner layer foil in high-density multilayer printed p 53 A84-17200 wiring boards COSMIC RAYS Pyroelectric materials as electronic pulse detectors of ultraheavy nuclei p 72 A84-23440 COSMOLOGY Natural selection of stellar civilizations by the limits of arowth [IAF PAPER 83-272] p 65 A84-11779 COSMONAUTS For the first time - Russian book on construction of first Soviet earth satellites p 16 A84-21564 Space vehicles -- Russian book on development of Soviet spacecraft and planning of first manned flights p 4 A84-21573 COST ANALYSIS Determination of critical parameters in large flexible space structures with uncertain modal data p 33 A84-20047 Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems p 71 A84-21488 Space Station needs, attributes and architectural options, volume 2, book 3: Cost and programmatics [NASA-CR-173320] p 14 N84-16 n 14 N84-18304 COST EFFECTIVENESS Advanced Control and Power System (ACAPS) p 37 N84-12243 technology program Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COST ESTIMATES Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 COST REDUCTION New component development for multi-100 kW low-co solar array applications p 47 A84-22963 Large area, low cost space solar cells p 47 A84-22979 The space van and its potential impact on the design of communications satellites p 74 A84-25309 [AIAA 84-0758] p 11 N84-18278 Systems/operations technology p 11 N84-18283 Auxiliary propulsion COUPLING Radiating dipole model of interference induced in pacecraft circuitry by surface discharges p 50 N84-16247 [NASA-TP-2240] CRACK PROPAGATION Fracture mechanics of ceramics. Volume 5 - Surface flaws, statistics, and microcracking p 54 A84-24501 Assessment of reliability of ceramic materials p 54 A84-24508 CRACKING (FRACTURING) Cracked inner layer foil in high-density multilayer printed p 53 A84-17200 wiring boards CREW WORK STATIONS Environmental control and life support (ECLS) design p 73 A84-24637 optimization approach CRITICAL LOADING Optimization of shallow trusses against limit point instability p 20 A84-23366 CRYOGENIC COOLING NASA needs and trends in cryogenic cooling

p 25 N84-15329

D		
DATA ACQUISITION		
Study of a tracking and data acquisit 1990's. Volume 3: TDAS Commu Model	ion sys nicatio	tem for the
	p 79	N84-19371
Space station data management - / from changing requirements and a dy base		
(AIAA PAPER 83-2338) DATA LINKS	p 43	A84-10016
Communications Space Station needs, attributes options. Volume 2, book 2, part 3:	and a	N84-18285 rchitectural munication
system [NASA-CR-173318]	p 14	N84-18302
DATA PROCESSING Spacelab Data Processing Facility		
(NASA-TM-85556) DATA REDUCTION	p 51	N84-19382
Computational savings in view factor e prescreening large space structures		on on mode
		N84-21618
DATA SAMPLING Sampled data control of large space		
constant gain velocity feedback - A ne		view A84-19169
DATA SYSTEMS Data system architecture considera	tions f	or a space
station		
[AIAA PAPER 83-2346] Space Station needs, attributes a		A84-10066 chitectural
options. Volume 2, book 2, part 2, Ta management system	isk 2:	Information
[NASA-CR-173317] Spacelab Data Processing Facility	p 13	N84-18301
[NASA-TM-85556]	p 51	N84-19382
DATA TRANSMISSION Experiment data communications (44	B Mbit/	's) between
Spacelab, the Space Shuttle and the g	round p 44	A84-10396
A communications system conceptu		
earth orbiting Manned Space Station Spacelab Data Processing Facility	p 45	A84-15643
[NASA-TM-85556] DEGRADATION	p 51	N84-19382
Evaluation of spacecraft materials a		
optical degradation potential DEPLOYMENT	p 54	A84-28458
Transient dynamics during the orbiter of flexible members	based	deployment
[AIAA PAPER 84-0061]	p 34	A84-21285
structure	p 38	ble space N84-16056
Synchronously deployable truss struct [NASA-CASE-LAR-13117-1]	p 59	N84-16250
The STEP/STACBEAM experin		technology
development for very large solar array	deploy	ers
Low concentration ratio solar	p 8 array	N84-17220 structural
configuration	p 17	N84-17225
Development of Test Article Building deployable platform systems	p Block	(TABB) for N84-17226
Space telescope: Solar array prin	nary d	evelopment
mechanism	p 51	N84-18458
Geometric modeling of large deployment	space p 22	antenna N84-22225
DESIGN ANALYSIS ACOSS Fourteen (Active Control of		
		N84-15181

[AD-A133411] p 38 N84-15181 Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1 [ESA-CR(P)-1779-VOL-3] p 43 N84-21611

Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical tesign p 18 N84-21624 [ESA-CR(P)-1779-VOL-1]

Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal desian [ESA-CR(P)-1779-VOL-2] p 18 N84-21625

Mathematical synthesization of complex structures p 19 N84-22224 DEVELOPING NATIONS

The solar power satellite - development aid A programme for p 68 A84-17074 DIELECTRICS

Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings Dielectric charging in space - Ground test data and model verification p 47 A84-20709 DIGITAL SYSTEMS Digital technologies and systems for geostationary orbit atellites [AIAA PAPER 84-0749] o 74 A84-25304 Digital control system for space structural dampers [NASA-CR-175355] p 39 N84-16246 DILUTION On modeling dilution jet flowfields [AIAA PAPER 84-1379] p 58 A84-44183 DISPLACEMENT New elements for analysis of space frames with tapered p 20 N84-14561 members DISTILLATION EQUIPMENT Phase change water recovery techniques - Vapor compression distillation and thermoelectric/membrane concepts --- from waste water as part of Space Station life support system (SAE PAPER 831122) p 6 A84-29056 DISTRIBUTED PARAMETER SYSTEMS Aggregate models for distributed parameter systems with applications to flexible air and spacecraft p 31 A84-11945 Model error estimation for distributed systems described by elliptic equations p 15 A84-11946 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian) regulators [AD-A137760] p 43 N84-21172 DISTRIBUTED PROCESSING p 40 N84-18281 Attitude, control and stabilization Data managèment p-12 N84-18287 DOCUMENTATION A voice interactive system for aiding and documentation of space-based tasks [AIAA PAPER 83-2355] o 43 A84-10025 DOMESTIC SATELLITE COMMUNICATIONS SYSTEMS Reduced domestic satellite orbit spacing p 73 A84-25253 [AIAA PAPER 84-0652] MSAT mobile communication demonstration satellite system and bus tradeoff considerations [AIAA PAPER 84-0751] p 48 A84-25306 DOWNLINKING Experiment data communications (48 Mbit/s) between Spacelab, the Space Shuttle and the ground 0 44 A84-10396 DRUGS pharmaceutical Role of a space station in p 73 A84-24632 manufacturing DUCTED FLOW On modeling dilution jet flowfields [AIAA PAPER 84-1379] p 58 A84-44183 DURABILITY Assessment of potential for batteries in space pplications p 48 N84-12246 applications DUST Feasibility study to conduct windblown sediment experiments aboard a space station [NASA-CR-175434] p 15 N84-21586 DYNAMIC CHARACTERISTICS Dynamics of nonrigid articulated robot linkages p 58 A84-25531 DYNAMIC CONTROL Geodetic control of the reflectors of large antennas p 31 A84-15785 Closed-form solutions for feedback control with terminal constraints p 36 A84-29471 ar array controls p 39 N84-17227 A deployable structure and solar experiment for STEP DYNAMIC LOADS Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering Analysis Language (EAL) system [NASA-TM-85743] p 42 N84-20880 DYNAMIC RESPONSE Finite element analysis of a deployable space p 38 N84-16056 structure Self-shadowing of orbiting trusses [NASA-CR-173215] p 25 N84-16565 Photovoltaic concentrator pointing dynamics and plasma interaction study p 50 N84-17224 Validation methods for mathematical models of flexible atellite dynamics p 40 N84-17241 [ESA-CR(P)-1794] p 40 N84-17241 Dynamic behaviour of a satellite antenna structure in random vibration environment p 42 N84-19900 Evaluation of modal testing techniques for spacecraft p 28 N84-19906 structures DYNAMIC STABILITY

ACOSS eleven (Active Control Of Space Structures), votume 1 [AD-A135675]

DYNAMIC STABILITY

DYNAMIC STRUCTURAL ANALYSIS

DYNAMIC STRUCTURAL ANALYSIS

Dynamics and control of a large space antenna p 32 A84-17361 The beam-like behavior of space truss p 19 A84-21517 A variational theorem for the viscoelastodynamic

analysis of high-speed linkage machinery fabricated from composite materials (ASME PAPER 83-DET-6) p 55 A84-29101

- Multibody dynamics Analysis of flexibility effects [AD-A132533] p 36 A84-29145 Study on damping representation related to spacecraft
- structural design [EMSB-18/83] p 38 N84-15182
- Finite element analysis of a deployable space tructure p 38 N84-16056 structure
- STEP/STACBEAM experiment technology The development for very large solar array deployers
- p 8 N84-17220 General requirements for Shuttle flight experiments p 8 N84-17221
- Validation methods for mathematical models of flexible atellite dynamics
- p 40 N84-17241 [ESA-CR(P)-1794] Scale model testing for control system parameters of large structures
- AD-A135652] p 41 N84-18313 Analysis of large space structures p 18 N84-20621 {AD-A135652} Environmental effects on the dynamics and control of
- an orbiting large flexible antenna system [NASA-CR-175448] p p 42 N84-20627
- Derivation and combination of impedance matrices for flexible satellites [ESA-STR-209] p 43 N84-21604
- The solution of the dynamic problem of the periodic structures by cyclosymmetric technique --- large space structures p 43 N84-21612
- Simplified models and computational schemes of the aerodynamic load --- large space structures p 28 N84-21614
- Finite element formulations for tensioned members large space structures p 21 N84-21615 Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural
- p 29 N84-21621 analysis

Ε

- EARTH OBSERVATIONS (FROM SPACE)
- Space applications at the crossroads: Proceedings of the Twenty-first Goddard Memorial Symposium, Greenbelt, MD, March 24, 25, 1983 p 64 A84-10883 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420
- Technology needs of advanced Earth observation spacecraft [NASA-CR-3698] o 9 N84-17248
- EARTH ORBITS Reactions of high velocity atomic oxygen with carbon
- p 53 A84-18159 [AIAA PAPER 84-0549] EARTH TERMINALS Improved orbit utilization using auxiliary feeds in existing
- earth terminals p 46 A84-20647 ECCENTRIC OBBITS Semiautonomous stationkeeping of geosynchronous
- p 32 A84-17359 ECONOMIC ANALYSIS Commercial communications satellite market and
- technology in the 90's [IAF PAPER 83-86] n 65 A84-11739
- Space stations A key to socio-economic benefits from p 69 A84-19850 space? GEO space platform economics - Impact of concept, size, launch mode and lifetime [AIAA PAPER 84-0704] ECONOMIC DEVELOPMENT p 74 A84-25281
- The solar power satellite -A programme for development aid p 68 A84-17074 ECONOMIC FACTORS
- Financing a solar power satellite project p 70 A84-21482
- ECONOMIC IMPACT
- The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309
- EIGENVALUES
- Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian) regulators [AD-A137760]
- p 43 N84-21172 ELASTIC BARS
- Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic p 35 A84-26977 rods
- A-6

- Geometrically nonlinear analysis of beam-in-space structu (MITT-28) p 22 N84-21914
- ELASTIC BENDING The beam-like behavior of space trusses
- p 19 A84-21517 ELASTIC PROPERTIES
- Parameter identification in continuum models p 16 A84-25525
- ELASTIC SHELLS Numerical solution of several classes of nonlinear flexible shell theory problems p 35 A84-25586
- ELASTODYNAMICS
- A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials (ASME PAPER 83-DET-6) p 55 A84-29101
- ELECTRIC CONDUCTORS
- Electrically conductive black optical paint p 55 A84-28553
- ELECTRIC DIPOLES Radiating dipole model of interference induced in spacecraft circuitry by surface discharges
- [NASA-TP-2240] p 50 N84-16247 ELECTRIC FIELDS
- Radiating dipole model of interference induced in spacecraft circuitry by surface discharges [NASA-TP-2240] p 50 N84-16247
- Spacecraft/plasma interactions and their influence on field and particle measurements --- conferences [ESA-SP-198] o 56 N84-17253
- **ELECTRIC POTENTIAL** Current collection from the space plasma through defects in high voltage solar array insulation
- p 49 N84-15970 ELECTRIC POWER TRANSMISSION
- Application of beam power technology to a space p 45 A84-15642 Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing p 71 A84-21488
- power generation systems ELECTRIC PROPULSION An electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beamed D 61 A84-21485 microwave power
- Utilization of electric propulsion for communication eatallitas
- [AIAA PAPER 84-0729] p 62 A84-25293 ELECTRIC PULSES
- Pyroelectric materials as electronic pulse detectors of ultraheavy nuclei p 72 A84-23440 ELECTRIC WIRE
- Orbiting wire as a dynamo: Auxiliary power possibilities for space platforms
- [IFSI-83-3] p 49 · N84-12653 ELECTRICAL IMPEDANCE
- Evaluation of bus impedance on the SPOT multimission p 44 A84-13521 platform ELECTRO-OPTICS
- Coordinate transformation assembly --- for space platform angular coordinate linking p 75 A84-28579 ELECTROCHEMICAL CELLS
- Electrochemical and steam-desorbed amine CO2 concentration Subsystem comparison - for oxygen recovery on Space Station [SAE PAPER 831120]
- p 6 A84-29054 ELECTROCHEMISTRY
- Assessment of potential for batteries in space applications p 48 N84-12246 ELECTRODYNAMICS
- Investigation of electrodynamic stabilization and control of long orbiting tethers
- [NASA-CR-170972] p 40 N84-17251 Tethers in space: Birth and growth of a new avenue to space utilization
- ELECTROMAGNETIC COMPATIBILITY Assessment of activity Assessment of satellite power flux-density limits in the 2025-2300 MHz frequency range, part 1 p 51 N84-18532
- [PB84-129402]
- **ELECTRON BEAMS** Sheath ionization model of beam emissions from large spacecrafts
- [AD-A137181] p 52 N84-19463 ELECTRON IRRADIATION
- Dielectric charging in space Ground test data and model verification p 47 A84-20709 ELECTRONS
- Interpretation of STS-3/plasma diagnostics package results in terms of large space structure plasma interactions [NASA-CR-173266] p 78 N84-16991
- ELECTROSTATIC SHIELDING
 - Electrically conductive black optical paint p 55 A84-28553

CI	10	ECT	14	n	EV
36	ω,	EUT	//¥	$\boldsymbol{\nu}$	28

50	DULC	
ELECTROSTATICS		
Static shape forming for an electro		
membrane mirror Adaptive microwave reflector	р 16 р 50	A84-25551 N84-17235
ELLIPTIC DIFFERENTIAL EQUATIONS		1104-17233
Model error estimation for distributed	system	
by elliptic equations ELLIPTICAL ORBITS	p 15	A84-11946
	ACSAT	(passive
communication satellite) in orbit		-
[AD-A131406]	p 36	N84-11195
EMBEDDED COMPUTER SYSTEMS A system for intelligent teleoperation	n resea	rch
[AIAA PAPER 83-2376]	p 57	A84-10070
ENERGY CONSUMPTION		faa' aatatiitaa
Market potential and possible limit solar power stations	p 70	A84-21481
ENERGY CONVERSION EFFICIENCY	F · -	
Space station energy sizing	p 48	N84-12233
Power ENERGY REQUIREMENTS	p 12	N84-18288
Power	p 12	N84-18288
ENERGY SOURCES		
Energy from space - Legal implicat the geostationary orbit		A84-17075
ENERGY STORAGE	F	
Space station control requirements a		
weights for combined momentum and	p 37	v storage N84-12236
Advanced Control and Power	Syster	n (ACAPS)
technology program		N84-12243
Assessment of potential for ba applications		in space N84-12246
Integrated Power/Attitude Control		
technology experiment	p 39	NB4-17229
ENERGY TECHNOLOGY High capacity power systems for sp	ace	
[IAF PAPER 83-421]	ρ44	A84-11816
Consequences of transmission of		
outer space Energy from space; Proceedings of		A84-17076
Solar Energy from Space, Vienna, AL		
1982	p 69	A84-21476
Evolution of the solar power satell	ite cor p 70	Cept - The A84-21478
utilization of energy from space A system study of the solar power s		
	ρ70	A84-21480
European questions related to satel		
Space solar power in perspective	р70 р71	A84-21483 A84-21489
	atteries	
applications	p 48	N84-12246
ENVIRONMENT EFFECTS	litoo im	nest on the
Legal aspects of solar power satel environment	p 68	A84-17077
Evaluation and prediction of long-t	•	nvironmental
effects of nonmetallic materials, secon		
[NASA-CR-170915]	p 56	N84-11595
Environmental control and life supp	ort (E	CLS) désian
optimization approach	p 73	
Environmental Control and Life	Supp	ort for an
evolutionary Space Station [SAE PAPER 831108]	n 5	A84-29043
	ofa	preliminary
conceptual design of the space sta		• •
control and life support system	р 5	A84-29044
[SAE PAPER 831109] The thermal design of the Europe		
FSLP First SpaceLab Mission		
[SAE PAPER 831144]	p 24	
Regenerable non-venting thermal co	ntrol si	ubsystem for
extravehicular activity [SAE PAPER 831151]	D 24	A84-29076
ENVIRONMENTAL ENGINEERING	F - 1	
Environmental control and life supp		
	р73	A84-24637
Systems engineering aspects conceptual design of the space sta	u a tioner	vironmental
control and life support system		
[SAE PAPER 831109]	р5	A84-29044
ENVIRONMENTAL LABORATORIES The Large Space Simulator (LSS)	at ES/	VESTEC (a
summary of the main characteristics)		
ENVIRONMENTAL TESTS		
The effect of pressure and		erature on
time-dependent changes in graphite/ below the glass transition	ероху р 54	A84-21775
Effect of temperature, moisture and	radiatio	n exposures
on composite mechanical properties		A84-28900
EQUATIONS OF MOTION	1	in of fourt-1-
Validation methods for mathematica satellite dynamics	u mode	ns of nexable
[ESA-CR(P)-1794]	р 40	N84-17241
-		

SUBJECT INDEX
EROSION
Erosion of mytar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949
ERROR ANALYSIS Model error estimation for distributed systems described
by elliptic equations p 15 A84-11946
Evolution of European telecommunication satellite pointing performance
[AIAA PAPER 84-0725] p 34 A84-25291 ESA SATELLITES
Unfurlable offset antenna design for multipurpose
applications (AIAA PAPER 84-0659) p 16 A84-25259
Development and application of new technologies in the
ESA Olympus Programme [AIAA PAPER 84-0706] p 4 A84-25282
A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class
[AIAA PAPER 84-0727] p 62 A84-25292
Development trends in Europe on satellite clusters and geostationary platforms
(AIAA PAPER 84-0703) p 75 A84-25327
ESA SPACECRAFT European utilisation aspects for a space station
[IAF PAPER 83-54] p 64 A84-11727 ESTIMATING
Spline-based estimation techniques for parameters in
elliptic distributed systems (NASA-TM-85439) p 9 N84-17947
EULER-LAGRANGE EQUATION Recursive lagrangian dynamics of flexible manipulator
arms via transformation matrices
[AD-A137345] p 60 N84-20316 EURECA (ESA)
ESA space station activities
[IAF PAPER 83-30] p 64 A84-11722 Utilisation of the European retrieval carrier EURECA for
life science research p 65 A84-11753
The attitude and orbit control system for Eureca [DGLR PAPER 83-091] p 76 A84-29658
EUROPE
European questions related to satelite power systems p 70 A84-21483
EUROPEAN COMMUNICATIONS SATELLITE
Development and application of new technologies in the ESA Olympus Programme
[AIAA PAPER 84-0706] p 4 A84-25282
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spaceflab's development p 66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the
[AIAA PAPER 84-0706] p.4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p.34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Spacelab's development p.66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the present p.66 A84-14764
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13001 Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13001 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [INASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS
[AIAA PAPER 84-0706] p.4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p.34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Spacelab's development p.66 A84-13901 SpaceStation needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p.14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p.64 A84-11722
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11722 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30]
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13001 Spacelab's development p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-44] p 1 PAPER 83-44] p 4 European utilisation aspects for a space station [IAF PAPER 83-54] p 64
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901 SpaceElight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 Payload placing using an operational support platform [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-11327
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-30] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-13376 [AIAA PAPER 83-2685] p 66 A84-13762
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13001 SpaceElight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 Payload placing using an operational support platform [IAF PAPER 83-54] p 64 A84-11727 The Spacelab terogram [AIAA PAPER 83-2685] p 66 A84-117762 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-117762
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-14764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-30] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AAA PAPER 83-2685] p 64 A84-17762 Coperational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763 The German Spacelab mission D1 p 60 A84-17763 Technology components of solar arrays for space
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-13001 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 Payload placing using an operational support platform [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-11727 The German Spacelab mission D1 p 69 A84-11763 Technology components of solar arrays for space platforms [AIAA PAPER 83-c685] p 66 A84-117763 Technology components of solar arrays for space platforms
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-13901 Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-13901 options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 A84-11724 Payload placing using an operational support platform [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AlAA PAPER 83-54] p 66 A84-13762 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17762 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-22569
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11724 Space Station needs, attributes and architectural obox sward from the present p 66 A84-13803 EUROPEAN SPACE PROGRAMS p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-54] p 64 A84-11727 The Spacelab tet program [AIAA PAPER 83-2685] p 66 A84-11726 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-11762 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-11762 Operational planning, simulation, and performance of the German Spacelab
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11724 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-13001 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-2685] p 64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 64 A84-11727 The German Spacelab mission D1 p 69 A84-17763 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763 IAIAA PAPER 83-2685] p 47
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11722 SpaceElight to 2000 - Interavia looks forward from the present p 66 A84-11724 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-54] p 64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-11726 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763 Technology components of solar arrays for space platforms p 4 A84-22859 Technology components of solar arrays for space platforms p 4 A84-22859
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-11724 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [IAF PAPER 83-30] p 64 A84-11722 Page Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 [IAF PAPER 83-54] p 1 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 [IAF PAPER 83-2685] p 66 A84-11726 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763 Technology components of solar arrays for space platforms p 4 A84-22269 The Franco-German DBS program TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 A84-2225
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11724 Spacelight to 2000 - Interavia looks forward from the present p 66 A84-11724 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11724 Payload placing using an operational support platform [IAF PAPER 83-34] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-2685] p 66 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-11726 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-12763 Technology components of solar arrays for space platforms p 47 A84-22589 The Franco-German DBS program TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 <t< td=""></t<>
[AIAA PAPER 84-0706]p 4A84-25282Evolution of European telecommunication satellite pointing performance[AIAA PAPER 84-0725]p 34A84-25291EUROPEAN SPACE AGENCYESA space station activities[IAF PAPER 83-30]p 64A84-11722Spacelab's developmentp 66A84-11721Spacelab's developmentp 66A84-11722Spacelab's developmentp 66A84-11722Spacelab's developmentp 66A84-11722options, volume 2, book 2, part 4:International reports[NASA-CR-173319]p 14N84-18303ESA space station needs, attributes and architectural options, volume 2, book 2, part 4:International reports[IAF PAPER 83-30]p 64A84-11722Payload placing using an operational support platform[IAF PAPER 83-30]p 64A84-11724Payload placing using an operational support platform[IAF PAPER 83-54]p 66A84-11727The Spacelab test programf A84-11762Operational planning, simulation, and performance of[AIAA PAPER 83-2685]p 66A84-17762Operational planning, simulation, and performance ofthe German Spacelab mission D1p 69A84-22550Tel-X - The first step in a satellite communicationssystem for the Nordic countries[AIAA PAPER 84-0661]PA PAR 84-02661]p 4A84-25287Geodetic aspects of ESA projects, studies andinvestigationsp 78N84-16677The thermal design of L-SAT large telecommunicationsatellitep 27 <t< td=""></t<>
[AIAA PAPER 84-0706] p.4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p.34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Spacelab's development p.66 A84-11724 Spacelight to 2000 - Interavia looks forward from the present p.66 A84-11764 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p.14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p.1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-2685] p.64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p.64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p.64 A84-12763] Operational planning, simulation, and performance of the German Spacelab mission D1 p.69 A84-12707 [AIAA PAPER 84-0661] p.47 A84-225297 The Franco-German DBS pro
[AIAA PAPER 84-0706]p 4A84-25282Evolution of European telecommunication satellite pointing performance[AIAA PAPER 84-0725]p 34A84-25291EUROPEAN SPACE AGENCYESA space station activities[IAF PAPER 83-30]p 64A84-11722Spacelab's developmentp 66A84-11722Spacelight to 2000 - Interavia looks forward from the presentp 66A84-11722Space Station needs, attributes and architectural options, volume 2, book 2, part 4:International reports[IAF PAPER 83-30]p 14N84-18303EUROPEAN SPACE PROGRAMSESA space station activities[IAF PAPER 83-30]p 64A84-11722Payload placing using an operational support platform[IAF PAPER 83-30]p 64A84-11727The Spacelab test program[IAF PAPER 83-54]p 66[AAF PAPER 83-54]p 66A84-17762Operational planning, simulation, and performance of[AIAA PAPER 83-2685]p 66A84-17763Technology components of solar arrays for spaceplatformsp 47A84-25260Tale-X - The first step in a satellite communicationssystem for the Nordic countries[AIAA PAPER 84-0661][AIAA PAPER 84-0713]p 4A84-25287Geodetic aspects of ESA projects, studies andinvestigationsp 78N84-16677The thermal design of L-SAT large telecommunication satelliteSystem[SAE PAPER 831122]p 6A84-25056EXCITATIONDynamic behaviour of a sate
[AIAA PAPER 84-0706] p 4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Spacelab's development p 66 A84-11722 SpaceElight to 2000 - Interavia looks forward from the present p 66 A84-11722 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 European utilisation aspects for a space station [IAF PAPER 83-2685] p 66 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p 66 A84-11726 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-12763 Technology components of solar arrays for space platforms p 4 A84-22269 The Franco-German DBS program TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 <t< td=""></t<>
[AIAA PAPER 84-0706] p.4 A84-25282 Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p.34 A84-25291 EUROPEAN SPACE AGENCY ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Spacelab's development p.66 A84-11724 Spaceflight to 2000 - Interavia looks forward from the present p.66 A84-11724 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p.14 N84-18303 EUROPEAN SPACE PROGRAMS ESA space station activities [IAF PAPER 83-30] p.64 A84-11722 Payload placing using an operational support platform [IAF PAPER 83-34] p.1 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p.64 A84-11727 The Spacelab test program [AIAA PAPER 83-2685] p.64 A84-17763 Coperational planning, simulation, and performance of the German Spacelab mission D1 p.69 A84-17763 [AIAA PAPER 84-0661] p.44 A84-225297 The Franco-German DBS program TV-SAT/TDF-11 [AIAA PAPER 84-0661] p.47 A84-225287 Geodetic aspects of ESA pro

Gravitational biology on the space station [SAE PAPER 831133] p 75 A84-29063

Vibration characteristics of self-expanding stayed p 34 A84-21237 columns for use in space Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 p 59 N84-16250 EXPERIMENT DESIGN STEP experiment integration o 8 N84-17215 EXPERT SYSTEMS Knowledge based systems for intelligent robotics p 57 A84-15667 EXPLORER SATELLITES Thermally induced spin rate ripple on spacecraft with long radial appendages [NASA-TM-85058] p 39 N84-16249 **EXTERNAL SURFACE CURRENTS** Spacecraft/plasma interactions and their influence on ield and particle measurements - conference [ESA-SP-198] p 56 N84-17253 EXTERNAL TANKS Low cost space science and astronomy platforms in orhit (AIAA PAPER 84-0297) p 4 A84-18005 Identification of new potential scientific and technology areas for DoD application. Summary of activities p 78 N84-17050 [AD-A1343721 A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604 EXTRATERRESTRIAL INTELLIGENCE Natural selection of stellar civilizations by the limits of arowth [IAF PAPER 83-272] p 65 A84-11779 EXTRATERRESTRIAL LIFE Natural selection of stellar civilizations by the limits of arowth [IAF PAPER 83-272] p 65 A84-11779 EXTRAVEHICULAR ACTIVITY Regenerable non-venting thermal control subsystem for extravehicular activity [SAE PAPER 831151] o 24 A84-29076 Orbiter-based construction equipment study. The HPA/DTA technology advancement plan p 17 N84-14233 [NASA-CR-174605] Crew and life support: EVA p 11 N84-18279 Space station needs, attributes and architectural options. Volume 2, attachment 2: Supporting data and

EXPANDABLE STRUCTURES

analysis reports [NASA-CR-173329] p 12 N84-18291 Shuttle interaction study [NASA-CR-173400] p 60 N84-21592

F

=	RD.	C A	Th	ON I

Materials and construction techniques for large spacecraft structures p 53 A84-17768 Solar array Shuttle flight experiment - Hardware development and testing p 47 A84-22961 Large area space solar cell assemblies p 61 A84-22980 FABRICS

New fabric structures of carbon fiber p 52 A84-17108 FAILURE ANALYSIS

Graphite/polyimide joints extend temperature limits p 55 A84-29572 An evaluation of Techroll seal flexible joint material

p 56 N84-16037 Reliability issues in active control of large flexible space

[NASA-CR-175341] p 39 N84-16248 FAILURE MODES

- An evaluation of Techroll seal flexible joint material p 56 N84-16037
- FAST FOURIER TRANSFORMATIONS Validation methods for mathematical models of flexible satellite dynamics

[ESA-CR(P)-1794] p 40 N84-17241 FEASIBILITY ANALYSIS

- Multivariable direct adaptive control for a general class of time-varying commands p 33 A84-19118 Space stations - A key to socio-economic benefits from space? p 69 A84-19850 FEDERAL BUDGETS
 - National Aeronautics and Space Administration Act, 1985 p 9 N84-18116 Department of Housing and Urban Development-independent agencies appropriations for 1984: National Aeronautics and Space Administration p 80 N84-21440

Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441 FEEDBACK CONTROL

A flexible structure controller design method using mode residualization and output feedback --- for Large Flexible Space System Control of large space structures

[AIAA PAPER 84-0081] p 32 A84-17866 Algorithms and computational aspects pertaining to

block diagonal dominance methods for design of decentralized feedback compensation p 15 A84-19108

- Sampled data control of large space structures using constant gain velocity feedback - A negative view p 46 A84-19169
- Closed-form solutions for feedback control with terminal constraints p 36 A84-29471
- Experimental study of active vibration control [AD-A133818] p 38 N84-14548 Direct multivariable model reference adaptive control
- with applications to large structural systems p 38 N84-15840
- Selection of noisy sensors and actuators for regulation of linear systems — large space structures [AD-A135442] p 51 N84-17931

Decentralized control of a large space structure using direct output feedback [AD-A136781] p 41 N84-19464

- [AD-A136761] p 41 N84-19464 Time domain analysis and synthesis of robust controllers for large scale LOG (Linear Quadratic Gaussian) regulators
- [AD-A137760] p 43 N84-21172 FIBER COMPOSITES

New fabric structures of carbon fiber

- p 52 A84-17108 Local stability of sandwich structures with thin fibre reinforced face skins for space application [MBB-UD-381-83-OE] p 19 A84-22859 Review report of the third year's activities on the study survey of advanced materials --- for spacecraft and launch vehicles [R878] p 56 N84-21675 FIBER OPTICS
- Communications p 12 N84-18285 FIBER ORIENTATION Thermal control of tubular composite structures in space
- environment p 22 A84-10440
 FIBER REINFORCED COMPOSITES
- Surface analysis of graphite fiber reinforced polyimide composites [NASA-TM-85700] p 55 N84-11220
- FINANCIAL MANAGEMENT
- Financing large space projects p 67 A84-15321 Financing a solar power satellite project p 70 A84-21482
- Alternative strategies for space station financing [NASA-CR-175412] p 60 N84-21437
- FINGERS
- Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 59 N84-11761 FINITE ELEMENT METHOD
- A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures
- [AIAA PAPER 84-0069] p 16 A84-19887 Potential of minicomputer-array processor system for nonlinear finite-element analysis p 46 A84-20583 The dynamics and control of large flexible space structures 6
- [NASA-CR-174450] p 36 N84-10173 Finite element analysis of a deployable space structure p 38 N84-16056
- Scale model testing for control system parameters of large structures
- [AD-A135652] p 41 N84-18313 Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering
- Analysis Language (EAL) system [NASA-TM-85743] p 42 N84-20880 Finite element formulations for tensioned members —
- large space structures p 21 N84-21615 Geometrically nonlinear analysis of beam-in-space structures

[MITT-28] p 22 N84-21914 FLEXIBILITY

- Multibody dynamics Analysis of flexibility effects
- [AD-A132533] p 36 A84-29145 The dynamics and control of large flexible space structures, 6 [NASA-CR-174450] p 36 N84-10173
- [NASA-CR-174450] p 36 N84-10173 Control of flexible spacecraft by optimal model following p 36 N84-12222 Flexible radiator system
- [NASA-CR-171765] p 28 N84-20623 FLEXIBLE BODIES
 - Analysis and design of leaf-spring flexible joints for driving gyroscopic rotors p 19 A84-11922 Model error estimation for distributed systems described by elliptic equations p 15 A84-11946

- FLEXIBLE SPACECRAFT Control of large space structures p 32 A84-17866 [AIAA PAPER 84-0081] Aeroelastic stability and response of flexible tactical weapons [AIAA PAPER 84-0392] p 32 A84-18060 Manipulator interactive design with interconnected flexible elements p 58 A84-25484 Numerical solution of several classes of nonlinear p 35 A84-25586 flexible shell theory problems A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials [ASME PAPER 83-DET-6] p 55 A84-29101 Multibody dynamics - Analysis of flexibility effects p 36 A84-29145 [AD-A132533] Stability enhancement of a flexible robot manipulator p 59 N84-16807 [AD-A134185] p 40 N84-18281 Attitude, control and stabilization Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment [INPE-2749-PRE/325] p 41 N84-19383 FLEXIBLE SPACECRAFT A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 Technology requirements for large flexible space structures [IAF PAPER 83-404] p 2 A84-11811 Some aspects of simulation studies in spacecraft p 15 A84-11930 dvnamics Simulation of the motion of a Shuttle-attached flexible manipulator arm p 57 A84-11935 Simulation of the Galileo spacecraft axial - Delta-V p 66 A84-11938 algorithm Aggregate models for distributed parameter systems with applications to flexible air and spacecraft p 31 A84-11945 Dynamics and control of a deformable gyrostat, utilizing p 31 A84-12488 continuum vehicle modes The Toysat structural control experiment --- for large p 31 A84-13320 flexible space structure A hardware demonstration of control for a flexible offset-feed antenna p 31 A84-13321 Dynamics and control of a large space antenna p 32 A84-17361 A flexible structure controller design method using mode residualization and output feedback --- for Large Flexible p 32 A84-17369 Space System Comments on 'Dynamics of a spacecraft during extension of flexible appendages' p 32 A84-17370 Structural parameter identification for flexible spacecraft [AIAA PAPER 84-0060] p 23 A84-17853 Determination of critical parameters in large flexible space structures with uncertain modal data n 33 A84-20047 Transient dynamics during the orbiter based deployment of flexible members [AIAA PAPER 84-0061] p 34 A84-21285 On the number and placement of actuators for independent modal space control --- for large flexible spacecraft p 34 A84-24990 Identification of large flexible structures mass/stiffness and damping from on-orbit experiments p 34 A84-24995 Static shape forming for an electrostatically controlled p 16 A84-25551 membrane mirror A simulator to study dynamic interaction of the Space Shuttle on-orbit flight control system with deployed flexible p 35 A84-26717 payloads p 35 A84-26717 Stability of large flexible damped spacecraft modeled as elastic continua p 35 A84-26845 Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic rods p 35 A84-26977 On transient dynamics and stability of large space p 36 A84-29143 structures Closed-form solutions for feedback control with terminal p 36 A84-29471 constraints The effects of the space environment on damping materials and damping designs on flexible structure p 56 N84-17217 The 55-meter-structure flight experiment p 8 N84-17233 Validation methods for mathematical models of flexible atellite dynamics p 40 N84-17241 [ESA-CR(P)-1794] Control of large flexible spacecraft by the independent modal-space control method [NASA-CR-3760] p 40 N84-18262
- Modular design attitude control system p 41 N84-19392 [NASA-CR-170996]
- Maintenance and operational enhancement of the flexible spacecraft dynamics program [NASA-CR-175211] p 41 N84-19394

Precise control of flexible manipulators [NASA-CR-175389]

- p 60 N84-20175 Exhibit D modular design attitude control system study [NASA-CR-170993] p 42 N84-20625 Environmental effects on the dynamics and control of
- an orbiting large flexible antenna system [NASA-CR-175448] p 42 N84-20627 Derivation and combination of impedance matrices for
- flexible satellites [FSA-STR-209] p 43 N84-21604
- FLIGHT CONTROL
- A simulator to study dynamic interaction of the Space Shuttle on-orbit flight control system with deployed flexible p 35 A84-26717 pavloads Attitude, control and stabilization p 40 N84-18281
- FLIGHT SIMULATORS A simulator to study dynamic interaction of the Space
- Shuttle on-orbit flight control system with deployed flexible pavloads p 35 A84-26717 FLIGHT TESTS
- STEP flight experiments Large Deployable Reflector (LDR) telescope p 8 N84-17231
- Flight test of a synthetic aperture radar antenna using STEP p 9 N84-17237 Study on synthesis and characterization of large space systems, phase 2. Part 3: Experimental design verification
- techniques [ESA-CR(P)-1779-VOL-51 p 18 N84-21620
- Proposals for additions, modifications, and new experimental methods. Part 1: Ground tests. Part 2: Flight tests --- large space structures p 15 N84-21623 FLOW DISTRIBUTION
- On modeling dilution jet flowfields
- [AIAA PAPER 84-1379] p 58 A84-44183 FLUID DYNAMICS
- Space station attitude control system concept and requirements p 37 N84-12234 FLUID FILTERS
- Hyperfiltration wash water recovery subsystem Design and test results --- for extended mission spacecraft such as space stations [SAE PAPER 831112] p 6 A84-29047
- FLUX DENSITY Assessment of potential for batteries in space p 48 N84-12246 applications FLYING PLATFORMS Multibeam phased arrays SOC/Free-Flyer communication Application to communication system Space p 45 A84-15641 Operation Center
- FLYWHEELS
- Integrated Flywheel Technology, 1983 p 78 N84-12228 [NASA-CP-2290] Space station energy sizing p 48 N84-12233 The Boeing flywheel study D 37 N84-12235 Space station control requirements and flywheel system weights for combined momentum and energy storage p 37 N84-12236 IPACS attitude control technology considerations p 37 N84-12238 Advanced Control and Power System (ACAPS) p 37 N84-12243 technology program FOILS (MATERIALS)
- Cracked inner layer foil in high-density multilayer printed p 53 A84-17200 wiring boards
- FOLDING STRUCTURES Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 55 p 59 N84-11761
- Synchronously deployable truss structure p 59 N84-16250 [NASA-CASE-LAR-13117-11 Low concentration ratio solar arrav structural configuration N84-17225 p 17
- FRACTURE MECHANICS Fracture mechanics of ceramics. Volume 5 - Surface
- flaws, statistics, and microcracking p 54 A84-24501 Assessment of reliability of ceramic materials p 54 A84-24508 FRAMES
 - Approximations method for space frame synthesis
- p 19 A84-10141 New elements for analysis of space frames with tapered members p 20 N84-14561 FREE VIBRATION
- Vibration characteristics of self-expanding stayed p 34 A84-21237 columns for use in space FREQUENCY ASSIGNMENT
- Land-mobile communications satellite system desig [AIAA PAPER 84-0753] p 5 A84-2530 p 5 A84-25308 FRICTION FACTOR
- A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 FUNCTIONAL DESIGN SPECIFICATIONS
- Space station attitude control system concept and requirements p 37 N84-12234

FURLABLE ANTENNAS

Unfurlable offset antenna design for multipurpose applications [AIAA PAPER 84-0659] p 16 A84-25259

G

GALILEO SPACECRAFT

Simulation of the Galileo spacecraft axial - Delta-V algorithm p 66 A84-11938 Science platform and attitude subsystem in-flight

calibration for the Galileo spacecraft GAMMA RAY TELESCOPES p 32 A84-17355

- A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604 GÀS DYNAMICS
- Thermofluidynamics of heat pipes GAS-SOLID INTERACTIONS p 27 N84-19423
- Reactions of high velocity atomic oxygen with carbon p 53 A84-18159 [AIAA PAPER 84-0549] GEARS
- Self-locking telescoping manipulator arm
- p 59 N84-11761 [NASA-CASE-MFS-25906-1] GEODESY studies and
- Geodetic aspects of ESA projects investigations p 78 N84-16677 GEODETIC COORDINATES
- Geodetic control of the reflectors of large antenna p 31 A84-15785 GEOMETRY
- Computer-Aided Geometry Modeling
- [NASA-CP-2272] p 18 N84-22179 Interactive geometry modeling of space station onceptual designs p 18 N84-22191
- **GEOSYNCHRONOUS ORBITS**
- An overview of the institutional and regulatory aspects and their impact on system design --- of geostationary eatellites
- [IAF PAPER 83-82] p 65 A84-11737 Analytical model of the evolution of orbit parameters of a quasi geostationary satellite
- [IAF PAPER 83-316] p 65 A84-11787 Autonomous navigation of geosynchronous satellites
- using the Navstar Global Positioning System p 45 A84-15671 A future solar orbital transfer vehicle concept
- n 61 A84-16116 Energy from space - Legal implications of the use of
- the geostationary orbit p 68 A84-17075
- Semiautonomous stationkeeping of geosynchronous p 32 A84-17359 satellites
- Vertical ascent from earth to geosynchronous orbit
- [AIAA PAPER 84-0509] p 61 A84-18141 Improved orbit utilization using auxiliary feeds in existing
- p 46 A84-20647 earth terminals Highly efficient, very low-thrust transfer to
- geosynchronous orbit Exact and approximate solutions p 61 A84-24980
 - Optimal low-thrust transfers to synchronous orbit p 62 A84-24981
- Reduced domestic satellite orbit spacing AIAA PAPER 84-0652 p 73 A84-25253 [AIAA PAPER 84-0652] Time phased introduction of advanced technologies -
- Its impact on orbit/spectrum conservation [AIAA PAPER 84-0653] p 7 p 74 A84-25254
- Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p 74 A84-25304
- Computer tools for optimizing orbit use p 74 A84-25318 [AIAA PAPER 84-0651]
- Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] p 74 A84-25319
- NASA's geostationary communications platform orogram
- [AIAA PAPER 84-0702] p 5 A84-25326 Development trends in Europe on satellite clusters and
- geostationary platforms p 75 A84-25327 [AIAA PAPER 84-0703] Capture-elector satellites
- [NASA-TM-85686] p 7 N84-15179 The role of potential barrier formation in spacecraft p 50 N84-17269 charging
- Introduction to geostationary orbits [ESA-SP-1053] p 80 N84-21590
- **GLOBAL POSITIONING SYSTEM** Autonomous navigation of geosynchronous satellites using the Navstar Global Positioning System
- p 45 A84-15671
- **GOVERNMENT/INDUSTRY RELATIONS** A legal charter for non-governmental space industrialization
- [AAS PAPER 83-225] p 77 A84-29868
- International competition in commercial aerospace markets
- [AAS PAPER 83-244] p 77 A84-29883

GRAPHITE Thermal-mechanical behavior of graphite/magnesium p 24 A84-28237 composites GRAPHITE-EPOXY COMPOSITES Field repair of graphite epoxy skin panels on the Daceship Columbia p 52 A84-17120 The effect of pressure and temperature on spaceship Columbia time-dependent changes in graphite/epoxy composites below the glass transition p 54 A84-21775 below the glass transition Design and development of the INTELSAT V graphite-epoxy central thrust tube p 19 A84-22153 GRAPHITE-POLYIMIDE COMPOSITES Higher temperature composite joints survive elimination p 55 A84-29565 tests Graphite/polyimide joints extend temperature limits p 55 A84-29572 Surface analysis of graphite fiber reinforced polyimide composites [NASA-TM-85700] p 55 N84-11220 GRAPHS (CHARTS) p 48 N84-12233 Space station energy sizing GRAVITATIONAL EFFECTS Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 Gravitational biology on the space station [SAE PAPER 831133] p 75 A84-29063 Microgravity conditions on orbital platforms [DGLR PAPER 83-90] p 76 A84-29657 Tethers in space: Birth and growth of a new avenue to space utilization [NASA-TM-82571] p 18 N84-21607 GRAVITATIONAL FIELDS The residual gravitational field of orbital space stations [DGLR PAPER 83-089] p 75 A84-29656 GRAVITY GRADIENT SATELLITES Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment p 41 N84-19383 [INPE-2749-PRE/325] GROUND STATIONS Narrow multibeam satellite ground station antenna employing a linear array with a geosynchronous arc coverage of 60 deg. II - Antenna design p 46 A84-17743 Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] p 74 A84-25319 GROUND SUPPORT EQUIPMENT Spacelab data book [ESA-BR-14] p 79 N84-18315 GROUND SUPPORT SYSTEMS Starlab Ground System guidelines document [NASA-CR-175192] p 14 N84-20435 GROUND TESTS Solar array Shuttle flight experiment - Hardware development and testing p 47 A84-22961 Study on synthesis and characterization of large space systems, phase 2. Part 3: Experimental design verification techniques [ESA-CR(P)-1779-VOL-5] p 18 N84-21620 Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural p 29 N84-21621 analysis Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Thermal test techniques p 29 N84-21622 Proposals for additions, modifications, and new experimental methods. Part 1: Ground tests. Part 2: Flight tests --- large space structures p 15 N84-21623 GUIDANCE SENSORS IPACS guidance navigation and control system considerations and test activities p 37 N84-12245 **GUY WIRES** Vibration characteristics of self-expanding stayed columns for use in space GYROSCOPIC STABILITY p 34 A84-21237 Dynamics and control of a deformable gyrostat, utilizing ontinuum vehicle modes p 31 A84-12488 Attitude stability for the yaw-wheel class of orbiting continuum vehicle modes gyrostats p 33 A84-19675 Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728

Η

HABITABILITY

- Habitability design elements for a space station [AAS PAPER 83-200] p 7 A84-29853 HANGARS
- Development of deployable structures for large space platforms. Volume 2: Design development [NASA-CR-170914] p 20 p 20 N84-10176

HARDWARE

HARDWARE	
Hardware simulation of spacec control	p 30 A84-11932
Space telescope [NASA-CR-170948]	p 78 N84-16097
HEAT EXCHANGERS Multi-megawatt space power th	-
system requirements	-
(AIAA PAPER 84-0056) Thermal management system tech	p 23 A84-21284 notoav development
for space station applications	
[SAE PAPER 831097] Thermal control	p 24 A84-29032 p 25 N84-18289
HEAT FLUX	ble to ensee station
Thermal analysis research applicate technology needs	
[NASA-TM-84658] HEAT PIPES	p 25 N84-15426
Thermal management system tech	nology development
for space station applications [SAE PAPER 831097]	p 24 A84-29032
Heat pipes for the L-SAT comm radiators	unications module p 26 N84-19405
A Variable Conductance Heat P	ipe (VCHP) radiator
system for communications payloads Thermofluidynamics of heat pipes	
HEAT RADIATORS	p 27 1104-10423
Thermal management system tech for space station applications	nology development
[SAE PAPER 831097]	p 24 A84-29032
Space Station Technology, 1983 [NASA-CP-2293]	p 11 N84-18277
Thermal control	p 25 N84-18289
Flexible radiator thermal vacuum te [NASA-CR-171764]	p 28 N84-20622
Flexible radiator system: Executive [NASA-CR-171766]	
HEAT SHIELDING	
Spacecraft thermal control, design,	, and operation p 22 A84-10224
HEAT STORAGE	•
Sodium heat transfer system mode [DE84-002051]	p 25 N84-16509
HEAT TRANSFER	P
Sodium heat transfer system mode [DE84-002051]	aling p 25 N84-16509
	p 25 N84-16509 ess experiment
[DE84-002051]	p 25 N84-16509
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni- ultraheavy nuclei HELIUM-NEON LASERS	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni- ultraheavy nuclei HELIUM-NEON LASERS	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier areas for DOD application. Summary [AD-A134372]	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroniultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scient areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circultry by surface dische	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology r of activities p 78 N84-17050 reference induced in urges
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discher [NASA-TP-2240]	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 lerence induced in
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scient areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 ierence induced in urges p 50 N84-16247
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electronic ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scient areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface dischas [NASA-TP-2240] HUBBLE SPACE TELESCOPE	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology r of activities p 78 N84-17050 reference induced in urges
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scient areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a si	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 reference induced in urges p 50 N84-16247 p 78 N84-16097 space station
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spaceraft circuitry by surface discher [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 terence induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scient areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spaceraft circuitry by surface dischar [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a st [AAS PAPER 83-200] Space Applications of Automat Machine Intelligence Systems (ARAM	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 lerence induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853 tion, Robotics and IIS), phase 2. Volume
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential sciel areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a 1 [AS PAPER 83-200] Space Applications of Automat Machine Intelligence Systems (ARAM 1: Telepresence technology base do [NASA-CR-3734]	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology r of activities p 78 N84-17050 ierence induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853 tion, Robotics and IS), phase 2. Volume avelopment p 59 N84-10583
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential sciential areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discher [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a to [AS PAPER 83-200] Space Applications of Automal Machine Intelligence Systems (ARAM 1: Telepresence technology base de [NASA-CR-3734] Space Applications of Automal	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 lerence induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853 ion, Robotics and IS), phase 2. Votume svelopment p 59 N84-10583 tion, Robotics and
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential sciel areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a s [AS PAPER 83-200] Space Applications of Automat Machine Intelligence Systems (ARAM 2: Telepresence project applications	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 reference induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853 tion, Robotics and IS), phase 2. Volume set
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential scier areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface dische [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a f [AAS PAPER 83-200] Space Applications of Automat Machine Intelligence Systems (ARAM 1: Telepresence technology base de [NASA-CR-3734] Space Applications of Automat Machine Intelligence Systems (ARAM 2: Telepresence project applications [NASA-CR-3735]	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-17050 ierence induced in urges p 50 N84-16247 p 78 N84-16097 space station p 7 A84-29853 tion, Robotics and IS), phase 2. Volume avelopment p 59 N84-10583 tion, Robotics and IS), phase 2. Volume
[DE84-002051] Thermal energy management proc HEAVY NUCLEI Pyroelectric materials as electroni ultraheavy nuclei HELIUM-NEON LASERS Application of laser interferometry HEURISTIC METHODS A heuristic method for the design trusses using discrete member sizes HIGH POWER LASERS Identification of new potential sciel areas for DoD application. Summary [AD-A134372] HIGH VOLTAGES Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] HUBBLE SPACE TELESCOPE Space telescope [NASA-CR-170948] HUMAN FACTORS ENGINEERING Habitability design elements for a s [AS PAPER 83-200] Space Applications of Automat Machine Intelligence Systems (ARAM 2: Telepresence project applications	p 25 N84-16509 ess experiment p 25 N84-17222 c pulse detectors of p 72 A84-23440 to robotics p 58 A84-28541 of minimum weight p 15 A84-16841 ntific and technology of activities p 78 N84-16841 p 78 N84-16247 p 78 N84-16097 espace station p 7 A84-29853 ion, Robotics and IS), phase 2. Volume avelopment p 59 N84-10583 ion, Robotics and IS), phase 2. Volume

- HYDRAZINE ENGINES
- Why don't we use ion propulsion? [AIAA PAPER 84-0730] p 62 A84-25294 HYDRODYNAMICS
- Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents [NASA-TM-77534] p 26 N84-18576

INTERNATIONAL COOPERATION

-	

I	
IMPACT -	
	PACSAT (passive
[AD-A131406] IN-FLIGHT MONITORING	p 36 N84-11195
Science platform and attitude a calibration for the Galileo spacecraft INERTIAL UPPER STAGE An evaluation of Techroll seal flexil	p 32 A84-17355
INFLATABLE SPACECRAFT	p 56 N84-16037
Study on large, ultralight long-life : phase 2C	structures in space,
[TM-EKR3] INFLATABLE STRUCTURES	p 17 N84-17284
Large inflated-antenna system INFORMATION DISSEMINATION	p 9 N84-17234
Crew and life support: EVA INFORMATION MANAGEMENT	p 11 N84-18279
Space Station needs, attributes options. Volume 2, book 2, part 2, management system	Task 2: Information
[NASA-CR-173317] INFRARED ASTRONOMY	p 13 N84-18301
Large Deployable Reflector (LDR) orbiting submittimeter-infrared telesco	pe for the 1990s
INFRARED RADIATION	p 66 A84-14586
Development of a spacecraft infrare an alternative to solar simulation: F	irst steps on L-SAT
thermal model	p 26 N84-19398
Spacecraft thermal balance testing on a dummy spacecraft	p 26 N84-19399
IRSIM: A program for the calcula	tion of infrared flux
intensity incident on a spacecraft insi	de a test chamber p 26 N84-19400
INFRARED TELESCOPES Large Deployable Reflector (LDR)	A
orbiting submillimeter-infrared telesco	pe for the 1990s
STEP flight experiments Large D	p 66 A84-14586 epiovable Reflector
(LDR) telescope	p 8 N84-17231
Geometric modeling of large deployment INTEGRATED ENERGY SYSTEMS	space antenna p 22 N84-22225
IPACS attitude control technology	
IPACS guidance navigation an considerations and test activities INTEGRITY	p 37 N84-12238 d control system p 37 N84-12245
Integrity control of carbon fiber i structural elements, phase 1 applications	
[TB-TS-11-01/82-A]	p 56 N84-18416
INTELSAT SATELLITES Solar power satellites - The institut	
Design and development of	p 70 A84-21479 the INTELSAT V
graphite-epoxy central thrust tube Technical aspects of the Intelsat V	
INTERACTIVE CONTROL	p 47 A84-22962
A voice interactive system for aiding of space-based tasks	and documentation
[AIAA PAPER 83-2355]	p 43 A84-10025
Algorithms and computational as block diagonal dominance metho	ds for design of
decentralized feedback compensation	p 15 A84-19108
Manipulator interactive design w flexible elements	p 58 A84-25484
Interactive structural-thermal-c formulations large space structure	S
INTERNATIONAL COOPERATION	p 29 N84-21619
European utilisation aspects for a : [IAF PAPER 83-54]	p 64 A84-11727
An overview of the institutional and and their impact on system design	
satellites [IAF PAPER 83-82]	p 65 A84-11737
Spacetab's development	p 66 A84-13901
Spaceflight to 2000 - Interavia loo present	p 66 A84-14764
Determination of applicable law to	
in space [IAF PAPER 82-IISL-45]	p 68 A84-17058
The solar power satellite -	A programme for
development aid Energy from space - A vision of the	p 68 A84-17074 e future
Solar power satellites - The institut	p 69 A84-21477 ional challenge
	p 70 A84-21479

INTERNATIONAL LAW

p 20 A84-29862

p 36 N84-10173

p 20 N84-10175

Financing a solar power satellite project p 70 A84-21482

Integrated requirements for a space station p 4 A84-24628 Tele-X - The first step in a satellite communications

system for the Nordic countries p 4 A84-25287 [AIAA PAPER 84-0713] International aspects of commercial space activities

p 77 A84-29866 [AAS PAPER 83-222] Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303

INTERNATIONAL LAW Determination of applicable law to living and working in outer space

[IAF PAPER 82-IISL-44] p 68 A84-17057 Energy from space - Legal implications of the use of p 68 A84-17075 the geostationary orbit

Legal aspects of solar power satellites impact on the p 68 A84-17077 environment INTERSTELLAR TRAVEL

p 71 A84-21499 Mankind's interstellar future Interstellar solar sailing - Consideration of real and projected sail materials p 62 A84-25344 Roundtrip interstellar travel using laser-pushed p 62 A84-27443 lightsai

ION BEAMS Sheath ionization model of beam emissions from large spacecrafts

p 52 N84-19463 [AD-A137181] ION ENGINES

Control structure interactions in large space structures Analysis using energy approach --- for constant and pulsed p 35 A84-27934 thrusters

ION IMPLANTATION Large area space solar cell assemblies p 61 A84-22980

ION PROPULSION

Why don't we use ion propulsion? [AIAA PAPER 84-0730] p 62 A84-25294 Discontinuous low thrust orbit transfer [AD-A136908] p 63 N84-19474

IONIZATION Sheath ionization model of beam emissions from large

spacecrafts [AD-A137181] p 52 N84-19463

IONOSPHERIC PROPAGATION The effects of aperture antennas after signal propagation through anisotropic ionized media

AD-A1382861 p 52 N84-21781 IONS Interpretation of STS-3/plasma diagnostics package

results in terms of large space structure plasma interactions p 78 N84-16991 NASA-CR-1732661

IRRADIATION Surface analysis of graphite fiber reinforced polyimide entizonmo

[NASA-TM-85700] p 55 N84-11220

J

- JET FLOW
- On modeling dilution let flowfields [AIAA PAPER 84-1379] p 58 A84-44183 JOINTS (JUNCTIONS)

Analysis and design of leaf-spring flexible joints for driving gyroscopic rotors p 19 A84-11922 Welded solar cell interconnection p 19 A84-22965 Higher temperature composite joints survive elimination

p 55 A84-29565 tests Graphite/polyimide joints extend temperature limits p 55 A84-29572

Κ

KEVLAR (TRADEMARK)

Review report of the third year's activities on the study survey of advanced materials - for spacecraft and launch vehicles (R878) p 56 N84-21675

KINEMATICS Dynamics of nonrigid articulated robot linkages

p 58 A84-25531

L-SAT Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT thermal model p 26 N84-19398 Heat pipes for the L-SAT communications module radiators p 26 N84-19405

The thermal design of L-SAT large telecommunication satellite p 27 N84-19414 LAGUERRE FUNCTIONS

Validation methods for mathematical models of flexible satellite dynamics [ESA-CR(P)-1794] p 40 N84-17241

LAMINATES

Cracked inner layer foil in high-density multilayer printed wiring boards p 53 A84-17200 A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials

[ASME PAPER 83-DET-6] p 55 A84-29101 LAND MOBILE SATELLITE SERVICE

An advanced generation land mobile satellite system and its critical technologies p 3 A84-15634 MSAT mobile communication demonstration satellite stem and bus tradeoff considerations

AIAA PAPER 84-07511 p 48 A84-25306 Land-mobile communications satellite system design [AIAA PAPER 84-0753] p 5 A84-25308

LARGE SPACE STRUCTURES Technology requirements for large flexible space

structures [IAF PAPER 83-404] D 2 A84-11811

Tests and prediction of composite material viscoelastic behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815 Torque from solar radiation pressure gradient during

- eclipse --- for very large spacecraft p 31 A84-12489 The Toysat structural control experiment --- for large flexible space structure p 31 A84-13320
- A hardware demonstration of control for a flexible offset-feed antenna p 31 A84-13321 Coherent arrays of separate optical telescopes in space

project Trio p 3 A84-15363 Dynamics and control of a large space antenna

p 32 A84-17361 A flexible structure controller design method using mode residualization and output feedback --- for Large Flexible Space System p 32 A84-17369

Materials and construction techniques for large p 53 A84-17768 spacecraft structures Structural parameter identification for flexible spacecraft

[AIAA PAPER 84-0060] p 23 A84-17853 Control of large space structures [AIAA PAPER 84-0081] p 32 A84-17866

Radiation-conduction interaction in large space structures [AIAA PAPER 84-0144]

p 23 A84-17911 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056

A large space structure benchmark problem - ACOSS Model No. 2 p 33 A84-19127 Number crunching on the ACOSS Model No. 2

p 33 A84-19128 Matrix(X) - Application to large space structure control

design problems p 16 A84-19129 Sampled data control of large space structures using constant gain velocity feedback - A negative view

p 46 A84-19169 A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures

p 16 A84-19887 TAIAA PAPER 84-00691 Determination of critical parameters in large flexible space structures with uncertain modal data

p 33 A84-20047 Potential of minicomputer-array processor system for p 46 A84-20583

nonlinear finite-element analysis Solar array Shuttle flight experiment - Hardware development and testing p 47 A84-22961 New component development for multi-100 kW low-cost

sotar array applications p 47 A84-22963 On the number and placement of actuators for independent modal space control --- for large flexible spacecraft p 34 A84-24990

Identification of large flexible structures mass/stiffness and damping from on-orbit experiments

p 34 A84-24995 Some applications of direct adaptive control to large structural systems p 34 A84-25496 Use of electromagnetic models in the optimal control of large space antennas p 35 A84-25552 Stability of large flexible damped spacecraft modeled as elastic continua p 35 A84-26845 Control structure interactions in large space structures Analysis using energy approach --- for constant and pulsed p 35 A84-27934 thrusters Thermal-mechanical behavior of graphite/magnesium

composites p 24 A84-28237 On transient dynamics and stability of large space p 36 A84-29143 structures

[NASA-CR-170914] p 20 N84-10176 Large space instrumentation to measure the interaction between space structures and the environment [AD-A129990] p 77 N84-10179 Actuator placement considerations for the control of rge space structures p 20 N84-11199 large space structures Resistojet propulsion for large spacecraft systems p 63 N84-11206 INASA-TM-834891 Control of flexible spacecraft by optimal model following p 36 N84-12222 Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary [NASA-CR-168193-VOL-1] p 63 N84-12226

The development of a composite beam building machine for on-site construction of large space structures

The dynamics and control of large flexible space

Development of deployable structures for large space platform systems. Volume 1: Executive summary

Development of deployable structures for large space platforms. Volume 2: Design development

TAAS PAPER 83-2171

[NASA-CR-170913]

structures, 6 [NASA-CR-174450]

Analysis of large space structures assembly: Man/machine assembly analysis [NASA-CR-3751] p 59 N84-13208

Study of auxiliary propulsion requirements for large space systems, volume 2 [NASA-CR-168193-VOL-2] p 63 N84-13218

Active control of large flexible space structures p 37 N84-14235 New elements for analysis of space frames with tapered

p 20 N84-14561 members ACOSS Fourteen (Active Control of Space Structures) [AD-A1334111 p 38 N84-15181

Direct multivariable model reference adaptive control with applications to large structural system: p 38 N84-15840

Finite element analysis of a deployable space p 38 N84-16056 structure Digital control system for space structural dampers [NASA-CR-175355] p 39 N84-16246 Reliability issues in active control of large flexible space

structures [NASA-CR-175341] p 39 N84-16248 Surface accuracy measurement sensor test on a 50-meter antenna surface model

[NASA-TM-85689] p 17 N84-16427

Self-shadowing of orbiting trusses [NASA-CR-173215] p 25 N84-16565 Interpretation of STS-3/plasma diagnostics package

results in terms of large space structure plasma interactions [NASA-CR-173266] p 78 N84-16991

STEP Experiment Requirements

[NASA-CP-2294] p 7 N84-17211 Deployable beam flight experiment (MAST) p 8 N84-17218

The STEP/STACBEAM technology experiment development for very large solar array deployers

p 8 N84-17220 General requirements for Shuttle flight experiments

p 8 N84-17221 Photovoltaic concentrator pointing dynamics and plasma interaction study p 50 N84-17224

Low concentration ratio solar алау structural p 17 N84-17225 configuration

Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226

A deployable structure and solar array controls p 39 N84-17227 eriment for STEP Vibration isolation technology experiment

p 39 N84-17228

Integrated Power/Attitude Control System (IPACS) technology experiment p 39 N84-17229 Investigation of articulated panel dynamics

p 40 N84-17230

Large deployable antenna flight experiment for the Space Technology Experiments Platform (STEP) p 8 N84-17232

The 55-meter-structure flight experiment p 8 N84-17233

Study on large, ultralight long-life structures in space, phase 2C p 17 N84-17284 TM-EKR31

Selection of noisy sensors and actuators for regulation of linear systems --- large space structures [AD-A135442] p 51 N84-17931

Control of large flexible spacecraft by the independent modal-space control method [NASA-CR-3760] p 40 N84-18262

ACOSS eleven (Active Control Of Space Structures), volume 1 [AD-A135675]

p 40 N84-18311

ACOSS eleven (Active Control Of Space Structures). volume 2 p 41 N84-18312 [AD-A135676] The thermal design of L-SAT large telecommunication satellite p 27 N84-19414 Decentralized control of a large space structure using direct output feedback [AD-A136781] p 41 N84-19464 The effect of mass and stiffness changes on the damping factor in a large space structure as represented by the CSDL 2 model p 42 N84-19465 [AD-A136984] Analysis of large space structures p 18 N84-20621 Construction concept for erecting an offset-fed entonna [NASA-TM-85774] p 60 N84-20626 Environmental effects on the dynamics and control of an orbiting large flexible antenna system p 42 N84-20627 [NASA-CR-175448] Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies [NASA-CR-175437] p 60 N84-20857 [NASA-CR-175437] Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1 [ESA-CR(P)-1779-VOL-3] p 43 N84-21611 The solution of the dynamic problem of the periodic structures by cyclosymmetric technique --- large space structures p 43 N84-21612 Computing the radiation pressure forces by adapting thermal design verification softwares --- large space p 28 N84-21613 structures Simplified models and computational schemes of the aerodynamic load --- large space structures p 28 N84-21614 Finite element formulations for tensioned members --large space structures p 21 N84-21615 Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616 Thermal design verification of the large open truss structures. The local approach and the shadow problem p 29 N84-21617 --- large space structures Computational savings in view factor evaluation on mode prescreening --- large space structures p 29 N84-21618 Interactive structural-thermal-control analytical formulations --- large space structures p 29 N84-21619 Study on synthesis and characterization of large space systems, phase 2. Part 3: Experimental design verification techniques [ESA-CR(P)-1779-VOL-5] p 18 N84-21620 Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural p 29 N84-21621 analysis Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Thermal test techniques p 29 N84-21622 Proposals for additions, modifications, and new

Proposals for additions, modifications, and new experimental methods. Part 1: Ground tests. Part 2: Flight tests -- large space structures p 15 N84-21623 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical

design p 18 N84-21624 [ESA-CR(P)-1779-VOL-1]

Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal desian p 18 N84-21625

[ESA-CR(P)-1779-VOL-2] LASER GUIDANCE Application of laser interferometry to robotics

p 58 A84-28541 LASER INTERFEROMETRY

Application of laser interferometry to robotics

p 58 A84-28541 LASER PROPULSION

- Vertical ascent from earth to geosynchronous orbit [AIAA PAPER 84-0509] p 61 A84-18141 Transportation - Options and high payoff choices - for p 61 A84-21484 spacecraft propulsion
- using laser-pushed Roundtrip interstellar travel lichtsails p 62 A84-27443 LAŴS
- IPACS attitude control technology considerations p 37 N84-12238
- LEAD ACID BATTERIES
- Assessment of potential for batteries in space p 48 N84-12246 applications

LIBRATIONAL MOTION

Transient dynamics during the orbiter based deployment of flexible members n 34 A84-21285

- LIFE SUPPORT SYSTEMS Environmental control and life support (ECLS) design
- p 73 A84-24637 Support for an optimization approach Environmental Control and Life evolutionary Space Station [SAE PAPER 831108]
- n 5 A84-29043 Probable missions and transportation scenarios to use egenerative life support systems
- o 76 A84-29854 AAS PAPER 83-2011 Space Station Technology, 1983
- [NASA-CP-2293] p 11 N84-18277 Crew and life support: ECLSS p 11 N84-18280 LINE OF SIGHT COMMUNICATION
- path Space operations center communications p 3 A84-15695 Assessment of satellite power flux-density limits in the obscuration 2025-2300 MHz frequency range, part 1
- p 51 N84-18532 PB84-1294021 LINEAR ARRAYS
- Narrow multibeam satellite ground station antenna employing a linear array with a geosynchronous arc coverage of 60 deg. II - Antenna design p 46 A84-17743
- LINEAR SYSTEMS
- A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84p 16 A84-19887 A degree of controllability definition - Fundamental
- concepts and application to modal systems p 34 A84-24991 Controllability and observability criteria for multivariable
- linear second-order models p 35 A84-25516 Selection of noisy sensors and actuators for regulation of linear systems --- large space structures
- p 51 N84-17931 [AD-A135442] Time domain analysis and synthesis of robust controllers for large scale LOG (Linear Quadratic Gaussian) regulators
- [AD-A137760] p 43 N84-21172 LINKAGES
- Dynamics of nonrigid articulated robot linkages p 58 A84-25531 A variational theorem for the viscoelastodynamic
- analysis of high-speed linkage machinery fabricated from composite materials [ASME PAPER 83-DET-6] o 55 A84-29101
- LISP (PROGRAMMING LANGUAGE) Implementation of MACLISP on a large address space
- computer [DE84-005042] p 79 N84-21145
- LOADS (FORCES) The flexural behavior of PACSAT (passive
- communication satellite) in orbit [AD-A131406] p 36 N84-11195
- LOCKING
- Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 59 p 59 N84-11761 LONG DURATION SPACE FLIGHT
- Roundtrip interstellar travel using laser-oushed liontseils p 62 A84-27443 LONG TERM EFFECTS
- Evaluation and prediction of long-term environmental effects of nonmetallic materials, second phase [NASA-CR-170915] p 56 N84-11595
- Auxiliary propulsion p 11 N84-18283 LOW ALTITUDE
- Thermal control of tethered satellite in a very low altitude aerodynamic mission p 27 N84-19444 LOW COST
- Mechanical wraparound contacted cell for low cost soaca arravs p 48 A84-22982
- LOW GRAVITY MANUFACTURING
- Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 p 71 A84-22327 LOW PRESSURE
- The effect of pressure and temperature on time-dependent changes in graphite/epoxy composites below the glass transition LOW THRUST PROPULSION p 54 A84-21775
- Highly efficient, very low-thrust transfer to geosynchronous orbit Exact and approximate solutions transfer to p 61 A84-24980
- Optimal low-thrust transfers to synchronous orbit p 62 A84-24981 LOW WEIGHT
- Approximations method for space frame synthesis p 19 A84-10141
- LÜNAR FLIGHT Management of the radiolink of the solar sail spacecraft by radio-amateurs
- **HAF PAPER 83-4471** p 44 A84-11823

Μ

MAGNESIUM Thermal-mechanical behavior of graphite/magnesium p 24 A84-28237 composites MAINTENANCE Field repair of graphite epoxy skin panels on the p 52 A84-17120 spaceshin Columbia MAN MACHINE SYSTEMS Space station autonomy requirements [AIAA PAPER 83-2352] p 63 A84-10024 Automation, Robotics, and Machine Intelligence Systems (ARAMIS) in space manufacturing o 58 A84-22337 Habitability design elements for a space station p 7 A84-29853 [AAS PAPER 83-200] A program to develop efficient manned operations in snace [AAS PAPER 83-207] p 76 A84-29857 Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary p 59 N84-10582 [NASA-CR-3736] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development p 59 N84-10583 [NASA-CR-3734] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 N84-10584 Analysis of large space structures assembly: Man/machine assembly analysis p 59 N84-13208 [NASA-CR-3751] Space Station Technology, 1983 p 11 N84-18277 [NASA-CP-2293] Human capabilities p 11 N84-18282 A manned-machine space station construction concept (NASA-TM-857621 p 21 N84-19395 MANAGEMENT METHODS Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings p 2 A84-15301 Proceedings Human organization ---and space project p 2 A84-15303 management The progression of projects --- in space industry p 2 A84-15305 MANAGEMENT PLANNING Shuttle interaction study extension [NASA-CR-173403] p 81 N84-21596 MANIPULATORS p 57 A84-22336 Remote manipulators in space Manipulator interactive design with interconnected p 58 A84-25484 flexible elements Dynamics of nonrigid articulated robot linkages p 58 A84-25531 Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 59 p 59 N84-11761 Stability enhancement of a flexible robot manipulator p 59 N84-16807 [AD-A134185] Recursive lagrangian dynamics of flexible manipulator rms via transformation matrices [AD-A137345] MANNED ORBITAL LABORATORIES p 60 N84-20316 Jurisprudential philosophies of the art of living in space The transnational imperative [IAF PAPER 82-IISL-38] p 68 A84-17054 Space stations - A key to socio-eco omic benefits from space? p 69 A84-19850 p 72 A84-24627 The role of man in space Integrated requirements for a space station p 4 A84-24628 p 72 A84-24629 Use of space station for science MANNED SPACE FLIGHT Overview of space station operations [IAF PAPER 83-38] p 64 A84-11723 The German Spacelab mission D1 p 69 A84-17762 Manned planetary missions? Mankind's interstellar future p 71 A84-21497 p 71 A84-21499 For the first time - Russian book on construction of first Soviet earth satellites p 16 A84-21564 Space vehicles --- Russian book on development of Soviet spacecraft and planning of first manned flights p 4 A84-21573 Hyperfiltration wash water recovery subsystem - Design and test results -- for extended mission spacecraft such as space stations [SAE PAPER 831112] p 6 A84-29047 An alternate concept for expanding man's presence in snana [NASA-TM-84617] p 7 N84-15172

MANNED SPACECRAFT Overview of NASA space station activities [IAF PAPER 83-48] p 1 A84-11726 p 72 A84-24627 The role of man in space

MARKET RESEARCH

MARKET RESEARCH

- Market potential and possible limitations for satellite blar power stations p 70 A84-21481 MSAT mobile communication demonstration satellite solar power stations
- system and bus tradeoff considerations AIAA PAPER 84-07511 p 48 A84-25306 MÅRKETING
- Commercial communications satellite market and technology in the 90's [IAF PAPER 83-86] D 65 A84-11739
- MARS (PLANET) Mission to Mars - The case for a settlement
- p 67 A84-15092 MARS ENVIRONMENT

Mission to Mars - The case for a settlement

INISSION TO INGLE . THE CASE IOF & S	serneinei	н.
	p 67	A84-15092
MATERIALS HANDLING		
Shutter Interaction Study		
[NASA-CR-173402]	p 81	N84-21595

MATERIALS SCIENCE		P -	-			
Manufacturing in	space:	Proceedings	of	the	Winter	

Annual Meeting, Boston, MA, November 13-18, 1983 p 71 A84-22327

MATERIALS TESTS

- Tests and prediction of composite material viscoelastic behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815
- Using the outgassing test to screen materials for p 53 A84-17174 contamination potential Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings
- Electrically conductive black optical paint p 55 A84-28553

MATHEMATICAL MODELS

- Model error estimation for distributed systems described p 15 A84-11946 by elliptic equations Thermal design verification of the large open truss structures. The local approach and the shadow problem
- p 29 N84-21617 - large space structures Development of procedures for component mode synthesis
- [DFVLR-IB-232-82-C-09] p 30 N84-21626 Computer-Aided Geometry Modeling
- [NASA-CP-2272] p 18 N84-22179 Interactive geometry modeling of space station conceptual designs p 18 N84-22191
- Mathematical synthesization of complex structures p 19 N84-22224 **MATRICES (MATHEMATICS)**
- Recursive lagrangian dynamics of flexible manipulator arms via transformation matrices
- AD-41373451 p 60 N84-20316 MATRIX METHODS
- Study on damping representation related to spacecraft structural design
- [EMSB-18/83] p.38 N84-15182 Derivation and combination of impedance matrices for flexible satellites [ESA-STR-2091
- p 43 N84-21604 The solution of the dynamic problem of the periodic structures by cyclosymmetric technique --- large space structures p 43 N84-21612 Finite element formulations for tensioned members
- large space structures MAYPOLE ANTENNAS p 21 N84-21615
- Spline-based estimation techniques for parameters in elliptic distributed systems
- [NASA-TM-85439] p 9 N84-17947 MEASURING INSTRUMENTS
- Space Station needs, attributes and architectural options. Volume 2, book 1, part 4: Payload element mission data sheets p 13 N84-18299 [NASA-CB-173315]
- MECHANICAL DRIVES
- Design and development of an advanced solar array drive mechanism p 17 N84-18457 Space telescope: Solar array primary development p 51 N84-18458 mechanism

MECHANICAL ENGINEERING

- U.S. National Congress of Applied Mechanics, 9th, Cornell University, Ithaca, NY, June 21-25, 1982, Proceedings p 75 A84-29126
- MECHANICAL IMPEDANCE Derivation and combination of impedance matrices for flexible satellites
- IESA-STR-2091 p 43 N84-21604 MECHANICAL PROPERTIES
- Thermal-mechanical behavior of graphite/magnesium p 24 A84-28237 composites SiC-reinforced-aluminum alloys for aerospace applications p 54 A84-28242 Effect of temperature, moisture and radiation exposures p 55 A84-28900 on composite mechanical properties Composite structural materials [NASA-CR-173259] p 56 N84-17293

- U.S. National Congress of Applied Mechanics, 9th, Cornell University, Ithaca, NY, June 21-25, 1982 Proceedings p 75 A84-29126
- MEMBRANE STRUCTURES Static shape forming for an electrostatically controlled membrane mirror p 16 A84-25551
- METAL FILMS Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949 p 52 A84-10949 METAL MATRIX COMPOSITES
- Thermal-mechanical behavior of graphite/magnesium p 24 A84-28237 for aerospace composites. SiC-reinforced-aluminum alloys p 54 A84-28242 applications
- MICROCRACKS Thermo-mechanical behaviour of CFRP tubes for space structures
- [IAF PAPER 83-417] n 22 A84-11814 Fracture mechanics of ceramics. Volume 5 - Surface flaws, statistics, and microcracking p 54 A84-24501
- MICROMETEOROIDS Flexible radiator thermal vacuum test report
- [NASA-CR-171764] MICROPROCESSORS
- of algorithms for the processing of radio signals and nois in large antenna arrays p 48 A84-28067 MICROWAVE ANTENNAS
- The small transmitter receiver stations in the Sirio experiment --- microwave transmission
- [FUB-50-1982] p 49 N84-15386 p 50 N84-17235 Adaptive microwave reflector Microwave reflector characterization using simple instruments in EVA p 50 N84-17236
- MICROWAVE EQUIPMENT The US space station: Potential base for a spaceborne
- microwave facility p 78 N84-16420 MICROWAVE RADIOMETERS
- Technology needs of advanced Earth observation spacecraft NASA-CR-36981 p 9 N84-17248
- MICROWAVE TRANSMISSION
- Application of beam power technology to a space tation p 45 A84-15642 An electric propulsion transportation system from station low-earth orbit to geostationary orbit utilizing beamed microwave power p 61 A84-21485 Radiation characteristics of array antennas with
- disturbed aperture coverage p 48 A84-26516 The small transmitter receiver stations in the Sirio experiment --- microwave transmission
- p 49 N84-15386 FUB-50-19821 MILITARY OPERATIONS
- Potential military applications of space platforms and nace stations p 2 A84-13330 MILITARY SPACECRAFT
- Systems considerations in mosaic focal planes --- for military spaceborne surveillance MILITARY TECHNOLOGY p 75 A84-28576
 - National security implications of a U.S. space station
- p 73 A84-24635 Identification of new potential scientific and technology areas for DoD application. Summary of activities [AD-A134372] p 78 N84-17050
- MINICOMPUTERS Potential of minicomputer-array processor system for
- nonlinear finite-element analysis p 46 A84-20583 MIRRORS
- Spacecraft thermal control selection for seven years of lifetime in synchronous orbit [MBB-UR-584-82-OE]
- p 25 N84-11200 Optical coating in space (NASA-CR-175441) p 56 N84-21290
- MISSION PLANNING
- Space logistics --- preparing for future space missio [IAF PAPER 83-24] p 64 A84-11719 Overview of NASA space station activities
- [IAF PAPER 83-48] p 1 A84-11726 European utilisation aspects for a space station p 64 A84-11727 [IAF PAPER 83-54]
- Space station A Canadian perspective p 65 A84-11728 [IAF PAPER 83-55] p 65 A84-11728 Management of the radiolink of the solar sail spacecraft
- y radio-amateurs p 44 A84-11823 [IAF PAPER 83-447]
- The German Spacelab mission D1 p 69 A84-17762 Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763
- Manned planetary missions? p 71 A84-21497 Mankind's interstellar future p 71 A84-21499 Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20.
 - 1983 p 72 A84-24626

Use of space station for science p 72 A84-24629 The role of space station in earth sciences p 72 A84-24631 Probable missions and transportation scenarios to use regenerative life support systems [AAS PAPER 83-201] p 76 A84-29854 Payload missions integration p 7 N84-15171 [NASA-CR-170949] An alternate concept for expanding man's presence in space [NASA-TM-84617] p 7 N84-15172 STS-9: Orbital workshop spacelab to fly on ninth Shuttle mission [NASA-TM-85497] p 78 N84-16242 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-18265 Space station needs, attributes and architectural options tudy. Volume 2: Mission analysis [NASA-CR-173333] p 9 N84-18266 Space station needs, attributes and architectural options study. Final executive review [NASA-CR-173335] p 10 N84-18269 Space station needs, attributes and architectural options. Part 1: Summary [NASA-CR-175382] p 10 N84-18270 Space Station needs, attributes and architectural options: Summary briefing [NASA-CR-173328] p 10 N84-18271 Space station needs, attributes and architectural options study. Briefing material: Final review and executive summary [NASA-CR-173321] p 10 N84-18273 Space Station needs, attributes, and architectural options study [NASA-CR-173327] p 11 N84-18274 Space station needs, attributes and architectural options. Summary of major study activities and results. Space station program observations [NASA-CR-173345] p 11 N84-18275 Space station needs, attributes and architectural options. Volume 4, attachment 1: Task 2 and 3 mission implementation and cost [NASA-CR-173330] p 12 N84-18290 Space station needs, attributes and architectural options. Volume 1, attachment 1: Executive summary NASA [NASA-CR-173337] p 12 N84-18293 Space station needs, attributes and architectural options. Volume 1, attachment 2: Supporting data and analysis reports [NASA-CR-173336] p 13 N84-18294 Space Station needs, attributes and architectural Volume 2, book 1, part 1: options. Mission requirements [NASA-CR-173312] p 13 N84-18296 Space Station needs, attributes and architectural options. Volume 2, book 1, part 2, task 1: Mission requirements [NASA-CR-173313] p 13 N84-18297 Space Station needs, attributes and architectural options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites [NASA-CR-173314] p 13 N84-18298 Space Station needs, attributes and architectural options. Volume 2, book 1, part 4: Payload element mission data sheets [NASA-CR-173315] p 13 N84-18299 Space Station needs, attributes and architectural options. Volume 2, book 2, part 2, Task 2: Information management system [NASA-CR-173317] p 13 N84-18301 Space Station needs, attributes and architectural options. Volume 2, book 2, part 3: Communication system [NASA-CR-173318] p 14 N84-18302 Space Station needs, attributes and architectural options, volume 2, book 3: Cost and programmatics [NASA-CR-173320] p 14 N84-16 p 14 N84-18304 Spacelab data book p 79 N84-18315 [ESA-BR-14] Definition of technology development missions for early space stations orbit transfer vehicle serving. Phase 2, task 1: Space station support of operational OTV servicing [NASA-CR-170984] p 14 N84-19377 Civil space station (S-REPT-98-523) p 79 N84-20613 MODAL RESPONSE Experimental study of active vibration control p 38 N84-14546 [AD-A133818] Component mode synthesis and large deflection vibrations of complex structures --- beams and trusses [NASA-CR-173338] p 21 N84-18680

p 21 N84-18680

Integrated requirements for a space station p 4 A84-24628

p 28 N84-20622 Characteristics of the microprocessor implementation

Development of procedur	es fo	r compo	nent mode
synthesis	•		
(DFVLR-IB-232-82-C-09)		p 30	N84-21626

MOISTURE CONTENT Effect of temperature, moisture and radiation exposures on composite mechanical properties p 55 A84-28900

MOMENTUM TRANSFER Soace station control requirements and flywheel system

weights for combined momentum and energy storage N84-12236 p 37

MSAT

MSAT mobile communication demonstration satellite system and bus tradeoff considerations

p 48 A84-25306 [AIAA PAPER 84-0751] MULTIBEAM ANTENNAS

ULTIBEAM ANTENNAS Multibeam phased arrays - Application to SOC/Free-Flyer communication system — Space p 45 A84-15641 Narrow multibeam satellite ground station antenna

employing a linear array with a geosynchronous arc coverage of 60 deg. II - Antenna design p 46 A84-17743

- A deployable 30/20 GHz multibeam offset antenna [AIAA PAPER 84-0658] p 20 A84-25258
- Land-mobile communications satellite system design [AIAA PAPER 84-0753] A84-25308 p 5

MULTIMISSION MODULAR SPACECRAFT Application of a common reflector configuration to a

multimission satellite of the 90's [IAF PAPER 83-60] p 1 A84-11731

MYLAR (TRADEMARK) Erosion of mylar and protection by thin metal films

p 52 A84-10949 [AIAA PAPER 83-2636]

Ν

NASA PROGRAMS

Space applications at the crossroads; Proceedings of the Twenty-first Goddard Memorial Symposium, Greenbelt, MD, March 24, 25, 1983 p 64 A84-10883 Overview of NASA space station activities [IAF PAPER 83-48] p 1 A84-11726 European utilisation aspects for a space station p 64 A84-11727 [IAF PAPER 83-54] NASA priority technologies p 1 A84-11793 [IAF PAPER 83-345] p 66 A84-13901 Spacelab's development Spaceflight to 2000 - Interavia looks forward from the present p 66 A84-14764 Mission to Mars - The case for a settlement p 67 A84-15092 Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October p 67 A84-15381 25-27, 1982 Space stations - A key to socio-economic benefits from p 69 A84-19850 space? p 71 A84-21720 Space 1991 NASA's geostationary communications platform program AIAA PAPER 84-07021 p 5 A84-25326 NASA research in teleoperation and robotics p 58 A84-28523 Space stations - The next step in space? [AAS PAPER 83-202] p 76 AAS PAPER 83-202] p 76 A84-29855 International aspects of commercial space activities p 77 [AAS PAPER 83-222] A84-29866 International competition in commercial aerospace markets p 77 A84-29883 [AAS PAPER 83-244] Research and technology, 1983 [NASA-TM-85702] p 7 N84-12026 NASA's space station activities [GPO-27-393] p 7 N84-14234 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Civil space station [S-REPT-98-523] p 79 N84-20613 Housing Department of and Urban Development-independent agencies appropriations for 1984: National Aeronautics and Space Administration p 80 N84-21440 Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 p 80 N84-21441 [H-REPT-98-6291

Review of the National Aeronautics and Space Act of 1958 [GPO-28-915] p 80 N84-21442

National Aeronautics	and	Space Administration
Authorization Act, 1985		p 80 N84-21443
National Aeronautics	and	Space Administration
Authorization Act, 1985		
[H-REPT-98-629]		p 80 N84-21444

NASTRAN

Component mode synthesis and large deflection vibrations of complex structures - beams and trusses [NASA-CR-173338] p 21 N84-18680 Decentralized control of a large space structure using direct output feedback [AD-A136781] p 41 N84-19464 The effect of mass and stiffness changes on the damping factor in a large space structure as represented by the CSDL 2 model

(AD-A1369841 p 42 N84-19465 NAVSTAR SATELLITES

Autonomous navigation of geosynchronous satellites using the Navstar Global Positioning System p 45 A84-15671

NEAR FIELDS A cylindrical near-field test facility for large satellite antennas

[MBB-UR-628-83-OE] p 72 A84-22862 NETWORK CONTROL

Space station communications and tracking equipment anagement/control system p 45 A84-15639

NONEQUILIBRIUM THERMODYNAMICS Thermofluidynamics of heat pipes p 27 N84-19423 NONLINEAR EQUATIONS

Numerical solution of several classes of nonlinear flexible shell theory problems p 35 A84-25586

NONLINEAR SYSTEMS A comparison of linear and geometrically nonlinear finite

element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887

NUMERICAL CONTROL Digital control system for space structural dampers

[NASA-CR-175355] p 39 N84-16246

0

OBSERVABILITY (SYSTEMS) Controllability and observability criteria for multivariable linear second-order models p 35 A84-25516 OCCULTATION Space operations center communications oath p 3 A84-15695 obscuration ONBOARD DATA PROCESSING Modern software development tools in space projects on the example of a Spacelab experiment p 49 N84-14761 **OPERATORS (MATHEMATICS)** Active control of large flexible space structures p 37 N84-14235 OPTICAL EQUIPMENT Coherent arrays of separate optical telescopes in space project Trio p 3 A84-15363 OPTICAL MEASUREMENT Systems considerations in mosaic focal planes --- for military spaceborne surveillance p 75 A84-28576 p 75 A84-28576 **OPTICAL MEASURING INSTRUMENTS** Coordinate transformation assembly --- for space platform angular coordinate linking p 75 A84-28579 OPTICAL PATHS path Space operations center communications obscuration p 3 A84-15695 OPTICAL PROPERTIES Evaluation of spacecraft materials and processes for optical degradation potential p 54 A84-28458 Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials p 27 N84-19449 space shuttle payloads OPTIMAL CONTROL A hardware demonstration of control for a flexible p 31 A84-13321 offset-feed antenna Number crunching on the ACOSS Model No. 2 p 33 A84-19128 Use of electromagnetic models in the optimal control of large space antennas p 35 A84-25552 OPTIMIZATION Approximations method for space frame synthesis A84-10141 p 19 Optimization of shallow trusses against limit point instability p 20 A84-23366 Optimal low-thrust transfers to synchronous orbit p 62 A84-24981 Computer tools for optimizing orbit use [AIAA PAPER 84-0651] p 74 A84-25318 ORBIT MANEUVERING ENGINE (SPACE SHUTTLE) An alternate concept for expanding man's presence in [NASA-TM-84617] p 7 N84-15172 **ORBIT PERTURBATION** Analytical model of the evolution of orbit parameters

a quasi geostationary satellite

(IAF PAPER 83-316) p 65 A84-11787 Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit

p 33 A84-19728

ORBITAL SPACE STATION	NS
-----------------------	----

ORBITAL SPACE STATIONS
ORBIT SPECTRUM UTILIZATION
Improved orbit utilization using auxiliary feeds in existing earth terminals p 48 A84-20847
Reduced domestic satellite orbit spacing
[AIAA PAPER 84-0652] p 73 A84-25253 Time phased introduction of advanced technologies -
Its impact on orbit/spectrum conservation [AIAA PAPER 84-0653] p 74 A84-25254
Computer tools for optimizing orbit use
ORBIT TRANSFER VEHICLES
Servicing vehicle for satellites and platforms in low earth orbits
[DGLR PAPER 83-102] p 6 A84-29666 Development of deployable structures for large space
platforms. Volume 2: Design development
[NASA-CR-170914] p 20 N84-10176 Fluid management p 11 N84-18284
Definition of technology development missions for early
space stations orbit transfer vehicle serving. Phase 2, task 1: Space station support of operational OTV
servicing [NASA-CR-170984] p 14 N84-19377
ORBITAL ASSEMBLY A voice interactive system for aiding and documentation
of space-based tasks
[AIAA PAPER 83-2355] p 43 A84-10025 A manned-machine space station construction
concept [NASA-TM-85762] p 21 N84-19395
Construction concept for erecting an offset-fed antenna
[NASA-TM-85774] p 60 N84-20626
Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593
ORBITAL MANEUVERS Payload placing using an operational support platform
[IAF PAPER 83-44] p 1 A84-11724 ORBITAL MECHANICS
Investigation of electrodynamic stabilization and control
of long orbiting tethers [NASA-CR-170972] p 40 N84-17251
Introduction to geostationary orbits [ESA-SP-1053] p 80 N84-21590
ORBITAL POSITION ESTIMATION
Semiautonomous stationkeeping of geosynchronous satellites p 32 A84-17359
ORBITAL SERVICING A voice interactive system for aiding and documentation
of space-based tasks [AIAA PAPER 83-2355] p 43 A84-10025
Manufacturing space systems in space
p 71 A84-22338 NASA research in teleoperation and robotics
p 58 A84-28523 Servicing vehicle for satellites and platforms in low earth
orbits [DGLR PAPER 83-102] p 6 A84-29666
An alternate concept for expanding man's presence in
space [NASA-TM-84617] p 7 N84-15172
On-orbit spacecraft/stage servicing during STS life cycle
[NASA-CR-171775] p 79 N84-20617 ORBITAL SHOTS
 Capture-ejector satellites
[NASA-TM-85686] p 7 N84-15179 ORBITAL SPACE STATIONS
Space station autonomy requirements [AIAA PAPER 83-2352] p 63 A84-10024
Overview of space station operations [IAF PAPER 83-38] p 64 A84-11723
European utilisation aspects for a space station
[IAF PAPER 83-54] p 64 A84-11727 Photovoltaic solar arrays leading to a candidate space
power system in the regime beyond 100 kW [IAF PAPER 83-422] p 44 A84-11817
Communications, tracking, and docking on the Space
Station p 45 A84-15640 Application of beam power technology to a space
station p 45 A84-15642
A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643
Determination of applicable law to living and working in space
[IAF PAPER 82-IISL-45] p 68 A84-17058
Project space station - Plans for a permanent manned space center Book p 69 A84-21344
Space station - An early experimental solar power
satellite p 70 A84-21487 Space station: Policy, planning and utilization;
Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 p 72 A84-24626
The role of man in space p 72 A84-24627
Integrated requirements for a space station p 4 A84-24628

ORBITAL VELOCITY

Use of space station for science The role of space station in earth s	p 72 A84-24629 ciences
	p 72 A84-24631
Role of a space station i	n pharmaceutical
manufacturing	p 73 A84-24632
Architectural options and developm	
••••••••••••••••••••••••••••••••••••••	p 4 A84-24633
Space station architectural issues as	s viewed by the user
community - Applications	p 4 A84-24634
National security implications of a L	
	p 73 A84-24635
Space station communications	p 73 A84-24636
Environmental control and life sup	
optimization approach Thermal management system techr	
for space station applications	lology development
[SAE PAPER \$31097]	p 24 A84-29032
The residual gravitational field of or	
[DGLR PAPER 83-089]	p 75 A84-29656
Microgravity conditions on orbital pl	
[DGLR PAPER 83-90]	p 76 A84-29657
Probable missions and transportation	on scenarios to use
regenerative life support systems	
[AAS PAPER #3-201]	p 76 A84-29854
Study of multi-kilowatt solar arra	ys for Earth orbit
applications	
[NASA-CR-170939]	p 49 N84-12634
An alternate concept for expanding	man's presence in
space	
[NASA-TM-84617]	p7 N84-15172
Capture-ejector satellites	
[NASA-TM-85686]	p 7 N84-15179
Feasibility study to conduct wi	ndblown sediment
experiments aboard a space station	- 15 NO4 01500
[NASA-CR-175434] Shuttle interaction study	p 15 N84-21586
[NASA-CR-173400]	p 80 N84-21592
Shutter interaction study extension	p 60 1104-21382
[NASA-CR-173401]	p 81 N84-21593
ORBITAL VELOCITY	p 01 1104-21000
Capture-ejector satellites	
[NASA-TM-85686]	p 7 N84-15179
ORBITS	
Space Station needs, attributes	and architectural
Space Station needs, attributes options. Volume 2, book 1, p	
options. Volume 2, book 1, p requirements [NASA-CR-173312]	
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS	p 13 N84-18296
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and	part 1: Mission p 13 N84-18296 space project
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management	p 13 N84-18296
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS	p 13 N84-18296 space project p 2 A84-15303
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si	p 13 N84-18296 space project p 2 A84-15303 atellite with respect
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or	p 13 N84-18296 space project p 2 A84-15303 atellite with respect
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space	bart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING	p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr	p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination of spaceoraft materials	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination of spaceoraft materials	aart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spaceocraft materials optical degradation potential	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effet	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters	aart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 htts on surfaces
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effec of Space Shuttle Orbiters [AIAA PAPER 84-0548]	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 with an surfaces
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 with an surfaces
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacesarily Evaluation of spacesarily Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection 1	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 54 A84-28458 cts on surfaces p 53 A84-19912 p 53 A84-19912
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING USing the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection 1 [AIAA PAPER 83-2836] OXYGEN ATOMS Reactions of high velocity atomic of	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 acts on surfaces p 53 A84-19912 oy thin metal films p 52 A84-10949 oxygen with carbon
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection II [AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549]	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 hots on surfaces p 53 A84-19912 oy thin metal films p 52 A84-10949 p 53 A84-18159
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection t [AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 hots on surfaces p 53 A84-19912 oy thin metal films p 52 A84-10949 p 53 A84-18159
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 53 A84-28458 cts on surfaces p 53 A84-19912 by thin metal films p 52 A84-10949 bygen with carbon p 53 A84-18159 cts on surfaces
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 hots on surfaces p 53 A84-19912 oy thin metal films p 52 A84-10949 p 53 A84-18159
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection to [AIAA PAPER 84-0548] OXIGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXYGEN PLASMA	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17174 and processes for p 54 A84-28458 https on surfaces p 53 A84-19912 by thin metal films p 52 A84-10949 by thin metal films p 53 A84-18159 cts on surfaces p 53 A84-18159 cts on surfaces p 53 A84-18912
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection t [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] CXYGEN PLASMA Effects of combined ultraviolet a	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17077 een materials for p 53 A84-17174 and processes for p 53 A84-17174 and processes for p 53 A84-19912 by thin metal films p 52 A84-10949 by thin metal films p 52 A84-10949 by thin surfaces p 53 A84-18159 cts on surfaces p 53 A84-19912 nd oxygen plasma
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection t [AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal c	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 est on surfaces p 53 A84-19912 p 53 A84-19912 ov thin metal films p 53 A84-18159 cts on surfaces p 53 A84-19912 nd oxygen plasma ontrol materials
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN ATOMS Effects of combined ultraviolet a environment on spacecraft thermal c space shuttle payloads	part 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17077 een materials for p 53 A84-17174 and processes for p 53 A84-17174 and processes for p 53 A84-19912 by thin metal films p 52 A84-10949 by thin metal films p 52 A84-10949 by thin surfaces p 53 A84-18159 cts on surfaces p 53 A84-19912 nd oxygen plasma
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effec of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection t [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effec of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] DOXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal c space shuttle payloads OXYGEN PRODUCTION	bart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17077 een materials for p 53 A84-17174 and processes for p 53 A84-17174 and processes for p 53 A84-19912 by thin metal films p 52 A84-10949 p 53 A84-19912 oxygen with carbon p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 83-2636] OXIGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0549] Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal c space shuttle payloads OXYGEN PRODUCTION Electrochemical and steam-desc	aart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-19912 p 53 A84-19912 p 53 A84-18159 cts on surfaces p 53 A84-19912 oy thin metal films p 53 A84-19912 nd oxygen vith carbon p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449 orbed amine CO2
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal of space shuttle payloads OXYGEN PRODUCTION Electrochemical and steam-deso concentration Subsystem compari	aart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-19912 p 53 A84-19912 p 53 A84-18159 cts on surfaces p 53 A84-19912 oy thin metal films p 53 A84-19912 nd oxygen vith carbon p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449 orbed amine CO2
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection th [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal c space shuttle polyadas OXYGEN PRODUCTION Electrochermical and steam-desc concentration Subsystem compari recovery on Space Station	bart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 extra on surfaces p 53 A84-19912 by thin metal films p 52 A84-10949 p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449 broked amine CO2 son for oxygen
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 83-2636] OXYGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of (AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal of space shuttle payloads OXYGEN PRODUCTION Electrochemical and steam-deso concentration Subsystem compari	aart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-19912 p 53 A84-19912 p 53 A84-18159 cts on surfaces p 53 A84-19912 oy thin metal films p 53 A84-19912 nd oxygen vith carbon p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449 orbed amine CO2
options. Volume 2, book 1, p requirements [NASA-CR-173312] ORGANIZATIONS Human organization and management OSCILLATIONS Periodic oscillations of a gyrostat si to the centers of mass in a circular or OUTER SPACE TREATY Determination of applicable law to in outer space [IAF PAPER 82-IISL-44] OUTGASSING Using the outgassing test to scr contamination potential Evaluation of spacecraft materials optical degradation potential OXIDATION Low earth orbit atomic oxygen effe of Space Shuttle Orbiters [AIAA PAPER 84-0548] OXIDATION RESISTANCE Erosion of mylar and protection th [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN ATOMS Reactions of high velocity atomic of [AIAA PAPER 84-0548] OXYGEN PLASMA Effects of combined ultraviolet a environment on spacecraft thermal c space shuttle polyadas OXYGEN PRODUCTION Electrochermical and steam-desc concentration Subsystem compari recovery on Space Station	bart 1: Mission p 13 N84-18296 space project p 2 A84-15303 atellite with respect bit p 33 A84-19728 living and working p 68 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 een materials for p 53 A84-17057 extra on surfaces p 53 A84-19912 by thin metal films p 52 A84-10949 p 53 A84-19912 nd oxygen plasma ontrol materials p 27 N84-19449 broked amine CO2 son for oxygen

- Electrically conductive black optical paint p 55 A84-28553 PANEL FLUTTER
 - Investigation of articulated panel dynamics p 40 N84-17230

P

PAINTS

PANELS

- Field repair of graphite epoxy skin panels on the spaceship Columbia p 52 A64-17120 Investigation of articulated panel dynamics p 40 N84-17230 Fiexible radiator thermal vacuum test report
- [NASA-CR-171764] p 28 N84-20622 Flexible radiator system: Executive summary [NASA-CR-171766] p 28 N84-20624
- [NASA-CR-171766] p 28 N84-20624 PARABOLIC ANTENNAS
- Large inflated-antenna system p 9 N84-17234
 PARABOLIC REFLECTORS
- Study on large, ultralight long-life structures in space, phase 2C [TM-EKR3] p 17 N84-17284
- PARAMETER IDENTIFICATION Structural parameter identification for flexible
- Spacecraft [AIAA PAPER 84-0060] p 23 A84-17853
- Determination of critical parameters in large flexible space structures with uncertain modal data p 33 A84-20047
- Identification of large flexible structures mass/stiffness and damping from on-orbit experiments
- p 34 A84-24995 Parameter identification in continuum models p 16 A84-25525
- PARTICLE INTERACTIONS Feasibility study to conduct windblown sediment experiments aboard a space station
- [NASA-CR-175434] p 15 N84-21586 PARTICLE MOTION
- Feasibility study to conduct windblown sediment experiments aboard a space station
- [NASA-CR-175434] p 15 N84-21586 PARTICLE TRAJECTORIES
- Feasibility study to conduct windblown sediment experiments aboard a space station [NASA-CR-175434] p 15 N84-21586
- [NASA-CH-1/2434] p 15 N84-21586 PARTITIONS (MATHEMATICS) Algorithms and computational aspects pertaining to block diagonal dominance methods for design of
- decentralized feedback compensation p 15 A84-19108
- PAYLOAD CONTROL A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 A design strategy for multiple payload pointing from a three axis stabilized spacecraft [AIAA PAPER 84-0566] p 33 A84-18168
- Space platform accommodations --- for multiple interchangeable payloads p 16 A84-22131 Geometric modeling of large space antenna deployment p 22 N84-22225 PAYLOAD DELIVERY (STS)
- Space platform accommodations --- for multiple interchangeable payloads p16 A84-22131 Space station needs, attributes and architectural options. Part 1: Summary [NASA-CR-175382] p10 N84-18270
- Space station needs, attributes and architectural options study. Briefing material: Final review and executive summary [NASA-CR-173321] p 10 N84-18273
- PAYLOAD INTEGRATION PLAN Launch processing for Spacelab 1
- [AIAA PAPER 83-2622] p 64 A84-10965 Space platform accommodations --- for multiple interchangeable payloads p 16 A84-22131 Payload missions integration
- [NASA-CR-170949] p 7 N84-15171 PAYLOAD RETRIEVAL (STS)
- On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 PAYLOAD TRANSFER
- Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 PAYLOADS
- Space Station needs, attributes and architectural options. Volume 2, book 1, part 2, task 1: Mission requirements
- [NASA-CR-173313] p 13 N84-18297 Space Station needs, attributes and architectural options. Volume 2, book 1, part 4: Payload element mission data sheets
- [NASA-CR-173315] p 13 N84-18299 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports [NASA-CR-173319] p 14 N84-18303 A Variable Conductance Heat Pipe (VCHP) radiator
- system for communications payloads p 27 N84-19406 **PERFORMANCE PREDICTION** Prediction of solar cell performance in space
 - p 48 A84-22997

p 44 A84-10396

Experiment data communications (48 Mbit/s) between

Spacelab, the Space Shuttle and the ground

PERFORMANCE TESTS

The Spacelab test program p 66 A84-13376 [AIAA PAPER 83-2685] Design and development of the INTELSAT p 19 A84-22153 graphite-epoxy central thrust tube A cylindrical near-field test facility for large satellite entennas [MBB-UR-628-83-OE] p 72 A84-22862 Hyperfiltration wash water recovery subsystem - Design and test results --- for extended mission spacecraft such as space stations (SAE PAPER 831112) p.6 A84-29047 PHASE CHANGE MATERIALS Weight characteristics of future spacecraft thermal management systems [AIAA PAPER 84-0054] p 23 A84-17850 PHASED ARRAYS Multibeam phased arrays - Application to SOC/Free-Flyer communication system -- Space Operation Center p 45 A84-15641 Radiation characteristics of array antennas with D 48 A84-26516 disturbed aperture coverage PHOTONIC PROPULSION Management of the radiolink of the solar sail spacecraft by radio-amateurs [IAF PAPER 83-447] p 44 A84-11823 Roundtrip interstellar travel using laser-pushed p 62 A84-27443 lightsails PHOTOVOLTAIC CELLS Photovoltaic solar arrays leading to a candidate space power system in the regime beyond 100 kW p 44 A84-11817 [IAF PAPER 83-422] PHOTOVOLTAIC CONVERSION Mechanical wraparound contacted cell for low cost pace arrays p 48 A84-22982 PHYSIOLOGICAL EFFECTS Man in space - An overview p 67 A84-15161 PHYSIOLOGY The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station p 14 N84-20610 [NASA-CB-175436] PIPES (TUBES) Thermal control of tubular composite structures in space environment nvironment p 22 A84-10440 Thermo-mechanical behaviour of CFRP tubes for space structures [IAF PAPER 83-417] p 22 A84-11814 PIVOTS Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 59 N84-11761 PLASMA DENSITY Interpretation of STS-3/plasma diagnostics package results in terms of large space structure plasma interactions [NASA-CR-173266] p 78 N84-16991 PLASMA DIAGNOSTICS Interpretation of STS-3/plasma diagnostics package results in terms of large space structure plasma interactions [NASA-CR-173266] p 78 N84-16991 PLASMA INTERACTIONS Plasma sheath structure surrounding a large powered spacecraft p 46 A84-18025 (AIAA PAPER 84-0329) Interpretation of STS-3/plasma diagnostics package results in terms of large space structure plasma interactions [NASA-CR-173266] p 78 N84-16991 Photovoltaic concentrator pointing dynamics and plasma interaction study p 50 N84-17224 Spacecraft/plasma interactions and their influence on field and particle measurements --- conferences p 56 N84-17253 [ESA-SP-198] PLASMA POTENTIALS Spacecraft/plasma interactions and their influence on field and particle measurements --- conferences p 56 N84-17253 [ESA-SP-198] The role of potential barrier formation in spacecraft p 50 N84-17269 charging PLASMA SHEATHS Plasma sheath structure surrounding a large powered acecraft p 46 A84-18025 [AIAA PAPER 84-0329] Sheath ionization model of beam emissions from large spacecrafts

- spacecrafts [AD-A137181] p 52 N84-19463 PLATFORMS
- STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211

Space Technology Experiments overview	Platform (STEP) p 8 N84-17212
STEP mechanical systems	p 8 N84-17213
STEP experiment integration	p 8 N84-17215
POINTING CONTROL SYSTEMS	
Simulation of the Galileo spacecra algorithm	p 66 A84-11938
A design strategy for multiple paylo	•
three axis stabilized spacecraft	- 00
(AIAA PAPER 84-0566) Evolution of European telecom	p 33 A84-18168
pointing performance	incriteacon satenite
[AIAA PAPER 84-0725]	p 34 A84-25291
Photovoltaic concentrator pointing dy interaction study	p 50 N84-17224
Space Station needs, attributes	
options, volume 2, book 2, part 4: 1	nternational reports
[NASA-CR-173319]	p 14 N84-18303
Precise control of flexible manipulat [NASA-CR-175389]	p 60 N84-20175
POLAR REGIONS	
Large space instrumentation to mea between space structures and the em	
[AD-A129990]	p 77 N84-10179
POLICIES	
Global implications of space activitie Institute Assessment Book	p 67 A84-15189
Space station: Policy, planning	
Proceedings of the Symposium, Arling	ton, VA, Juty 18-20,
1983 Review of the National Aeronautics	p 72 A84-24626
1958	
[GPO-28-915]	p 80 N84-21442
POSITIONING Geometric modeling of large	space antenna
deployment	p 22 N84-22225
POWER CONDITIONING	
A programmable power processor fo applications	p 46 A84-18394
Power-economical considerations for	
terrestrial and extraterrestrial solar gen	
power generation systems IPACS attitude control technology of	p 71 A84-21488
in ree alliage conserteeningy a	p 37 N84-12238
Advanced Control and Power	System (ACAPS)
technology program IPACS guidance navigation and	p 37 N84-12243 d control system
considerations and test activities	p 37 N84-12245
POWER EFFICIENCY	
	p 46 A84-18394
applications POWER SUPPLIES	p 46 A84-18394
applications POWER SUPPLIES Current collection from the spa	p 46 A84-18394 ce plasma through
applications POWER SUPPLIES	p 46 A84-18394 ce plasma through
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE : Development of procedures for	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVUR-IB-232-82-C-09]	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management -	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338]	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving tynamic technology p 43 A84-10016 in pharmaceutical
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a c base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 eproject: The SPOT p 78 N84-14752
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a c base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modem software development tool on the example of a Spacelab experim	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrJB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experint Design and development of an add	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14751 s in space projects nent p 49 N84-14761
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modem software development tool on the example of a Spacelab experim	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrIB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experint Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14761 yance projects nent p 49 N84-14761 Vanced solar array p 17 N84-18457
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modem software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p project: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Vanced solar array p 17 N84-18457 tiques - Realization al robot system
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrJB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experint Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Vanced solar array p 17 N84-18457 hiques - Realization al robot system p 58 A84-25828
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modem software development tool on the example of a Spacelab experind Design and development of an add drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p project: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Vanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis (DFVLR-IB-232-82-C-09) PRODUCT DEVELOPMENT Space station data management - from changing requirements and a c base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Nanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLFIB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center Modern software development of an ad drive mechanism PRODUCT DENERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Nanced Solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space Vay 3-14, 1882, p 2 A84-15301 space project
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis (DFVLR-IB-232-82-C-09) PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techr of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Nanced solar array p 17 N84-18457 tiques - Realization al robot system
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLFIB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center Modern software development of an ad drive mechanism PRODUCT DENERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Nanced solar array p 17 N84-18457 tiques - Realization al robot system
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis (DFVLR-IB-232-82-C-09) PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modem software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space projects Management of large space projects	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14751 Nanced solar array p 17 N84-18457 siques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15301 space industry p 2 A84-15305 - Quality assurance
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a c base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toutouse, France, I Proceedings Human organization and management of large space projects or 'product assurance'	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761 Nanced solar array p 17 N84-18457 hiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15301 space industry p 2 A84-15305
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis (DFVLR-IB-232-82-C-09) PRODUCT DEVELOPMENT Space station data management - from changing requirements and a c base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management The progression of projects in sp Management of large space projects The Spacelab program - The mit	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-21626 A system evolving dynamic technology p 43 A84-10016 p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s nspace projects ne space p 73 N84-14751 Vanced solar array p 17 N84-14751 N84-14753 siques - Realization al robot system p 58 A84-25828 s; Course on Space system on Space May 3-14, 1982, p 2 A84-15303 space industry p 2 A84-15303 p 73 A84-15305 -Coullity assurance p 3 A84-15310 p 67 p 67 A84-15310 p 67 A84-15321 anagement of the
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Tochnology, Toutouse, France, I Proceedings Human organization and management The progression of projects in s Management of large space projects The Spacelab program - The ma program, problems encountered tool	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761 Nanced solar array p 17 N84-18457 hiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1982; p 2 A84-15301 space project p 2 A84-15303 p 2 A84-15310 p 67 A84-15311 anagement of the and the solutions
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis (DFVLrB-232-82-C-09) PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management The progression of projects in af Management of large space projects The Spacelab program - The mi program, problems encountered of	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Vkanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15305 sace industy p 2 A84-15305 Quality assurance p 3 A84-15321 anagement of the and the solutions p 3 A84-15321
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-322-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toutouse, France, I Proceedings Human organization and management The progression of projects in s Management of large space projects The Spacelab program - The ma program, problems encountered a adopted Solar power satellites - The instituti	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-21626 p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761 Nanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15301 space project p 2 A84-15303 ace industry p 2 A84-15303 ace industry p 2 A84-15303 p 67 A84-15310 p 67 A84-15321 anagement of the and the solutions p 3 A84-15325 onal challenge p 70 A84-21479
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development of an ad drive mechanism PRODUCTION ENGINEERING Sudy of artificial intelligence techni of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management The progression of projects in af Management of large space projects The Spacelab program - The mit program, problems encountered a adopted Space station - An earty experti-	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Veanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15303 sace industry p 3 A84-15325 onal challenge p 3 A84-15325 onal challenge p 70 A84-21479 mental solar power
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLR-IB-322-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a co base [AIAA PAPER 83-2338] Role of a space station i manufacturing Software production in a large space mission center Modern software development tool on the example of a Spacelab experim Design and development of an ad drive mechanism PRODUCTION ENGINEERING Study of artificial intelligence techn of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toutouse, France, I Proceedings Human organization and management The progression of projects in s Management of large space projects The Spacelab program - The ma program, problems encountered a adopted Solar power satellites - The instituti	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-21626 p 73 A84-24632 project: The SPOT p 78 N84-14752 s in space projects ment p 49 N84-14761 Nanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15301 space project p 2 A84-15303 ace industry p 2 A84-15303 ace industry p 2 A84-15303 p 67 A84-15310 p 67 A84-15321 anagement of the and the solutions p 3 A84-15325 onal challenge p 70 A84-21479
applications POWER SUPPLIES Current collection from the spa defects in high voltage solar array ins PREDICTION ANALYSIS TECHNIQUE: Development of procedures for synthesis [DFVLrB-232-82-C-09] PRODUCT DEVELOPMENT Space station data management - from changing requirements and a C base [AIAA PAPER 83-2338] Role of a space station in manufacturing Software production in a large space mission center Modern software development of an ad drive mechanism PRODUCTION ENGINEERING Sudy of artificial intelligence techni of a highly autonomous experiment French thesis PROJECT MANAGEMENT Management of large space project Technology, Toulouse, France, I Proceedings Human organization and management The progression of projects in af Management of large space projects The Spacelab program - The mit program, problems encountered a adopted Space station - An earty experti-	p 46 A84-18394 ce plasma through ulation p 49 N84-15970 S component mode p 30 N84-21626 A system evolving dynamic technology p 43 A84-10016 in pharmaceutical p 73 A84-24632 p roject: The SPOT p 78 N84-14752 s in space projects nent p 49 N84-14761 Veanced solar array p 17 N84-18457 tiques - Realization al robot system p 58 A84-25828 s; Course on Space May 3-14, 1882, p 2 A84-15303 sace industry p 3 A84-15325 onal challenge p 3 A84-15325 onal challenge p 70 A84-21479 mental solar power

Software production in a large space project: The SPOT
mission center p 78 N84-14752
Space Station needs, attributes and architectural
options, volume 2, book 3: Cost and programmatics
[NASA-CR-173320] p 14 N84-18304
An Attached Payload Operations Center (APOC) at the
Goddard Space Flight Center (GSFC), volume 1
[NASA-CR-175160] p 79 N84-20605
PROJECT PLANNING
Spacelab's development p 66 A84-13901
Management of large space projects; Course on Space
Technology, Toulouse, France, May 3-14, 1982,
Proceedings p 2 A84-15301
The progression of projects in space industry
p 2 A84-15305
Tethers in space: Birth and growth of a new avenue
to space utilization
[NASA-TM-82571] p 18 N84-21607
PROPELLANT STORAGE
Shuttle interaction study extension
[NASA-CR-173398] p 81 N84-21594
PROPULSION SYSTEM PERFORMANCE
Utilization of electric propulsion for communication
satellites
[AIAA PAPER 84-0729] p 62 A84-25293
Why don't we use ion propulsion?
[AIAA PAPER 84-0730] p 62 A84-25294
PROTECTIVE COATINGS
Erosion of mytar and protection by thin metal films
[AIAA PAPER 83-2636] p 52 A84-10949
Optical coating in space
[NASA-CR-175441] p 56 N84-21290
PROTOTYPES
Feasibility study to conduct windblown sediment
experiments aboard a space station
[NASA-CR-175434] p 15 N84-21586
PUBLIC RELATIONS
Making the high frontier highly visible with a solar sail
race to the moon
[AAS PAPER 83-226] p 62 A84-29869
PYROELECTRICITY
Pyroelectric materials as electronic pulse detectors of
ultraheavy nuclei p 72 A84-23440
•
Q Q

QUALITY CONTROL Management of large space projects - Quality assurance or 'product assurance' p 3 A84-15310 Using the outgassing test to screen materials for p 53 A84-17174 contamination potential Software quality assurance Spacelab experience and p 17 N84-14759 future trends Integrity control of carbon fiber reinforced plastics structural elements, phase 1 report --space applications [TB-TS-11-01/82-A] p 56 N84-18416 QUARTZ LAMPS Spacecraft thermal balance testing using infrared lamps

on a dummy spacecraft p 26 N84-19399 QUENCHING (COOLING)

The effect of pressure and temperature on time-dependent changes in graphite/epoxy composites p 54 A84-21775 below the glass transition

R

RADAR ANTENNAS RF systems in space. Volume 2: Space-based radar analyses
[AD-A133735] p 49 N84-14394
RF systems in space. Volume 1: Space antennas frequency (SARF) simulation
[AD-A133734] p 49 N84-14395
The effects of aperture antennas after signal propagation through anisotropic ionized media
[AD-A138286] p 52 N84-21781
RADIAL DISTRIBUTION
Thermally induced spin rate ripple on spacecraft with
long radial appendages
[NASA-TM-85058] p 39 N84-16249
RADIANT FLUX DENSITY
Assessment of satellite power flux-density limits in the
2025-2300 MHz frequency range, part 1
[PB84-129402] p 51 N84-18532
IRSIM: A program for the calculation of infrared flux
intensity incident on a spacecraft inside a test chamber
p 26 N84-19400
RADIANT HEATING
Radiation-conduction interaction in large space

50000005		
(AIAA PAPER 84-0144)	p 23	A84-17911

		4		
DE	חוות	EDC		νιτγ
nE.			1 N M	

RADIATION COUNTERS

Pyroelectric materials as electronic pulse detectors of ultraheavy nuclei p 72 A84-23440 RADIATION DAMAGE

Effect of temperature, moisture and radiation exposures on composite mechanical properties p 55 A84-28900 RADIATION EFFECTS

Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials space shuttle payloads p 27 N84-19449

RADIATION PRESSURE Torque from solar radiation pressure gradient during

eclipse --- for very large spacecraft p 31 A84-12489 Computing the radiation pressure forces by adapting thermal design verification softwares --- large space p 28 N84-21613 structures

RADIATION SHIELDING

Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p 74 A84-25304

RADIATIVE HEAT TRANSFER Thermal analysis research applicable to space station

technology needs

p 25 N84-15426 [NASA-TM-84658] RADIO ANTENNAS

Geodetic control of the reflectors of large antennas p 31 A84-15785

Characteristics of the microprocessor implementation of algorithms for the processing of radio signals and noise p 48 A84-28067 in large antenna arrays

RADIO COMMUNICATION

A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 Telecommunication systems for large-scale space manufacturing activity

[AAS PAPER 83-216] p 48 A84-29861 Space Station needs, attributes and architectural options. Volume 2, book 2, part 3: Communication system

[NASA-CR-173318] p 14 N84-18302 RADIO FREQUENCIES

Use of electromagnetic models in the optimal control of large space antennas p 35 A84-25552 RF systems in space. Volume 2: Space-based radar p 35 A84-25552

analyses p 49 N84-14394 [AD-A133735]

RF systems in space. Volume 1: Space antennas frequency (SARF) simulation

p 49 N84-14395 [AD-A133734] RADIO RELAY SYSTEMS

A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 RADIO TELEMETRY

Management of the radiolink of the solar sail spacecraft by radio-amateurs

[IAF PAPER 83-447] p 44 A84-11823 RANDOM VIBRATION

Dynamic behaviour of a satellite antenna structure in p 42 N84-19900 random vibration environment REACTION KINETICS

Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents

[NASA-TM-77534] p 26 N84-18576 REACTION WHEELS

BAe reaction wheels for Olympus --- Olympus telecommunication satellite p 17 N84-18475 p 17 N84-18475 **RECONNAISSANCE SPACECRAFT**

Systems considerations in mosaic focal planes --- for military spaceborne surveillance p 75 A84-28576 p 75 A84-28576 RECTANGULAR PLATES

Control structure interactions in large space structures Analysis using energy approach --- for constant and pulsed p 35 A84-27934 RECURSIVE FUNCTIONS

Recursive lagrangian dynamics of flexible manipulator arms via transformation matrices

p 60 N84-20316 [AD-A137345] REDUCED GRAVITY

Utilisation of the European retrieval carrier EURECA for te science research p 65 A84-11753 Microgravity conditions on orbital platforms life science research

p 76 A84-29657 [DGLR PAPER 83-90] p 76 A84-29657 Second All-Union Seminar on Hydromechanics and

Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents [NASA-TM-77534]

p 26 N84-18576 The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station [NASA-CR-175436]

p 14 N84-20610

REFLECTING TELESCOPES

- REFLECTING TELESCOPES STEP flight experiments Large Deployable Reflector (LDR) telescope p.8 N84-17231 REFLECTORS Application of a common reflector configuration to a multimission satellite of the 90's p 1 A84-11731 [IAF PAPER 83-60] Geodetic control of the reflectors of large antennas p 31 A84-15785 antenna reflectors for Advanced composite p 53 A84-17151 communications satellites Static shape forming for an electrostatically controlled p 16 A84-25551 membrane mirror **REGENERATION (ENGINEERING)** p 11 N84-18280 Crew and life support: ECLSS REGENERATIVE FUEL CELLS p.37 N84-12235 The Boeing flywheel study REGENERATORS Regenerable non-venting thermal control subsystem for extravehicular activity p 24 A84-29076 [SAE PAPER 831151] REGULATIONS A legal charter for non-governmental space industrialization p 77 A84-29868 [AAS PAPER 83-225] REINFORCED PLATES Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure RELIABILITY ANALYSIS p 23 A84-14050 Assessment of reliability of ceramic materials p 54 A84-24508 REMOTE CONTROL Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development p 59 N84-10583 [NASA-CR-3734] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications INASA CB-37351 p 59 N84-10584 REMOTE MANIPULATOR SYSTEM Canadarm and the Space Shuttle p 57 A83-44602 A system for intelligent teleoperation research p 57 A84-10070 [AIAA PAPER 83-2376] Simulation of the motion of a Shuttle-attached flexible p 57 A84-11935 manipulator arm The Shuttle remote manipulator system: CANADARM A robot arm in space p 57 A84-21486 p 57 A84-22336 Remote manipulators in space Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary p 59 N84-10582 [NASA-CR-3736] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume Telepresence technology base development p 59 N84-10583 [NASA-CR-3734] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 N84-10584 REMOTE SENSING Space station architectural issues as viewed by the user p 4 A84-24634 community - Applications Technology needs of advanced Earth observation spacecraft [NASA-CR-3698] p 9 N84-17248 REMOTE SENSORS Systems considerations in mosaic focal planes - for p 75 A84-28576 military spaceborne surveillance REPORTS Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents [NASA-TM-77534] REQUIREMENTS p 26 N84-18576 Space station needs, attributes and architectural options
- study. Volume 3: Requirements [NASA-CR-173332] p 10 N84-18267 Space station needs, attributes and architectural
- options. Part 1: Summary [NASA-CR-175382] p 10 N84-18270 RESEARCH
- Identification of new potential scientific and technology areas for DoD application. Summary of activities p 78 N84-17050 [AD-A134372]
- RESEARCH AND DEVELOPMENT A system for intelligent teleoperation research
- [AIAA PAPER 83-2376] p 57 A84-10070 NASA priority technologies [IAF PAPER 83-345] p 1 A84-11793
- Evolutionary concepts for a space station and the p 5 A84-26926 relevant utilisation potential National Aeronautics and Space Administration Act, p 9 N84-18116 1985

Department of Housing and Urban Development-independent agencies appropriations for 1984: National Aeronautics and Space Administration p 80 N84-21440 Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 p 80 N84-21441 [H-REPT-98-629] National Aeronautics and Space Administration Authorization Act, 1985 p 80 N84-21443 National Aeronautics and Space Administration Authorization Act. 1985 [H-REPT-98-629] p 80 N84-21444 RESEARCH MANAGEMENT National Aeronautics and Space Administration p 80 N84-21443 Authorization Act. 1985 Space Administration National Aeronautics and Authorization Act. 1985 [H-REPT-98-629] p 80 N84-21444 RESISTOJET ENGINES Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 REUSABLE SPACECRAFT The space van and its potential impact on the design of communications satellites [AIAA 84-07581 p 74 A84-25309 Reusable commercial space processing platforms [AAS PAPER 83-208] p 7 A84-29858 RIGID STRUCTURES Geometrically nonlinear analysis of beam-in-space structures [MITT-28] p 22 N84-21914 RIPPLES Thermally induced spin rate ripple on spacecraft with long radial appendages [NASA-TM-85058] p 39 N84-16249 ROBOTICS A system for intelligent teleoperation research [AIAA PAPER 83-2376] p 57 A84-10070 Knowledge based systems for intelligent robotics p 57 A84-15667 The Shuttle remote manipulator system: CANADARM p 57 A robot arm in space A84-21486 p 57 Remote manipulators in space A84-22336 Automation, Robotics, and Machine Intelligence Systems (ARAMIS) in space manufacturing p 58 A84-22337 Study of artificial intelligence techniques - Realization of a highly autonomous experimental robot system p 58 A84-25828 French thesis NASA research in teleoperation and robotics p 58 A84-28523 Application of laser interferometry to robotics p 58 A84-28541 p 11 N84-18282 Human capabilities ROBOTS Dynamics of nonrigid articulated robot linkages p 58 A84-25531 Stability enhancement of a flexible robot manipulator [AD-A134185] p 59 N84-16807 **ROCKET ENGINE DESIGN** A parametric study of space transfer-propulsion stages [IAF PAPER 83-401] p 61 A84-13397 Design and development of the INTELSAT graphite-epoxy central thrust tube p 19 A84-22153 ROCKET NOZZLES Design and development of the INTELSAT V graphite-epoxy central thrust tube ROTARY GYROSCOPES p 19 A84-22153 Analysis and design of leaf-spring flexible joints for

driving gyroscopic rotors ROTARY STABILITY p 19 A84-11922

Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic p 35 A84-26977 rods

S

SAILS Roundtrip interstellar travel using laser-pushed lightsails

SANDWICH STRUCTURES Local stability of sandwich structures with thin fibre reinforced face skins for space application

p 62 A84-27443

- [MBB-UD-381-83-OE] p 19 A84-22859 SATELLITE ANTENNAS
- Application of a common reflector configuration to a multimission satellite of the 90's
- [IAF PAPER 83-60] p 1 A84-11731 Multibeam phased SOC/Free-Flyer comm Application to arravs communication system -Space p 45 A84-15641 **Operation Center** Advanced composite reflectors antenna for communications satellites p 53 A84-17151

A cylindrical near-field test facility for large satellite entennas [MBB-UR-628-83-OE] p 72 A84-22862 A deployable 30/20 GHz multibeam offset antenna [AIAA PAPER 84-0658] p 20 A84-25258 Unfurlable offset antenna design for multipurpose applications (AIAA PAPER 84-0659) p 16 A84-25259 Evolution of European telecommunication satellite pointing performance p 34 A84-25291 RF systems in space. Volume 2: Space-based radar analyses [AD-A133735] p 49 N84-14394 Computer aided synthesis of a satellite antenna structure p 21 N84-19899 with probabilistic constraints Dynamic behaviour of a satellite antenna structure in p 42 N84-19900 random vibration environment Environmental effects on the dynamics and control of an orbiting large flexible antenna system [NASA-CR-175448] p 42 N84-20627 The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781 SATELLITE ATTITUDE CONTROL Hardware simulation of spacecraft dynamics and p 30 A84-11932 control Attitude control and dynamics of the space operations o 31 A84-11934 center Satellite attitude dynamics and control in the presence of environmental torques - A brief survey p 31 A84-12483 A hardware demonstration of control for a flexible p 31 A84-13321 offset-feed antenna Attitude stability for the yaw-wheel class of orbiting p 33 A84-19675 gyrostats Evolution of European telecommunication satellite pointing performance [AIAA PAPER 84-0725] p 34 A84-25291 The attitude and orbit control system for Eureca OGLR PAPER 83-091] p 76 A84-29658 [DGLR PAPER 83-091] Study of auxiliary propulsion requirements for large space systems, volume 2 [NASA-CR-168193-VOL-2] p 63 N84-13218 Sensitivity analysis of the influence of the flexibility of solar panels on the attitude dynamics of artificial satellites p 39 N84-16232 [INPE-2763-PRE/337] Canadian Attitude Sensing Experimental Package p 79 N84-17223 (CASEP) BAe reaction wheels for Olympus ---Olympus p 17 N84-18475 telecommunication satellite Modular design attitude control system p 41 N84-19392 NASA-CB-1709961 SATELLITE CONFIGURATIONS For the first time --- Russian book on construction of p 16 A84-21564 first Soviet earth satellites SATELLITE CONTROL On modeling and simulation of the dynamics of tether p 30 A84-11933 connected satellite systems On the dynamics of a subsatellite system supported by two tethers p 32 A84-17854 [AIAA PAPER 84-0062] A degree of controllability definition - Fundamental concepts and application to modal systems p 34 A84-24991 Reliability issues in active control of large flexible space structures [NASA-CR-175341] p 39 N84-16248 Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment [INPE-2749-PRE/325] P p 41 N84-19383 SATELLITE DESIGN An overview of the institutional and regulatory aspects and their impact on system design - of geostationary satellites p 65 A84-11737 [IAF PAPER 83-82] An advanced generation land mobile satellite system and its critical technologies p 3 A84-15634 Spacecraft thermal design using interactive graphics ALAA PAPER 84-0143] p 23 A84-17910 [AIAA PAPER 84-0143] INTELSAT Design and development of the graphite-epoxy central thrust tube p 19 A84-22153 New directions in solar array development p 47 A84-22958 Technical aspects of the Intelsat V solar array p 47 A84-22962 GEO space platform economics - Impact of concept, size, launch mode and lifetime p 74 A84-25281 (AIAA PAPER 84-07041

- Development and application of new technologies in the ESA Olympus Programme [AIAA PAPER 84-0706] p 4 A84-25282
- A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class [AIAA PAPER 84-0727] p 62 A84-25292

SUBJECT INDEX

Utilization of electric propulsion for communication satellites
[AIAA PAPER 84-0729] p 62 A84-25293
MSAT mobile communication demonstration satellite system and bus tradeoff considerations
[AIAA PAPER 84-0751] p 48 A84-25306
Land-mobile communications satellite system design {AIAA PAPER 84-07531 p 5 A84-25308
[AIAA PAPER 84-0753] p 5 A84-25308 The space van and its potential impact on the design
of communications satellites
[AIAA 84-0758] p 74 A84-25309 Thermal control of the Tethered Satellite Module
[SAE PAPER 831138] p 24 A84-29067
The thermal design of L-SAT large telecommunication satellite p 27 N84-19414
Derivation and combination of impedance matrices for
flexible satellites [ESA-STR-209] p 43 N84-21604
SATELLITE INSTRUMENTS
Attitude stability for the yaw-wheel class of orbiting gyrostats p 33 A84-19675
Canadian Attitude Sensing Experimental Package
(CASEP) p 79 N84-17223
SATELLITE NETWORKS An overview of the institutional and regulatory aspects
and their impact on system design of geostationary
satellites [IAF PAPER 83-82] p 65 A84-11737
Commercial communications satellite market and
technology in the 90's [IAF PAPER 83-86] p 65 A84-11739
Tele-X - The first step in a satellite communications
system for the Nordic countries [AIAA PAPER 84-0713] p 4 A84-25287
[AIAA PAPER 84-0713] p 4 A84-25287 Lessons learned during the first year of the TDRSS
[AIAA PAPER 84-0687] p 74 A84-25319
Development trends in Europe on satellite clusters and geostationary platforms
[AIAA PAPER 84-0703] p 75 A84-25327
SATELLITE ORBITS Analytical model of the evolution of orbit parameters
of a quasi geostationary satellite
[IAF PAPER 83-316] p 65 A84-11787 Attitude stability for the yaw-wheel class of orbiting
gyrostats p 33 A84-19675
SATELLITE PERTURBATION
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 p 68 A84-17077
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21,
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21476 Energy from space - A vision of the future
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1882 p 69 A84-21476 Energy from space - A vision of the future p 69 A84-21477
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit to the centers of mass in a circular orbit SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21476 Energy from space - A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1882 p 69 A84-21476 Energy from space - A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space A system study of the solar power satellite concept
$\label{eq:scalar} \begin{array}{llllllllllllllllllllllllllllllllllll$
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21476 Energy from space - A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 Market potential and possible limitations for satellite solar power satellite concept - The p 70 A84-21478
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit to the centers of mass in a circular orbit SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21476 Energy from space - A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21478 A system study of the solar power satellite concept p 70 Market potential and possible limitations for satellite solar power stations p 70 A84-21481 European questions related to satellite power systems p 70 A84-21481
$\begin{array}{c} \textbf{SATELLITE PERTURBATION} \\ Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 \\ SATELLITE POWER TRANSMISSION (TO EARTH) \\ Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 A system study of the solar power satellite concept p 70 A84-21478 Market potential and possible limitations for satellite solar power satellite solar power satellite solar power systems p 70 A84-21481 European questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power is a solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power in the solar power is a solar power in the solar power is a solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power in the solar power is a solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power in a solar power in the solar power is a solar power in the solar power is a solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power in the solar power is a solar power in the solar power is a solar power in the solar power is a solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power is a solar power in the solar power is a solar power in the solar power is a solar power satellite power part power is a solar power in the solar power is a station of power is a solar power satellite power part power is a solar power satelite power part power part power power part power p$
$\begin{array}{c} \textbf{SATELLITE PERTURBATION}\\ Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728\\ \textbf{SATELLITE POWER TRANSMISSION (TO EARTH))}\\ Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 A system study of the solar power satellite concept p 70 A84-21478 A system study of the solar power satellite p$
$\label{eq:second} \begin{array}{l} \textbf{SATELLITE PERTURBATION} \\ Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit \\ p 33 A84-19728 \\ \hline p 33 A84-19728 \\ \hline \textbf{SATELLITE POWER TRANSMISSION (TO EARTH)} \\ Consequences of transmission of solar energy from outer space p 68 A84-17076 \\ Legal aspects of solar power satellites impact on the environment p 68 A84-17077 \\ Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 \\ Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 \\ Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 \\ A system study of the solar power satellite concept p 70 A84-21478 \\ Barley to the solar power satellite power systems p 70 A84-21483 \\ Space station - An early experimental solar power satellite solar power satellite power satellite solar power satellite power satellite solar power satellite solar power satellite power satellite solar power satellite power satellite solar power satellite power satellite power satellite solar power satellite power satellite power satellite solar power satell$
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite concept - p 70 A84-21481 European questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite power satellite Power-conomical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems
$\begin{array}{c} \textbf{SATELLITE PERTURBATION}\\ Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728\\ SATELLITE POWER TRANSMISSION (TO EARTH) \\ Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite power satellite solar $
$\label{eq:space} \begin{array}{llllllllllllllllllllllllllllllllllll$
$\begin{array}{c} \textbf{SATELLITE PERTURBATION}\\ Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728\\ \hline p 33 A84-19728\\ \hline p 33 A84-19728\\ \hline \textbf{SATELLITE POWER TRANSMISSION (TO EARTH)}\\ Consequences of transmission of solar energy from outer space p 68 A84-17076\\ Legal aspects of solar power satellites impact on the environment p 68 A84-17077\\ Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477\\ Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477\\ Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478\\ A system study of the solar power satellite concept p 70 A84-21478\\ Space stations related to satellite power systems p 70 A84-21483\\ Space station - An early experimental solar power satellite on space p 70 A84-21483\\ Space station - An early experimental solar power satellite so$
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21480 Market potential and possible limitations for satellite solar power stations p 70 A84-21483 Space station - An early experimental solar power satellite p 70 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 71 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 70 N84-21489 Power-economical considerations for the integration of terrestrial and extraterrestrial solar govers p 70 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 70 N84-15179 SATELLITE FOTATION Capture-ejector satellites [NASA-TM-85686] p 70 N84-15179
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21478 Market potential and possible limitations for satellite solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems p 71 A84-21488 Radiation characteristics of array antennas with distur
SATELLITE PERTURBATION Periodic oscillations of a gyrostal satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space - A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite power systems p 70 A84-21481 Buropean questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite Power-conomical considerations for the integration of terrestrial and extraterestrial solar generators into existing power generator systems p 71 A84-21485 Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26518 SATELLITE ROLAR POWER STATIONS
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21478 Market potential and possible limitations for satellite solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems p 71 A84-21488 Radiation characteristics of array antennas with distur
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite solar power satellite concept p 70 A84-21478 Market potential and possible limitations for satellite solar power stations p 70 A84-21483 Space station - An early experimental solar power satellite on characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 SATELLITE ROTATION Capture-ejector satellites [NASA-TM-85685] p 7 N84-15179 SATELLITE SOLAR POWER STATIONS Application of beam power technology to a space station p p 45 A84-15642 Space solar power in perspective p 71 A84-21489 ELIPPE Solar POWER STATIONS Application of beam power technology to a space station p 45 A84-15642 Space solar power in perspective p 71 A84-21489 Satellite SURFACES Large space instrumentation to measure the interaction between space structures and the environment
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept p 69 A84-21477 Evolution of the solar power satellite concept p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21478 Market potential and possible limitations for satellite solar power satellite concept p 70 A84-21481 European questions related to satellite power satellite solar power satellite oncept p 70 A84-21483 Space station - An early experimental solar power satellite oncept p 70 A84-21483 Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems p 71 A84-21483 Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 SATELLITE ROTATION Capture-ejeotor satellites [NASA-TM-858686] p 7 N84-15179 <
SATELLITE PERTURBATION Periodic oscillations of a gyrostal satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space = A vision of the future p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite concept - p 70 A84-21481 Buropean questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite space station - An early experimental solar power satellite Power-conomical considerations for the integration of terrestrial and extraterestrial solar generators into existing power generators systems p 71 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 46 A84-26518 SATELLITE SOLAR POWER STATIONS Application of beam power technology t
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space, Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 A system study of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept p 70 A84-21483 European questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite on a extraterestrial solar generators into existing power generation systems p 71 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 SATELLITE ROTATION Capture-ejector satellites Space solar power in perspective p 71 A84-21489 Actilite solar power in perspective p 71 A84-21489 Space solar power in perspective p 71 A84-21489 SATELLITE SURFACES Large space instrumentation to measure the interaction between space structures and the environment [AD-A128990] p7 N84-10179 SATELLITE TELEVISION
SATELLITE PERTURBATION Periodic oscillations of a gyrostal satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite concept - p 70 A84-21481 Buropean questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite power-conomical considerations for the integration of terrestrial and extraterestrial solar generators into existing power generation systems p 71 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26518 SATELLITE ROTATION Capture-ejector satellites [NASA-TIM-BS6866] p 7 N84-15179 SATELLITE SOLAR POWER STATI
SATELLITE PERTURBATION Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1882 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21478 A system study of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite power systems p 70 A84-21483 Space station characteristics of array antennas with disturbed aperture coverage p 71 A84-21470 Capture-ejector satellites SATELLITE FOOMER TRANSMISSION for the integration of terrestrial and extraterestrial solar gower stating on the integration of terrestrial and extraterestrial solar gower satellite power satellite p 70 A84-21480 Space station - An early experimental solar power satellite p 69
SATELLITE PERTURBATION Periodic oscillations of a gyrostal satellite with respect to the centers of mass in a circular orbit p 33 A84-19728 SATELLITE POWER TRANSMISSION (TO EARTH) Consequences of transmission of solar energy from outer space p 68 A84-17076 Legal aspects of solar power satellites impact on the environment p 68 A84-17077 Energy from space; Proceedings of the Symposium on Solar Energy from space, Vienna, Austria, August 9-21, 1982 p 69 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21477 Evolution of the solar power satellite concept - The utilization of energy from space p 70 A84-21480 Market potential and possible limitations for satellite solar power satellite concept - p 70 A84-21481 Buropean questions related to satellite power systems p 70 A84-21483 Space station - An early experimental solar power satellite power-conomical considerations for the integration of terrestrial and extraterestrial solar generators into existing power generation systems p 71 A84-21488 Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26518 SATELLITE ROTATION Capture-ejector satellites [NASA-TIM-BS6866] p 7 N84-15179 SATELLITE SOLAR POWER STATI

Space station communications and tracking equipment nanagement/control system p 45 A84-15639 management/control system

SATELLITE TRANSMISSION Narrow multibeam satellite ground		
Narrow multipeam satellite ground		
employing a linear array with a ge		
coverage of 60 deg. II - Antenna desi	gn	
	p 46	A84-17743
SATELLITE-BORNE INSTRUMENTS	ia aaali	••
NASA needs and trends in cryogen		N84-15329
SCALE MODELS	p 20	
Scale model testing for control sys	stem pa	arameters of
large structures		104 40040
[AD-A135652] Spacecraft thermal balance testing (p 41 Ising in	N84-18313 fraced tamos
on a dummy spacecraft		N84-19399
SCATHA SATELLITE		
A review of SCATHA satellite resu		
discharging SCIENCE	p 50	N84-17254
Use of space station for science	p 72	A84-24629
SCIENTIFIC SATELLITES	•	
Use of space station for science	p 72	A84-24629
SEALS (STOPPERS)		motorial
An evaluation of Techroll seal flexib		N84-16037
SECURITY	p	
National security implications of a L		
	p 73	A84-24635
SELF EXCITATION		
Interactive structural-thermal-co formulations — large space structures		analytical
iomerations large space succures		N84-21619
SENSITIVITY	•	
Sensitivity analysis of the influence		
solar panels on the attitude dyn	amics	of artificial
satellites [INPE-2763-PRE/337]	o 39	N84-16232
SERVICE LIFE	<i>p</i> 00	
Flexible radiator thermal vacuum te	st repo	rt
[NASA-CR-171764]	p 28	N84-20622
SERVICE MODULES		
Servicing vehicle for satellites and pl orbits	attorms	s in low earth
[DGLR PAPER 83-102]	D 6	A84-29666
SHADOWS	•	
Self-shadowing of orbiting trusses		
[NASA-CR-173215]	p 25	N84-16565
SHAPE CONTROL Model error estimation for distributed	evetor	ne described
by elliptic equations		A84-11946
On the number and placement	of a	
independent modal space control	for la	rge flexible
independent modal space control spacecraft	for la p 34	rge flexible A84-24990
independent modal space control spacecraft A degree of controllability definit	for la p 34 tion - F	rge flexible A84-24990
independent modal space control spacecraft	for la p 34 tion - F stems	rge flexible A84-24990 Fundamental
independent modal space control spacecraft A degree of controllability defini concepts and application to modal sy:	for la p 34 tion - F stems p 34	rge flexible A84-24990 Fundamental A84-24991
independent modal space control spacecraft A degree of controllability definit	for la p 34 tion - F stems p 34 statical	rge flexible A84-24990 Fundamental A84-24991
independent modal space control spacecraft A degree of controllability defini concepts and application to modal sy Static shape forming for an electro	for la p 34 tion - F stems p 34 statical p 16 ment	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi	for la p 34 tion - F stems p 34 statical p 16 ment	rge flexible A84-24990 Fundamental A84-24991 ly controlled
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 5S-meter-structure flight experi SHAPES	for la p 34 tion - F stems p 34 statical p 16 ment p 8	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelin	for la p 34 tion - F stems p 34 statical p 16 ment p 8	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551 N84-17233
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 5S-meter-structure flight experi SHAPES	for la p 34 tion - F stems p 34 statical p 16 ment p 8	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser	rge flexible A84-24990 Fundamental A84-24991 Ily controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismatit and compression loaded anisotrop	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser pic pla	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 nbly of shear tes with an
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser pic pla	rge flexible A84-24990 Fundamental A84-24991 Ily controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser pic pla p 23	rge flexible A84-24990 Fundamental A84-24991 iy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 ic asser pic pla p 23 lasses	rge flexible A84-24990 Fundamental A84-24991 iy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelin [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 ic asser p 18 ic asser p 23 lasses p 35	rge flexible A84-24990 Fundamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 ic asser p 18 ic asser p 23 lasses p 35	rge flexible A84-24990 Fundamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi- SHAPES Computer-Aided Geometry Modelin [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser p 23 lasses p 35	rge flexible A84-24990 Fundamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi- SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3]	for la p 34 tion - F stems p 34 statical p 16 ment p 8 g p 18 c asser p 23 lasses p 35	rge flexible A84-24990 Fundamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi- SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space ptatforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the	for la p 34 bion - F stems p 34 statical p 16 ment p 8 g p 18 c asser p 23 c asses p 23 v power p 49 mmal co	rge flexible A84-24990 Fundamental A84-24991 hy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi- SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites	for la p 34 bion - F stems p 34 statical p 16 ment p 8 g p 18 c asser p 23 c asses p 23 v power p 49 mmal co	rge flexible A84-24990 -undamental A84-24991 iy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-43-3] SHUTTERS A Maltese cross shaped mobile the for satellites	for la p 34 kion - F stems p 34 statical p 16 ment p 8 g p 18 c asser p 35 r power p 49 mmal cco p 27	rge flexible A84-24990 Fundamental A84-24991 iy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-19454
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili	for la p 34 statical p 16 ment p 8 g p 18 ic asser p 23 j 23 iasses p 35 r power p 49 p 27 ary fee	rge flexible A84-24990 -undamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 Introl shutter N84-19454 ds in existing
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electron membrane mirror The 55-meter-structure flight experi- SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals	for la p 34 statical p 16 ment p 8 g p 18 ic asser p 23 j 23 iasses p 35 r power p 49 p 27 ary fee	rge flexible A84-24990 Fundamental A84-24991 iy controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-19454
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili	for la p 34 iston - F stems p 34 statical p 16 ment p 8 g p 18 ic asser joic pla c asser p 23 asses p 35 v power p 49 p 27 ary fee p 48	rge flexible A84-24990 Fundamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-214050 of nonlinear A84-25586 rpossibilities N84-12653 mtrol shutter N84-19454 ds in existing A84-20647
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electron membrane mirror The 55-meter-structure flight experit SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIGDAL PROCESSING Characteristics of the microproces of algorithms for the processing of rad	for la p 34 p 34 statical p 16 ment p 8 g p 18 g p 18 p 23 p 23 p 23 p 23 p 23 p 23 p 24 p 24 p 24 p 27 p 49 p 27 p 27 p 24 p 27 p 24 p 27 p 24 p 27 p 24 p 25 p 25 p 25 p 25 p 25 p 25 p 25 p 25	rge flexible A84-24990 -undamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-19454 ds in existing A84-20647
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelin [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression toaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several c flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals SIGNAL PROCESSING Characteristics of the microproces of algorithms for the processing of rad in large antenna arrays	for la p 34 p 34 statical p 16 ment p 8 g p 18 g p 18 p 23 p 23 p 23 p 23 p 23 p 23 p 24 p 24 p 24 p 27 p 49 p 27 p 27 p 24 p 27 p 24 p 27 p 24 p 27 p 24 p 25 p 25 p 25 p 25 p 25 p 25 p 25 p 25	rge flexible A84-24990 -undamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-19454 ds in existing A84-20847 oberentation
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CURCUT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-43-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals SIGNAL PROCESSING Characteristics of the microproces of algorithms for the processing of rad in large antenna arrays SIGNAL TO NOISE RATIOS	for la p 34 ison - F stems p 34 statical p 16 ment p 8 g p 18 ic asser j 35 asses p 35 v power p 49 p 49 comp 27 ary fee p 48 sor imp p 48	rge flexible A84-24990 Fundamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 r possibilities N84-12653 mtrol shutter N84-19454 ds in existing A84-20847 olementation is and noise A84-28067
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelini [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliany for space platforms [IFSI-83-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals SIGNAL PROCESSING Characteristics of the microproces of algorithms for the processing of rad in large antenna arrays SIGNAL TO NOISE RATIOS Characteristics of the microproces	for la p 34 statical p 16 ment p 8 g p 18 scasser p 23 p 18 scasser p 23 p 23 mmal co p 23 p 35 r power p 49 p 49 p 48 sor imp p 48 sor imp	rge flexible A84-24990 -undamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-12653 entrol shutter N84-19454 ds in existing A84-20647 olementation uls and noise A84-28067
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy: Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modeline [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression loaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several cl flexible shell theory problems SHORT CURCUT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-43-3] SHUTTERS A Maltese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals SIGNAL PROCESSING Characteristics of the microproces of algorithms for the processing of rad in large antenna arrays SIGNAL TO NOISE RATIOS	for la p 34 ision - F stems p 34 statical p 16 ment p 8 g p 18 c assert p 3 c assert p 4 c assert c	rge flexible A84-24990 -undamental A84-24991 ly controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-12653 entrol shutter N84-19454 ds in existing A84-20647 olementation uls and noise A84-28067
independent modal space control spacecraft A degree of controllability definit concepts and application to modal sy Static shape forming for an electro membrane mirror The 55-meter-structure flight experi SHAPES Computer-Aided Geometry Modelin [NASA-CP-2272] SHEAR STRESS Buckling and vibration of any prismati and compression toaded anisotrop arbitrary supporting structure SHELL THEORY Numerical solution of several c flexible shell theory problems SHORT CIRCUIT CURRENTS Orbiting wire as a dynamo: Auxiliary for space platforms [IFSI-83-3] SHUTTERS A Mattese cross shaped mobile the for satellites SIDELOBE REDUCTION Improved orbit utilization using auxili earth terminals SIGNAL PROCESSING Characteristics of the microprocess of algorithms for the processing of rad in large antenna arrays	for la p 34 ision - F stems p 34 statical p 16 ment p 8 g p 18 c assert p 3 c assert p 4 c assert c	rge flexible A84-24990 -undamental A84-24991 by controlled A84-25551 N84-17233 N84-17233 N84-22179 mbly of shear tes with an A84-14050 of nonlinear A84-25586 possibilities N84-12653 mtrol shutter N84-12653 ontrol shutter N84-12653 ontrol shutter N84-12653 ontrol shutter A84-20847 obtementation as and noise A84-28067

p 54 A84-28242 applications SILICON NITRIDES Assessment of reliability of ceramic materials p 54 A84-24508 applications

SOLAR	GENER	TORS
-------	--------------	------

.

	GENERATORS
SIRIO SATELLITE	
The small transmitter receiver	
experiment microwave transmissi [FUB-50-1982]	on p49 N84-15386
SKIN (STRUCTURAL MEMBER) Field repair of graphite epoxy	skin panels on the
spaceship Columbia SKYLAB PROGRAM	p 52 A84-17120
The role of man in space	p 72 A84-24627
SOFTWARE ENGINEERING Space Station Technology, 1983	
[NASA-CP-2293]	p 11 N84-18277
Data management SOFTWARE TOOLS	p 12 N84-18287
Software production in a large space	
mission center Modern software development to	p 78 N84-14752 ols in space projects
on the example of a Spacelab expe	riment
SOLAR ARRAYS	p 49 N84-14761
Photovoltaic solar arrays leading	
power system in the regime beyond [IAF PAPER 83-422]	p 44 A84-11817
Evaluation of bus impedance on the	
platform New directions in solar array deve	p 44 A84-13521
	p 47 A84-22958
Technology components of so platforms	p 47 A84-22959
Solar array Shuttle flight expe	
development and testing Technical aspects of the Intelsat	p 47 A84-22961
rechnical aspects of the intersat	p 47 A84-22962
New component development for a	nulti-100 kW low-cost p 47 A84-22963
solar array applications Study of multi-kilowatt solar ar	
applications [NASA-CR-170939]	p 49 N84-12634
Current collection from the sp	
defects in high voltage solar array ir	
Finite element analysis of a	p 49 N84-15970 deployable space
structure The STEP/STACBEAM expe	p 38 N84-16056
development for very large solar an	ariment technology ay deployers
	- 0 ND4 47000
	p 8 N84-17220
interaction study	dynamics and plasma p 50 N84-17224
interaction study A deployable structure and s	dynamics and plasma p 50 N84-17224 olar array controls
interaction study	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17229
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17229
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array	dynamics and plasma p 50 N84-17224 kolar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18425 primary development
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism	dynamics and plasma p 50 N84-17224 volar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17228 advanced solar array p 17 N84-18457 primary development p 51 N84-18458
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772]	dynamics and plasma p 50 N84-17224 volar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17228 advanced solar array p 17 N84-18457 primary development p 51 N84-18458
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection	dynamics and plasma p 50 N84-17224 solar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-1729 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contr technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 51 N84-21608 p 19 A84-22965 cells p 47 A84-22979
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-65772] SOLAR CELLS Welded solar cell interconnection Large area space solar cell asser	dynamics and plasma p 50 N84-17224 solar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-1729 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacted	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980 d cell for low cost
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-65772] SOLAR CELLS Welded solar cell interconnection Large area space solar cell asser	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980 d cell for low cost p 48 A84-22982 ce in space
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri- technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performance	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 51 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980 dd cell for low cost p 48 A84-22982 ce in space p 48 A84-22997
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space (NASA-TM-85772) SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 p 17 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980 cell for low cost p 48 A84-22982 ce in space p 48 A84-22997 vace plasma through sultation
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space (NASA-TM-85772) SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell assert Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22987 nace plasma through rsulation p 49 N84-15970
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772]	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22987 nace plasma through rsulation p 49 N84-15970
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell assen Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18455 station construction p 21 N84-18458 station construction p 21 N84-21608 p 47 A84-22982 cells p 47 A84-22982 cell for low cost p 48 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22997 subation construction p 49 N84-15970 station construction p 21 N84-21608
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacte space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of mutti-kilowatt solar ar applications	dynamics and plasma p 50 N84-17224 loar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-1729 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 47 A84-22980 rold cell for low cost p 48 A84-22982 rold cell for low cost p 48 A84-22982 rold cell for low cost p 48 A84-22987 race plasma through sulation p 49 N84-15970 station construction p 21 N84-21608 rays for Earth orbit
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A64-22965 cells p 47 A84-22979 nblies p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22997 acce plasma through rsulation p 49 N84-15634 dynamics and plasma
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell assert Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22982 race plasma through sulation p 49 N84-12634
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation pres	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A64-22965 cells p 47 A84-22979 nblies p 47 A84-22979 nblies p 48 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22997 race plasma through rsulation p 49 N84-15670 station construction p 21 N84-21608 rays for Earth orbit p 49 N84-12634 dynamics and plasma p 50 N84-17224 ssure gradient during
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area, low cost space solar Large area space solar cell assert Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation pres-	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18455 station construction p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22985 cells p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 50 N84-17224
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation pres- eclipse for very large spacecraft SOLAR ELECTRIC PROPULSION Discontinuous low thrust orbit trar	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A64-22965 cells p 47 A84-22979 nblies p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22982 race plasma through rsulation p 21 N84-15670 station construction p 21 N84-21608 rays for Earth orbit p 49 N84-12634 dynamics and plasma p 50 N84-17224 ssure gradient during p 31 A84-12489
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri- technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell asser Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation pret eclipse for very large spacearaft SOLAR ELECTRIC PROPULSION	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 ol System (IPACS) p 39 N84-17227 ol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18455 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22987 nace plasma through sulation p 21 N84-1608 rays for Earth orbit p 49 N84-12634 dynamics and plasma p 50 N84-17224 ssure gradient during p 31 A84-12489
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri- technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area space solar cell assen Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of mutti-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation presidentiates SoLAR ELECTRIC PROPULSION Discontinuous low thrust orbit trar [AD-A136508] SOLAR ENERGY CONVERSION Consequences of transmission consequences of transmissi	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 47 A84-22979 nblies p 47 A84-22982 ce in space p 48 A84-22982 ce in space p 48 A84-22997 acc plasma through rsulation p 21 N84-15970 station construction p 21 N84-21608 rays for Earth orbit p 49 N84-12634 dynamics and plasma p 50 N84-17224 ssure gradient during p 31 A84-12489 rsfer p 63 N84-19474 af solar energy from
interaction study A deployable structure and s experiment for STEP Integrated Power/Attitude Contri- technology experiment Design and development of an a drive mechanism Space telescope: Solar array mechanism Operational modules for space [NASA-TM-85772] SOLAR CELLS Welded solar cell interconnection Large area, low cost space solar Large area, low cost space solar Large area space solar cell assert Mechanical wraparound contacter space arrays Prediction of solar cell performant Current collection from the sp defects in high voltage solar array in Operational modules for space [NASA-TM-85772] SOLAR COLLECTORS Study of multi-kilowatt solar ar applications [NASA-CR-170939] Photovoltaic concentrator pointing interaction study SOLAR ECLIPSES Torque from solar radiation pret eclipse for very large spacecraft SOLAR ELECTRIC PROPULSION Discontinuous low thrust orbit trar [AD-A136908] SOLAR ENERGY CONVERSION	dynamics and plasma p 50 N84-17224 olar array controls p 39 N84-17227 rol System (IPACS) p 39 N84-17229 advanced solar array p 17 N84-18457 primary development p 51 N84-18458 station construction p 21 N84-21608 p 19 A84-22965 cells p 47 A84-22979 nblies p 61 A84-22980 de cell for low cost p 48 A84-22982 ce flasma through sultation p 49 N84-1570 station construction p 49 N84-1568 rays for Earth orbit p 49 N84-12634 dynamics and plasma p 50 N84-17224 sure gradient during p 31 A84-12489 ISFer p 63 N84-19474 of solar energy from p 68 A84-17076

 Satellite
 p 70
 A84-21487

 Space solar power in perspective
 p 71
 A84-21489

 SOLAR GENERATORS
 p 71
 A84-21489

 Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing power generation systems
 p 71
 A84-21489

SOLAR POWER SATELLITES

SOLAR POWER SATELLITES

The solar power satellite -A programme for p 68 A84-17074 development aid Energy from space - Legal implications of the use of

- p 68 A84-17075 the geostationary orbit Consequences of transmission of solar energy from outer space p 68 A84-17076
- Legal aspects of solar power satellites impact on the p 68 A84-17077 environment
- Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, D 69 A84-21476 1982
- Energy from space A vision of the future p 69 A84-21477
- Evolution of the solar power satellite concept The p 70 A84-21478 utilization of energy from space Solar power satellites - The institutional challenge
- p 70 A84-21479 A system study of the solar power satellite concept p 70 A84-21480
- Market potential and possible limitations for satellite solar power stations p 70 A84-21481 Financing a solar power satellite project
- p 70 A84-21482 European questions related to satelite power systems
- p 70 A84-21483 Space station - An early experimental solar power p 70 A84-21487 satellite
- Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing p 71 A84-21488 power generation systems p 71 A84-21489 Space solar power in perspective Radiation characteristics of array antennas with p 48 A84-26516
- disturbed aperture coverage Sensitivity analysis of the influence of the flexibility of solar panels on the attitude dynamics of artificial satellites
- [INPE-2763-PRE/337] p 39 N84-16232 SOLAR RADIATION
- Torque from solar radiation pressure gradient during eclipse --- for very large spacecraft p 31 A84-12489 Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT p 26 N84-19398 thermal model
- IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber p 26 N84-19400
- Computing the radiation pressure forces by adapting thermal design verification softwares --- large space structures p 28 N84-21613 SOLAR SAILS
- Management of the radiolink of the solar sail spacecraft

by radio-amateurs	
[IAF PAPER 83-447]	p 44 A84-11823
Interstellar solar sailing - Co	
projected sail materials	p 62 A84-25344
Making the high frontier highly	visible with a solar sail
race to the moon	
[AAS PAPER 83-226]	p 62 A84-29869

SOLAR SYSTEM	-		
Manned planet	ary missions?	p 71	A84-21497

SOLAR THERMAL PROPULSION A future solar orbital transfer vehicle concept

- p 61 A84-16116 SOLDERING
- p 19 A84-22965 Welded solar cell interconnection SOLID STATE LASERS
- Application of laser interferometry to robotics p 58 A84-28541
- SOVIET SPACECRAFT
- For the first time Russian book on construction of first Soviet earth satellites p 16 A84-21564 Space vehicles --- Russian book on development of Soviet spacecraft and planning of first manned flights p 4 A84-21573
- SPACE BASED RADAR
- RF systems in space. Volume 2: Space-based radar analyse
- p 49 N84-14394 [AD-A133735] RF systems in space. Volume 1: Space antennas frequency (SARF) simulation
- p 49 N84-14395 [AD-A1337341 The effects of aperture antennas after signal propagation
- through anisotropic ionized media p 52 N84-21781 [AD-A138286]
- SPACE COLONIES Natural selection of stellar civilizations by the limits of arowth
- [IAF PAPER 83-272] p 65 A84-11779 Mission to Mars - The case for a settlement p 67 A84-15092
- Understanding space settlements as human systems [AAS PAPER 83-204] p 76 A84-29856

SPACE COMMERCIALIZATION	National Aeronautics and Space Administration
Space Shuttle, private enterprise and intellectual	Authorization Act, 1985 p 80 N84-21443
properties in the context of space manufacturing	National Aeronautics and Space Administration
p 72 A84-22341	Authorization Act, 1985
Space station: Policy, planning and utilization;	[H-REPT-98-629] p 80 N84-21444
Proceedings of the Symposium, Arlington, VA, July 18-20,	SPACE INDUSTRIALIZATION
1983 p 72 A84-24626	Determination of applicable law to living and working
Role of a space station in pharmaceutical	
manufacturing p 73 A84-24632	[IAF PAPER 82-IISL-45] p 68 A84-17058
Space station architectural issues as viewed by the user	Leasecraft - An innovative space vehicle p 5 A84-27945
community - Applications p 4 A84-24634	With the Space Shuttle towards space industrialization
Leasecraft - An innovative space vehicle	p 75 A84-28975
p 5 A84-27945 Major concerns of private enterprise regarding recent	A legal charter for non-governmental space
developments in space law	industrialization
[AAS PAPER 83-221] p 77 A84-29865	[AAS PAPER 83-225] p 77 A84-29868
International aspects of commercial space activities	SPACE LABORATORIES
[AAS PAPER 83-222] p 77 A84-29866	The Alpha-Helix Concept: Innovative utilization of the
A legal charter for non-governmental space	Space Station Program. A report to the National
industrialization	Aeronautical and Space Administration requesting
[AAS PAPER 83-225] p 77 A84-29868	establishment of a Sensory Physiology Laboratory on the
International competition in commercial aerospace	Space Station
markets	[NASA-CR-175436] p 14 N84-20610
[AAS PAPER 83-244] p 77 A84-29883	SPACE LAW
Alternative strategies for space station financing	An overview of the institutional and regulatory aspects
[NASA-CR-175412] p 80 N84-21437	and their impact on system design of geostationary satellites
	[IAF PAPER 83-82] p 65 A84-11737
NTC '82; National Telesystems Conference, Galveston,	Colloquium on the Law of Outer Space, 25th, Paris,
TX, November 7-10, 1982, Conference Record p 44 A84-15623	France, September 27-October 2, 1982, Proceedings
Space station architectural issues as viewed by the user	p 67 A84-17026
community - Applications p 4 A84-24634	Jurisprudential philosophies of the art of living in space
Telecommunication systems for large-scale space	The transnational imperative
manufacturing activity	[IAF PAPER 82-IISL-38] p 68 A84-17054
[AAS PAPER 83-216] p 48 A84-29861	Determination of applicable law to living and working
SPACE ENVIRONMENT SIMULATION	in outer space
Hardware simulation of spacecraft dynamics and	[IAF PAPER 82-IISL-44] p 68 A84-17057
control p 30 A84-11932	Determination of applicable law to living and working
Simulated space radiation effects on dielectrics and	in space
coatings p 54 A84-20682	[IAF PAPER 82-IISL-45] p 68 A84-17058
Evaluation and prediction of long-term environmental	Major concerns of private enterprise regarding recent
effects of nonmetallic materials, second phase	developments in space law
[NASA-CR-170915] p 56 N84-11595	[AAS PAPER 83-221] p 77 A84-29865 A legal charter for non-governmental space
Development of a spacecraft infrared test technique as	A legal charter for non-governmental space industrialization
an alternative to solar simulation: First steps on L-SAT thermal model p 26 N84-19398	[AAS PAPER 83-225] p 77 A84-29868
Spacecraft thermal balance testing using infrared lamps	SPACE LOGISTICS
on a dummy spacecraft p 26 N84-19399	Space logistics preparing for future space missions
IRSIM: A program for the calculation of infrared flux	[IAF PAPER 83-24] p 64 A84-11719
intensity incident on a spacecraft inside a test chamber	Shutter interaction study extension
p 26 N84-19400	[NASA-CR-173401] p 81 N84-21593
Thermal cycling tests in space environment simulation	SPACE MAINTENANCE
chambers p 26 N84-19401	Servicing vehicle for satellites and platforms in low earth
The Large Space Simulator (LSS) at ESA/ESTEC (a	orbits
summary of the main characteristics) p 27 N84-19458	[DGLR PAPER 83-102] p 6 A84-29666
Assessment of the existing ground test technology and	Shuttle interaction study extension [NASA-CR-173398] p 81 N84-21594
confronting with the Large Space Structures (LSS)	[NASA-CR-173398] p 81 N84-21594 SPACE MANUFACTURING
requirements. Thermal test techniques	Knowledge based systems for intelligent robotics
p 29 N84-21622 SPACE ERECTABLE STRUCTURES	p 57 A84-15667
The development of a composite beam building machine	The Shuttle remote manipulator system: CANADARM
for on-site construction of large space structures	- A robot arm in space p 57 A84-21486
[AAS PAPER 83-217] p 20 A84-29862	Remote manipulators in space p 57 A84-22336
Development of deployable structures for large space	Automation, Robotics, and Machine Intelligence
platform systems. Volume 1: Executive summary	Systems (ARAMIS) in space manufacturing
[NASA-CR-170913] p 20 N84-10175	p 58 A84-22337
Development of deployable structures for large space	Manufacturing space systems in space
platforms. Volume 2: Design development	p 71 A84-22338
[NASA-CR-170914] p 20 N84-10176	Space Shuttle, private enterprise and intellectual
Orbitor based construction equipment study The	properties in the context of space manufacturing
Orbiter-based construction equipment study. The	p 72 A84-22341
HPA/DTA technology advancement plan	
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233	
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure	Role of a space station in pharmaceutical
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250	Role of a space station in pharmaceutical manufacturing p 73 A84-24632
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronousty deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology	Role of a space station in pharmaceutical manufacturing p 73 A84-24632
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A A64-24632 A a space constructable heat pipe radiator for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 <
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronousty deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A A64-24632 A a space constructable heat pipe radiator for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 <
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 631101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12,
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29052 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronousty deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures p 26 A84-29861
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment p 60 N84-17220 development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABE) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29052 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension (NASA-CR-173401] p 81 N84-21593	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures p 26 A84-29861
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CR-174805] p 59 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-27] p 20 A84-29862 SPACE MISSIONS Space logistics — preparing for future space missions Space mains of the space missions
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology p 8 N84-17220 development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17227 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-2952 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 Space Inscisions Space logistics preparing for future space missions [IAF PAPER 83-24] p 64 A84-11719
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension (NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-27] p 20 A84-29862 SPACE MISSIONS Space logistics — preparing for future space missions Space mains of the space missions
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CR-174805] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-17227 SPACE EXPLORATION Developing the space frontier: Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-1381 Manned planetary missions? p 71 A84-21497	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-2952 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 Space Inscisions Space logistics preparing for future space missions [IAF PAPER 83-24] p 64 A84-11719
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology p 8 N84-17220 development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17225 A deployable structure and solar array controls experiment for STEP p 39 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381 Manned planetary missions? p 71 A84-21497 Mankind's interstellar future p 71 A84-21497	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-26936 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29832 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 SPACE MISSIONS Space logistics — preparing for future space missions [IAF PAER 83-24] p 64 A84-11719 The Tiros-based asteroid mission p 2 A84-14762
HPA/DTA technology advancement plan [NASA-CR-174805] p 17 N84-14233 Synchronously deployable truss structure [NASA-CR-174805] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17225 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-17227 SPACE EXPLORATION Developing the space frontier: Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-1381 Manned planetary missions? p 71 A84-21497	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 631101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 Space logistics preparing for future space missions [IAF PAPER 83-24] p 64 A84-11719 The Tros-based asteroid mission p 2 A84-114762 The German Spacelab mission D1 p 69 A84-17762
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CR-174605] p 59 N84-16250 Erectable beam experiment p 60 N84-17219 The STEP/STACBEAM experiment technology development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 A deployable platform systems p 39 N84-17227 Shutter interaction study extension (NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the Twenty-nith Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381 Manned planetary missions? p 71 A84-21499 Mankind's interstellar future p 71 A84-21499	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 631101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conterence, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 Space logistics preparing for future space missions [IAF PAPER 83-24] p 64 A84-11719 The German Spacelab mission D1 p 69 A84-117762 The role of man in space p 72 A84-24627
HPA/DTA technology advancement plan [NASA-CR-174605] p 17 N84-14233 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 N84-16250 Erectable beam experiment beam experiment p 60 N84-17219 The STEP/STACBEAM experiment development for very large solar array deployers p 8 N84-17220 Low concentration ratio solar array structural configuration p 17 N84-17220 Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17225 Development of STEP p 39 N84-17227 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 SPACE EXPLORATION Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-21497 Manned planetary missions? p 71 A84-21497 Mankind's interstellar future p 71 A84-21420 Space 1991 p 71 A84-21720	Role of a space station in pharmaceutical manufacturing p 73 A84-24632 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852 Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 The development of a composite beam building machine for on-site construction of large space structures [AAS PAPER 83-217] p 20 A84-29862 Space logistics preparing for future space missions [IAF PAPER 83-24] p 64 A84-11719 The German Spacelab mission p 2 A84-14762 The German Spacelab mission p 2 A84-1762 The orele of man in space p 72 A84-24827 Integrated requirements for a space station

SUBJECT INDEX

Buckette - incides and transportation comparing to use
Probable missions and transportation scenarios to use regenerative life support systems
[AAS PAPER 83-201] p 76 A84-29854
A program to develop efficient manned operations in space
[AAS PAPER 83-207] p 76 A84-29857
Space Station needs, attributes and architectural
options. Voturne 2, book 1, part 1: Mission requirements
[NASA-CR-173312] p 13 N84-18296
Space Station needs, attributes and architectural options. Volume 2, book 1, part 2, task 1: Mission
requirements
[NASA-CR-173313] p 13 N84-18297
Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593
SPACE NAVIGATION
Autonomous navigation of geosynchronous satellites
using the Navstar Global Positioning System p 45 A84-15671
SPACE OPERATIONS CENTER (NASA)
Attitude control and dynamics of the space operations center p 31 A84-11934
Multibeam phased arrays - Application to
SOC/Free-Flyer communication system - Space
Operation Center p 45 AB4-15641 Space operations center communications path
obscuration p 3 A84-15695
Shuttle interaction study
[NASA-CR-173400] p 80 N84-21592 Shutter interaction study extension
[NASA-CR-173401] p 81 N84-21593
Shutter Interaction Study [NASA-CR-173402] p 81 N84-21595
Shuttle interaction study extension
[NASA-CR-173403] p 81 N84-21596
SPACE PLASMAS Radiating dipole model of interference induced in
spacecraft circuitry by surface discharges
[NASA-TP-2240] p 50 N84-16247 SPACE PLATFORMS
Payload placing using an operational support platform
[tAF PAPER 83-44] p 1 A84-11724 The Fairchild Leasecraft system - A
The Fairchild Leasecraft system - A commercially-operated platform for science and business
in space
[IAF PAPER 83-232] p 65 A84-11773 Potential military applications of space platforms and
space stations p 2 A84-13330
Science platform and attitude subsystem in-flight calibration for the Galileo spacecraft p 32 A84-17355
Low cost space science and astronomy platforms in
orbit [AIAA PAPER 84-0297] p 4 A84-18005
Space platform accommodations - for multiple
interchangeable payloads p 16 A84-22131
Technology components of solar arrays for space platforms p 47 A84-22959
Architectural options and development issues
p 4 A84-24633 GEO space platform economics - Impact of concept,
size, launch mode and lifetime
[AIAA PAPER 84-0704] p 74 A84-25281 NASA's geostationary communications platform
program
[AIAA PAPER 84-0702] p 5 A84-25326
Evolutionary concepts for a space station and the relevant utilisation potential p 5 A84-26926
Leasecraft - An innovative space vehicle
p 5 A84-27945 Coordinate transformation assembly for space
platform angular coordinate linking p 75 A84-28579
Microgravity conditions on orbital platforms [DGLR PAPER 83-90] p 76 A84-29657
The attitude and orbit control system for Eureca
[DGLR PAPER 83-091] p 76 A84-29658
Servicing vehicle for satellites and platforms in low earth orbits
[DGLR PAPER 83-102] p 6 A84-29666
Reusable commercial space processing platforms [AAS PAPER 83-208] p 7 A84-29858
A definition of STS accommodations for attached
payloads
[NASA-CR-172223] p 17 N84-10114 Development of deployable structures for large space
platform systems. Volume 1: Executive summary
[NASA-CR-170913] p 20 N84-10175 Development of deployable structures for large space
platforms. Volume 2: Design development
[NASA-CR-170914] p 20 N84-10176
Identification of new potential scientific and technology areas for DoD application. Summary of activities
[AD-A134372] p 78 N84-17050
Development of Test Article Building Block (TABB) for

Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226

A deployable structure and solar array controls experiment for STEP p 39 N84-17227 STEP flight experiments Large Deployable Reflector (LDR) telescope n.8 N84-17231 Flight test of a synthetic aperture radar antenna using STEP 0.9 N84-17237 p 9 N84-17237 Space Station needs, attributes and architectural options: Summary briefing p 10 N84-18271 [NASA-CR-173328] Space station needs, attributes and architectural options study. Briefing material: Final review and executive summan [NASA-CR-173321] p 10 N84-18273 Space Station needs, attributes and architectural options. Volume 2, book 2, part 1: Mission implementation concepts [NASA-CR-173316] p 13 N84-18300 A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604 p 14 N84-20604 The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Snace Station [NASA-CR-175436] p 14 N84-20610 Exhibit D modular design attitude control system study [NASA-CR-170993] p 42 N84-20625 SPACE PROCESSING Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 p 71 A84-22327 Space station architectural issues as viewed by the use p 4 A84-24634 community - Applications p 4 A84-24 Reusable commercial space processing platforms [AAS PAPER 83-208] p 7 A84-29858 Significant scientific and technical results at Marshal Space Flight Center [NASA-TM-82562] p 78 N84-16075 SPACE PROGRAMS Management of large space projects; Course on Space Technology, Toulouse, France, May 3-14, 1982, Proceedings p 2 A84-15301 organization ----Human space project and p 2 A84-15303 management The contract --- management for space projects p 2 A84-15304 The progression of projects --- in space industry p 2 A84-15305 Management of large space projects - Quality assurance p 3 A84-15310 p 67 A84-15321 or 'product assurance' Financing large space projects A program to develop efficient manned operations in [AAS PAPER 83-207] AS PAPER 83-207] p 76 A84-29857 International aspects of commercial space activities p 77 A84-29866 [AAS PAPER 83-222] Making the high frontier highly visible with a solar sail race to the moon [AAS PAPER 83-226] p 62 A84-29869 Review of the National Aeronautics and Space Act of 1958 [GPO-28-915] p 80 N84-21442 SPACE SHUTTLE ORBITERS Canadarm and the Space Shuttle p 57 A83-44602 Experiment data communications (48 Mbit/s) between Spacelab, the Space Shuttle and the ground p 44 A84-10396 Low earth orbit atomic oxygen effects on surfaces of Space Shuttle Orbiters [AIAA PAPER 84-0548] p 53 A84-19912 Regenerable non-venting thermal control subsystem for extravehicular activity [SAE PAPER 831151] p 24 A84-29076 Orbiter-based construction equipment study. The HPA/DTA technology advancement plan p 17 N84-14233 [NASA-CR-174605] The complementary roles of existing and advanced environmental, thermal control and life support technology for space stations p 79 N84-19429 SPACE SHUTTLE PAYLOADS A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 Utilisation of the European retrieval carrier EURECA for life science research p 65 A84-11753 Fairchild Leasecraft The system commercially-operated platform for science and business in space [IAF PAPER 83-232] p 65 A84-11773 Low cost space science and astronomy platforms in orbit [AIAA PAPER 84-0297] p 4 A84-18005 Automation, Robotics, and Machine Intelligence Systems (ARAMIS) in space manufacturing

p 58 A84-22337

Space Shuttle, private enterprise and intellectual properties in the context of space manufacturing p 72 A84-22341 Solar array Shuttle flight experiment - Hardware svelopment and testing p 47 A84-22961 development and testing A simulator to study dynamic interaction of the Space Shuttle on-orbit flight control system with deployed flexible p 35 A84-26717 pavloads Thermal control of the Tethered Satellite Module [SAE PAPER 831138] p 24 A84-29067 A definition of STS accommodations for attached pavloads [NASA-CR-172223] p 17 N84-10114 Molecular contamination math model support (ASA-CR-170899) p 77 N84-10174 [NASA-CR-170899] General requirements for Shuttle flight experiments p 8 N84-17221 Effects of combined uttraviolet and oxygen plasma environment on spacecraft thermal control materials space shuttle payloads p 27 N84-19449 A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604 On-orbit spacecraft/stage servicing during STS life cvrte [NASA-CR-171775] p 79 N84-20617 Flexible radiator system p 28 N84-20623 [NASA-CB-171765] Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies p 60 N84-20857 [NASA-CR-175437] Alternative strategies for space station financing [NASA-CR-175412] p 80 N84-21437 Shuttle interaction study [NASA-CR-173400] p 80 N84-21592 Shutter Interaction Study [NASA-CR-173402] p 81 N84-21595 Shuttle interaction study extension [NASA-CR-173403] p 81 N84-21596 SPACE SHUTTLE UPPER STAGES A parametric study of space transfer-propulsion [IAF PAPER 83-401] p 61 A84-13397 SPACE SHUTTLES High capacity power systems for space [IAF PAPER 83-421] p 44 A84-11816 With the Space Shuttle towards space industrialization p 75 A84-28975 Molecular contamination math model support [NASA-CR-170899] p 77 N84-10174 Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary [NASA-CR-168193-VOL-1] p 63 N p 63 N84-12226 STS-9: Orbital workshop spacelab to fly on ninth Shuttle mission [NASA-TM-85497] p 78 N84-16242 Identification of new potential scientific and technology areas for DoD application. Summary of activities p 78 N84-17050 [AD-A134372] Starlab Ground System guidelines document [NASA-CR-175192] p 14 N84-20435 Shuttle interaction study p 80 N84-21592 [NASA-CR-173400] Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 Shuttle interaction study extension p 81 N84-21594 [NASA-CB-173398] Operational modules for space station construction [NASA-TM-85772] p 21 N84-21608 SPACE STATIONS Space station data management - A system evolving from changing requirements and a dynamic technology [AIAA PAPER 83-2338] p 43 A84-10016 Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 Space applications at the crossroads; Proceedings of the Twenty-first Goddard Memorial Symposium, Greenbelt, p 64 A84-10883 MD, March 24, 25, 1983 ESA space station activities [IAF PAPER 83-30] p 64 A84-11722 Overview of NASA space station activitie [IAF PAPER 83-48] p 1 A84-11726 Soace station - A Canadian perspective [IAF PAPER 83-55] p 65 A84-11728 Commercial communications satellite market and technology in the 90's [IAF PAPER 83-86] p 65 A84-11739 Potential military applications of space platforms and p 2 A84-13330 snace stations

Space station communications and tracking equipment management/control system p 45 A84-15639 Jurisprudential philosophies of the art of living in space

The transnational imperative [IAF PAPER 82-IISL-38] p 68 A84-17054

SPACE STATIONS

SPACE SURVEILLANCE (SPACEBORNE)

Space stations - A key to socio-economic benefits from
space? p 69 A84-19850 Project space station - Plans for a permanent manned
space center P 69 A84-21344 Space 1991 p 71 A84-21720
Evolutionary concepts for a space station and the
relevant utilisation potential p 5 A84-26926 Environmental Control and Life Support for an
evolutionary Space Station [SAE PAPER 831108] p 5 A84-29043
Systems engineering aspects of a preliminary conceptual design of the space station environmental
control and life support system
[SAE PAPER 831109] p 5 A84-29044 Integrated water management system - Description and
test results for Space Station waste water processing [SAE PAPER 831111] p 6 A84-29046
Electrochemical and steam-desorbed amine CO2
concentration Subsystem comparison for oxygen recovery on Space Station
[SAE PAPER 831120] p 6 A84-29054 Phase change water recovery techniques - Vapor
compression distillation and thermoelectric/membrane
concepts from waste water as part of Space Station life support system
[SAE PAPER 831122] p 6 A84-29056 Gravitational biology on the space station
[SAE PAPER 831133] p 75 A84-29063 Regenerable non-venting thermal control subsystem for
extravehicular activity
[SAE PAPER 831151] p 24 A84-29076 Habitability design elements for a space station
[AAS PAPER 83-200] p 7 A84-29853 Space stations - The next step in space?
[AAS PAPER 83-202] p 76 A84-29855
A program to develop efficient manned operations in space
[AAS PAPER 83-207] p 76 A84-29857 International aspects of commercial space activities
[AAS PAPER 83-222] p 77 A84-29866
Integrated Flywheel Technology, 1983 [NASA-CP-2290] p 78 N84-12228
Space station attitude control system concept and requirements p 37 N84-12234
Space station control requirements and flywheel system
weights for combined momentum and energy storage p 37 N84-12236
Advanced Control and Power System (ACAPS) technology program p 37 N84-12243
NASA's space station activities
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426
NASA's space station activities [GPO-27-393] p 7 NB4-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 NASA-CP-2294] p 7 Space Technology Experiments Platform (STEP) overview p 8 N84-17212
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-72-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP)
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 NASA-CP-2294] p 7 NASA-CP-2294] p 7 NB4-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 Overview p 8 N84-17212 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 Deployable beam flight experiment (MAST)
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-14234 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17213 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment p 8 N84-17215 Deployable beam experiment p 8 N84-17218 Erectable beam experiment p 60 N84-17219
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) Overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment p 60 N84-17218 Erectable beam experiment p 60 N84-17219 Integrated Power/Attitude Control System (IPACS) PASet N84-17218 N84-17218
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17213 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment user manual of the CATSS system (version 1.0) setsets
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne p 78 N84-16420 STEP Experiment Requirements p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 User manual of the CATSS system (version 1.0) communication analysis tool for space station (NAS-CR-1711728] p 51 N84-17431
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne p 78 N84-16420 STEP Experiment Requirements p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17219 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) set (IPACS) User manual of the CATSS system (version 1.0) communication analysis tool for space station (NASA-CR-171728) p 51 N84-17431
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-171728] p 51 N84-17431 Airborne antenna pattern calculations p 51 N84-17436 Space station needs, attributes and architectural options
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-1711728] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-173284] p 51 Space station needs, attributes and architectural options study. Volume 1: Executive study
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-16420 STEP Experiment Requirements p 7 N84-16420 [NASA-CP-2294] p 7 N84-17211 Space station: Potential base for a spaceborne microwave facility p 8 [NASA-CP-2294] p 7 N84-17212 STEP Experiment Requirements Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment p 39 N84-17229 User manual of the CATSS system (version 1.0) communication analysis tool for space station 100 communication analysis tool for space station [NASA-CR-17128] p 51 N84-17436 Space station needs, attributes and architectural options Study. Volume 1: Executive study [NASA-CR-173334] p 9
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne p 7 N84-16420 STEP Experiment Requirements p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) p 8 N84-17219 Integrated Power/Attitude Control System (Version 1.0) communication analysis tool for space station (NASA-CR-17128) [NASA-CR-17128] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-1717324] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-17236 Space station needs, attributes and architectural options
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 The US space station: Potential base for a spaceborne p 78 N84-16420 STEP Experiment Requirements p 7 N84-16420 [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17219 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) User manual of the CATSS system (version 1.0) communication analysis tool for space station (NASA-CR-171728] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-173334] p 51 N84-17326 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173333] p 9 N84-18265 Space station needs, attributes and architectural options
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17213 Deployable beam experiment p 60 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment p 39 N84-17229 User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-173284] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-173334] p 51 N84-17236 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173333] p 9<
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 7 N84-16420 STEP Experiment Requirements p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment Integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-171728] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-18265 Space station needs, attributes and architectural options study. Volume 3: Requirements [NASA-CR-173332] p 9 N84-18267 Space station needs, attributes and architectural options study. Volume 3: Requirements
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17218 Erectable beam experiment p 60 N84-17219 User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-171728] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-173324] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173333] p 9 N84-18265 Space station needs, attributes and architectural options study. Volume 2: Mission analysis [NASA-CR-173332] p 10
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-16420 STEP Experiment Requirements p 7 N84-16420 [NASA-CP-2294] p 7 N84-17211 Space station: Potential base for a spaceborne microwave facility p 8 [NASA-CP-2294] p 7 N84-17212 STEP experiment Requirements P 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment p 30 N84-17229 User manual of the CATSS system (version 1.0) communication analysis tool for space station 100 [NASA-CR-171728] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-17436 Space station needs, attributes and architectural options study. Volume 3: Requirements [NASA-CR-173332]
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-16420 The US space station: Potential base for a spaceborne microwave facility p 7 N84-17211 Space Technology Experiments Platform (STEP) Overview p 8 N84-17212 STEP mechanical systems p 8 N84-17213 STEP experiment integration p 8 N84-17213 STEP experiment integration p 8 N84-17219 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) p 51 N84-17219 Integrated Power/Attitude Control System (version 1.0) communication analysis tool for space station (NASA-CR-173284] p 51 N84-17431 Airborne antenna pattern calculations [NASA-CR-173334] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173333] p 9 N84-17236 Space station needs, attributes and architectural options study. Volume 3:
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-16420 STEP Experiment Requirements p 7 N84-16420 [NASA-CR-72294] p 7 N84-17211 Space station: Potential base for a spaceborne microwave facility p 8 [NASA-CR-72294] p 7 N84-17212 STEP experiment Requirements P 8 N84-17212 STEP mechanical systems p 8 N84-17212 STEP experiment integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment p 60 N84-17229 User manual of the CATSS system (version 1.0) communication analysis tool for space station 10 [NASA-CR-171728] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-18265 Space station needs, attributes and architectural options stu
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements P181form (STEP) (NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17215 Deployable beam experiment p 60 N84-17219 User manual of the CATSS system (version 1.0) communication analysis tool for space station 1.01 (NASA-CR-171728] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 2: Mission analysis [NASA-CR-173333]<
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-14234 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 7 N84-16420 STEP Experiment Requirements [INASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17212 STEP experiment Integration p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17219 Integrated Power/Attitude Control System (IPACS) technology experiment p 60 N84-17229 User manual of the CATSS system (version 1.0) communication analysis tool for space station 100 [NASA-CR-173284] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study 100 N84-17436 Space station needs, attributes and architectural options study. Volume 2: Mission analysis p 9 N84-17436 Space station needs, attributes and architectural options study. Volume 4: Architectural options, subsystems, technology and programmatics NASA-CR-173331] p 10 N84-18265<
NASA's space station activities [GPO-27-393] p 7 N84-14234 Thermal analysis research applicable to space station technology needs p 25 N84-15426 [NASA-TM-84658] p 25 N84-15426 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420 STEP Experiment Requirements P181form (STEP) (NASA-CP-2294] p 7 N84-17211 Space Technology Experiments Platform (STEP) overview p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17215 Deployable beam flight experiment (MAST) p 8 N84-17215 Deployable beam experiment p 60 N84-17219 User manual of the CATSS system (version 1.0) communication analysis tool for space station 1.01 (NASA-CR-171728] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 1: Executive study [NASA-CR-173334] p 51 N84-17436 Space station needs, attributes and architectural options study. Volume 2: Mission analysis [NASA-CR-173333]<

Space station needs, attributes and	architectural options
study. Final review executive summa	
[NASA-CR-173674]	p 10 N84-18272
Space station needs, attributes and	architectural options
study. Briefing material: Final re	eview and executive
summary [NASA-CR-173321]	p 10 N84-18273
Space Station needs, attributes	F
options study	, and arcintectural
[NASA-CR-173327]	p 11 N84-18274
Space station needs, attributes	
options. Summary of major study a	
Space station program observations [NASA-CR-173345]	
Space Station Technology, 1983	p 11 N84-18275
INASA-CP-22931	p 11 N84-18277
Systems/operations technology	p 11 N84-18278
Crew and life support: EVA	p 11 N84-18279
Crew and life support: ECLSS	p 11 N84-18280
Attitude, control and stabilization	p 40 N84-18281
Human capabilities	p 11 N84-18282
Auxiliary propulsion	p 11 N84-18283
Fluid management	p 11 N84-18284
Communications	p 12 N84-18285
Structures and mechanisms	p 21 N84-18286
Data management	p 12 N84-18287
Power	p 12 N84-18288
Thermal control	p 25 N84-18289
Space station needs, attributes	
options. Volume 4, attachment 1: T	ask 2 and 3 mission
implementation and cost [NASA-CR-173330]	p 12 N84-18290
Space station needs, attributes	
options. Volume 2, attachment 2:	
analysis reports	
[NASA-CR-173329]	p 12 N84-18291
Space station needs, attributes	
options. Volume 1: Executive summ	p 12 N84-18292
[NASA-CR-172792] Space station needs, attributes	
options. Volume 1, attachment 1:	
NASA	
[NASA-CR-173337]	p 12 N84-18293
Space station needs, attributes	
options. Volume 1, attachment 2:	Supporting data and
analysis reports [NASA-CR-173336]	p 13 N84-18294
Space Station needs, attribute	
options. Volume 2, book 1,	
requirements	
[NASA-CR-173312]	p 13 N84-18296
Space Station needs, attributes	s and architectural
options. Volume 2, book 1, part	2, task 1: Mission
requirements [NASA-CR-173313]	p 13 N84-18297
Space Station needs, attributes	
options. Volume 2, book 1, part 3: M	
relevance to commercial telecomm	
[NASA-CR-173314]	p 13 N84-18298
Space Station needs, attribute	s and architectural
options. Volume 2, book 1, part 4 mission data sheets	i: Payload element
[NASA-CR-173315]	p 13 N84-18299
Space Station needs, attribute	
options. Volume 2, book 2, part 1: Mit	
concepts	
[NASA-CR-173316]	p 13 N84-18300
Space Station needs, attributes options. Volume 2, book 2, part 2,	
management system	· · · · · · · · · · · · · · · · · · ·
[NASA-CR-173317]	p 13 N84-18301
Space Station needs, attribute	
options. Volume 2, book 2, part 3	3: Communication
system	
[NASA-CR-173318]	p 14 N84-18302
[NASA-CR-173318] Space Station needs, attribute	p 14 N84-18302 s and architectural
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4:	p 14 N84-18302
[NASA-CR-173318] Space Station needs, attribute	p 14 N84-18302 s and architectural International reports p 14 N84-18303
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attribute: options, volume 2, book 3: Cost and	p 14 N84-18302 es and architectural International reports p 14 N84-18303 s and architectural d programmatics
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributer options, volume 2, book 3: Cost and [NASA-CR-173320]	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attribute options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ent missions for early
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributes options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme space stations orbit transfer vehicle	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ent missions for early a serving. Phase 2,
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributer options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme space stations orbit transfer vehicle task 1: Space station support of	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ent missions for early a serving. Phase 2,
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributes options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme space stations orbit transfer vehicle	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ent missions for early a serving. Phase 2,
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributer options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme space stations orbit transfer vehick task 1: Space station support c servicing [NASA-CR-170984] A manned-machine space s	p 14 N84-18302 is and architectural International reports p 14 N84-18303 is and architectural d programmatics p 14 N84-18304 ant missions for early a serving. Phase 2, of operational OTV
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attribute: options, volume 2, book 3: Cost and [NASA-CR-17320] Definition of technology developme space stations orbit transfer vehicle task 1: Space station support of servicing [NASA-CR-170984] A manned-machine space s concept	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ant missions for early a serving. Phase 2, of operational OTV p 14 N84-19377 tation construction
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attributes options, volume 2, book 3: Cost and [NASA-CR-173320] Definition of technology developme space stations orbit transfer vehicle task 1: Space station support c servicing [NASA-CR-170984] A manned-machine space s concept [NASA-TM-85762]	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ant missions for early a serving. Phase 2, of operational OTV p 14 N84-19377 tation construction p 21 N84-19395
[NASA-CR-173318] Space Station needs, attribute options, volume 2, book 2, part 4: [NASA-CR-173319] Space Station needs, attribute: options, volume 2, book 3: Cost and [NASA-CR-17320] Definition of technology developme space stations orbit transfer vehicle task 1: Space station support of servicing [NASA-CR-170984] A manned-machine space s concept	p 14 N84-18302 s and architectural International reports p 14 N84-18303 s and architectural d programmatics p 14 N84-18304 ent missions for early a serving. Phase 2, of operational OTV p 14 N84-19377 tation construction p 21 N84-19395 sting and advanced

for space stations p 79 N84-19429 Civil space station [S-REPT-98-523] p 79 N84-20613

On other papages that as a series of the STO He
On-orbit spacecraft/stage servicing during STS life cycle
[NASA-CR-171775] p 79 N84-20617
Alternative strategies for space station financing (NASA-CR-175412) p 80 N84-21437
Interactive geometry modeling of space station
conceptual designs p 18 N84-22191 SPACE SURVEILLANCE (SPACEBORNE)
National security implications of a U.S. space station
p 73 A84-24635 SPACE TRANSPORTATION
Transportation - Options and high payoff choices for
spacecraft propulsion p 61 A84-21484 An electric propulsion transportation system from
low-earth orbit to geostationary orbit utilizing beamed
microwave power p 61 A84-21485
The space van and its potential impact on the design of communications satellites
[AIAA 84-0758] p 74 A84-25309 SPACE TRANSPORTATION SYSTEM
Overview of space station operations
[IAF PAPER 83-38] p 64 A84-11723
The Fairchild Leasecraft system - A commercially-operated platform for science and business
in space
[IAF PAPER 83-232] p 65 A84-11773 Low cost space science and astronomy platforms in
orbit
[AIAA PAPER 84-0297] p 4 A84-18005 Space Shuttle, private enterprise and intellectual
properties in the context of space manufacturing
p 72 A84-22341 With the Space Shuttle towards space industrialization
p 75 A84-28975
Space Technology Experiments Platform (STEP) overview p 8 N84-17212
National Aeronautics and Space Administration Act,
1985 p 9 N84-18116 Spacelab data book
[ESA-BR-14] p 79 N84-18315
On-orbit spacecraft/stage servicing during STS life cycle
[NASA-CR-171775] p 79 N84-20617
Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985
[H-REPT-98-629] p 80 N84-21441
SPACE TRANSPORTATION SYSTEM FLIGHTS Field repair of graphite epoxy skin panels on the
spaceship Columbia p 52 A84-17120
Low earth orbit atomic oxygen effects on surfaces of Space Shuttle Orbiters
[AIAA PAPER 84-0548] p 53 A84-19912
Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593
SPACE VEHICLE CHECKOUT PROGRAM
Launch processing for Spacelab 1 [AIAA PAPER 83-2622] p 64 A84-10965
SPACE WEAPONS
National security implications of a U.S. space station p 73 A84-24635
SPACEBORNE ASTRONOMY
Space applications at the crossroads; Proceedings of the Twenty-first Goddard Memorial Symposium, Greenbelt,
MD, March 24, 25, 1983 p 64 A84-10883
The Tiros-based asteroid mission p 2 A84-14762 SPACEBORNE EXPERIMENTS
Utilisation of the European retrieval carrier EURECA for
life science research p 65 A84-11753 Space platform accommodations for multiple
interchangeable payloads p 16 A84-22131
The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420
STEP Experiment Requirements
[NASA-CP-2294] p 7 N84-17211 The STEP/STACBEAM experiment technology
development for very large solar array deployers
p 8 N84-17220 General requirements for Shuttle flight experiments
p 8 N84-17221
Thermal energy management process experiment p 25 N84-17222
Canadian Attitude Sensing Experimental Package
(CASEP) p 79 N84-17223 Photovoltaic concentrator pointing dynamics and plasma
interaction study p 50 N84-17224
A deployable structure and solar array controls experiment for STEP p 39 N84-17227
experiment to: 51EF p 39 1404-1/22/
Vibration isolation technology experiment
p 39 N84-17228
p 39 N84-17228 STEP flight experiments Large Deployable Reflector (LDR) telescope p 8 N84-17231
p 39 N84-17228 STEP flight experiments Large Deployable Reflector

- ogy
- p 8 N84-17232 p 9 N84-17234 p 50 N84-17235 Large inflated-antenna system Adaptive microwave reflector

SUBJECT INDEX

Microwave reflector characterization using simple

instruments in EVA	p 50 N84-17236
Flight test of a synthetic aperture r	adar antenna using
STEP Space station needs, attributes and	p 9 N84-17237 architectural options
study. Volume 2: Mission analysis	
[NASA-CR-173333]	p 9 N84-18266
Space Station needs, attributes options. Volume 2, book 1, part	2, task 1: Mission
requirements	
[NASA-CR-173313] Space Station needs, attributes	p 13 N84-18297 and architectural
options. Volume 2, book 1, parl 4	: Payload element
mission data sheets	p 13 N84-18299
[NASA-CR-173315] Feasibility study to conduct W	
experiments aboard a space station	
[NASA-CR-175434] SPACEBORNE TELESCOPES	p 15 N84-21586
Large Deployable Reflector (LDR)	- A concept for an
orbiting submillimeter-infrared telesco	pe for the 1990s p 66 A84-14586
Coherent arrays of separate optical	telescopes in space
project Trio	p 3 A84-15363
STEP flight experiments Large De (LDR) telescope	p 8 N84-17231
The effect of mass and stiffness char	nges on the damping
factor in a large space structure AS CSDL 2 model	represented by the
[AD-A136984]	p 42 N84-19465
Optical coating in space	p 56 N84-21290
[NASA-CR-175441] SPACECRAFT ANTENNAS	
Technology requirements for la	rge flexible space
structures [IAF PAPER 83-404]	p 2 A84-11811
A hardware demonstration of CO	ntrol for a flexible
offset-feed antenna Static shape forming for an electro	p 31 A84-13321
membrane mirror	p 16 A84-25551
Large deployable antenna flight	experiment for the
Space Technology Experiments Plati	p 8 N84-17232
Large inflated-antenna system	p 9 N84-17234
Study on large, ultralight long-life phase 2C	structures in space,
[TM-EKR3]	p 17 N84-17284
Airborne antenna pattern calculatio	ns
[NASA-CR-173284]	p 51 N84-17436
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems	p 51 N84-17436 is for parameters in
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING	p 51 N84-17436 is for parameters in p 9 N84-17947
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grout	p 51 N84-17436 is for parameters in p 9 N84-17947 d test data and model
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grout verification	p 51 N84-17436 s for parameters in p 9 N84-17947 d test data and model p 47 A84-20709
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha	p 51 N84-17436 s for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MU} verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240]	p 51 N84-17436 p 50 parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MU} verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C	p 51 N84-17436 is for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groum verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198]	p 51 N84-17436 ps for parameters in p p 9 N84-17947 d test data and model p 47 p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutine verification Radiating dipole model of interf spacecraft circulity by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging	p 51 N84-17436 is for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 sults: Charging and p 50 N84-17253
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groum verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft /plasma interactions an field and particle measurements [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (om	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spaceraft
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grout werification Radiating dipole model of interf spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging	p 51 N84-17436 es for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 aufts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17254
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft /plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of bean ¹ e spacecrafts	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 imissions from large
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grout werflication Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam e spacecrafts [AD-A137181]	p 51 N84-17436 es for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 aufts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17254
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry based of the space- discharging The role of potential barrier (cm charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications 6	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-18247 d their influence on onferences p 56 N84-17253 utts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutine verification Radiating dipole model of interf spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [SA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam ¹ e spacecrafts [AD-A137181] SPACECRAFT.COMMUNICATION	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-18247 d their influence on onferences p 56 N84-17253 utts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft //plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (cm charging Sheath ionization model of beant e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the	p 51 N84-17436 p 9 N84-17947 dtest data and model p 47 p 44 A84-20709 erence induced in rrges p 50 p 50 N84-16247 dt teir influence on onferences p 56 p 50 N84-17253 auts: Charging and p 50 p 50 N84-17254 nation in spacecraft p 50 p 50 N84-17253 autis: Charging and p 50 p 50 N84-17253 nation in spacecraft p 50 p 50 N84-17269 missions from large p 52 p 52 N84-19463 48 Mbit/s) between ground p 44
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouter verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [ASA-TP-2240] Spacecraft circuitry by surface discha field and particle measurements C [ESA-SP-188] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erance induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacerati p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutine verification Radiating dipole model of interf spacecraft circulity by surface dische [NASA-TP-2240] Spacecraft circulity by surface dische [NASA-TP-2240] Spacecraft circulity by surface dische [NASA-TP-2240] Spacecraft circulity based of the set discharging The role of potential barrier form charging Sheath ionization model of beant e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447]	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 utts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-11823 tracking equipment
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groum verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [INASA-TP-2240] Spacecraft circuitry by surface discha [INASA-TP-2240] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beant e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erance induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacerati p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-11823 tracking equipment p 45 A84-15639
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erance induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacerati p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-11823 tracking equipment p 45 A84-15639
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouter verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-188] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications f Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 45 A84-15639 cking on the Space p 45 A84-15630
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MM} verification Radiating dipole model of interf spacecratt circulity by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beant ¹ E spacecrafts [AD-A137181] SPACECRAFT COMMUNICATION Experiment data communications 6 Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-emateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Flyer communication s	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 autis: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 45 A84-15639 ching on the Space p 45 A84-15640 Application to system — Space
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Ground verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (Am charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Flyer communication s	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-11823 l tracking equipment p 45 A84-15639 cking on the Space p 45 A84-15640 Application to system Space p 45 A84-15641 mmunications path
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MM} verification Radiating dipole model of interf spacecratt circulity by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beant ¹ E spacecrafts [AD-A137181] SPACECRAFT COMMUNICATION Experiment data communications 6 Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-emateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Flyer communication s	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 autis: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 imissions from large p 52 N84-17269 imissions from large p 52 N84-17269 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 44 A84-11823 I tracking equipment p 45 A84-15639 ching on the Space p 45 A84-15640 Application to tystem — Space p 45 A84-15641 immunications path p 3 A84-15651
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouter verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-188] A review of SCATHA satellite (est discharging The role of potential barrier form charging Sheath ionization model of bean (est spacecrafts [AD-A137181] SPACECRAFT COMUNICATION Experiment data communications (f Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Fyer communication s Operation Center Space operations center coff obscuration Satellite System'S	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 ults: Charging and p 50 N84-17253 ults: Charging and p 50 N84-17259 missions from large p 52 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 45 A84-15639 cking on the Space p 45 A84-15639 cking on the Space p 45 A84-15695 p 45 A84-15695 p 45 A84-24636 Conference, 10th, p 37 A84-24636
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutinverification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft //plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (Am charging Sheath ionization model of beam e spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Flyer communications Space operations center cof obscuration	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 auts: Charging and p 50 N84-17253 auts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 45 A84-15649 ching on the Space p 45 A84-15641 nmunications path p 3 A84-15643 Conference, 10th, thnical Papers
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouthur verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (r/m charging Sheath ionization model of beant espace-rafts [AD-A137181] SPACECRAFT.COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays SOC/Free-Flyer communications Space station communications Space station communications Space operations center cof obscuration Space station communications Communication Statellite System's Operation Center Space station communications Communication Statellite System's Operation Center Space station communications Communication Statellite System's Oriando, FL, March 19-22, 1984, Tech	p 51 N84-17436 is for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 duts: Charging and p 50 N84-17253 duts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 imissions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 44 A84-11823 I tracking equipment p 45 A84-15639 cking on the Space p 45 A84-15649 A9plication to system Space p 45 A84-15645 p 73 A84-25655 p 73 A84-25251
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutine verification Radiating dipole model of interf spacecraft circulity by surface discha [NASA-TP-2240] Spacecraft circulity by surface discha [NASA-TP-2240] Spacecraft circulity by surface discha [NASA-TP-2240] A review of SCATHA satellite res- discharging The role of potential barrier form charging Sheath ionization model of beart ¹ 6 spacecrafts [AD-A137181] SPACECRAFT-COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Fyer communications Space station communications Space station communications Space station communications Space operations center cor obscuration Space station communications Communication Statellite System'ts Orlando, FL, March 19-22, 1984, Tec Time phased introduction of advall Its impact on orbit/spectrum consetVi	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 auts: Charging and p 50 N84-17253 auts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 imissions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 45 A84-15639 chipsent p 45 A84-15640 Application to tystem — Space p 45 A84-15641 mmunications path p 3 A84-2655 p 73 A84-2636 Conference, 10th, chipser Jaket Space p 45 chipser Space p 45
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouthur verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions ann field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier (Am charging Sheath ionization model of beant espace- spacecrafts [AD-A137181] SPACECRAFT.COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays SOC/Free-Flyer communications Communication Satellite System's Orbisouration Space station communications Communication Satellite System's Orbisouration Space station communications Communication Satellite System's Orbisouration Space station communications Communication Satellite System's Orlando, FL, March 19-22, 1984, Tec Time phased introduction of advail Its impact on orbit/spectrum conserv [AIAA PAPER 84-0653]	p 51 N84-17436 is for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 autis: Charging and p 50 N84-17253 autis: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17269 imissions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 44 A84-15639 ching on the Space p 45 A84-15640 Application to tystem Space p 45 A84-15640 Conference, 10th, shnical Papers p 73 A84-25251 need technologies - ation p 74 A84-25254
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MM} verification Radiating dipole model of interf spacecraft circulity by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beant ¹ 6 spacecrafts [AD-A137181] SPACECRAFT COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays Space station communications SoC/Free-Flyer communications Communication stellite System's Operation Center Space station communications Communication Stellite System's Orlando, FL, March 19-22, 1984, Tec Time phased introduction of adval Its impact on orbit/spectrum conset/V [AIAA PAPER 84-0653] User manual of the CATSS \$) communication analysis tool for space	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 auts: Charging and p 50 N84-17253 auts: Charging and p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 45 A84-15639 charging on the Space p 45 A84-15640 Application to system — Space p 45 A84-15641 nmunications path p 3 A84-15645 p 73 A84-24636 Conference, 10th, thnical Papers p 73 A84-28554 rstem (version 1.0) e station
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Groutine verification Radiating dipole model of interf spacecraft circuitry by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beam ¹ & spacecrafts [AD-A137181] SPACECRAFT.COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays - SOC/Free-Flyer communications S Operation Center Space operations center cof obscuration Space station communications Communication Statellite System's Orlando, FL, March 19-22, 1984, Tec Time phased introduction of ad ^{vall} Its impact on orbit/spectrum consetv [AIA PAPER 84-0653] User manual of the CATSS \$ communication analysis tool for space [NASA-CR-171728]	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 d their influence on onferences p 56 N84-17253 utts: Charging and p 50 N84-17253 utts: Charging and p 50 N84-17254 mation in spacecraft p 50 N84-17269 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-11823 tracking equipment p 45 A84-15639 cking on the Space p 45 A84-15641 numunications path p 3 A84-15655 p 73 A84-25254 ration p 74 A84-25254 ration p 74 A84-25254
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grou ^{MM} verification Radiating dipole model of interf spacecraft circulity by surface discha [NASA-TP-2240] Spacecraft/plasma interactions an field and particle measurements C [ESA-SP-198] A review of SCATHA satellite res discharging The role of potential barrier form charging Sheath ionization model of beant ¹ 6 spacecrafts [AD-A137181] SPACECRAFT COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communications, tracking, and do Station Multibeam phased arrays Space station communications SoC/Free-Flyer communications Communication stellite System's Operation Center Space station communications Communication Stellite System's Orlando, FL, March 19-22, 1984, Tec Time phased introduction of adval Its impact on orbit/spectrum conset/V [AIAA PAPER 84-0653] User manual of the CATSS \$) communication analysis tool for space	p 51 N84-17436 is for parameters in p 9 N84-17947 dtest data and model p 47 A84-20709 erence induced in rges p 50 N84-16247 dt heir influence on onferences p 56 N84-17253 auts: Charging and p 50 N84-17253 auts: Charging and p 50 N84-17259 missions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 44 A84-10396 solar sail spacecraft p 45 A84-15639 charging on the Space p 45 A84-15640 Application to system — Space p 45 A84-15641 nmunications path p 3 A84-15645 p 73 A84-24636 Conference, 10th, thnical Papers p 73 A84-28554 rstem (version 1.0) e station
[NASA-CR-173284] Spline-based estimation technique elliptic distributed systems [NASA-TM-85439] SPACECRAFT CHARGING Dielectric charging in space - Grouter verification Radiating dipole model of interf spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische [NASA-TP-2240] Spacecraft circuitry by surface dische discharging The role of potential barrier (Am charging Sheath ionization model of beant e spacecrafts [AD-A137181] SPACECRAFT COMMUNICATION Experiment data communications (Spacelab, the Space Shuttle and the Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] Space station communications and management/control system Communication, tracking, and 40 Station Multibeam phased arrays - SOC/Free-Flyer communications Space operations center cor obscuration Space station communications Communication Satellite System's Oriando, FL, March 19-22, 1984, Tec Time phased introduction of advai Its impact on orbit/spectrum conset/v [AIAA PAPER 84-0653] User manual of the CATSS \$ communication analysis tool for space [NASA-CR-171728] Space Station Technology, 1983	p 51 N84-17436 ps for parameters in p 9 N84-17947 d test data and model p 47 A84-20709 erence induced in rges p 50 N84-18247 d their influence on onferences p 56 N84-17253 utts: Charging and p 50 N84-17254 nation in spacecraft p 50 N84-17259 imissions from large p 52 N84-19463 48 Mbit/s) between ground p 44 A84-10396 solar sail spacecraft p 45 A84-15639 cking on the Space p 45 A84-15635 p 73 A84-15655 p 73 A84-25251 need technologies - ation p 74 A84-25254 rstem (version 1.0) e station p 51 N84-17431

Communications	n 12	N84-18285
Study of a tracking and data		
1990's. Volume 3: TDAS (
Model		
[NASA-CR-175195]	p 79	N84-19371
An Attached Payload Operation	ons Center (A	POC) at the
Goddard Space Flight Center (C	SSFC), volum	e 1 .
[NASA-CR-175160]		N84-20605

Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441

The effects of aperture antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781

SPACECRAFT COMPONENTS Transient dynamics during the orbiter based deployment

of flexible members [AIAA PAPER 84-0061] p 34 A84-21285

Design and development of an advanced solar array drive mechanism p 17 N84-18457 Design and manufacturing of a heat rejection system

for advanced thermal control — spacecraft and or payload cooling p 27 N84-19434 Flexible radiator system: Executive summary

[NASA-CR-171766] p 28 N84-20624 Development of procedures for component mode synthesis

[DFVLR-IB-232-82-C-09] p 30 N84-21626 SPACECRAFT CONFIGURATIONS

Space station attitude control system concept and requirements p 37 N84-12234 Space station needs, attributes and architectural

options. Part 1: Summary [NASA-CR-175382] p 10 N84-18270 Space Station needs, attributes and architectural

options: Summary briefing [NASA-CR-173328] p 10 N84-18271 Space station needs, attributes and architectural options

study. Briefing material: Final review and executive summary [NASA-CR-173321] p 10 N84-18273

Space Station needs, attributes and architectural options. Volume 2, book 1, part 1: Mission requirements [NASA-CR-173312] p 13 N84-18296

[NASA-CR-173312] p 13 N84-18296 Space Station needs, attributes and architectural options. Volume 2, book 2, part 1: Mission implementation concepts [NASA-CR-173316] p 13 N84-18300

[NASA-CR-173316] p 13 N84-18300 PACECRAFT CONSTRUCTION MATERIALS Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949

Tests and prediction of composite material viscoelastic behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815 Using the outgassing test to screen materials for p 53 A84-17174 contamination potential Cracked inner layer foil in high-density multilayer printed viring boards p 53 A84-17200 niques for large p 53 A84-17768 Materials and construction tech spacecraft structures Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings The effect of pressure and temperature on time-dependent changes in graphite/epoxy composit p 54 A84-21775 below the glass transition

Interstellar solar saling - Consideration of real and projected sail materials p 62 A84-25344 SiC-reinforced-aluminum alloys for aerospace applications p 54 A84-28242 Evaluation of spacecraft materials and processes for optical degradation potential p 54 A84-28458 Electrically conductive black optical paint

p 55 A84-28553 Research and technology, 1983 [NASA-TM-85702] p 7 N84-12026

Composite structural materials [NASA-CR-173259] p 56 N84-17293 Review report of the third year's activities on the study

survey of advanced materials -- for spacecraft and launch vehicles [R878] p 56 N84-21675

SPACECRAFT CONTAMINATION Using the outgassing test to screen materials for contamination potential p 53 A84-17174 Evaluation of spacecraft materials and processes for optical degradation potential p 54 A84-28458 Molecular contamination math model support

[NASA-CR-170899] p 77 N84-10174 SPACECRAFT CONTROL

Spacecraft thermal control, design, and operation p 22 A84-10224 Simulation of the motion of a Shuttle-attached flexible manipulator arm p 57 A84-11935 Simulation of the Galileo spacecraft axial - Delta-V algorithm p 66 A84-11938 Aggregate models for distributed parameter systems with applications to flexible air and spacecraft

p 31 A84-11945 Dynamics and control of a deformable gyrostat, utilizing continuum vehicle modes p 31 A84-12488

The Toysat structural control experiment — for large flexible space structure p 31 A84-13320 Structural parameter identification for flexible spacecraft

[AIAA PAPER 84-0060] p 23 A84-17853 A design strategy for multiple payload pointing from a three axis stabilized spacecraft

[AIAA PAPER 84-0566] p 33 A84-18168 The spatial order reduction problem and its effect on adaptive control of distributed parameter systems

p 33 A84-19056 Sampled data control of large space structures using constant gain velocity feedback - A negative view

p 46 A84-19169 On the number and placement of actuators for independent modal space control — for large flexible spacecraft p 34 A84-24990

Manipulator interactive design with interconnected flexible elements p 58 A84-25484

A simulator to study dynamic interaction of the Space Shuttle on-orbit flight control system with deployed flexible payloads p 35 A84-26717

Closed-form solutions for feedback control with terminal constraints p 36 A84-29471

Actuator placement considerations for the control of large space structures p 20 N84-11199

Integrated Power/Attitude Control System (IPACS) technology experiment p 39 N84-17229 Control of large flexible spacecraft by the independent

modal-space control method [NASA-CR-3760] p 40 N84-18262

Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985 [H-REPT-98-629] p 80 N84-21441

(H-REPT-98-629) p SPACECRAFT DESIGN

Spacecraft thermal control, design, and operation p 22 A84-10224

Overview of NASA space station activities [IAF PAPER 83-48] p 1 A84-11726

Utilisation of the European retrieval carrier EURECA for life science research p 65 A84-11753 Some aspects of simulation studies in spacecraft

dynamics p 15 A84-11930 Spacelab's development p 66 A84-13901

Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381

A future solar orbital transfer vehicle concept p 61 A84-16116

Weight characteristics of future spacecraft thermal management systems

[AIAA PAPER 84-0054] p 23 A84-17850 Plasma sheath structure surrounding a large powered

spacecraft [AIAA PAPER 84-0329] p 46 A84-18025 Multi-megawatt space power thermal management

system requirements [AIAA PAPER 84-0056] p 23 · A84-21284

Project space station - Plans for a permanent manned space center --- Book p 69 A84-21344 Space platform accommodations ---- for multiple

Space platform accommodations --- for multiple interchangeable payloads p 16 A84-22131 Solar array Shuttle flight experiment - Hardware

development and testing p 47 A84-22961 Architectural options and development issues p 4 A84-24633

Environmental control and life support (ECLS) design optimization approach p 73 A84-24637

Leasecraft - An innovative space vehicle p 5 A84-27945

The thermal design of the European complement of FSLP --- First SpaceLab Mission [SAE PAPER 831144] p 24 A84-29071

On transient dynamics and stability of large space structures p 36 A84-29143

Space station attitude control system concept and requirements p 37 N84-12234

ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181

Study on damping representation related to spacecraft structural design

[EMSB-18/83] p 38 N84-15182 Thermal analysis research applicable to space station

technology needs [NASA-TM-84658] p 25 N84-15426 Study on large, ultralight long-life structures in space,

phase 2C [TM-EKR3] pt N84-17284

Space station needs, attributes and architectural options

study. Volume 1: Executive study [NASA-CR-173334] p 9 N84-18265

SPACECRAFT DOCKING

Space Station needs, attributes, and architectural options study p 11 N84-18274 [NASA-CR-173327] Space Station needs, attributes and architectural options, volume 2, book 3: Cost and programmatics [NASA-CR-173320] p 14 N84-18304 Environmental and thermal control systems for space vehicles --- conferences p 26 N84-19396 [ESA-SP-200] Recent and planned developments at the Goddard Space Flight Center in thermal control technology p 26 N84-19402 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical design [ESA-CR(P)-1779-VOL-1] p 18 N84-21624 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal [ESA-CR(P)-1779-VOL-2] p 18 N84-21625 Development of procedures for component mode nthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 SPACECRAFT DOCKING Communications, tracking, and docking on the Space p 45 A84-15640 Station Shuttle interaction study p 80 N84-21592 [NASA-CR-173400] Shuttle interaction study extension [NASA-CR-173398] p 81 N84-21594 SPACECRAFT DOCKING MODULES Shuttle interaction study [NASA-CR-173400] p 80 N84-21592 SPACECRAFT ENVIRONMENTS Thermal control of tubular composite structures in space p 22 A84-10440 environment Satellite attitude dynamics and control in the presence of environmental torques - A brief survey p 31 A84-12483 Plasma sheath structure surrounding a large powered snacecraft [AIAA PAPER 84-0329] p.46 A84-18025 Low earth orbit atomic oxygen effects on surfaces of Space Shuttle Orbiters p 53 A84-19912 [AIAA PAPER 84-0548] Environmental Control and Life Support for an evolutionary Space Station [SAE PAPER 831108] p 5 A84-29043 Phase change water recovery techniques - Vapor compression distillation and thermoelectric/membrane concepts --- from waste water as part of Space Station life support system [SAE PAPER 831122] p 6 A84-29056 The residual gravitational field of orbital space stations [DGLR PAPER 83-089] p 75 A84-29656 Microgravity conditions on orbital platforms [DGLR PAPER 83-90] p 76 A84-29657 Large space instrumentation to measure the interaction etween space structures and the environment [AD-A129990] SPACECRAFT INSTRUMENTS p 77 N84-10179 Science platform and attitude subsystem in-flight calibration for the Galileo spacecraft p 32 A84-17355 Coordinate transformation assembly --- for space platform angular coordinate linking p 75 A84-28579 Large space instrumentation to measure the interaction between space structures and the environment AD-A1299901 p 77 N84-10179 SPACECRAFT LAUNCHING GEO space platform economics - Impact of concept, size, launch mode and lifetime [AIAA PAPER 84-0704] p 74 A84-25281 Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary [NASA-CR-168193-VOL-1] p 63 N p 63 N84-12226 SPACECRAFT MANEUVERS Simulation of the Galileo spacecraft axial - Delta-V p 66 A84-11938 algorithm Semiautonomous stationkeeping of geosynchronous p 32 satellites A84-17359 Closed-form solutions for feedback control with terminal onstraints p 36 A84-29471 SPACECRAFT MODELS On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 Simulation of the motion of a Shuttle-attached flexible manipulator arm p 57 A84-11935 A large space structure benchmark problem - ACOSS Model No. 2 p 33 A84-19127 Number crunching on the ACOSS Model No. 2 p 33 A84-19128 Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT thermal model p 26 N84-19398

Spacecraft thermal balance testing using infrared lamps on a dummy spacecraft p 26 N84-19399 Development of procedures for component mode synthesis

[DEVI B-IB-232-82-C-09] p 30 N84-21626 SPACECRAFT MODULES A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class [AIAA PAPER 84-0727] p 62 A84-25292 Operational modules for space [NASA-TM-85772] station construction p 21 N84-21608 SPACECRAFT MOTION Some aspects of simulation studies in spacecraft dynamics p 15 Å84-11930 On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 Attitude control and dynamics of the space operations center p 31 A84-11934 Simulation of the motion of a Shuttle attached flexible manipulator arm p 57 A84-11935 Satellite attitude dynamics and control in the presence of environmental torques - A brief survey p 31 A84-12483 Comments on 'Dynamics of a spacecraft during extension of flexible appendages' p 32 A84-17370 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854 Stability of large flexible damped spacecraft modeled as elastic continua p 35 A84-26845 Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic p 35 A84-26977 SPACECRAFT PERFORMANCE Evolution of European telecommunication satellite pointing performance p 34 A84-25291 SPACECRAFT POWER SUPPLIES High capacity power systems for space [IAF PAPER 83-421] p p 44 A84-11816 Photovoltaic solar arrays leading to a candidate space ower system in the regime beyond 100 kW [IAF PAPER 83-422] p 44 A84-11817

Application of beam power technology to a space tation p 45 A84-15642 station Plasma sheath structure surrounding a large powered spacecraft [AIAA PAPER 84-0329] p 46 A84-18025 A programmable power processor for high power space pplications p 46 A84-18394 applications Multi-megawatt space power thermal management system requirements [AIAA PAPER 84-0056] p 23 A84-21284 New directions in solar array developm p 47 A84-22958 Technology components of solar arrays for space platforms p 47 A84-22959 Technical aspects of the Intelsat V solar array p 47 A84-22962 New component development for multi-100 kW low-cost solar array applications p 47 A84-22963 Large area, low cost space solar cells p 47 A84-22979 Large area space solar cell assemblies p 61 A84-22980 Mechanical wraparound contacted cell for low cost space arrays p 48 A84-22982 Prediction of solar cell performance in space p 48 A84-22997 p 48 N84-12233 Space station energy sizing Study of multi-kilowatt solar arrays for Earth orbit applications [NASA-CR-170939] p 49 N84-12634 Orbiting wire as a dynamo: Auxiliary power possibilities for space platforms [IFSI-83-3] p 49 N84-12653 Integrated Power/Attitude Control System (IPACS) p 39 N84-17229 technology experiment p 12 N84-18288 Powe SPACECRAFT PROPULSION A parametric study of space transfer-propulsion stages [IAF PAPER 83-401] p 61 A84-13397 Transportation - Options and high payoff choices --- for p 61 A84-21484 spacecraft propulsion An electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beamed p 61 A84-21485 microwave power A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class p 62 A84-25292 [AIAA PAPER 84-0727] Utilization of electric propulsion for communication satellites [AIAA PAPER 84-0729] p 62 A84-25293 Why don't we use ion propulsion? p 62 A84-25294 [AIAA PAPER 84-0730]

Resistojet propulsion for large spacecraft systems NASA-TM-83489] p 63 N84-11206 [NASA-TM-83489] Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary [NASA-CR-168193-VOL-1] p 63 N84-12226 Auxiliary propulsion p 11 N84-18283 SPACECRAFT RADIATORS Spacecraft thermal control, design, and operation p 22 A84-10224 Weight characteristics of future spacecraft thermal management systems [AIAA PAPER 84-0054] p 23 A84-17850 Multi-megawatt space power thermal management system requirements [AIAA PAPER 84-0056] p 23 A84-21284 Thermal management system technology development for space station applications [SAE PAPER 831097] p 24 A84-29032 A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 . A84-29036 Thermal energy management process experiment p 25 N84-17222 Heat pipes for the L-SAT communications module p 26 N84-19405 radiators A Variable Conductance Heat Pipe (VCHP) radiator system for communications payloads p 27 N84-19406 Flexible radiator system [NASA-CR-171765] p 28 N84-20623 SPACECRAFT SHIELDING Reactions of high velocity atomic oxygen with carbon [AIAA PAPER 84-0549] p 53 A84-18159 A Maltese cross shaped mobile the nal control shutter for satellites p 27 N84-19454 SPACECRAFT STABILITY On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 A design strategy for multiple payload pointing from a three axis stabilized spacecraft [AIAA PAPER 84-0566] p 33 A84-18168 The beam-like behavior of space trusses p 19 A84-21517 Stability of large flexible damped spacecraft modeled p 35 A84-26845 as elastic continua On transient dynamics and stability of large space p 36 A84-29143 structures Digital control system for space [NASA-CR-175355] structural dampe p 39 N84-16246 SPACECRAFT STRUCTURES Thermal control of tubular composite structures in space p 22 A84-10440 environment Thermo-mechanical behaviour of CFRP tubes for space structures [IAF PAPER 83-417] p 22 A84-11814 Field repair of graphite epoxy skin panels on the p 52 A84-17120 spaceship Columbia Comments on 'Dynamics of extension of flexible appendages' spacecraft during p 32 A84-17370 The beam-like behavior of space trusses p 19 A84-21517 the INTELSAT V Design and development of p 19 A84-22153 graphite-epoxy central thrust tube Local stability of sandwich structures with thin fibre reinforced face skins for space application p 19 A84-22859 [MBB-UD-381-83-OE] Higher temperature composite joints survive elimination p 55 A84-29565 tests ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181 Integrity control of carbon fiber reinforced plastics space structural elements, phase 1 report --applications [TB-TS-11-01/82-A] p 56 N84-18416 Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT p 26 N84-19398 thermal model IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber p 26 N84-19400 Computer aided synthesis of a satellite antenna structure p 21 N84-19899 with probabilistic constraints Dynamic behaviour of a satellite antenna structure in p 42 N84-19900 random vibration environment Evaluation of modal testing techniques for spacecraft p 28 N84-19906 structures Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1 [ESA-CR(P)-1779-VOL-3] p 43 N84-21611 Mathematical synthesization of complex structures p 19 N84-22224 SPACECRAFT TRACKING Communications, tracking, and docking on the Space tation p 45 A84-15640 Station

SUBJECT INDEX

SPACECRAFT TRAJECTORIES Discontinuous low thrust orbit transfer
[AD-A136908] p 63 N84-19474 SPACECREWS
Determination of applicable law to living and working
in outer space [IAF PAPER 82-IISL-44] p 68 A84-17057
Spacelab data book [ESA-BR-14] p 79 N84-18315
SPACELAB Experiment data communications (48 Mbit/s) between
Spacelab, the Space Shuttle and the ground p 44 A84-10396
Launch processing for Spacelab 1
[AIAA PAPER 83-2622] p 64 A84-10965 The Spacelab test program
[AIAA PAPER 83-2685] p 66 A84-13376
Spacelab's development p 66 A84-13901
The Spacelab program - The management of the program, problems encountered and the solutions
adopted p 3 A84-15325
The German Spacelab mission D1 p 69 A84-17762
Operational planning, simulation, and performance of the German Spacelab mission D1 p 69 A84-17763
The thermal design of the European complement of
FSLP First SpaceLab Mission
[SAE PAPER 831144] p 24 A84-29071
Software quality assurance Spacelab experience and future trends p 17 N84-14759
Modern software development tools in space projects
on the example of a Spacelab experiment
p 49 N84-14761 Payload missions integration
[NASA-CR-170949] p 7 N84-15171 Space telescope
[NASA-CR-170948] p 78 N84-16097
STS-9: Orbital workshop spacelab to fly on ninth Shuttle
mission [NASA-TM-85497] p 78 N84-16242
STEP mechanical systems p 8 N84-17213
Spacelab data book
[ESA-BR-14] p 79 N84-18315 Spacelab Data Processing Facility
[NASA-TM-85556] p 51 N84-19382
Operational modules for space station construction
[NASA-TM-85772] p 21 N84-21608
SPACELAB PAYLOADS Spacetab data book
[ESA-BR-14] p 79 N84-18315
An Attached Payload Operations Center (APOC) at the Goddard Space Flight Center (GSFC), volume 1
[NASA-CR-175160] p 79 N84-20605
SPACETENNAS
Use of electromagnetic models in the optimal control of large space antennas p 35 A84-25552
SPIN DYNAMICS
Satellite attitude dynamics and control in the presence of environmental torques - A brief survey
p 31 A84-12483
Maintenance and operational enhancement of the
flexible spacecraft dynamics program [NASA-CR-175211] p 41 N84-19394
SPIN-ORBIT INTERACTIONS Thermally induced spin rate ripple on spacecraft with
long radial appendages
[NASA-TM-85058] p 39 N84-16249 SPLINE FUNCTIONS
Parameter identification in continuum models
p 16 A84-25525 Spline-based estimation techniques for parameters in
elliptic distributed systems
[NASA-TM-85439] p 9 N84-17947
SPOT (FRENCH SATELLITE) Evaluation of bus impedance on the SPOT multimission
platform p 44 A84-13521
Software production in a large space project: The SPOT mission center p 78 N84-14752
STABILIZATION
Investigation of electrodynamic stabilization and control of long orbiting tethers
[NASA-CR-170972] p 40 N84-17251 STAR TRACKERS
Canadian Attitude Sensing Experimental Package
(CASEP) p 79 N84-17223 STARLAB
Starlab Ground System guidelines document
[NASA-CR-175192] p 14 N84-20435 STATIC LOADS
Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering
Analysis Language (EAL) system
[NASA-TM-85743] p 42 N84-20880

STATIC TESTS Assessment of the existing ground test technology and

confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural analysis p 29 N84-21621 STATIONARY ORBITS

Introduction to geostationary orbits [ESA-SP-1053] p 80 N84-21590 STATIONKEEPING

Semiautonomous stationkeeping of geosynchronous satellites p 32 A84-17359 Utilization of electric propulsion for communication satellites

[AIAA PAPER 84-0729] p 62 A84-25293 STIFFNESS Stability, vibration and passive damping of partially

Stability, vibration and passive damping of partially restrained imperfect columns [NASA-TM-85697] p 37 N84-13608

STIFFNESS MATRIX Identification of large flexible structures mass/stiffness

and damping from on-orbit experiments p 34 A84-24995 New elements for analysis of space frames with tapered members p 20 N84-14561 Geometrically nonlinear analysis of beam-in-space

structures [MITT-28] p 22 N84-21914 STOCHASTIC PROCESSES

Active control of large flexible space structures p 37 N84-14235

STORAGE BATTERIES

Assessment of potential for batteries in space applications p 48 N84-12246 STRESS ANALYSIS

Instability analysis of space trusses

p 32 A84-16885 A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887

STRUCTURAL ANALYSIS Parameter identification in continuum models p 16 A84-25525

Development of deployable structures for large space platforms. Volume 2: Design development [NASA-CR-170914] p 20 p 20 N84-10176 Control of flexible spacecraft by optimal model p 36 N84-12222 following New elements for analysis of space frames with tapered p 20 N84-14561 members ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181 Thermal analysis research applicable to space station technology needs [NASA-TM-84658] p 25 N84-15426 Self-shadowing of orbiting trusses p 25 N84-16565 [NASA-CR-173215] NASA-CR-173215j p.23 (Not rection the solar array structural configuration p.17 N84-17225 configuration p 21 N84-18286 Structures and mechanisms Integrity control of carbon fiber reinforced plastics structural elements, phase 1 report --- space

applications [TB-TS-11-01/82-A] p 56 N84-18416 Component mode synthesis and large deflection vibrations of complex structures -- beams and trusses [NASA-CR-173338] p 21 N84-18680 The effect of mass and stiffness changes on the damping factor in a large space structure as represented by the CSDL 2 model [AD-A136984] p 42 N84-19485

Computer aided synthesis of a satellite antenna structure with probabilistic constraints p 21 N84-19899

Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering Analysis Language (EAL) system (NASA-TM-85743) p 42 N84-20880

Mathematical synthesization of complex structures p 19 N84-22224

STRUCTURAL DESIGN

Approximations method for space frame synthesis p 19 A84-10141 A heuristic method for the design of minimum weight

trusses using discrete member sizes p 15 A84-16841 Radiation-conduction interaction in large space structures [AIAA PAPER 84-0144] p 23 A84-17911

A large space structure benchmark problem - ACOSS Model No. 2 p 33 A84-19127 Matrix(X) - Application to large space structure control design problems p 16 A84-19129

Potential of minicomputer-array processor system for nonlinear finite-element analysis p 46 A84-20583 Optimization of shallow trusses against limit point instability p 20 A84-23368

Some applications of direct adaptive control to large structural systems p 34 A84-25496

Study on damping representation related to spacecraft structural design
[EMSB-18/83] p 38 N84-15182
Surface accuracy measurement sensor test on a
50-meter antenna surface model
[NASA-TM-85689] p 17 N84-16427 Study on large, ultralight long-life structures in space,
phase 2C
[TM-EKR3] p 17 N84-17284
Spacelab data book
[ESA-BR-14] p 79 N84-18315 Study on synthesis and characterization of large space
systems, phase 2. Part 2: Proposals for additions,
modifications and new analytical methods, volume 1
[ESA-CR(P)-1779-VOL-3] p 43 N84-21611 Mathematical methodization of complex structures
Mathematical synthesization of complex structures p 19 N84-22224
STRUCTURAL ENGINEERING
The Toysat structural control experiment for large
flexible space structure p 31 A84-13320 STRUCTURAL STABILITY
Instability analysis of space trusses
p 32 A84-16885
Dynamics and control of a large space antenna
p 32 A84-17361 Aeroelastic stability and response of flexible tactical
weapons
[AIAA PAPER 84-0392] p 32 A84-18060
Local stability of sandwich structures with thin fibre reinforced face skins for space application
[MBB-UD-381-83-OE] p 19 A84-22859
Stability, vibration and passive damping of partially
restrained imperfect columns
[NASA-TM-85697] p 37 N84-13608 STRUCTURAL VIBRATION
Buckling and vibration of any prismatic assembly of shear
and compression loaded anisotropic plates with an
arbitrary supporting structure p 23 A84-14050
Control of large space structures [AIAA PAPER 84-0081] p 32 A84-17866
Identification of large flexible structures mass/stiffness
and damping from on-orbit experiments
p 34 A84-24995
Stability of large flexible damped spacecraft modeled as elastic continua p 35 A84-26845
Experimental study of active vibration control
[AD-A133818] p 38 N84-14546
Component mode synthesis and large deflection
vibrations of complex structures beams and trusses [NASA-CR-173338] p 21 N84-18680
Evaluation of modal testing techniques for spacecraft
structures p 28 N84-19906
Analysis of large space structures p 18 N84-20621
STRUCTURAL WEIGHT A heuristic method for the design of minimum weight
trusses using discrete member sizes p 15 A84-16841
Optimization of shallow trusses against limit point
instability p 20 A84-23366 SUBMILLIMETER WAVES
Large Deployable Reflector (LDR) - A concept for an
orbiting submillimeter-infrared telescope for the 1990s
p 66 A84-14586
SURFACE DEFECTS Fracture mechanics of ceramics. Volume 5 - Surface
flaws, statistics, and microcracking p 54 A84-24501
SURFACE PROPERTIES
Surface analysis of graphite fiber reinforced polyimide
composites [NASA-TM-85700] p 55 N84-11220
SURFACES
Computer-Aided Geometry Modeling
[NASA-CP-2272] p 18 N84-22179 SYMMETRY
The solution of the dynamic problem of the periodic
structures by cyclosymmetric technique large space
structures p 43 N84-21612
SYNCHRONOUS PLATFORMS NASA's geostationary communications platform
program
[AIAA PAPER 84-0702] p 5 A84-25326
Development trends in Europe on satellite clusters and
geostationary platforms [AIAA PAPER 84-0703] p 75 A84-25327
Contraction of the second seco
SYNCHRONOUS SATELLITES
Analytical model of the evolution of orbit parameters
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite [IAF PAPER 83-316] p 65 A84-11787
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite (IAF PAPER 83-316) p 65 A84-11787 Energy from space - Legal implications of the use of the geostationary orbit p 68 A84-17075
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite [IAF PAPER 83-316] p 65 A84-11787 Energy from space - Legal implications of the use of the geostationary orbit p 68 A84-17075 Semiautonomous stationkeeping of geosynchronous
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite [IAF PAPER 83-316] p 65 A84-11787 Energy from space - Legal implications of the use of the geostationary orbit p 68 A84-17075 Semiautonomous stationkeeping of geosynchronous satellites p 32 A84-17359
Analytical model of the evolution of orbit parameters of a quasi geostationary satellite [IAF PAPER 83-316] p 65 A84-11787 Energy from space - Legal implications of the use of the geostationary orbit p 68 A84-17075 Semiautonomous stationkeeping of geosynchronous

 [AIAA PAPER 84-0749]
 p 74
 A84-25304

 Computer tools for optimizing orbit use
 [AIAA PAPER 84-0651]
 p 74
 A84-25318

SYNCHRONOUS SATELLITES

SYNOPTIC METEOROLOGY

Spacecraft thermal control selection for seven years of lifetime in synchronous orbit [MBB-UR-584-82-OE] p 25 N84-11200

SYNOPTIC METEOROLOGY The role of space station in earth sciences

p 72 A84-24631 SYNTAX

Interactive geometry modeling of space station conceptual designs p 18 N84-22191 SYNTHETIC APERTURE RADAR

Flight test of a synthetic aperture radar antenna using STE p 9 N84-17237 SYSTEMS

Space station needs, attributes and architectural options. Volume 1, attachment 2: Supporting data and nalysis reports

[NASA-CR-173336] p 13 N84-18294 Space Station needs, attributes and architectural options. Volume 2, book 2, part 2, Task 2: Information management system [NASA-CR-173317] p 13 N84-18301

SYSTEMS ANALYSIS A system study of the solar power satellite concept

p 70 A84-21480 A degree of controllability definition - Fundamental

concepts and application to modal systems p 34 A84-24991 p8 N84-17213 STEP mechanical systems Space station needs, attributes and architectural options

study. Volume 4: Architectural options, subsystems, technology and programmatics [NASA-CR-173331] p 10 N84-18268

Space station needs, attributes and architectural options. Part 1: Summary [NASA-CR-175382] p 10 N84-18270

Space station needs, attributes and architectural options study. Briefing material: Final review and executive summary

[NASA-CR-173321] p 10 N84-18273 Space Station needs, attributes and architectural ptions. Volume 2, book 1, part 1: Mission options. requirements [NASA-CR-173312] p 13 N84-18296

Space Station needs, attributes and architectural options. Volume 2, book 2, part 3: Communication system [NASA-CR-173318] p 14 N84-18302

SYSTEMS ENGINEERING Data system architecture considerations for a space

station [AIAA PAPER 83-2346] p 63 A84-10066 Photovoltaic solar arrays leading to a candidate space

power system in the regime beyond 100 kW p 44 A84-11817 [IAF PAPER 83-422]

Architectural options and development issues p 4 A84-24633 Study of artificial intelligence techniques - Realization

of a highly autonomous experimental robot system --French thesis p 58 A84-25828 Thermal management system technology development

for space station applications [SAE PAPER 831097] p 24 A84-29032 Systems engineering aspects of a preliminary conceptual design of the space station environmental

control and life support system [SAE PAPER 831109] p 5 A84-29044

Hyperfiltration wash water recovery subsystem - Design and test results --- for extended mission spacecraft such as snace stations

[SAE PAPER 831112] p 6 A84-29047 Research and technology, 1983

[NASA-TM-85702] p 7 N84-12026 Space station needs, attributes and architectural options. Summary of major study activities and results.

Space station program observations [NASA-CR-173345] p 11 N84-18275 Crew and life support: ECLSS p 11 N84-18280

p 21 N84-18286 Structures and mechanisms Space station needs, attributes and architectural options. Volume 4, attachment 1: Task 2 and 3 mission mplementation and cost

p 12 N84-18290 [NASA-CFI-173330] Space station needs, attributes and architectural options. Volume 2, attachment 2: Supporting data and nalysis reports

[NASA-CFI-173329] p 12 N84-18291 Space station needs, attributes and architectural options. Volume 1: Executive summary NASA

[NASA-CR-172792] p 12 N84-18292 Space Station needs, attributes and architectural options. Volume 2, book 2, part 1: Mission implementation concepts

[NASA-CR-173316]	p 13	N84-18300
Flexible radiator system		
[NASA-CR-171765]	p 28	N84-20623

SYSTEMS INTEGRATION

Integrated Flywheel Technology	, 1983	
[NASA-CP-2290]	p 78	N84-12
The Boeing flywheel study	p 37	N84-12
STEP experiment integration	p 8	N84-17

SYSTEMS SIMULATION Simulation of the motion of a Shuttle-attached manipulator arm p 57 A8-

A flexible structure controller design method usir residualization and output feedback --- for Large p 32 A8 Space System Selection of noisy sensors and actuators for re

of linear systems --- large space structures [AD-A135442] p 51 N8 SYSTEMS STABILITY

Controllability and observability criteria for multi linear second-order models Stability enhancement of a flexible robot manipulator [AD-A134185] p 59 N84-16807 p 59 N84-16807

Т

TAPERING

New elements for analysis of space frames with tapered p 20 N84-14561 members TDR SATELLITES

path Space operations center communications obscuration

p 3 A84-15695 Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] p 74 A84-25319 An evaluation of Techroll seal flexible joint material p 56 N84-16037 **TECHNOLOGICAL FORECASTING** Overview of NASA space station activities [IAF PAPER 83-48] p 1 A84-11726 Commercial communications satellite market and technology in the 90's [IAF PAPER 83-86] p 65 A84-11739 High capacity power systems for space [IAF PAPER 83-421] p 44 A84-11816 Spaceflight to 2000 - Interavia looks forward from the p 66 A84-14764 present An advanced generation land mobile satellite system and its critical technologies p 3 A84-15634 Project space station - Plans for a permanent manned space center --- Book p 69 A84-21344 Mankind's interstellar future p 71 A84-21499 Space 1991 p 71 A84-21720 National security implications of a U.S. space station p 73 A84-24635 Space station communications p 73 A84-24636 A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class [AIAA PAPER 84-0727] p 62 A84-25292 for future Development trends in Europe on satellite clusters and geostationary platforms [AIAA PAPER 84-0703] p 75 A84-25327 Evolutionary concepts for a space station and the relevant utilisation potential p 5 A84-26926 Space Station needs, attributes and architectural options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites [NASA-CR-173314] p 13 N84-18298 TECHNOLOGY ASSESSMENT Space station data management - A system evolving from changing requirements and a dynamic technology [AIAA PAPER 83-23381 p 43 A84-10016 NASA priority technologies [IAF PAPER 83-345] p 1 A84-11793 Global implications of space activities: An AIAA/ASPEN astitute Assessment --- Book p 67 A84-15189 Institute Assessment --- Book Developing the space frontier: Proceedings of the Twenty-ninth Annual Conference, Houston, TX, October 25-27, 1982 p 67 A84-15381 Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, 1982 p 69 A84-21476 A system study of the solar power satellite concept p 70 A84-21480 Market potential and possible limitations for satellite solar power stations p 70 A84-21481 European questions related to satelite power systems p 70 A84-21483 New directions in solar array development A84-22958 D 47 Time phased introduction of advanced technologies Its impact on orbit/spectrum conservation [AIAA PAPER 84-0653] p 74 A84-25254 Why don't we use ion propulsion? p 62 A84-25294 [AIAA PAPER 84-0730] Digital technologies and systems for geostationary orbit

etellites [AIAA PAPER 84-0749] p 74 A84-25304

	Lessons learned during the first y	ear of	the TDRSS
	[AIAA PAPER 84-0687]	р74	A84-25319
34-12228	Systems/operations technology	p 11	N84-18278
34-12235	Auxiliary propulsion	p 11	N84-18283
34-17215	Fluid management	p 11	N84-18284
	TECHNOLOGY TRANSFER		
d flexible	Identification of new potential scient areas for DoD application. Summary		
34-11935	[AD-A134372]	p 78	
ing mode Flexible	Structures and mechanisms TECHNOLOGY UTILIZATION	p 21	N84-18286
34-17369	Evolution of the solar power sate	lite co	ncept - The
egulation	utilization of energy from space		
34-17931	Space station: Policy, planning Proceedings of the Symposium, Arling 1983	ton, VA	
tivariable	Space station architectural issues as		
A 05546			

p 35 A84-25516 community - Applications Development and application of new technologies in the ESA Olympus Programme

[AIAA PAPER 84-0706] p 4 A84-25282 With the Space Shuttle towards space industrialization p 75 A84-28975 Understanding space settlements as human systems

[AAS PAPER 83-204] p 76 A84-29856 The complementary roles of existing and advanced environmental, thermal control and life support technology for space stations TELECOMMUNICATION p 79 N84-19429

NTC '82; National Telesystems Conference, Galveston, TX, November 7-10, 1982, Conference Record p 44 A84-15623 Tele-X - The first step in a satellite communications

system for the Nordic countries [AIAA PAPER 84-0713] p 4 A84-25287

Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861

Space Station needs, attributes and architectural options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites NASA-CR-173314] p 13 N84-18298 TEL EMETRY

Space Station needs, attributes and architectural options. Volume 2, book 2, part 2, Task 2: Information management system [NASA-CR-173317] p 13 N84-18301

TELEOPERATORS

A system for intelligent teleoperation research [AIAA PAPER 83-2376] p 57 A8 p 57 A84-10070 p 57 A84-22336 Remote manipulators in space NASA research in teleoperation and robotics p 58 A84-28523 Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS), Volume 3, phase 2: Executive summary p 59 N84-10582

[NASA-CR-3736] p 59 Analysis of large space structures Man/machine assembly analysis assembly:

p 59 N84-13208 [NASA-CR-3751] Human capabilities p 11 N84-18282

TELESCOPES

Surface accuracy measurement sensor test on a 50-meter antenna surface model NASA-TM-85689] p 17 N84-16427

TELEVISION SYSTEMS

The Franco-German DBS program 'TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 A84-25260 TEMPERATURE CONTROL

Spacecraft thermal control, design, and operation p 22 A84-10224 Thermal control of tubular composite structures in space

p 22 A84-10440 environment Weight characteristics of future spacecraft thermal

- management systems [AIAA PAPER 84-0054] p 23 A84-17850
- Multi-megawatt space power thermal management system requirements

p 23 A84-21284 [AIAA PAPER 84-0056]

Thermal management system technology development for space station applications

[SAE PAPER 831097] p 24 A84-29032

Thermal control of the Tethered Satellite Module p 24 A84-29067 [SAE PAPER 831138] The thermal design of the European complement of

FSLP --- First SpaceLab Mission [SAE PAPER 831144] p 24 A84-29071

Regenerable non-venting thermal control subsystem for extravehicular activity

[SAF PAPER 831151] p 24 A84-29076 Thermal energy management process experiment

p 25 N84-17222 Environmental and thermal control systems for space

vehicles --- conferences [ESA-SP-200] p 26 N84-19396

SUBJECT INDEX

p 4 A84-24634

- Spacecraft thermal balance testing using infrared lamps On a dummy spacecraft p 26 N84-19399 Recent and planned developments at the Goddard Space Flight Center in thermal control technology p 26 N84-19402 The thermal design of L-SAT large telecommunication p 27 N84-19414 Satellite The complementary roles of existing and advanced environmental, thermal control and life support technology for space stations p 79 N84-19429 Design and manufacturing of a heat rejection system for advanced thermal control --- spacecraft and or payload p 27 N84-19434 cooling Thermal control of tethered satellite in a very low altitude aerodynamic mission p 27 N84-19444 A Maltese cross shaped mobile thermal control shutter p 27 N84-19454 --- for satellites Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616 structural-thermal-control Interactive analytical formulations --- large space structures p 29 N84-21619 **TEMPERATURE EFFECTS** Effect of temperature, moisture and radiation exposures on composite mechanical properties p 55 A84-28900 Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616 Thermal design verification of the large open truss structures. The local approach and the shadow problem large space structures p 29 N84-21617 TERMINAL GUIDANCE Closed-form solutions for feedback control with terminal constraints p 36 A84-29471 TERRESTRIAL RADIATION Computing the radiation pressure forces by adapting thermal design verification softwares --- large space structures p 28 N84-21613 TEST FACILITIES A cylindrical near-field test facility for large satellite antennas p 72 A84-22862 [MBB-UR-628-83-OE] IPACS guidance navigation and p 37 N84-12245 considerations and test activities The Large Space Simulator (LSS) at ESA/ESTEC (a summary of the main characteristics) p 27 N84-19458 TETHERED SATELLITES On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by wo tethers p 32 A84-17854 [AIAA PAPER 84-0062] Thermal control of the Tethered Satellite Module [SAE PAPER 831138] p 24 A84-29067 Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 Thermal control of tethered satellite in a very low altitude aerodynamic mission p 27 N84-19444 Tethers in space: Birth and growth of a new avenue to space utilization [NASA-TM-82571] p 18 N84-21607 THERMAL ANALYSIS Thermal control of the Tethered Satellite Module [SAE PAPER 831138] p 24 A84-29067 The thermal design of the European complement of FSLP --- First SpaceLab Mission [SAE PAPER 831144] p 24 A84-29071 THERMAL CONDUCTIVITY Thermal conductance and torque of thin section four-point contact ball bearings in vacuum p 25 N84-15562 [ESA-ESTL-54] THERMAL CONDUCTORS A contact conductance interface for a space constructable heat pipe radiator [SAE PAPER 831101] p 24 A84-29036 THERMAL CONTROL COATINGS Spacecraft thermal control selection for seven years of lifetime in synchronous orbit [MBB-UR-584-82-OE] o 25 N84-11200 Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials p 27 N84-19449 space shuttle payloads THERMAL CYCLING TESTS Thermo-mechanical behaviour of CERP tubes for space structures p 22 A84-11814 [IAF PAPER 83-417] Higher temperature composite joints survive elimination p 55 A84-29565 tests
 - Thermal cycling tests in space environment simulation chambers p 26 N84-19401 The Large Space Simulator (LSS) at ESA/ESTEC (a
 - summary of the main characteristics) p 27 N84-19458

etructures [IAF PAPER 83-417] p 22 A84-11814 THERMAL RADIATION Computational savings in view factor evaluation on mode prescreening --- large space structures p 29 N84-21618 THERMAL SIMULATION Spacecraft thermal design using interactive graphics [AIAA PAPER 84-0143] p 23 A84-17910 THERMAL STRESSES Radiation-conduction interaction in large space structures p 23 A84-17911 TAIAA DADED 84-01441 THERMAL VACUUM TESTS Thermal conductance and torque of thin section four-point contact ball bearings in vacuum p 25 N84-15562 [ESA-ESTL-54] Spacecraft thermal balance testing using infrared lamps on a dummy spacecraft p 26 N84-19399 Thermal cycling tests in space environment simulation p 26 N84-19401 chambers The Large Space Simulator (LSS) at ESA/ESTEC (a summary of the main characteristics) p 27 N84-19458 Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Thermal test techniques p 29 N84-21622 THERMODYNAMIC PROPERTIES Thermal-mechanical behavior of graphite/magnesium p 24 A84-28237 omposites

Assessment of the existing ground test technology and

Thermo-mechanical behaviour of CFRP tubes for space

p 29 N84-21622

confronting with the Large Space Structures (LSS)

requirements. Thermal test techniques

THERMAL EXPANSION

- Thermally induced spin rate ripple on spacecraft with long radial appendages p 39 N84-16249 [NASA-TM-85058] THIN PLATES Radiation-conduction interaction in large space structures [AIAA PAPER 84-0144] p 23 A84-17911 THREE AXIS STABILIZATION A design strategy for multiple payload pointing from a three axis stabilized spacecraft [AIAA PAPER 84-0566] p 33 A84-18168 TIME OPTIMAL CONTROL low-thrust transfer to Highly efficient. Verv geosynchronous orbit - Exact and approximate solutions p 61 A84-24980 TIROS SATELLITES The Tiros-based asteroid mission p 2 A84-14762
- TOROUE Satellite attitude dynamics and control in the presence
 - of environmental torques A brief survey p 31 A84-12483 Torque from solar radiation pressure gradient during - for very large spacecraft p 31 A84-12489 eclipse -
- Thermal conductance and torque of thin section four-point contact ball bearings in vacuum p 25 N84-15562 [ESA-ESTL-54] TRACKING NETWORKS
- Space station communications and tracking equipment anagement/control system p 45 A84-15639 management/control system Study of a tracking and data acquisition system for the 1990's. Volume 3: TDAS Communication Mission Model
- [NASA_CB-175195] p 79 N84-19371 TRAJECTORY CONTROL
- Simulation of the Galileo spacecraft axial Delta-V p 66 A84-11938 alcorithm TRANSFER FUNCTIONS
- Algorithms and computational aspects pertaining to block diagonal dominance methods for design of decentralized feedback compensation
- p 15 A84-19108 TRANSFER ORBITS
- A future solar orbital transfer vehicle concept p 61 A84-16116 An electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beamed p 61 A84-21485 microwave power Highly efficient, very low-thrust transfer to geosynchronous orbit - Exact and approximate solutions p 61 A84-24980 Optimal low-thrust transfers to synchronous orbit p 62 A84-24981 Capture-elector satellites p 7 N84-15179 [NASA-TM-856861 Discontinuous low thrust orbit transfer
- p 63 N84-19474 [AD-A136908]
- TRANSFORMATIONS (MATHEMATICS) Recursive lagrangian dynamics of flexible manipulator arms via transformation matrices
 - [AD-A137345] p 60 N84-20316

USER REQUIREMENTS

TRANSIENT HEATING Weight characteristics of	future	spacecr	aft thermal
management systems [AIAA PAPER 84-0054]		p 23	A84-17850
TRANSIENT LOADS A methodology to inclu	de stat	ic and ki	netic friction

effects in Space Shuttle payload transient loads analys TAIAA PAPER 83-26541 p 30 A84-10956 TRANSIENT RESPONSE

Transient dynamics during the orbiter based deployment of flexible members

p 34 A84-21285 [AIAA PAPER 84-0061] On transient dynamics and stability of large space structures p 36 A84-29143 TRANSITION TEMPERATURE

The effect of pressure and temperature on time-dependent changes in graphite/epoxy composites p 54 A84-21775 helow the class transition TRANSMISSION EFFICIENCY

User manual of the CATSS system (version 1.0) communication analysis tool for space static [NASA-CB-171728]

- p 51 N84-17431 TRANSMITTER RECEIVERS
- An advanced generation land mobile satellite system and its critical technologies p 3 A84-15634 The small transmitter receiver stations in the Sirio
- experiment --- microwave transmission p 49 N84-15386 (FUB-50-1982)
- TRIBOLOGY Thermal conductance and torgue of thin section
- four-point contact ball bearings in vacuum [ESA-ESTL-54] p 2 p 25 N84-15562
- TRUSSES
 - A heuristic method for the design of minimum weight p 15 A84-16841 trusses using discrete member sizes Instability analysis of space trusses
 - p 32 A84-16885 The beam-like behavior of space trusses p 19 A84-21517
 - Optimization of shallow trusses against limit point instability p 20 A84-23366 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 p 59 N84-16250 Self-shadowing of orbiting trusses
- p 25 N84-16565 [NASA-CR-173215] Development of Test Article Building Block (TABB) for p 21 N84-17226 deployable platform systems Component mode synthesis and large deflection vibrations of complex structures --- beams and trusses [NASA-CR-1733381 p 21 N84-18680 TUBE HEAT EXCHANGERS A contact conductance interface for a space constructable heat pipe radiator
- [SAE PAPER 831101] p 24 A84-29036 Flexible radiator system [NASA-CR-171765] p 28 N84-20623 TWO PHASE FLOW Thermal control p 25 N84-18289

IJ

- U.S.S.R. SPACE PROGRAM For the first time - Russian book on construction of first Soviet earth satellites p 16 A84-21564 ULTRAHIGH FREQUENCIES Assessment of satellite power flux-density limits in the 2025-2300 MHz frequency range, part 1 p 51 N84-18532 [PB84-129402] ULTRASONIC WELDING Welded solar cell interconnection p 19 A84-22965 Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials space shuttle payloads p 27 N84-19449 Optical coating in space [NASA-CR-175441] p 56 N84-21290 UNITED STATES Space stations - The next step in space? [AAS PAPER 83-202] p 76 A84-29855 UPPER STAGE BOCKET ENGINES A parametric study of space transfer-propulsion stages [IAF PAPER 83-401] p 61 A84-13397 USER MANUALS (COMPUTER PROGRAMS) User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-171728] p 51 N84-17431 USER REQUIREMENTS Space station - A Canadian perspective p 65 A84-11728 [IAF PAPER 83-55] The Boeing flywheel study p 37 N84-12235 Space station needs, attributes and architectural options
 - study. Final review executive summary briefing p 10 N84-18272 [NASA-CR-173674]

VACUUM CHAMBERS

Space Station Technology, 1983 p 11 N84-18277 [NASA-CP-2293] p 11 Systems/operations technology N84-18278 N84-18279 Crew and life support: EVA 0 11 Human capabilities p 11 N84-18282 Thermal control p 25 N84-18289 Space station needs, attributes and architectural options. Volume 1, attachment 1: Executive summary

NASA [NASA-CR-173337] p 12 N84-18293 Space Station needs, attributes and architectural options. Volume 2, book 1, part 2, task 1: Mission requirements

[NASA-CR-173313] p 13 N94-18297 Space Station needs, attributes and architectural options. Volume 2, book 1, part 4: Payload element mission data sheets

[NASA-CR-173315] p 13 N84-18299

V

VACUUM CHAMBERS

- IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber p 26 N84-19400
- Thermal cycling tests in space environment simulation chambers p 26 N84-19401 VACUUM EFFECTS
- Canadarm and the Space Shuttle p 57 AB3-44602 VARIABILITY
- A Variable Conductance Heat Pipe (VCHP) radiator system for communications payloads p 27 N84-19406 VARIABLE GEOMETRY STRUCTURES
- Approximations method for space frame synthesis p 19 A84-10141

VARIATIONAL PRINCIPLES

- A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials
- [ASME PAPER 83-DET-6] p 55 A84-29101 VAX-11 SERIES COMPUTERS Implementation of MACLISP on a large address space
- computer [DE84-005042] p 79 N84-21145 VERTICAL TAKEOFF
- Vertical ascent from earth to geosynchronous orbit [AIAA PAPER 84-0509] p 61 A84-18141
- VIBRATION The flexural behavior of PACSAT (passive communication satellite) in orbit
- [AD-A131406] p 36 N84-11195 VIBRATION DAMPING
- A flexible structure controller design method using mode residualization and output feedback --- for Large Flexible Space System p 32 A84-17369 Control of large space structures
- [AIAA PAPER 84-0081] p 32 A84-17866 Identification of large flaxible structures mass/stiffness and damping from on-orbit experiments
- p 34 A84-24995 Control structure interactions in large space structures Analysis using energy approach – for constant and pulsed thrusters p 35 A84-27934
- Stability, vibration and passive damping of partially restrained imperfect columns [NASA-TM-85697] p 37 N84-13608
- Experimental study of active vibration control [AD-A133818] p 38 N84-14546
- Study on damping representation related to spacecraft structural design [EMSB-18/83] p 38 N84-15182
- [EMSB-18/83]
 p 38
 N84-15182

 Digital control system for space structural dampers
 [NASA-CR-175355]
 p 39
 N84-16246
- The effects of the space environment on damping materials and damping designs on flexible structures
- p 56 N84-17217 Vibration isolation technology experiment p 39 N84-17228
- Investigation of articulated panel dynamics p 40 N84-17230
- ACOSS eleven (Active Control Of Space Structures), volume 1 [AD-A135675] p 40 N84-18311
- Maintenance and operational enhancement of the
- flexible spacecraft dynamics program [NASA-CR-175211] p 41 N84-19394 The effect of mass and stiffness changes on the damping
- factor in a large space structure as represented by the CSDL 2 model [AD-A136984] p 42 N84-19465
- Analysis of large space structures p 18 N84-20621 VIBRATION ISOLATORS
- Vibration isolation technology experiment p 39 N84-17228

VIBRATION MODE

Determination of critical parameters in large flexible space structures with uncertain modal data p 33 A84-20047

Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906

- VIBRATION TESTS
- Vibration characteristics of self-expanding stayed columns for use in space p 34 A84-21237 Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906
- VIDEO EQUIPMENT Communications p 12 N84-18285
- VIEW EFFECTS
- Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616
- VISCOELASTIC DAMPING
- Study on damping representation related to spacecraft structural design [EMSB-18/83] 0 38 N84-15182
- VISCOELASTICITY
- Tests and prediction of composite material viscoelastic behaviour for large space structure
- [IAF PAPER 83-418] p 30 A84-11815 A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials
- [ASME PAPER 83-DET-6] p 55 A84-29101 VOICE COMMUNICATION
- A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 VOICE CONTROL
- A voice interactive system for aiding and documentation of space-based tasks
- [AIAA PAPER 83-2355] p 43 A84-10025 VOLTAGE REGULATORS
- Evaluation of bus impedance on the SPOT multimission platform p 44 A84-13521

W

- WASTE TREATMENT
- Hyperfiltration wash water recovery subsystem Design and test results --- for extended mission spacecraft such as space stations
- [SAE PAPER 831112] p 6 A84-29047 WASTE UTILIZATION
- Phase change water recovery techniques Vapor compression distillation and thermoelectric/membrane concepts -- from waste water as part of Space Station life support system
- [SAE PAPER 831122] p 6 A84-29056 WASTE WATER
- Integrated water management system Description and test results --- for Space Station waste water processing [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results --- for extended mission spacecraft such
- and test results --- for extended mission spacecraft such as space stations [SAE PAPER 831112] p 6 A84-29047
- WATER MANAGEMENT Integrated water management system - Description and
- test results for Space Station waste water processing [SAE PAPER 831111] p 6 A84-29046 WATER RECLAMATION
- Hyperfiltration wash water recovery subsystem Design and test results --- for extended mission spacecraft such as space stations
- [SAE PAPER 831112] p 6 A84-29047 Phase change water recovery techniques - Vapor compression distillation and thermoelectric/membrane concepts -- from waste water as part of Space Station life support system
- life support system
 [SAE PAPER 831122] p 6 A84-29056
 WEAPONS
 Aeroelastic stability and response of flexible tactical
- weapons (AIAA PAPER 84-0392) p 32 A84-18060
- WEIGHT ANALYSIS Weight characteristics of future spacecraft thermal
- management systems [AIAA PAPER 84-0054] p 23 A84-17850 WEIGHT REDUCTION
- Multi-megawatt space power thermal management system requirements [AIAA PAPER 84-0056] p 23 A84-21284
- [AIAA PAPER 84-0056] p 23 A84-21284 WEIGHTLESSNESS Second All-Union Seminar on Hydromechanics and
- Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents [NASA-TM-77534] p 26 N84-18576

Feasibility study to conduct windblown sediment experiments aboard a space station

- [NASA-CR-175434] p 15 N84-21586 WELDED STRUCTURES
- Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies [NASA-CR-175437] p 60 N84-20857 WHTE NOISE
- Research on boundary feedback and control theories, 1978 - 1983
- [AD-A136531] p 41 N84-18987 WIND EFFECTS
 - Feasibility study to conduct windblown sediment experiments aboard a space station
- [NASA-CR-175434] p 15 N84-21586

Y

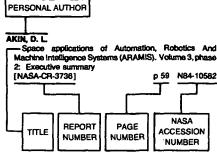
YAW Attitude stability for the yaw-wheel class of orbiting gyrostats p 33 A84-19675

PERSONAL AUTHOR INDEX

TECHNOLOGY FOR LARGE SPACE SYSTEMS / A Bibliography (Supplement 11)

JANUARY 1985

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

ABRATE, S.

- Analysis of large space structures p 18 N84-20621 ABT. B.
- A deplovable 30/20 GHz multibeam offset antenna [AIAA PAPER 84-0658] p 20 A84-25258 ADELMAN, H. M.
- Thermal analysis research applicable to space station technology needs
- [NASA-TM-84658] p 25 N84-15426 Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering
- Analysis Language (EAL) system [NASA-TM-85743] p 42 N84-20880
- AGAPAKIS, J. E.
- Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies [NASA-CR-175437] p 60 N84-20857 AGNENI, A.
- Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural p 29 N84-21621 analysis AHMED. S.
- Flight test of a synthetic aperture radar antenna using STEP p 9 N84-17237
- AIKENHEAD, B. A. Canadarm and the Space Shuttle p 57 A83-44602 AKIN, D. L.
- Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary
- [NASA-CR-37361 p 59 N84-10582 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development
- p 59 N84-10583 [NASA-CR-3734] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications
- [NASA-CR-3735] p 59 N84-10584 AL-ASTRABADI, F.
- Thermal control of tethered satellite in a very low altitude p 27 N84-19444 aerodynamic mission

ALET. I.

- A Maltese cross shaped mobile thermal control p 27 N84-19454 shutter ALEXANDER. G.
- Developing the space frontier; Proceedings of the Twenty-ninth Annual Conference, Houston, TX, Octob p 67 A84-15381 25-27, 1982 ALLEN, J. L., JR.
- Deployable beam flight experiment (MAST) p 8 N84-17218
- Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] p 74 A84-25319 p 74 A84-25319 AMBRUS, J. H.
- p 44 A84-11816
- Narrow multibeam satellite ground station antenna employing a linear array with a geosynchronous arc coverage of 60 deg. II - Antenna design
- ANDERSON, J. L.
- Space station autonomy requirements p 63 A84-10024 [AIAA PAPER 83-2352]
- ANDERSON, L. Tele-X The first step in a satellite communications system for the Nordic countries
- p 4 A84-25287 TAIAA PAPER 84-07131 ANDERSON, M. S.
- Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure p 23 A84-14050 arbitrary supporting structure ANDERSON, R. H.
- Application of laser interferometry to robotics p 58 A84-28541
- ANDING, D. ACOSS eleven (Active Control Of Space Structures), volume 2
- [AD-A135676] p 41 N84-18312 ANDRONIKOU, A. M.
- Attitude control and dynamics of the space operations p 31 A84-11934 center ANDUINI, C.
- Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2
- p 29 N84-21616 [ESA-CR(P)-1779-VOL-4] ANSELL. G. S.
- Composite structural materials [NASA-CR-173259] p 56 N84-17293
- ARDUINI, C. Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1
- p 43 N84-21611 [ESA-CR(P)-1779-VOL-3] The solution of the dynamic problem of the periodic
- structures by cyclosymmetric technique p 43 N84-21612 Computing the radiation pressure forces by adapting thermal design verification softwares p 28 N84-21613
- Thermal design verification of the large open truss structures. The local approach and the shadow problem p 29 N84-21617 Computational savings in view factor evaluation on mode
- p 29 N84-21618 prescreening Interactive structural-thermal-control analytical formulations p 29 N84-21619 Study on synthesis and characterization of large space systems, phase 2. Part 3: Experimental design verification
- techniques [ESA-CR(P)-1779-VOL-5] p 18 N84-21620 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical
- design [ESA-CR(P)-1779-VOL-1] p 18 N84-21624
- Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal design [ESA-CR(P)-1779-VOL-2] p 18 N84-21625

- ARMSTRONG, E. S.
- Spline-based estimation techniques for parameters in elliptic distributed systems [NASA-TM-85439] p 9 N84-17947
- ARNBAK, J. Improved orbit utilization using auxiliary feeds in existing
- p 46 A84-20647 earth terminals ARNDT, G. D.
- Application of beam power technology to a space p 45 A84-15642 station ARNIM, R.
- The Franco-German DBS program 'TV-SAT/TDF-1' [AIAA PAPER 84-0661] p 4 A84-25260
- ARNOLD, D. Investigation of electrodynamic stabilization and control of long orbiting tethers
- [NASĂ-CR-170972] p 40 N84-17251 ARNOLD, G. S.
- Reactions of high velocity atomic oxygen with carbon p 53 A84-18159 [AIAA PAPER 84-0549] ARNOLD. W. F.
- Controllability and observability criteria for multivariable p 35 A84-25516 linear second-order models AUGERSON, W.
 - p 11 N84-18282

В

Human capabilities

- BACKLUND, L. Tele-X The first step in a satellite communications system for the Nordic countries by 4 A84-25287 BAGHERIAN, A. B.
- Airborne antenna pattern calculations [NASA-CR-173284] p 51 N84-17436 BAILEY, W.
- Space platform accommodations p 16 A84-22131 BAINUM, P. M.
- The dynamics and control of large flexible space tructures, 6
- [NASA-CR-174450] p 36 N84-10173 Environmental effects on the dynamics and control of
 - an orbiting large flexible antenna system p 42 N84-20627 [NASA-CR-175448]
- BAIOCCHI, G. A parametric study of space transfer-propulsion stages
- [IAF PAPER 83-401] p 61 A84-13397 BAKER, A. F.
- Sodium heat transfer system modeling p 25 N84-16509 [DE84-002051]
- BALAKRISHNAN, A. V. Research on boundary feedback and control theories, 1978 . 1983
- [AD-A136531] p 41 N84-18987 BALAS, M. J.
- The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056

BANDURSKI, R. S.

- The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station [NASA-CR-175436]
- p 14 N84-20610 BANERJEE, J. R.
 - Vibration characteristics of self-expanding stayed p 34 A84-21237 columns for use in space BANKS. H. T.
 - Parameter identification in continuum models
 - p 16 A84-25525 Spline-based estimation techniques for parameters in
- elliptic distributed systems [NASA-TM-85439] p 9 N84-17947
- BANSEMIR. H. Local stability of sandwich structures with thin fibre
 - reinforced face skins for space application [MBB-UD-381-83-OE] p 19 A84-22859

- ALLER. R. O.
 - High capacity power systems for space [IAF PAPER 83-421] p
 - AMITAY, N.
 - p 46 A84-17743

BAR-KANA, I.

- Multivariable direct adaptive control for a general class of time-varving commands p 33 A84-19118 Some applications of direct adaptive control to large structural systems p 34 A84-25496 Direct multivariable model reference adaptive control
- with applications to large structural systems p 38 N84-15840
- BARAS. J. S.
- Algorithms and computational aspects pertaining to block diagonal dominance methods for design of decentralized feedback compensation p 15 A84-19108
- BARBERA, R.
- A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class p 62 A84-25292 [AIAA PAPER 84-0727] BARBERIS, N.
- Design and development of the INTELSAT p 19 A84-22153 graphite-epoxy central thrust tube BARBONI, R.
- Tests and prediction of composite material viscoelastic behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815
- BARBOUR, R. T. Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226
- BARNABA, A. Evaluation of bus impedance on the SPOT multimission platform p 44 A84-13521
- BARNEY, J. Coordinate transformation assembly p 75 A84-28579
- BARON, W. R. Technical aspects of the Intelsat V solar array
- p 47 A84-22962 BARTEK, R. J.
- RF systems in space. Volume 2: Space-based radar analyses [AD-A133735] p 49 N84-14394
- BASHFORD, D. P. Review report of the third year's activities on the study
- survey of advanced materials [R878] p 56 N84-21675
- BAUER. H. The attitude and orbit control system for Eureca [DGLR PAPER 83-091] p 76 A84-29658
- BÂUER, P. E. Spacecraft thermal control, design, and operation
- p 22 A84-10224 BAULDRY, R. D.
- A hardware demonstration of control for a flexible offset-feed antenna p 31 A84-13321 BEERS, B. L
- Dielectric charging in space Ground test data and model verification p 47 A84-20709 BENHABIB, R. J.
- ACOSS Fourteen (Active Control of Space Structures) p 38 N84-15181 [AD-A133411] BENNETT, W. H.
- Algorithms and computational aspects pertaining to block diagonal dominance methods for design of decentralized feedback compensation p 15 A84-19108
- BERNASCONI, M. C. Study on large, ultralight long-life structures in space,
- phase 2C TM-EKR31 p 17 N84-17284 BERRETTA, G.
- Application of a common reflector configuration to a timission satellite of the 90's [IAF PAPER 83-60] p 1 A84-11731
- BERRY. W. Utilization of electric propulsion for communication
- eatellitee [AIAA PAPER 84-0729] p 62 A84-25293
- BERTRAM, A. Development of procedures for component mode synthesis
- [DFVLR-IB-232-82-C-09] p 30 N84-21626 BESTE. D.
- RF systems in space. Volume 2: Space-based radar analyse [AD-A133735] p 49 N84-14394
- BHAT, R. B. Computer aided synthesis of a satellite antenna structure with probabilistic constraints p 21 N84-19899 Dynamic behaviour of a satellite antenna structure in
- random vibration environment p 42 N84-19900 BHAVNANI, K. H. Sheath ionization model of beam emissions from large spacecrafts

[AD-A137181]	p 52	N84-19463
BIGNIER, M.		
Spacelab's development	р 66	A84-13901

B-2

- BINGHAM, N.
 - Evolution of European telecommunication satellite pointing performance
 - AIAA PAPER 84-0725] p 34 A84-25291 BIRNBAUM M.M.
 - Electrically conductive black optical paint
 - p 55 A84-28553 BLOSSER, M. L. Operational modules for space station construction
 - [NASA-TM-85772] p 21 N84-21608 BOFFEY, T. B. A heuristic method for the design of minimum weight
 - trusses using discrete member sizes p 15 A84-16841 BOGGIATTO, D.
 - Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L -SAT thermal model p 26 N84-19398 The thermal design of L-SAT large telecommunication p 27 N84-19414
 - entollito BOGUS, K.
 - Technology components of solar arrays for space olatforms A84-22959 p 47 BOLOTINA, N. E.
 - Motion of a symmetric satellite about the center of mass in circular orbit in the presence of flexible viscoelastic p.35 A84-26977 rods BONELLE, G. J.
 - Communications BONHOMME, R. p 12 N84-18285
 - Development and application of new technologies in the
 - ESA Olympus Programm [AIAA PAPER 84-0706] p 4 A84-25282 BÒOK. W. J.
 - Recursive lagrangian dynamics of flexible manipulator arms via transformation matrices
 - [AD-A137345] p 60 N84-20316 **BORRIELLO.** G
 - Thermal control of the Tethered Satellite Module [SAE PAPER 831138] p 24 A84-29067 Thermal control of tethered satellite in a very low altitude . N84-19444 aerodynamic mission D 27
 - BOSSI, J. A. A flexible structure controller design method using mode residualization and output feedback p 32 A84-17369 BOUCHEZ, J. P.
 - Design and manufacturing of a heat rejection system for advanced thermal control p 27 N84-19434 BOUQUET, F. L.
 - Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings
 - BRADLEY, O. H., JR. p 8 N84-17213 STEP mechanical systems
 - BRADT, R. C. Fracture mechanics of ceramics. Volume 5 - Surface
 - flaws, statistics, and microcracking p 54 A84-24501 BRANDON, L IPACS attitude control technology considerations
 - p 37 N84-12238 BREAKWELL, J. A.
 - The Toysat structural control experiment p 31 A84-13320 A hardware demonstration of control for a flexible
 - p 31 A84-13321 offset-feed antenna BREAKWELL, J. V. Optimal low-thrust transfers to synchronous orbit
 - p 62 A84-24981
 - BRINKMANN, P. W. The Large Space Simulator (LSS) at ESA/ESTEC (a summary of the main characteristics) p 27 N84-19458
 - BROOKS, G. F. Surface accuracy measurement sensor test on a
 - 50-meter antenna surface model [NASA-TM-85689] p 17 N84-16427
- BROOKS, T. H.
 - ACOSS eleven (Active Control Of Space Structures), volume 2 [AD-A135676] p 41 N84-18312
- BROOME, P. A. A definition of STS accommodations for attached
- sheoiven [NASA-CR-172223] p 17 N84-10114
- BROSE, H. F. Environmental control and life support (ECLS) design
- p 73 A84-24637 optimization approach The complementary roles of existing and advanced environmental, thermal control and life support technology for space stations p 79 N84-19429
- BROWN, S. M. Scale model testing for control system parameters of large structures
- [AD-A135652] p 41 N84-18313 BROWN, W. C.
- An electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beamed p 61 A84-21485 microwave power

- BROWNE, E. R. Welded solar cell interconnection p 19 A84-22965 STEP Experiment Requirements [NASA-CP-2294] p 7 N84-17211 BUBNOV, I. p 4 A84-21573 Space vehicles BUCHANAN, H. J. IPACS guidance navigation and control system considerations and test activities p 37 N84-12245 BULLOCH. C. Spaceflight to 2000 - Interavia looks forward from the p 66 A84-14764 present BUNNER, A. N. Optical coating in space [NASA-CR-175441] p 56 N84-21290 BURATTI, P. Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT p 26 .N84-19398 thermal model BURCHER, E. E. Surface accuracy measurement sensor test on a 50-meter antenna surface model [NASA-TM-85689] p 17 N84-16427 BURKE, J. D. Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, p 76 A84-29852 1983 BURKE, W. R. Introduction to geostationary orbits [ESA-SP-1053] p 80 N84-21590 BURKETT, W. L., JR. A design strategy for multiple payload pointing from a three axis stabilized spacecraft [AIAA PAPER 84-0566] p 33 A84-18168 BUSH, H. G. Stability, vibration and passive damping of partially restrained imperfect columns [NASA-TM-85697] p 37 N84-13608 Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 p 59 N84-16250 A manned-machine space station construction concent [NASA-TM-85762] p 21 N84-19395 BUSH, J. R., JR. A programmable power processor for high power space applications p 46 A84-18394 BUSSOLINO, L. Design and manufacturing of a heat rejection system p 27 N84-19434 for advanced thermal control С CAMARDA, C. J. Static and dynamic structural-sensitivity derivative calculations in the finite-element-based Engineering Analysis Language (EAL) system [NASA-TM-85743] p 42 N84-20880 CAMERON, J. M. Dynamics and control of a large space antenna p 32 A84-17361 CAMPBELL, T. G. Large deployable antenna flight experiment for the Space Technology Experiments Platform (STEP) p 8 N84-17232 CANNON, R. H., JR. Precise control of flexible manipulators [NASA-CR-175389] p 60 N84-20175 CAPEL A. Evaluation of bus impedance on the SPOT multimission platform p 44 A84-13521 CAPP. J. D. RF systems in space. Volume 1: Space antennas frequency (SARF) simulation [AD-A133734] p 49 N84-14395 CARL, J. R. Space operations center communications path
- obscuration p 3 A84-15695 CASS, J. R., JR.
- Discontinuous low thrust orbit transfer [AD-A136908]
- p 63 N84-19474 CASTELLANI, A. Tests and prediction of composite material viscoelastic
- behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815
- CASWELL, R. D. MSAT mobile communication demonstration satellite
- system and bus tradeoff considerations [AIAA PAPER 84-0751] p 48 A84-25306 CHAMBERS, G. J.
 - - The Toysat structural control experiment
- p 31 A84-13320 A hardware demonstration of control for a flexible p 31 A84-13321 offset-feed antenna

PERSONAL AUTHOR INDEX

CHANDLER, D.
Space telescope: Solar array primary development mechanism p 51 N84-18458
CHAO, C. C.
Semiautonomous stationkeeping of geosynchronous satellites p 32 A84-17359
CHARHUT, D.
Space station needs, attributes and architectural options. Summary of major study activities and results.
Space station program observations
(NASA-CR-173345) p 11 N84-18275 CHIARELLI, C.
Thermal control of tethered satellite in a very low altitude
aerodynamic mission p 27 N84-19444 CHICHESTER, F.
Exhibit D modular design attitude control system study
[NASA-CR-170993] p 42 N84-20625 CHICHESTER, F. D.
Modular design attitude control system
[NASA-CR-170996] p 41 N84-19392
CHUN, H. M. Closed-form solutions for feedback control with terminal
constraints p 36 A84-29471
CLAVERIE, M. J. Market potential and possible limitations for satellite
solar power stations p 70 A84-21481
CLELAND, E. L. Electrically conductive black optical paint
p 55 A84-28553
COCCA, A. A. Consequences of transmission of solar energy from
outer space p 68 A84-17076
CODEN, M. H. Communications, tracking, and docking on the Space
Station p 45 A84-15640
COFFMAN, P. E. A parametric study of space transfer-propulsion
stages
[IAF PAPER 83-401] p 61 A84-13397 COHEN, H. A.
Sheath ionization model of beam emissions from large
spacecrafts [AD-A137181] p 52 N84-19463
COLIZZI, E.
The thermal design of L-SAT large telecommunication
satellite p 27 N84-19414 COLLET, J.
ESA space station activities
[IAF PAPER 83-30] p 64 A84-11722
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G.
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space Data Space Space
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station Nasaccestation Space station
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Data System architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode Pater Participation
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. p 22 A84-10224 COLOMBO, G. p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLF.IB-232-82-C-09] p 30 N84-21626
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. p 22 A84-10224 COLOMBO, G. p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLF.IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. Data system Counce the system structure
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [IFVLFIB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORETT, R. Power p 12 N84-18288
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18288 CORMIER, L The space van and its potential impact on the design of communications satellities
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18288 CORMIER, L. The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18268 CORMEIR, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] CONKAD, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18288 CORMIER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309 COUGNET, C. Application of a common reflector configuration to a mutimision satellite of the 90's </td
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18268 CORMEIR, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [IDFVLr.IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORMER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309 COUGNET, C. Application of a common reflector configuration to a multimission satellites of the 90's [IAF PAPER 83-60] p 1 A84-11731 COX, R. L Flexible radiator system: Executive s
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOKAN, C. W. National security implications of a U.S. space station p 73 A84-24635 CORMIER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309 COUGNETT, C. Application of a common reflector configuration to a multimission satellites [IAF PAPER 83-60] p 1 A84-11731 COX, R. L Fixelible radiator system: Executive summary
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORMEIER, L The space van and its potential impact on the design of communications satellites p 74 A84-25309 (AIAA 84-0758] p 1 A84-11731 COUGNET, C. Application of a common reflector configuration to a multimission satellite of the 90's [IAF
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORMIER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309 COUGINET, C. Application of a common reflector configuration to a muttimission satelities of the 90's
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 p 73 A84-24635 CORBETT, R. Power p 12 N84-18268 CORMER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] [IAF PAPER 83-60] p 1 A84-11731 COX, R. L <t< td=""></t<>
[IAF PAPER 83-30] p 64 A84-11722 COLLICOTT, H. E. Spacecraft thermal control, design, and operation p 22 A84-10224 COLOMBO, G. Investigation of electrodynamic stabilization and control of long orbiting tethers [NASA-CR-170972] p 40 N84-17251 CONAWAY, A. E. A comparison of linear and geometrically nonlinear finite element analyses applied to large space structures [AIAA PAPER 84-0069] p 16 A84-19887 CONNELL, E. B. Data system architecture considerations for a space station [AIAA PAPER 83-2346] p 63 A84-10066 CONRAD, P. Development of procedures for component mode synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626 COOGAN, C. O. Space logistics [IAF PAPER 83-24] p 64 A84-11719 COOK, C. W. National security implications of a U.S. space station p 73 A84-24635 CORBETT, R. Power p 12 N84-18288 COMMER, L The space van and its potential impact on the design of communications satellites [AIAA 84-0758] p 74 A84-25309 COUBETT, C. Application of a common reflector configuration to a multimission satellite of

CREL	LIN	E.

Derivation and combination of impe	dance	matrices for
flexible satellites		
[ESA-STR-209]	p 43	N84-21604
CREMA, L. B.		
Tests and prediction of composite m	aterial	viscoetastic
behaviour for large space structure		
[IAF PAPER 83-418]	p 30	A84-11815
CRIMI, P.		
Aeroelastic stability and response	of flexi	ible tactical
weapons		
[AIAA PAPER 84-0392]	p 32	A84-18060
CROUTHAMEL, M. S.		
Spacecraft thermal design using it	nteract	ive graphics
[AIAA PAPER 84-0143]	p 23	A84-17910
CROWLEY, J. M.		
Parameter identification in continuum	n mode	els
	p 16	A84-25525
CUCCIA C.L.	•	

CUCCIA, C. L Space station communications	р 73	A84-24636

D

DALTON, M. C.	
Habitability design elements for a	
[AAS PAPER 83-200]	p 7 A84-29853
DAMMANN, R. E.	
Effects of combined ultraviolet	
environment on spacecraft thermal of	
	p 27 N84-19449
DANIEL, P. L.	
Spline-based estimation technique elliptic distributed systems	es for parameters in
[NASA-TM-85439]	p 9 N84-17947
DANIELL, R. G.	p 0 1104/1704/
Canadarm and the Space Shuttle	p 57 A83-44602
DARMON, C. A.	•
Validation methods for mathematic	cal models of flexible
satellite dynamics	
[ESA-CR(P)-1794]	p40 N84-17241
DAVENPORT, R.	
Software quality assurance Spac	
future trends	p 17 N84-14759
DAVID, S. S. A simulator to study dynamic inte	raction of the Second
Shuttle on-orbit flight control system	
payloads	p 35 A84-26717
DAVIS, F. M.	
Canadarm and the Space Shuttle	p 57 A83-44602
DE CACQUEREY, A.	•
Management of large space project	ts - Quality assurance
or 'product assurance'	p3 A84-15310
DE GRAAUW, T.	
Coherent arrays of separate optica	
project Trio	p 3 A84-15363
DÉBICCARI, A.	al wolding in space
Feasibility of remotely manipulate A step in the development of novel	
	i johning teennologies
INASA-CH-1/543/1	
(NASA-CR-175437] DEERING, A. M.	p 60 N84-20857
DEERING, A. M.	p 60 N84-20857
	p 60 N84-20857
DEERING, A. M. International competition in com markets [AAS PAPER 83-244]	p 60 N84-20857
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G.	p 60 N84-20857 Imercial aerospace p 77 A84-29883
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization	p 60 N84-20857 Imercial aerospace
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L.	p 60 N84-20857 Imercial aerospace p 77 A84-29883 p 2 A84-15303
DEERING, A. M. International competition in com markets (AAS PAPER 83-244) DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac	p 60 N84-20857 Imercial aerospace p 77 A84-29883 p 2 A84-15303
DEERING, A. M. International competition in com markets (AAS PAPER 83-244) DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems	p 60 N84-20857 Imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442]	p 60 N84-20857 Imercial aerospace p 77 A84-29883 p 2 A84-15303
DEERING, A. M. International competition in com markets (AAS PAPER 83-244) DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D.	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p.51 N84-17931 of space station
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H.	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-2225
DEERING, A. M. International competition in com markets (AAS PAPER 83-244) DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems (AD-A135442) DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-2225
DEERING, A. M. International competition in com markets (AAS PAPER 83-244) DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems (AD-A135442) DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-2225 to living and working
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45]	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-2225
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J.	p 60 N84-20857 amercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 p 51 N84-17931 of space station p 18 p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 p 68 A84-17058
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45]	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 duators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-22225 to living and working p 68 A84-17058 vehicle
DEERING, A. M. International competition in commarkets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space	p 60 N84-20857 amercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 p 51 N84-17931 of space station p 18 p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 p 68 A84-17058
DEERING, A. M. International competition in commarkets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space	p 60 N84-20857 amercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 p 51 N84-17931 of space station p 18 p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 A84-17058 vehicle p 5 p 5 A84-27945
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space DIAMOND, G. S. On the dynamics of a subsatellite	p 60 N84-20857 amercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 p 51 N84-17931 of space station p 18 p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 A84-17058 vehicle p 5 p 5 A84-27945
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space to DIAMOND, G. S. On the dynamics of a subsatellite two tethers	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 ituators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-2225 to living and working p 68 A84-17058 vehicle p 5 A84-27945 system supported by N84-27945
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space of DIAMOND, G. S. On the dynamics of a subsatellite two tethers [AIAA PAPER 84-0062]	p 60 N84-20857 amercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p 51 p 51 N84-17931 of space station p 18 p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 A84-17058 vehicle p 5 p 5 A84-27945
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space DIAMOND, G. S. On the dynamics of a subsatellite two tethers [AIAA PAPER 84-0062] DIEDERIKS-VERSCHOOR, I. H. PH.	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 duators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-22225 to living and working p 68 A84-17058 vehicle p 5 A84-27945 system supported by p 32 A84-17854
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space of DIAMOND, G. S. On the dynamics of a subsatellite two tethers [AIAA PAPER 84-0062]	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 duators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-22225 to living and working p 68 A84-17058 vehicle p 5 A84-27945 system supported by p 32 A84-17854
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space [IAIA PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space [IAIA PAPER 84-0062] DIEDERIKS-VERSCHOOR, I. H. PH. Legal aspects of solar power sat environment	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 tuators for regulation p-51 p 51 N84-17931 of space p 18 N84-22191 e space p 22 N84-2225 to living and working p 68 p 5 A84-27945 system supported by p 32 p 32 A84-17654
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DENYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space to DIAMOND, G. S. On the dynamics of a subsatellite two tethers [AIAA PAPER 84-0062] DIEDERIKS-VERSCHOOR, I. H. PH. Legal aspects of solar power sat environment DISMER, J. H. Overview of space station operativ	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 ituators for regulation p-51 p-51 N84-17931 of space p 18 N84-22191 e space p 22 N84-2225 ko living p 68 A84-17058 vehicle p 5 p 5 A84-27945 system supported by p 32 A84-17654 velicites impact on the p 68 A84-17077
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DERYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law to in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space [IAF PAPER 84-0062] DIEDERIKS-VERSCHOOR, I. H. PH. Legal aspects of solar power sat environment DISHER, J. H. Overview of space station operatio [IAF PAPER 83-38]	p 60 N84-20857 immercial aerospace p 77 A84-29883 p 2 A84-15303 duators for regulation p 51 p 51 N84-17931 of space p 78 N84-22191 e space and working p 22 p 68 A84-17058 vehicle p 5 p 52 A84-27945 system supported by p 32 p 32 A84-17854 ellites impact on the p 68
DEERING, A. M. International competition in com markets [AAS PAPER 83-244] DELMAS, M. G. Human organization DELORENZO, M. L. Selection of noisy sensors and ac of linear systems [AD-A135442] DENYDER, D. D. Interactive geometry modeling conceptual designs Geometric modeling of large deployment DESAUSSURE, H. Determination of applicable law t in space [IAF PAPER 82-IISL-45] DESKEVICH, J. Leasecraft - An innovative space to DIAMOND, G. S. On the dynamics of a subsatellite two tethers [AIAA PAPER 84-0062] DIEDERIKS-VERSCHOOR, I. H. PH. Legal aspects of solar power sat environment DISMER, J. H. Overview of space station operativ	p 60 N84-20857 imercial aerospace p 77 A84-29883 p 2 A84-15303 ituators for regulation p 51 N84-17931 of space station p 18 N84-22191 e space antenna p 22 N84-22255 to living and working p 68 A84-17058 vehicle p 5 A84-27945 system supported by p 32 A84-17854 sellites impact on the p 68 A84-17077 ons p 64 A84-11723

[IAF PAPER 83-55] p 65 A84-11728

	FARRAR,	A .
DONAHUE, T. M.		
Use of space station for science DORSEY, J. T. A manned-machine space sta	p 72 A84-246 tion construct	
concept (NASA-TM-85762)	p 21 N84-193	195
DRACHENBERG, F. Unfurlable offset antenna desigr		
applications		
(AIAA PAPER 84-0659) DRAKE, G.	p 16 A84-252	
Crew and life support: ECLSS DRESSER, K. J.	p 11 N84-182	280
Regenerable non-venting thermal con extravehicular activity	ntrol subsystem	for
[SAE PAPER 831151] DUPAS, A. P.	p 24 A84-290	976
Market potential and possible limita solar power stations	ations for satel p 70 A84-214	
DURRETT, R. NASA's geostationary communi	ications platfo	m
program [AIAA PAPER 84-0702]	p 5 A84-253	26
-		
E		
ECHOLS, F. L. A definition of STS accommoda payloads	tions for attack	ned
[NASA-CR-172223]	p 17 N84-10	14
EDGECOMBE, D. S. Space logistics		
[IAF PAPER 83-24] EDWARDS, P. W.	p 64 A84-117	19
Space station: Policy, planning	and utilizati	
Proceedings of the Symposium, Arlingt 1983	p 72 A84-24	
EILERS, D. Microgravity conditions on orbital pla	atforms	
[DGLR PAPER 83-90] EKMAN, A.	p 76 A84-291	
Tele-X - The first step in a satellit system for the Nordic countries		
[AIAA PAPER 84-0713] ELAM, F. M.	p4 A84-253	287
Space station control requirements a weights for combined momentum and		
ELDEN, N. C. Integrated water management system	m - Description :	and
test results [SAE PAPER 831111]	p6 A84-290	
ELDRED, C. H.	p 0 704-28	0
Capture-ejector satellites [NASA-TM-85686]	p7 N84-15	179
ELMS, R. V. Solar array Shuttle flight experi	ment - Hardw	
development and testing EMERY, A. F.	p 47 A84-229	961
Radiation-conduction interaction structures	in large spa	ace
[AIAA PAPER 84-0144]	p 23 A84-179	911
ERCHINGER, D. A. Scale model testing for control sys	tem parameters	ót
large structures [AD-A135652]	p 41 N84-183	913
ERWIN, H. O. Communications, tracking, and doc Station	king on the Spa p 45 A84-156	
ESTADIEU, B.		
The progression of projects EVANS, A. G. Fracture mechanics of ceramics. V	p 2 A84-150 folume 5 - Surfa	
flaws, statistics, and microcracking	p 54 A84-24	
EVANS, R. T. Scale model testing for control sys	tem parameters	of
large structures [AD-A135652]	p 41 N84-18	313
C ·		
F		
FABRIZI, A.	transfor propuls	ion

FABRIZI, A. A parametric study	of	space	transfe	er-propulsion
stages [IAF PAPER 83-401]			p 61	A84-13397
FALKENBURG, D. R.				

Dynamics of nonrigid articulated robot linkages p 58 A84-25531

FARRAR, A. Assessment of satellite power flux-density limits in the 2025-2300 MHz frequency range, part 1 [PB84-129402] p 51 N84-18532

EANNOETT C A G

FAWCETT, C. A. S.
FAWCETT, C. A. S.
Financing a solar power satellite project p 70 A84-21482
FEDOR, J. V.
Thermally induced spin rate ripple on spacecraft with long radial appendages
[NASA-TM-85058] p 39 N84-16249
FEKETE, L. Determination of applicable law to living and working
in outer space [IAF PAPER 82-IISL-44] p 68 A84-17057
FENNELL, J. F. A review of SCATHA satellite results: Charging and
discharging p 50 N84-17254 FEOKTISTOV, K.
Space vehicles p 4 A84-21573 FEREBEE, M. J., JR.
interactive geometry modeling of space station conceptual designs p 18 N84-22191
FERREIRA, D. L. Sensitivity analysis of the influence of the flexibility of
solar panels on the attitude dynamics of artificial satellites
[INPE-2763-PRE/337] p 39 N84-16232
Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment
[INPE-2749-PRE/325] p 41 N84-19383 FESTA A
Unfurlable offset antenna design for multipurpose applications
[AIAA PAPER 84-0659] p 16 A84-25259
FESTER, D. Fluid management p 11 N84-18284
FEWELL, M. E. Sodium heat transfer system modeling
[DE84-002051] p 25 N84-16509
FILEP, R. T. Commercial communications satellite market and
technology in the 90's [IAF PAPER 83-86] p 65 A84-11739
FISCHER, CP. A cylindrical near-field test facility for large satellite
antennas [MBB-UR-628-83-OE] p 72 A84-22862
FLASHNER, H. K.
ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181
FLEMING, M. L. A contact conductance interface for a space
constructable heat pipe radiator
[SAË PAPER 831101] p 24 A84-29036 FLOERY, E.
Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516
FLOOK, L
Evolution of European telecommunication satellite pointing performance
[AIAA PAPER 84-0725] p 34 A84-25291 FOGEL E.
ACOSS eleven (Active Control Of Space Structures), volume 1
[AD-A135675] p 40 N84-18311
FORD, F. E. Assessment of potential for batteries in space applications p 48 N84-12246
FORWARD, R. L.
Roundtrip interstellar travel using laser-pushed lightsails p 62 A84-27443
FRAUNDORF, P. Erosion of mylar and protection by thin metal films
[AIAA PAPER 83-2636] p 52 A84-10949 FREDERICK, D. H.
A methodology to include static and kinetic friction
effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956
FREELAND R.

- FREELAND, R. The 55-meter-structure flight experiment p 8 N84-17233
- FREELAND, R. E. Technology requirements for large flexible space structures
- p 2 A84-11811 [IAF PAPER 83-404] FREEMAN, J. R.
- RF systems in space. Volume 1: Space antennas frequency (SARF) simulation [AD-A133734] p 49 N84-14395
- FREEMAN, J. W. Energy from space; Proceedings of the Symposium on Solar Energy from Space, Vienna, Austria, August 9-21, p 69 A84-21476 1982 FULTON, R. E.
- Computer-Aided Geometry Modeling [NASA-CP-2272] 0 18 N84-22179

- GABRIEL, C. Design and development of the INTELSAT V graphite-epoxy central thrust tube p 19 A84-22153 GADDIS, J. L. Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 GALANTE, F. M. An overview of the institutional and regulatory aspects and their impact on system design [IAF PAPER 83-82] p 65 A84-11737 GANS, M. J. Narrow multibeam satellite ground station antenna employing a linear array with a geosynchronous arc coverage of 60 deg. II - Antenna design p 46 A84-17743 GARBA, J. A. The 55-meter-structure flight experiment p 8 N84-17233 GARCIA, N. F. Technology requirements for large flexible space structures [IAF PAPER 83-404] p 2 A84-11811 GARRETT, L. B. Mathematical synthesization of complex structures p 19 N84-22224 GARTRELL, C. F. A future solar orbital transfer vehicle concept p 61 A84-16116 GATES, R. L. Geometric modeling of large space antenna p 22 N84-22225 deployment GAZENKO, O. G. Man in space - An overview p 67 A84-15161 GERARD, M.
- Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 p 72 A84-24626 GERSHUNI, G. Z.
- Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents
- [NASA-TM-77534] p 26 N84-18576 GILLARD, C. W. Application of laser interferometry to robotics
- p 58 A84-28541 GLASER, P. E.
- Evolution of the solar power satellite concept The utilization of energy from space p 70 A84-21478 An electric propulsion transportation system from low-earth orbit to geostationary orbit utilizing beame p 61 A84-21485 microwaya power
- GLUSHANKOV, E. I. Characteristics of the microprocessor implementation
- of algorithms for the processing of radio signals and noise in large antenna arrays p 48 A84-28067 GOLDSWORTHY, W. B.
- The development of a composite beam building machine for on-site construction of large space structures AAS PAPER 83-217] p 20 A84-29862 GOOD, W. A.
- International competition in commercial aerospace markets
- [AAS PAPER 83-244] p 77 A84-29883 GOROVE. S.
- Energy from space Legal implications of the use of the geostationary orbit p 68 A84-17075 Major concerns of private enterprise regarding recent developments in space law

p 77 A84-29865

- [AAS PAPER 83-221]
- GÖSLEE, J. W. Adaptive microwave reflector p 50 N84-17235 Microwave reflector characterization using simple struments in EVA p 50 N84-17236
- GOUNDER. R. N. Advanced composite reflectors antenna for communications satellites p 53 A84-17151
- GRAHAN, W. R. Simulation of the motion of a Shuttle-attached flexible
- maniputator arm p 57 A84-11935 GRAHN. S. Tele-X - The first step in a satellite communications
- system for the Nordic countries [AIAA PAPER 84-0713] p 4 A84-25287
- GRAN, R. Number crunching on the ACOSS Model No. 2 p 33 A84-19128
- GRAVES. J. R. A programmable power processor for high power space applications p 46 A84-18394
- GREELEY. R. Feasibility study to conduct windblown sediment
- experiments aboard a space station [NASA-CR-175434] p 15 N84-21586

GREENBERG, H. S.

GREGORY, C., JR.

- Development of deployable structures for large space platform systems. Volume 1: Executive summary p 20 N84-10175 [NASA-CR-170913] Development of deployable structures for large space
- platforms. Volume 2: Design development [NASA-CR-170914] p 20 N84-10176
- Development of Test Article Building Block (TABB) for deployable platform systems p 21 N84-17226 GREENWOOD, L. R.
- The role of space station in earth sciences

p 72	A84-24631

- Matrix(X) Application to large space structure control design problems p 16 A84-19129 GRIGORÉNKO, IA. M.
- Numerical solution of several classes of nonlinear exible shell theory problems p 35 A84-25586 GROOM, N. J.
- integrated Flywheel Technology, 1983
- [NASA-CP-2290] p 78 N84-12228 Advanced Control and Power System (ACAPS) technology program p 37 N84-12243 GROSJEAN, O.
- Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724
- GROTEN, E. Geodetic aspects of ESA projects, studies and investigations p 78 N84-16677
- GULKIS, S. Large Deployable Reflector (LDR) - A concept for an orbiting submillimeter-infrared telescope for the 1990s
- p 66 A84-14586 GUSTAN. E.
- Probable missions and transportation scenarios to use egenerative life support systems [AAS PAPER 83-201] p 76 A84-29854
- GUYENNE, D. Spacecraft/plasma interactions and their influence on field and particle measurements
- (ESA-SP-198) p 56 N84-17253 GUYENNE, T. D.
- Environmental and thermal control systems for space vehicles [ESA-SP-200]
 - p 26 N84-19396

н

, F I
HAANAPPEL P.
Determination of applicable law to living and working
in space
[IAF PAPER 82-IISL-45] p 68 A84-17058
HABLANI, H. B.
Dynamics and control of a deformable gyrostat, utilizing
continuum vehicle modes p 31 A84-12488
HALL, W. B.
An evaluation of Techroll seal flexible joint material
p 56 N84-16037
HALLAUER, W. L., JR.
Experimental study of active vibration control
[AD-A133818] p 38 N84-14546
HAMIDI, M.
Use of electromagnetic models in the optimal control
of large space antennas p 35 A84-25552
HANKS, B. R.
Deployable beam flight experiment (MAST)
p 8 N84-17218
HARRIS, J. E.
Space Technology Experiments Platform (STEP)
overview p 8 N84-17212
HARTUNG, W.
Materials and construction techniques for large
spacecraft structures p 53 A84-17768
HASLETT, B.
Thermal control p 25 N84-18289
HASSELMAN, D. P. H.
Fracture mechanics of ceramics. Volume 5 - Surface
flaws, statistics, and microcracking p 54 A84-24501
HAVILAND, J. K.
Digital control system for space structural dampers
[NASA-CR-175355] p 39 N84-16246
HAWKINS, F. J.
Starlab Ground System guidelines document
[NASA-CR-175192] p 14 N84-20435
HAYATI, S. A.
Science platform and attitude subsystem in-flight
calibration for the Galileo spacecraft p 32 A84-17355
HAYES, S. M. Structural parameter identification for flexible
spacecraft
[AIAA PAPER 84-0060] p 23 A84-17853
HEACOCK. E. L.
Space applications at the crossroads; Proceedings of
the Twenty-first Goddard Memorial Symposium, Greenbelt,
MD, March 24, 25, 1983 p 64 A84-10883
mb, mb/or 24, 20, 1900 p.04 704-10000

PERSONAL AUTHOR INDEX

HEARD, W. L., JR. Erectable beam experiment p 60 N84-17219
HEENAN, A. T. Alternative strategies for space station financing [NASA-CR-175412] p 80 N84-21437
HEGG, D. R. ACOSS eleven (Active Control Of Space Structures),
votume 1 [AD-A135675] p 40 N84-18311
HENDERSON, T. C. A large space structure benchmark problem - ACOSS
Model No. 2 p 33 A84-19127 HENDRICKS, S. L. Structural parameter identification for flexible
spacecraft [AIA PAPER 84-0060] p 23 A84-17853
Identification of large flexible structures mass/stiffness and damping from on-orbit experiments
p 34 A84-24995
A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956
HENRY, W. A. Field repair of graphite epoxy skin panels on the spaceship Columbia p 52 A84-17120
HEPPNER, D. B. Electrochemical and steam-desorbed amine CO2
concentration Subsystem comparison [SAE PAPER 831120] p 6 A84-29054
HERBEN, M. H. A. J. Improved orbit utilization using auxiliary feeds in existing
earth terminals p 46 A84-20647 HERBERT, J. J.
Technology needs of advanced Earth observation spacecraft [NASA-CR-3698] p 9 N84-17248
HERBIG, H. Unfurlable offset antenna design for multipurpose
applications [AIAA PAPER 84-0659] p 16 A84-25259
HERDAN, B. L. Development and application of new technologies in the
ESA Olympus Programme [AIAA PAPER 84-0706] p 4 A84-25282
HILBRANDT, E. Study on damping representation related to spacecraft
structural design [EMSB-18/83] p 38 N84-15182
HILL, B. R. Remote manipulators in space p 57 A84-22336
HILL, H. C. Solar array Shuttle flight experiment - Hardware development and testing p 47 A84-22961
HINSON, W. F. Large inflated-antenna system p 9 N84-17234
HIXON, C. W. Flexible radiator thermal vacuum test report
[NASA-CR-171764] p 28 N84-20622 HODGSON, E. W., JR.
Regenerable non-venting thermal control subsystem for extravehicular activity
[SAE PAPER 831151] p 24 A84-29076 HOLDEMAN, J. D. On modeling dilution jet flowfields
[AlAA PAPER 84-1379] p 58 A84-44183 HOOK, W. R.
An alternate concept for expanding man's presence in space
[NASA-TM-84617] p 7 N84-15172 HORSTEIN, M.
Land-mobile communications satellite system design [AIAA PAPER 84-0753] p 5 A84-25308
HOSENBALL, S. N. Space Shuttle, private enterprise and intellectual properties in the context of space manufacturing
properties in the context of space maintacturing p 72 A84-22341 HUANG, CC.
Application of laser interferometry to robotics p 58 A84-28541
Coordinate transformation assembly p 75 A84-28579
HUANG, W. Static shape forming for an electrostatically controlled
membrane mirror p 16 A84-25551 HUBER, G.
Effect of temperature, moisture and radiation exposures
on composite mechanical properties p 55 A84-28900
on composite mechanical properties p 55 A84-28900 HUGHES, P. C. Torque from solar radiation pressure gradient during eclipse p 31 A84-12489

Attitude stability for the yaw-wheel class of orbiting p 33 A84-19675 ovrostata

HUNT, J. Soacecraft/plasma interactions and their influence on field and particle measurements p 56 N84-17253 [ESA-SP-198] Spacelab data book p 79 N84-18315 [ESA-BR-14] HUNT, J. J. Environmental and thermal control systems for space [ESA-SP-2001 p 26 N84-19396 HUNTER, M. W., II Transportation - Options and high payoff choices p 61 A84-21484

HUSTON, R. L. Multibody dynamics - Analysis of flexibility effects [AD-A132533] p 36 A84-29145

IBRAHIM, A. M. Transient dynamics during the orbiter based deployment of flexible members [AIAA PAPER 84-0061] p 34 A84-21285 ILES, P. A Large area, low cost space solar cells p 47 A84-22979 IRUDAYASAMY, J. Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian) regulators [AD-A137760] p 43 N84-21172 ITÔ, Y. Computer tools for optimizing orbit use [AIAA PAPER 84-0651] p 74 A84-25318 IVÀNOV, A. p 16 A84-21564 For the first time IVERSEN, J. D. Feasibility study to conduct windblown sediment experiments aboard a space station [NASA-CR-175434] p 15 N84-21586 IVES, S. T.

Dielectric charging in space - Ground test data and model p 47 A84-20709 verification

J

fo

JACKSON, L. R. Operational modules for space station construction [NASA-TM-85772] p 21 N84-21608 JACOBS, B. D. Advanced composite antenna reflectors communications satellites p 53 A84-17151 JALMARSSON, L Tele-X - The first step in a satellite communications system for the Nordic countries [AIAA PAPER 84-0713] p 4 A84-25287 JANKOVIC. M. S. Comments on 'Dynamics of a spacecraft during extension of flexible appendages' p 32 A84-17370 JANKOWITSCH. P. Energy from space - A vision of the future p 69 A84-21477 JANSSENS. F. Derivation and combination of impedance matrices for flavible satellites (ESA-STR-2091 p 43 N84-21604 JASPER, W. J. Control of large space structures [AIAA PAPER 84-0081] p 32 A84-17866 JHA. V. K. Computer aided synthesis of a satellite antenna structure with probabilistic constraints p 21 N84-19899 Dynamic behaviour of a satellite antenna structure in p 42 N84-19900 random vibration environment JOHANSEN, K. F. A hardware demonstration of control for a flexible p 31 A84-13321 offset-feed antenna JOHNSON, T. L. Aggregate models for distributed parameter systems with applications to flexible air and spacecraft p 31 A84-11945 JOHNSTON, R. S. p 11 N84-18279 Crew and life support: EVA JONGEWARD, G. A. Plasma sheath structure surrounding a large powered spacecraft [AIAA PAPER 84-0329] p 46 A84-18025 JORGENSEN, P.

Autonomous navigation of geosynchronous satellites using the Navstar Global Positioning System p 45 A84-15671 JOSLIN. D.

Mechanical wraparound contacted cell for low cost p 48 A84-22982 space аггауз

JUANG, J. N.

Static shape forming for an electrostatically controlled p 16 A84-25551 embrane mirror JUANG, J.-N.

Closed-form solutions for feedback control with terminal p 36 A84-29471 constraints JUDD, R. P.

Dynamics of nonrigid articulated robot linkages p 58 A84-25531

JUNKINS, J. L. Structural parameter identification for flexible pacecraft

[AIAA PAPER 84-0060] p 23 A84-17853 Identification of large flexible structures mass/stiffness and damping from on-orbit experiments

p 34 A84-24995

Κ

KAMAT, M. P. Optimization of shallow trusses against limit point p 20 A84-23366 instability Identification of large flexible structures mass/stiffness and damping from on-orbit experiments p 34 A84-24995 KAPELL, M. H. Space station communications and tracking equipment anagement/control system p 45 A84-15639 management/control system KAPUSTKA, R. E. A programmable power processor for high power space p 46 A84-18394 applications KARAM, R. D. Thermal control of tubular composite structures in space environment p 22 A84-10440 KASSING. D. European questions related to satelite power systems p 70 A84-21483 KATZ. I. Plasma sheath structure surrounding a large powered spacecraft [AIAA PAPER 84-0329] p 46 A84-18025 KAUFMAN. H. Multivariable direct adaptive control for a general class of time-varying commands p 33 A84-19118 Some applications of direct adaptive control to large structural systems p 34 A84-25496 KEAFER, L. S. Large inflated-antenna system KECKLER, C. R. p 9 N84-17234 Integrated Flywheel Technology, 1983 p 78 N84-12228 [NASA-CP-2290] Advanced Control and Power System (ACAPS) technology program p 37 N84-12243 Vibration isolation technology experiment p 39 N84-17228 Integrated Power/Attitude Control System (IPACS) p 39 N84-17229 technology experiment KEEFE, J. R. Gravitational biology on the space station [SAE PAPER 831133] p 75 A84-29063 KELLERMEIER, H. A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class p 62 A84-25292 [AIAA PAPER 84-0727] KEMPF. R. F. Space Shuttle, private enterprise and intellectual properties in the context of space manufacturing p 72 A84-22341 KHANG, V. T. Software production in a large space project: The SPOT mission center p 78 N84-14752 KHOT. N. S. Optimization of shallow trusses against limit point instability p 20 A84-23366 KIBBLEWHITE, J. Coherent arrays of separate optical telescopes in space project Trio p 3 A84-15363 KIDD. A. M. MSAT mobile communication demonstration satellite system and bus tradeoff considerations [AIAA PAPER 84-0751] p 48 A84-25306 KIEHNE. N. The German Spacelab mission D1 p 69 A84-17762 KIYA, M. Large Deployable Reflector (LDR) - A concept for an orbiting submillimeter-infrared telescope for the 1990s p 66 A84-14586 KLEINAU, W. Servicing vehicle for satellites and platforms in low earth orbits p 6 A84-29666 [DGLR PAPER 83-102] KLINE, R. A program to develop efficient manned operations in

AAS PAPER 83-2071 p 76 A84-29857

KLINE, R.

KLUESENER, M. F.

KLUESENER, M. F.

The effects of the space environment on damping materials and damping designs on flexible structures p 56 N84-17217

- KNABE, W.
- The residual gravitational field of orbital space stations IDGLR PAPER 83-0891 p 75 A84-29656 KNEPP. D. L.
- The effects of aperture antennas after signal propagation through anisotropic ionized media
- [AD-A138286] p 52 N84-21781 KOCH. D. G.
- A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604 KOELLE, D. E.
- GEO space platform economics Impact of concept, size, launch mode and lifetime [AIAA PAPER 84-0704] p 74 A84-25281
- A standardized propulsion module for future communications satellites in the 2000 to 3000 kg class
- [AIAA PAPER 84-0727] p 62 A84-25292 Reusable commercial space processing platforms [AAS PAPER 83-208] p 7 A84-29858 KOONS. H. C.
- A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 KOPS. L.
- Manufacturing in space; Proceedings of the Winter Annual Meeting, Boston, MA, November 13-18, 1983 p 71 A84-22327 KREEB. H.
- Heat pipes for the L-SAT communications module p 26 N84-19405 radiators KRIKORIAN, A. D.
- Gravitational biology on the space station [SAE PAPER 831133] p 75 A84-29063 KRISHNA, R.
- Environmental effects on the dynamics and control of an orbiting large flexible antenna system [NASA-CR-175448] p p 42 N84-20627
- KŮKULKA. J. Large area, low cost space solar cells
- p 47 A84-22979 KULPER. T. B. H.
- Large Deployable Reflector (LDR) A concept for an orbiting submillimeter-infrared telescope for the 1990s p 66 A84-14586
- KUMINECZ, J. F. Low earth orbit atomic oxygen effects on surfaces [AIAA PAPER 84-0548] p 53 A84-19912
- KURTH, W. S. Interpretation of STS-3/plasma diagnostics package results in terms of large space structure plasma
- interactions [NASA-CR-173266] p 78 N84-16991 KÜRTZMAN, C. R.
- Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase Executive summary
- [NASA-CB-37361 p 59 N84-10582 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume
- 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume
- Telepresence project applications p 59 N84-10584 [NASA-CR-37351

L

- LABEYRIE. A.
- Coherent arrays of separate optical telescopes in space p 3 A84-15363 project Trio LÁI. J. Y.
- Science platform and attitude subsystem in-flight calibration for the Galileo spacecraft p 32 A84-17355 LAI. S. T.
- Sheath ionization model of beam emissions from large spacecrafts
- [AD-A137181] p 52 N84-19463 LANGE E.E.
- Fracture mechanics of ceramics. Volume 5 Surface flaws, statistics, and microcracking p 54 A84-24501 LANIER, J. R., JR.
- A programmable power processor for high power space applications p 46 A84-18394 LANUSSE, A.
- Study of artificial intelligence techniques Realization of a highly autonomous experimental robot system p 58 A84-25828
- LARSEN, R. L. NASA research in teleoperation and robotics p 58 A84-28523

- LARSON, V. R.
- A parametric study of space transfer-propulsion stages p 61 A84-13397
- LÂUB. A. J.
- Controllability and observability criteria for multivariable linear second-order models p 35 A84-25516 LAUX. U.
- The thermal design of the European complement of FSLP
- [SAE PAPER 831144] p 24 A84-29071 LEE Y.W.
- New elements for analysis of space frames with tapered nomhor p 20 N84-14561 LEGENDRE, P.
- Analytical model of the evolution of orbit parameters of a quasi geostationary satellite [IAF PAPER 83-316] p 65 A84-11787
- LEGER, L J.
- Low earth orbit atomic oxygen effects on surfaces [AIAA PAPER 84-0548] p 53 A84-19 p 53 A84-19912 LEUNG, M. S.
- A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 LEVY. J.
- Potential military applications of space platforms and space stations p 2 A84-13330 LEVY. M. E.
- p 67 A84-15321 Financing large space projects LEY. W.
- European utilisation aspects for a space station p 64 A84-11727 (IAF PAPER 83-54)
- LIANG, R. C. The effect of pressure and temperature time-dependent changes in graphite/epoxy composites below the glass transition p 54 A84-21775 LIKINS, P. W.
- A degree of controllability definition Fundamental concepts and application to modal systems p 34 A84-24991
- Manipulator interactive design with interconnected flexible elements p 58 A84-25484 LIN. C.
- Regenerable non-venting thermal control subsystem for extravehicular activity p 24 A84-29076 [SAE PAPER 831151]
- LIN. C. H.
- Systems engineering aspects of a preliminary conceptual design of the space station environmental control and life support system [SAE PAPER 831109] p 5 A84-29044
- LIN. J. C.
- ACOSS eleven (Active Control Of Space Structures), volume 1 [AD-A135675] n 40 N84-18311
- LINDBERG, R. E.
- Actuator placement considerations for the control of p 20 N84-11199 large space structures LINDBERG, R. E., JR.
- On the number and placement of actuators for independent modal space control p 34 A84-24990 LINDSEY, W. C.
- User manual of the CATSS system (version 1.0) communication analysis tool for space station p 51 N84-17431 [NASA-CR-171728]
- LINDSTROM, D. Erosion of mylar and protection by thin metal films
- [AIAA PAPER 83-2636] p 52 A84-10949 LIPPNER, G.
- The attitude and orbit control system for Eureca p 76 A84-29658 [DGLR PAPER 83-091]

[AIAA PAPER 84-0509]

[NASA-TM-85686]

Capture ejector satellites

p 61 A84-18141

p 7 N84-15179

- LOEWY, R. G. Composite structural materials
- [NASA-CR-173259] p 56 N84-17293 LOGSDON, J. M.
- Space stations A key to socio-economic benefits from p 69 A84-19850 space? Solar power satellites - The institutional challenge
- p 70 A84-21479 Space stations - The next step in space?
- [AAS PAPER 83-202] p 76 A84-29855 LOMBARDI, P.
- The small transmitter receiver stations in the Sirio experiment [FUB-50-1982] p 49 N84-15386
- LONGDON, N. Spacelab data book
- p 79 N84-18315 [ESA-BR-14] LONGMAN, R. W.
- On the number and placement of actuators for independent modal space control p 34 A84-24990 A degree of controllability definition - Fundamental concepts and application to modal systems
 - p 34 A84-24991

PERSONAL AL	ITHOR INDEX
LONGUSKI, J. M. Simulation of the Galileo spacect	
algorithm LOOKE, T. D. Stability enhancement of a flexible	p 66 A84-11938 robot manipulator
[AD-A134185] LOURENCAO, P. T. D. M. Sensitivity analysis of the influence	
solar panels on the attitude dyn. satellites [INPE-2763-PRE/337]	p 39 N84-16232
Capture of satellite stabilized by gra flexible mast during and after deploym [INPE-2749-PRE/325]	
LOUSMA, J. R. The role of man in space LOVE, G.	p 72 A84-24627
Data management LU, B. P.	p 12 N84-18287
Space operations center com obscuration LUDWIG, A. C.	p 3 A84-15695
RF systems in space. Volume 1: frequency (SARF) simulation [AD-A133734]	Space antennas p 49 N84-14395
LUMPE, G. Geometrically nonlinear analysis	P
structures [MITT-28] LUNDSTROM, L-I.	p 22 N84-21914
Tele-X - The first step in a satellit system for the Nordic countries [AIAA PAPER 84-0713]	e communications
LUST, R. V. Approximations method for space fr	ame synthesis
м	p 19 A84-10141
MACCONOCHIE, I. O. Capture-ejector satellites [NASA-TM-85686]	p7 N84-15179
MACHLES, G. W. Study of auxiliary propulsion requ	
Study of auxiliary propulsion requisions space systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion required study of auxiliary propulsion required study study of auxiliary propulsion required study study of auxiliary propulsion required study stu	summary p 63 N84-12226
Study of auxiliary propulsion requision space systems. Volume 1: Executive [NASA-CR-168193-VOL-1]	summary p 63 N84-12226
Study of auxiliary propulsion requise space systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion require space systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space	p 63 N84-12226 rements for large p 63 N84-13218
Study of auxiliary propulsion requisance systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requires space systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gricomposites	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tros-based asteroid mission MAHANEY, J.	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K.	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisipace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215]	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisipace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-R-88193-VOL-1] Study of auxiliary propulsion requisipace systems, volume 2 [NASA-CR-R-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAEHL, R. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 iti-100 kW low-cost
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A.	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 htti-100 kW low-cost p 47 A84-22963 e space structures
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu solar array applications	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 ltit-100 kW low-cost p 47 A84-2963 re space structures p 35 A84-27934
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu solar array applications MANOHARAN, M. G. Control structure interactions in larg Analysis using energy approach MANSHADI, F. Use of electromagnetic models in of large space antennas MANOLR, W. M.	summary p 63 N84-12226 rements for large p 63 N84-13218 p 63 N84-13218 p 63 N84-13218 p 63 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 ltti-100 kW low-cost p 47 A84-2293 re space structures p 35 A84-27934 the optimal control p 35 A84-25552
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space and the systems of the systems of the system systems of the system	summary p 63 N84-12226 rements for large p 63 N84-13218 p 63 N84-13218 p 63 N84-13218 p 7 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 lti-100 kW low-cost p 47 A84-2893 re space structures p 35 A84-27934 the optimal control p 35 A84-25552 flexible joints for p 19 A84-11922
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAHANEY, J. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu solar array applications MANDARAN, M. G. Control structure interactions in larg Analysis using energy approach MANSHADI, F. Use of electromagnetic models in of large space antennas MANSUR, W. M. Analysis and design of leaf-spring driving gyroscopic rotors MARDESICH, N.	summary p 63 N84-12226 rements for large p 63 N84-13218 p 63 N84-13218 p 63 N84-13218 p 63 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 ltb: 100 kW low-cost p 47 A84-2293 re space structures p 35 A84-27934 the optimal control p 35 A84-25552 flexible joints for p 19 A84-11922 d cell for low cost p 48 A84-22982
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAEHL, R. The Tiros-based asteroid mission MAEHL, R. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu solar array applications MANCHARAN, M. G. Control structure interactions in larg Analysis using energy approach MANSUR, W. M. Analysis and design of leaf-spring driving gyroscopic rotors MARDESICH, N. Mechanical wraparound contacter space arrays	summary p 63 N84-12226 rements for large p 63 N84-13218 p 63 N84-13218 p 63 N84-13218 p 63 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 ltb: 100 kW low-cost p 47 A84-2293 re space structures p 35 A84-27934 the optimal control p 35 A84-25552 flexible joints for p 19 A84-11922 d cell for low cost p 48 A84-22982
Study of auxiliary propulsion requispace systems. Volume 1: Executive [NASA-CR-168193-VOL-1] Study of auxiliary propulsion requisispace systems, volume 2 [NASA-CR-168193-VOL-2] MACKAY, M. K. Active control of large flexible space MACLEAN, B. J. Thermal-mechanical behavior of gr composites SiC-reinforced-aluminum alloys applications MAEHL, R. The Tiros-based asteroid mission MAEHL, R. The Tiros-based asteroid mission MAEHL, R. Self-shadowing of orbiting trusses [NASA-CR-173215] MAHARANA, P. K. Stability of large flexible damped s as elastic continua MANDELL, M. J. Plasma sheath structure surroundin spacecraft [AIAA PAPER 84-0329] MANN, J. A. New component development for mu solar array applications MANCHARAN, M. G. Control structure interactions in larg Analysis using energy approach MANSUR, W. M. Analysis and design of leaf-spring driving gyroscopic rotors MARSHALL, P. F. Thermal management system techn for space station applications	summary p 63 N84-12226 rements for large p 63 N84-13218 e structures p 37 N84-14235 raphite/magnesium p 24 A84-28237 for aerospace p 54 A84-28242 p 2 A84-14762 p 25 N84-16565 pacecraft modeled p 35 A84-26845 g a large powered p 46 A84-18025 Iti-100 kW low-cost p 47 A84-22963 le space structures p 35 A84-27934 the optimal control p 35 A84-25552 flexible joints for p 19 A84-11922 d cell for low cost p 48 A84-22982 ology development

[IAF PAPER 83-401]

PERSONAL AUTHOR INDEX

PERSONAL AUTHOR INDE	EX
MASTRANTONIO, G. Orbiting wire as a dynamo: Auxi	liary power possibilities
for space platforms [IFSI-83-3]	p 49 N84-12653
MASUBUCHI, K. Feasibility of remotely maniput	
A step in the development of nor [NASA-CR-175437]	vel joining technologies p 60 N84-20857
MATHEWS, M. E. Scale model testing for control	system parameters of
large structures	
(AD-A135652) MATLOFF, G. L.	p 41 N84-18313
Interstellar solar sailing - Cons projected sail materials MATSUDA, H. S.	p 62 A84-25344
New fabric structures of carbon	fiber p 52 A84-17108
MATTHEWS, P. S. Remote manipulators in space	p 57 A84-22336
MAYS, C. R.	·
Space Station Technology, 198 [NASA-CP-2293] MAZZIO, V. F.	p 11 N84-18277
Effect of temperature, moisture and composite mechanical properti	
MCBRAYER, R. O.	-
Launch processing for Spacelal [AIAA PAPER 83-2622]	p 64 A84-10965
MCCARGO, M. Effects of combined ultraviol	et and oxygen plasma
environment on spacecraft therma	
ACOSS eleven (Active Control	Of Space Structures),
volume 1 [AD-A135675]	p 40 N84-18311
MCCLAMROCH, N. H. Sampled data control of large	space structures using
constant gain velocity feedback -	
MCCONNELL, D.	•
The US space station: Potential microwave facility	p 78 N84-16420
MCCREARY, T.	
Study of a tracking and data ac 1990's. Volume 3: TDAS Co Model	
[NASA-CR-175195] MCELROY, J. H.	p 79 N84-19371
Space applications at the cros	
the Twenty-first Goddard Memorial MD, March 24, 25, 1983	p 64 A84-10883
MCGEE, G. C. Attitude control and dynamics of	of the space operations
centør	p 31 A84-11934
MCKAY, C. P. Mission to Mars - The case for	a settlement p 67 A84-15092
MCMILLIN, M. L. Interactive geometry modelin	n of space station
conceptual designs MEESE, R. A.	p 18 N84-22191
Welded solar cell interconnection MEI, C.	on p19 A84-22965
Component mode synthesis	and large deflection
vibrations of complex structures [NASA-CR-173338]	p 21 N84-18680
MEINER, R. C. The solar power satellite -	A programme for
development aid MEINTEL, A. J., JR. NASA research in teleoperation	p 68 A84-17074
	p 58 A84-28523
MEIROVITCH, L. Control of targe flexible spaced	raft by the independent
modal-space control method [NASA-CR-3760]	p 40 N84-18262
MENG, C. I. Large space instrumentation to	measure the interaction
between space structures and the	environment
{AD-A129990} MESSICK, D. L	p 77 N84-10179
Surface analysis of graphite fib composites	er reinforced polyimide
[NASA-TM-85700]	p 55 N84-11220
MESSIDORO, P.	

[NASA-Im-03700], MESSIDORO, P. Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT stromal model p 26 N84-19398

 METZ, R. N.
 p 20
 N64-10356

 Radiating dipole model of interference induced in spacecraft circuitry by surface discharges
 [NASA-TP-2240]
 p 50
 N84-16247

METZLER, E. C. Electrically conductive black optical paint

p 55 A84-28553
MEYER, M. S.
Systems engineering aspects of a preliminary conceptual design of the space station environmental
control and life support system
[SAE PAPER 831109] p 5 A84-29044 MICHAELS, D.
Mechanical wraparound contacted cell for low cost
space arrays p 48 A84-22982
MIELKE, R. R. Airborne antenna pattern calculations
[NASA-CR-173284] p 51 N84-17436
MIGLIORINI, P. The small transmitter receiver stations in the Sirio
experiment
[FUB-50-1982] p 49 N84-15386 MIJOVIC, J.
The effect of pressure and temperature on
time-dependent changes in graphite/epoxy composites below the glass transition p 54 A84-21775
MIKULAS, M. M., JR.
Stability, vibration and passive damping of partially restrained imperfect columns
[NASA-TM-85697] p 37 N84-13608
Synchronously deployable truss structure
[NASA-CASE-LAR-13117-1] p 59 N84-16250 A manned-machine space station construction
concept
[NASA-TM-85762] p 21 N84-19395 MILLER, R. A.
Simulation of the motion of a Shuttle-attached flexible
manipulator arm p 57 A84-11935 MILLIGAN, R. J.
Effects of combined ultraviolet and oxygen plasma
environment on spacecraft thermal control materials p 27 N84-19449
MILLS-CURRAN, W. C.
Approximations method for space frame synthesis p 19 A84-10141
MINSKY, M. L.
Space applications of Automation, Robotics And
Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary
[NASA-CR-3736] p 59 N84-10582
Space Applications of Automation, Robotics and
Machine Intelligence Systems (ABAMIS) phase 2. Volume
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 N&A-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NRASA-CR-3735) p 59 NRASA-TM-83489] p 63 MISEL, J. E. A methodology to include static and kinetic friction
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NRAL-0584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K.
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NBSEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [(NASA-CR-3735] p 59 N84-10583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 On the dynamics of a subsatellite system supported by
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-10583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 On the dynamics of a subsatellite system supported by two tethers
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NMASA-CR-3735) p 59 NMASA-CR-3735) p 59 NMASA-CR-3735) p 63 NBSEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 AB4-17854 MISRA, M. S.
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NRAL-0583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems supported by two tethers [AIAA PAPER 84-0062] p 32 ABA-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 63 NRA-10584 MIRTICH, M. J. Resistoiet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NBEL, J. E. A A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 NBRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems [AIAA PAPER 84-0062] p 32 AB4-17854 MISRA, M. S. [AIAA PAPER 84-0062] p 32
$\label{eq:matrix} \begin{array}{llllllllllllllllllllllllllllllllllll$
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-TM-83489] p 63 NBEL, J. E. A A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 NISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 (AIAA PAPER 84-0062] p 32 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 [AIAA PAPER 84-0062] p 32 A84-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 </td
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735] p 59 NRAL-0583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems (IAA PAPER 84-062] p 30 A methodology vivo tethers [AIAA PAPER 84-062] p 32 ABA-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-reinforced-aluminum alloys p 54 A84-28242 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 63 NRA-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NBEL, J. E. A A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 NBTSRA, A.K. On modeling and simulation of the dynamics of tether connected satellite systems [AIAA PAPER 84-0062] p 32 AB4-11933 On the dynamics of a subsatellite system suported by two tethers [AIAA PAPER
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NRAL-0583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NBEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems (AIAA PAPER 84-0062] p 30 (AIAA PAPER 84-0062] p 32 (AIAA PAPER 84-0062] p 24 ABA-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 (AIAA PAPER 84-0297] p 4
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-TM-83489] p 63 NBEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] NISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0662] p 32 AB4-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-reinforced-aluminum alloys MITCHEL, P. M. Low cost space science and astronomy platforms in orbit (AIAA PAPER 84
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735] p 59 N84-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-117854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28247 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit [AIAA PAPER 84-0297] p 4 A84-18005 MITSUMA, H. Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906 MIZERA, P. F. A review of SCATHA satellite results: Charging and
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 59 NRA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-CR-3735] p 63 NRASA-TM-83489] p 63 NRSA-TM-83489] p 63 NBEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] NISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0662] p 32 AB4-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-reinforced-aluminum alloys MITCHEL, P. M. Low cost space science and astronomy platforms in orbit (AIAA PAPER 84
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735] p 59 N84-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-117854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28247 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit [AIAA PAPER 84-0297] p 4 A84-18005 MITSUMA, H. Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906 MIZERA, P. F. A review of SCATHA satellite results: Charging and
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 NREsistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NIFTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 NISEL, J.E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 [AIAA PAPER 84-0062] p 32 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 applications p 54 applications p 54 MITCHEL, P. M. Low cost space science and astronomy platforms in orbit (AIAA PAPER 84-0297] p 4
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 N84-10583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11953 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-creinforced-aluminum alloys for aerospace applications p 54 A84-28242 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit g 28 N84-18005 MITSUMA, M. Evaluation of modal testing te
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 N84-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-11833 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-reinforced-aluminum alloys for aerospace applications p 54 A84-28242 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit [AIAA PAPER 84-0297] p 4 A84-18005 MITSUMA, H. Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906 MIZERA, P. F. A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 MIZONO, T. Computer tools for optimizing orbit use [AIAA PAPER 84-0651] p 74 A84-25318 MOOL, V. J. Some aspects of simulation studies in spacecraft dynamics p 15 A84-11930
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 N84-10583 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-creinforced-aluminum alloys for aerospace applications p 24 A84-28242 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit g 28 N84-18005 MITSUMA, H. Evaluation of m
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 N84-10584 MIRTICH, M. J. Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206 MISEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 A84-10956 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-11833 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 32 A84-17854 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 A84-28237 SiC-reinforced-aluminum alloys for aerospace applications p 54 A84-28242 MITCHELL, P. M. Low cost space science and astronomy platforms in orbit (AIAA PAPER 84-0297] p 4 A84-18005 MITSUMA, H. Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906 MIZERA, P. F. A review of SCATHA satellite results: Charging and discharging p 50 N84-17254 MODI, V. J. Computer tools for optimizing orbit use [AIAA PAPER 84-0651] p 74 A84-25318 MODI, V. J. Some aspects of simulation studies in spacecraft dynamics p 15 A84-11933 On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933 Satelite attitude dynamics and control in the prese
Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications (NASA-CR-3735) p 59 NRAL-0583 MIRTICH, M. J. Resisticit propulsion for large spacecraft systems [NASA-TM-83489] p 63 NBEL, J. E. A methodology to include static and kinetic friction effects in Space Shuttle payload transient loads analysis [AIAA PAPER 83-2654] p 30 MISRA, A. K. On modeling and simulation of the dynamics of tether connected satellite systems Connected stellite systems p 30 [AIAA PAPER 84-0062] p 32 A84-11833 On the dynamics of a subsatellite system supported by two tethers [AIAA PAPER 84-0062] p 24 A84-28242 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 MISRA, M. S. Thermal-mechanical behavior of graphite/magnesium composites p 24 Nex cost space science and astronomy platforms in

Transient dynamics during the orbiter based deployment of flexible members [AIAA PAPER 84-0061] p 34 A84-21285

• • • • • • • • • •	
On transient dynamics and stabili structures MOORMAN, J. C.	p 36 A84-29143
STEP experiment integration	ρ8 N84-17215
MORAIS, B. G. Attitude, control and stabilization	p 40 N84-18281
MORTAZAVI, H. R. Radiation-conduction interaction	in large space
structures [AIAA PAPER 84-0144]	p 23 A84-17911
MOSES, J. Implementation of MACLISP on a la	arge address space
computer (DE84-005042)	p 79 N84-21145
MOSES, P. L. Operational modules for space :	•
[NASA-TM-85772] MOSLEY, W. C.	p 21 N84-21608
Space station data management - from changing requirements and a c base	
(AIAA PAPER 83-2338) MOSS, R.	p 43 A84-10016
Using the outgassing test to so contamination potential	reen materials for p 53 A84-17174
MRSTIK, A. V. RF systems in space. Volume 2:	Space-based radar
analyses [AD-A133735]	p 49 N84-14394
MULLIN, J. P. High capacity power systems for sp	ace
[IAF PAPER 83-421] MURAKAMI, M.	p44 A84-11816
Thermofluidynamics of heat pipes MURATANI, T.	p 27 N84-19423
Computer tools for optimizing orbit [AIAA PAPER 84-0651]	use p74 A84-25318
	p /4 A04-20010
N	
NADERI, F.	
An advanced generation land mot and its critical technologies	p 3 A84-15634
NAGATOMO, M. Space station - An early experim	ental solar power
satellite NALBANDIAN, S. J.	p 70 AB4-21487
Low concentration ratio solar configuration NAUCK, J.	array structural p 17 N84-17225
Development trends in Europe on s	atellite clusters and
geostationary platforms [AIAA PAPER 84-0703]	p 75 A84-25327
NAUMANN, A. Developing the space frontier;	
Twenty-ninth Annual Conference, Ho 25-27, 1982	p 67 A84-15381
NAZEMETZ, J. Geometric modeling of large	
deployment NEFF, O.	p 22 N84-22225
Modern software development tool on the example of a Spacelab experin	ment
NEIN, M. E.	p 49 N84-14761
Space platform accommodations NESMITH, M. F.	p 16 A84-22131
Self-locking telescoping manipulato [NASA-CASE-MFS-25906-1]	rann p59 N84-11761
NETO, O. M.	
Sensitivity analysis of the influence solar panels on the attitude dyn	
satellites [INPE-2763-PRE/337]	p 39 N84-16232
NGUYEN, N. C. A hardware demonstration of con	ntrol for a flexible
offset-feed antenna NICAISE, P. D.	p 31 A84-13321
Space station attitude control s requirements	p 37 N84-12234
NISHIMOTO, T. S. A deployable structure and sc	array controls
experiment for STEP NISHIMURA, A.	p 39 N84-17227
New fabric structures of carbon fib	вт р 52 А84-17108
	P. 42 1.04 11100
NOOR, A. K. Instability analysis of space trusses	1
Instability analysis of space trusses	p 32 A84-16885
Instability analysis of space trusses Potential of minicomputer-array pr nonlinear finite-element analysis	p 32 A84-16885
Instability analysis of space trusses Potential of minicomputer-array pr	p 32 A84-16885 ocessor system for p 46 A84-20583

NOORDAM, J.

NOWLAN, M. J. Large area space solar cell assemblies

p 61 A84-22980

0

- ODONNELL, T.
- Evaluation of spacecraft materials and processes for optical degradation potential p 54 A84-28458 OKEEFE. K. J.
- The 55-meter-structure flight experiment p8 N84-17233
- OLCOTT. T. Hyperfiltration wash water recovery subsystem - Design
- and test results ISAE PAPER 8311121 n.6 A84-29047 OLEARY, B.
- Project space station Plans for a permanent manned p 69 A84-21344 snace center OLLENDORF, S.
- Thermal energy management process experiment p 25 N84-17222 Recent and planned developments at the Goddard
- Space Flight Center in thermal control technology p 26 N84-19402
- OLMSTEAD, D. Telecommunication systems for large-scale space manufacturing activity
- [AAS PAPER 83-216] p 48 A84-29861 OLSEN. D. E. The effect of mass and stiffness changes on the damping
- factor in a large space structure as represented by the CSDL 2 model p 42 N84-19465 [AD-A136984]
- OLSON, R.
- Probable missions and transportation scenarios to use regenerative life support systems (AAS PAPER 83-2011 o 76 A84-29854
- OREN, J. A. A contact conductance interface for a space constructable heat pipe radiator
- [SAE PAPER 831101] p 24 A84-29036 Flexible radiator thermal vacuum test report [NASA-CR-171764] p 28 N84-20622
- Flexible radiator system [NASA-CR-171765] p 28 N84-20623 OREN, J. R.
- Flexible radiator system: Executive summary [NASA-CR-171766] p 28 N84-20624 ORLANDO, N. E.
- A system for intelligent teleoperation research [AIAA PAPER 83-2376] p 57 A8 p 57 A84-10070 OSBORNE, R. S.
- An alternate concept for expanding man's presence in SDACO
- [NASA-TM-84617] p 7 N84-15172 OSHIMA, K.
- Thermofluidynamics of heat pipes p 27 N84-19423 OTT. J. H.
- Multibeam phased arrays Application to SOC/Free-Flyer communication system p 45 A84-15641

Ρ

- PACK. G. J.
- New component development for multi-100 kW low-cost p 47 A84-22963 solar array applications PAILER. N.
- Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949 PANITZ H. J.
- Operational planning, simulation, and performance of p 69 A84-17763 the German Spacelab mission D1
- PAPACCIA, M. Heat pipes for the L-SAT communications module p 26 N84-19405 rediators
- PAPAGIANNIS, M. D. Natural selection of stellar civilizations by the limits of arow/th
- [IAF PAPER 83-272] p 65 A84-11779 PARKINSON, R. C.
- Manned planetary missions? p 71 A84-21497 PATACCIA, M.
- Development of a spacecraft infrared test technique as an alternative to solar simulation: First steps on L-SAT p 26 N84-19398 thermal model
- PATTERSON, R. E. Study of multi-kilowatt solar arrays for Earth orbit applications
- [NASA-CR-170939] p 49 N84-12634 PAUL G. R.
- Cracked inner layer foil in high-density multilayer printed p 53 A84-17200 wiring boards

- Integrity control of carbon fiber reinforced plastics structural elements, phase 1 report [TB-TS-11-01/82-A] n 56 N84-18416
- PAZICK. P. M. RF systems in space. Volume 2: Space-based radar
- analyses [AD-A133735] p 49 N84-14394 PEDERSEN, A.
- Spacecraft/plasma interactions and their influence on field and particle measurements
- [ESA-SP-198] p 56 N84-17253 PEDERSEN, K. S.
- International aspects of commercial space activities [AAS PAPER 83-222] p 77 A84-29866 PELLIS. G.
- Thermal control of the Tethered Satellite Module
- p 24 A84-29067 [SAE PAPER 831138] Thermal control of tethered satellite in a very low altitude N84-19444 aerodynamic mission D 27
- PENNINGS, N. H. A Variable Conductance Heat Pipe (VCHP) radiator system for communications payloads p 27 N84-19406 PEPLINSKI, D. R.
- Reactions of high velocity atomic oxygen with carbon [AIAA PAPER 84-0549] p 53 A84-18159 PERBOS. J. L.
- Application of a common reflector configuration to a multimission satellite of the 90's [IAF PAPER 83-60]
- p 1 A84-11731 PERONI I Tests and prediction of composite material viscoelastic
- behaviour for large space structure [IAF PAPER 83-418] p 30 A84-11815
- PEROTTO, V. Heat pipes for the L-SAT communications module p 26 N84-19405 radiators
- PERRET. A. Management of the radiolink of the solar sail spacecraft hy radio-amateurs
- [IAF PAPER 83-447] p 44 A84-11823 PETERS, G. ESA space station activities
- [IAF PAPER 83-30] p 64 A84-11722 PETERS J M
- Instability analysis of space trusses p 32 A84-16885
- PETERS, R.
- Digital technologies and systems for geostationary orbit satellites
- [AIAA PAPER 84-0749] p 74 A84-25304 PFEIFER, K.
- Local stability of sandwich structures with thin fibre reinforced face skins for space application [MBB-UD-381-83-OE] p 19 A84-22859
- PFEIFFER. B. R. K.
- The Spacelab program The management of the program, problems encountered and the solutions adopted p 3 A84-15325 PHILLIPS, A.
- Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings PIGNOLET. G.
- Making the high frontier highly visible with a solar sail race to the mooi
- [AAS PAPER 83-226] p 62 A84-29869 PILAND, R. O.
- A system study of the solar power satellite concept p 70 A84-21480
- PINE, V. W. Dielectric charging in space - Ground test data and model verification p 47 A84-20709
- POLLARD, H. E.
- Technical aspects of the Intelsat V solar array p 47 A84-22962
- PONTOPPIDAN, K. Unfurtable offset antenna design for multipurpose
- applications [AIAA PAPER 84-0659] p 16 A84-25259
- PONZI, U.
- Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1
- [ESA-CR(P)-1779-VOL-3] p 43 N84-21611 Simplified models and computational schemes of the
- p 28 N84-21614 aerodynamic load Study on synthesis and characterization of large space
- systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616 Study on synthesis and characterization of large space
- systems, phase 2. Part 3: Experimental design verification techniques [ESA-CR(P)-1779-VOL-5] p 18 N84-21620

- Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural p 29 N84-21621 analysis Assessment of the existing ground test technology and
- confronting with the Large Space Structures (LSS) requirements. Thermal test techniques p 29 N84-21622

Proposals for additions, modifications, and new experimental methods. Part 1: Ground tests. Part 2: p 15 N84-21623 Flight tests

Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical desian

[ESA-CR(P)-1779-VOL-1] p 18 N84-21624 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal desia

[ESA-CR(P)-1779-VOL-2] p 18 N84-21625 POPOVSKII, V. V.

Characteristics of the microprocessor implementation of algorithms for the processing of radio signals and noise p 48 A84-28067 in large antenna arrays

- POSTUCHOW, J. R. Technology needs of advanced Earth observation snacecraft
 - p 9 N84-17248 [NASA-CR-3698]
- POUX, C.

PRADO, J. Y.

and test results

PRITCHARD, E. B.

PROGAR. D. J.

composites

PRUETT, E. C.

PURDY, D.

PURVIS, C. K.

charging

QÙIRK, J. A.

following

RAAB, B.

The

in space

RADANY, E.

snace stations

RAJARAM N.S.

[IAF PAPER 83-48]

[NASA-TM-85700]

Space telescope

[NASA-CR-170948]

Structures and mechanisms

volutionary Space Station

Fairchild

[IAF PAPER 83-232]

[SAE PAPER 831108]

PRICE G.A.

[SAE PAPER 831112]

- Thermal cycling tests in space environment simulation p 26 N84-19401 chambers POWELL, L. E.
- Architectural options and development issues
 - p 4 A84-24633

p 6 A84-29047

p 1 A84-11726

p 4 A84-24628

p 55 N84-11220

p 78 N84-16097

p 21 N84-18286

p 5 A84-29043

p 36 N84-12222

p 65 A84-11773

p 2 A84-13330

p 57 A84-15667

system

- Management of the radiolink of the solar sail spacecraft by radio-amateurs
- [IAF PAPER 83-447] p 44 A84-11823 PREUSS L Spacecraft thermal control selection for seven years of
- lifetime in synchronous orbit [MBB-UR-584-82-OE] p 25 N84-11200
- PRICE. D. F. Integrated water management system - Description and test results
- [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design

A flexible structure controller design method using mode

Surface analysis of graphite fiber reinforced polyimide

The role of potential barrier formation in spacecraft harging p 50 N84-17269

Q

QUATTRONE, P. D. Environmental Control and Life Support for an

Control of flexible spacecraft by optimal model

R

Leasecraft

commercially-operated platform for science and business

Potential military applications of space platforms and

Knowledge based systems for intelligent robotics

residualization and output feedback p 32 A84-17369

Overview of NASA space station activities

Integrated requirements for a space station

PERSONAL AUTHOR INDEX

RAJARAM, S.
Identification of large flexible structures mass/stiffness
and damping from on-orbit experiments p 34 A84-24995
RAMLER, J. NASA's geostationary communications platform
program [AIAA PAPER 84-0702] p 5 A84-25326
RANEY, W. P. Space station architectural issues as viewed by the user
community - Applications p 4 A84-24634 RANKIN, J. G.
Thermal management system technology development for space station applications
[SAE PAPER 831097] p 24 A84-29032
RATH, J. Photovoltaic solar arrays leading to a candidate space
power system in the regime beyond 100 kW [IAF PAPER 83-422] p 44 A84-11817
RAZZAQ, Z. Stability, vibration and passive damping of partially
restrained imperfect columns [NASA-TM-85697] p 37 N84-13608
REDDING, D. C. Highly efficient, very low-thrust transfer to
geosynchronous orbit - Exact and approximate solutions
p 61 A84-24980 Optimal low-thrust transfers to synchronous orbit
p 62 A84-24981
REED, W. Space telescope
[NASA-CR-170948] p 78 N84-16097 REIBALDI, G.
Thermo-mechanical behaviour of CFRP tubes for space
structures [IAF PAPER 83-417] p 22 A84-11814
REINEL, K. Hardware simulation of spacecraft dynamics and
control p 30 AB4-11932 RENNER, U.
Development trends in Europe on satellite clusters and geostationary platforms
[AIAA PAPER 84-0703] p 75 A84-25327
RENTON, J. D. The beam-like behavior of space trusses
p 19 A84-21517
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P.
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. PAPER 831112] p 6 A84-29047
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 Abdrefittation wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 Abdrefittation p 7 Abdrefit
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 83111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manned-machine space station construction
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept [NASA-TM-85762] p.21 N84-19395 Construction concept for erecting an offsat-fed antenna
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 83111] p 6 AB4-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 AB4-29047 RHODES, M. D. A manned-machine space station construction concept [NASA-TM-85762] p 21 [NASA-TM-85774] p 60 [NASA-TM-85774] p 60
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79N84-17223REYSA, R. P. Integrated water management system - Description and test results[SAE PAPER 831111] p 6A84-29046Hyperfiltration wash water recovery subsystem - Design and test results[SAE PAPER 831112] p 6[SAE PAPER 831112] p 6A84-29047RHODES, M. D. A manned-machine space station construction concept[NASA-TM-85762] p 21[NASA-TM-85762] p 21N64-19395Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p 60N84-20626RICE, J. S. Multibearn phased arraysApplication to system
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79N84-17223REYSA, R. P. Integrated water management system - Description and test results[SAE PAPER 83111] p 6A84-29046Hyperfiltration wash water recovery subsystem - Design and test results[SAE PAPER 831112] p 6[SAE PAPER 831112] p 6A84-29047RHODES, M. D.A manned-machine space station construction concept[NASA-TM-85762] p 21N84-19395Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p 60N84-20626RICE, J. S. Multibeam phased arraysApplication to SQC/Free-Flyer communication system p 45A84-15641RICE, R. R.
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfitration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manned-machine space station construction concept p 21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85762] p 21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p 60 N84-20626 RICE, J. S. Multibeam phased arrays Application to SOC/Free-Fiyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing p 48 N84-12233
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results j.84-17223 [SAE PAPER 83111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results j.86 A84-29047 [SAE PAPER 831112] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept j.84 Saese-29047 [NASA-TM-85762] p.21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p.60 N84-20626 RICE, J. S. Multibearn phased arrays Application to SOC/Free-Flyer communication system p.45 A84-15641 RICE, R. R. Space station energy sizing p.48 N84-12233 The Boeing flywheel study p.37 N84-12235 RIED, R. C. p.10 p.37 N84-12235 RIED, R. C.
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfitration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manad-machine space station construction concept p 21 N84-18395 Construction concept for erecting an offset-fed antenna [NASA-TM-85762] p 21 N84-20626 RICE, J. S. Multibeam phased arrays Application to SOC/Free-Fiyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing p 48 N84-12233 The Boeing flywheel study p 37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p 35 A84-27934
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package p 79 N84-17223REYSA, R. P. Integrated water management system - Description and test results[SAE PAPER 83111]p \hat{b} A84-29046Hyperfiltration wash water recovery subsystem - Design and test resultsp \hat{b} A84-29047[SAE PAPER 831112]p \hat{b} A84-29047 RHODES, M. D. A manned-machine space station construction concept[NASA-TM-85762]p 21 N84-19395Construction concept for erecting an offset-fed antenna [NASA-TM-85774]p 60 N84-20626 RICE, J. S. Multibeam phased arrays- Application to SOC/Free-Flyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing The Boeing flywheel study Analysis using energy approachp 35 A84-27834 RIEDLER, W. Radiation characteristics of array antennas with
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 83111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 83111] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept p.1 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85762] p.21 N84-20626 RICE, J. S. Multibeam phased arrays Application to SOC/Free-Flyer communication system p.45 A84-15641 RICE, R. R. Space station energy sizing p.48 N84-12233 The Boeing flywheel study p.37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p.36 A84-27934
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 83111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept [NASA-TM-85762] p.21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p.60 N84-20626 RICE, J. S. Multibearn phased arrays Application to SOC/Free-Flyer communication system Desce station energy sizing p.46 A84-15641 RICE, R. R. Space station energy sizing p.48 N84-12233 The Boeing flywheel study p.37 N84-12235 RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coverage p.48 A84-27934 RIEGER, R. Digital technologies and systems for geostationary orbit Testationary orbit
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfitration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manned-machine space station construction concept p 21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85762] p 21 N84-20626 RICE, J. S. Multibeam phased arrays Application to SOC/Free-Flyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing p 48 N84-12233 The Boeing flywheel study p 37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p 35 A84-27834 RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 RIEGER, R. Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p 74 A84-25304
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP)CASEP)p 79N84-17223REYSA, R. P. Integrated water management system - Description and test results[SAE PAPER 83111]p 6A84-29046Hyperfiltration wash water recovery subsystem - Design and test resultsp 6A84-29047[SAE PAPER 831112]p 6A84-29047[RHODES, M. D. A manned-machine space station construction conceptA manned-machine space station concept enterna[NASA-TM-85762]p 21N84-19395Construction concept for erecting an offset-fed antenna [NASA-TM-85774]p 60[NASA-TM-85774]p 60N84-20626RICE, J. S. Multibearn phased arraysApplication to SOC/Free-Flyer communication systemp 45A84-15641RICE, R. R. Space station energy sizingp 48N84-12233The Boeing flywheel studyp 37N84-12235RIED, R. C. Control structure interactions in large space structures Analysis using energy approachp 36A84-27934RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coveragep 48AB4-26516RIEGER, R. Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749]p 74A84-25304RILEY, V. A voice interactive system for aiding and documentation
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manned-machine space station construction concept p 21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85762] p 21 N84-20626 RICE, J. S. Multibeam phased arrays Application to SOC/Free-Flyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing p 48 N84-12233 The Boeing flywheel study p 37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p 35 A84-27834 RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 RIEGER, R. Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p 74 A84-25304 RILEY, V. A voice interactive system for aiding and documentation of space-based tasks p 74
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results j.84-17223 [SAE PAPER 831111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results j.86 [SAE PAPER 831112] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept j.84-29047 RHODES, M. D. A manned-machine space station construction concept j.84-29047 [NASA-TM-85762] p.21 N84-19395 Construction concept for erecting an offset-fed antenna j.86-20626 [NICE, J. S. Multibearn phased arrays Application to SOC/Free-Flyer communication system p.45 A84-15641 RICE, R. R. Space station energy sizing p.48 N84-12233 The Boeing flywheel study p.37 N84-12235 RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coverage p.48 A84-25316 RIEEGER, R. Digital technologies and systems for geostationary orbit satellites j.74 A84-25304 RILEA, W. A voice interactive system for aiding and documentation of space-based tasks
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p.79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 83111] p.6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p.6 A84-29047 RHODES, M. D. A manned-machine space station construction concept [NASA-TM-85762] p.21 N84-19395 Construction concept for erecting an offset-fed antenna [NASA-TM-85774] p.60 N84-20626 RICE, J. S. Multibearn phased arrays Application to SOC/Free-Flyer communication system p.45 A84-15641 RICE, R. R. Space station energy sizing p.48 N84-12233 The Boeing flywheel study p.37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p.35 A84-27834 RIEDLER, W. Radiation characteristics of array antennas with disturbed apertura coverage p.48 A84-26516 RIEGER, R. Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p.74 A84-25304 RILEY, V. A voice interactive system for aiding and documentation of space-based tasks [AIAA PAPER 83-2355] p.43 A84-10025
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223 REYSA, R. P. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 RHODES, M. D. A manned-machine space station construction concept [NASA-TM-85762] p 21 N84-19395 Construction concept for erecting an offsat-fed antenna [NASA-TM-85762] p 21 N84-20626 RICE, J. S. Multibearn phased arrays - Application to SOC/Free-Flyer communication system p 45 A84-15641 RICE, R. R. Space station energy sizing p 48 N84-12233 The Boeing flywheel study p 37 N84-12235 RIED, R. C. Control structure interactions in large space structures Analysis using energy approach p 36 A84-27834 RIEDLER, W. Radiation characteristics of array antennas with disturbed aperture coverage p 48 A84-26516 RIEGER, R. Digital technologies and systems for geostationary orbit satellites [AIAA PAPER 84-0749] p 74 A84-25304 RILEY, V. A voice interactive system for aiding and documentation of space-based tasks [AIAA PAPER 83-2355] p 43 A84-10025 RITTER, J. E., J.R. Assessment of reliability of ceramic materials p 54 A84-24508 ROBERTSON, K. B.
REYNAUD, A. H. Canadian Attitude Sensing Experimental Package (CASEP)CASEP)p 79N84-17223REYSA, R. P. Integrated water management system - Description and test results[SAE PAPER 831111]p 6A&E PAPER 831112]p 6A84-29046Hyperfiltration wash water recovery subsystem - Design and test results[SAE PAPER 831112]p 6[SAE PAPER 831112]p 6A84-29047RHODES, M. D.Amanad-machine space station construction concept[NASA-TM-85762]p 21N64-19395Construction concept for erecting an offset-fed antenna [NASA-TM-85774]p 60RICE, J. S. Multibearn phased arraysApplication to SOC/Free-Flyer communication systemp 45A84-15641RICE, R. R. Space station energy sizingp 48NBAE-12233 The Boeing flywheel studyp 37N84-12235RIED, R. C. Control structure interactions in large space structures Analysis using energy approachMadiation characteristics of array antennas with disturbed aperture coveragep 48A84-26516RIEGER, R. Digital technologies and systems for geostationary orbit satellities [AIAA PAPER 84-0749]p 74RILEY, V. A voice interactive system for aiding and documentation of space-based tasks [AIAA PAPER 83-2355]p 43RILEY, V. A sessment of reliability of ceramic materials p 54A84-24508

Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials p 27 N84-19449

ROBINSON, L. M. Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] o 74 A84-25319 RODRIGUEZ G Model error estimation for distributed systems described by elliptic equations p 15 A84-11946 RODRIGUEZ, G. E. Integrated Flywheel Technology, 1983 [NASA-CP-2290] p p 78 N84-12228 ROEBELEN, G. J., JR. Regenerable non-venting thermal control subsystem for extravehicular activity [SAE PAPER 831151] p 24 A84-29076 ROEDERER, A. Unfurlable offset antenna design for multipurpose applications [AIAA PAPER 84-0659] p 16 A84-25259 ROGERS, R. P. IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber p 26 N84-19400 ROSE, J. T. Role of a space station in pharmaceutical manufacturing p 73 A84-24632 ROSENBERG, S. D. Auxiliary propulsion p 11 N84-18283 ROSSI, M. Number crunching on the ACOSS Model No. 2 p 33 A84-19128 ROTHBLATT. M. A. Telecommunication systems for large-scale space manufacturing activity [AAS PAPER 83-216] p 48 A84-29861 A legal charter for non-governmental space industrialization [AAS PAPER 83-225] p 77 A84-29868 ROUSSEL. H. Coherent arrays of separate optical telescopes in space project Trio p 3 A84-15363 ROWNTREE, R. A. Thermal conductance and torque of thin section four-point contact ball bearings in vacuum [ESA-ESTL-54] p 25 N84-15562 RUNAVOT. J. J. Payload placing using an operational support platform [IAF PAPER 83-44] p 1 A84-11724 RUNGE, F. C. STEP flight experiments Large Deployable Reflector (LDR) telescope p.8 N84-17231 RUSSELL D. A. Simulated space radiation effects on dielectrics and coatings p 54 A84-20682 S SACCHI. E. The thermal design of L-SAT large telecommunication p 27 N84-19414 SACKETT, L L A simulator to study dynamic interaction of the Space

Shuttle on-orbit flight control system with deployed flexible payloads p 35 A84-26717 SADIN, S. R. NASA priority technologies [IAF PAPER 83-345] p 1 A84-11793 SAGE. K. Geometric modeling of large space antenna deployment p 22 N84-22225 SAGGESE, E. The small transmitter receiver stations in the Sirio ovnoriment

 EFUB-So-1982]
 p 49
 N84-15386

 SAINT-AUBERT, P.
 Application of a common reflector configuration to a multimission satellite of the 90's

 [IAF PAPER 83-60]
 p 1
 A84-11731

 SAINT-AUBERT, PH.
 Utilization of electric propulsion for communication satellites

 [AIAP PAPER 84-0729]
 p 62
 A84-25293

SAMUELS, R. The STEP/STACBEAM experiment technology development for very large solar array deployers

SANDAR, T. S. Dynamic behaviour of a satellite antenna structure in

random vibration environment p 42 N84-19900 SANDFORD, S. Erosion of mylar and protection by thin metal films

[AIAA PAPER 83-2636] p 52 A84-10949 SANKAR, T. S.

Computer aided synthesis of a satellite antenna structure with probabilistic constraints p 21 N84-19899 SAUNDERS, C. G.

Surface accuracy measurement sensor test on a 50-meter antenna surface model [NASA-TM-85689] p 17 N84-18427

[NASA-IM-85009] p17 No4-10427 SAVAGE, C. J.

A Variable Conductance Heat Pipe (VCHP) radiator system for communications payloads p 27 N84-19406 SAX, H. European utilisation aspects for a space station

[IAF PAPER 83-54] p 64 A84-11727 SAZONOV, V. V.

Periodic oscillations of a gyrostat satellite with respect to the centers of mass in a circular orbit p 33 A84-19728

SCHAECHTER, D. B. A hardware demonstration of control for a flexible

- offset-feed antenna p 31 A84-13321 SCHAEFER, W.
- Unturtable offset antenna design for multipurpose applications
- [AIAA PAPER 84-0659] p 16 A84-25259 SCHAELLIG, R.
 - Unfurlable offset antenna design for multipurpose applications
- [AIAA PAPER 84-0659] p 16 A84-25259 SCHARTEL, W. A. Technology needs of advanced Earth observation
- spacecraft [NASA-CR-3698] p 9 N84-17248
- SCHMIDT, R. Modern software development tools in space projects

on the example of a Spacelab experiment p 49 N84-14761 SCHMIT. L. A.

- Approximations method for space frame synthesis p 19 A84-10141
- SCHNEIDER, H. J.

Modern software development tools in space projects on the example of a Spacelab experiment

p 49 N84-14761 SCHNEIDER, W. C.

Overview of space station operations [IAF PAPER 83-38] p 64 A84-11723 SCHOLL F. W.

- Communications, tracking, and docking on the Space Station p 45 A84-15640
- SCHUBERT, F. H. Electrochemical and steam-desorbed amine CO2 concentration Subsystem comparison
- [SAE PAPER 631120] p 6 A84-29054 Phase change water recovery techniques - Vapor
- compression distillation and thermoelectric/membrane concepts [SAE PAPER 631122] p 6 A84-29056
- SCIESZKO, J. L
- Analysis and design of leaf-spring flexible joints for driving gyroscopic rotors p 19 A84-11922 SCOTT-MONCK, J.

New directions in solar array development p 47 A84-22958

- SCOTT, S. J. Operational modules for space station construction [NASA-TM-85772] p 21 N84-21608 SEIBERT, G.
- Utilisation of the European retrieval carrier EURECA for life science research p 65 A84-11753
- SELG, R. J. Experiment data communications (48 Mbit/s) between Spacelab, the Space Shuttle and the ground

p 44 A84-10396 SESSIONS, B.

Heat pipes for the L-SAT communications module radiators p 26 N84-19405 SEYL J. W.

Space station communications and tracking equipment management/control system p 45 A84-15639 SGUBINI. S.

Finite element formulations for tensioned members

p 21 N84-21615 Computational savings in view factor evaluation on mode prescreening p 29 N84-21618

SHAH, S. Matrix(X) - Application to large space structure control

design problems p 16 A84-19129 SHANBHAG, R. N.

- Time domain analysis and synthesis of robust controllers for large scale LOG (Linear Quadratic Gaussian) regulators
- [AD-A137760] p 43 N84-21172 SHARP, G. L.

Reduced domestic satellite orbit spacing [AIAA PAPER 84-0652] p 73 A84-25253 SHARP, P. W.

Evolutionary concepts for a space station and the relevant utilisation potential p 5 A84-26926

SHEFFIELD, J. W.

- SHEFFIELD, J. W. Weight characteristics of future spacecraft thermal management systems
- [AIAA PAPER 84-0054] p 23 A84-17850 SHENAR, J.
- Control of large flexible spacecraft by the independent modal-space control method [NASA-CR-3760]
- p 40 N84-18262 SHEPPARD, J. S.
- Design and development of an advanced solar array drive mechanism p 17 N84-18457 SHERMAN, A.
- NASA needs and trends in cryogenic cooling p 25 N84-15329 SHIRAKI, K.
- Evaluation of modal testing techniques for spacecraft structures p 28 N84-19906 SHOOSMITH, J. N.
- Computer-Aided Geometry Modeling [NASA-CP-2272]
- D18 N84-22179 SHRIVASTAVA. S. K.
- Satellite attitude dynamics and control in the presence of environmental torques - A brief survey p 31 A84-12483
- Stability of large flexible damped spacecraft modeled as elastic continua p 35 A84-26845 Control structure interactions in large space structures
- Analysis using energy approach p 35 A84-27934 SHU, C. F. Advanced composite reflectors antenna
- p 53 A84-17151 communications satellites SIMMONS, B. J. Scale model testing for control system parameters of
- large structures [AD-A135652] p 41 N84-18313
- SIMPSON, J. A. Pyroelectric materials as electronic pulse detectors of ultraheavy nuclei p 72 A84-23440
- SINCARSIN, G. B. Torque from solar radiation pressure gradient during clipse p 31 A84-12489 eclipse
- SINGH, N. The Alpha-Helix Concept: Innovative utilization of the
- Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station
- p 14 N84-20610 [NASA-CR-175436] SINGH. R. P. Manipulator interactive design with interconnected
- flexible elements p 58 A84-25484 SKELTON. R. E.
- Determination of critical parameters in large flexible space structures with uncertain modal data p 33 A84-20047
- SKOOG, A. I. The complementary roles of existing and advanced environmental, thermal control and life support technology p 79 N84-19429 for space stations SLONE. H. O.
- NASA priority technologies [IAF PAPER 83-345] p 1 A84-11793 SMITH, S. O. Radiation-conduction interaction in large space
- structures [AIAA PAPER 84-0144] p 23 A84-17911 SMITH, W. W.
- Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary [NASA-CR-168193-VOL-1] p 63 N84-12226 Study of auxiliary propulsion requirements for large space systems, volume 2
- [NASA-CR-168193-VOL-2] p 63 N84-13218 SOLLFREY, W. The flexural behavior of PACSAT (passive communication satellite) in orbit
- [AD-A131406] p 36 N84-11195 SOOP. E. M. Introduction to geostationary orbits
- [ESA-SP-1053] p 80 N84-21590 SPERBER, R. Why don't we use ion propulsion? p 62 A84-25294 [AIAA PAPER 84-0730]
- SPIERS, R. B. Surface accuracy measurement sensor test on a 50-meter antenna surface model
- [NASA-TM-85689] p 17 N84-16427 SPITZER, M. B. Large area space solar cell assemblies p 61 A84-22980
- SRINIVASAN, R. On modeling dilution jet flowfields [AIAA PAPER 84-1379] p 58 A84-44183
- STAHLE, C. V., JR. Investigation of articulated panel dynamics
- p 40 N84-17230

- STANLEY. A.
 - Digital technologies and systems for geostationary orbit eatallitae [AIAA PAPER 84-0749] p 74 A84-25304
- STATLER, R. L.
- Prediction of solar cell performance in space p 48 A84-22997
- STEELS, R. Development and application of new technologies in the ESA Olympus Programme
- [AIAA PAPER 84-0706] p 4 A84-25282 STEIMLE. H.
- The German Spacelab mission D1 p 69 A84-17762 STEINBRONN, O.
- Space station needs, attributes and architectural options. Summary of major study activities and results. Space station program observations p 11 N84-18275 [NASA-CR-173345]
- STERN. T. G.
- Photovoltaic concentrator pointing dynamics and plasma interaction study p 50 N84-17224 STERNS, P. M.
- Jurisprudential philosophies of the art of living in space The transnational imperative
- p 68 A84-17054 [IAF PAPER 82-IISL-38] STILLWELL, R. P.
- Current collection from the space plasma through defects in high voltage solar array insulation p 49 N84-15970
- STOFEL, E. J.
- p 19 A84-22965 Welded solar cell interconnection STOKER, C.
- Mission to Mars The case for a settlement p 67 A84-15092 STOY, I. B.
- Power-economical considerations for the integration of terrestrial and extraterrestrial solar generators into existing p 71 A84-21488 power generation systems STROHKORB, G. A.
- Potential of minicomputer-array processor system for p 46 A84-20583 nonlinear finite-element analysis STUART. D. G.
- Robotics, and Machine Intelligence Automation, Systems (ARAMIS) in space manufacturing p 58 A84-22337
- STUMP. C. W.
- Surface accuracy measurement sensor test on a 50-meter antenna surface model [NASA-TM-85689] p 17 N84-16427
- STURTIVANT, G. J.
- BAe reaction wheels for Olympus p 17 N84-18475 SU, Y. T.
- User manual of the CATSS system (version 1.0) communication analysis tool for space station p 51 N84-17431 [NASA-CR-171728] SUDDATH, J. H.
- Application of beam power technology to a space tation p 45 A84-15642 station SUNG, C. K.
- A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials
- [ASME PAPER 83-DET-6] p 55 A84-29101 SWAN, P.
- Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949 SWANSON, P. N.
- Large Deployable Reflector (LDR) A concept for an orbiting submillimeter-infrared telescope for the 1990s p 66 A84-14586

Т

- TAN. G. B. T. Spacecraft thermal balance testing using infrared lamps on a dummy spacecraft p 26 N84-19399 TANKERSLY, B. C.
- Large deployable antenna flight experiment for the Space Technology Experiments Platform (STEP) p 8 N84-17232
- TAUSSIG. R. T. Multi-megawatt space power thermal management
- system requirements [AIAA PAPER 84-0056] o 23 A84-21284
- TAUTZ, M. F. Sheath ionization model of beam emissions from targe spacecrafts
- [AD-A137181] p 52 N84-19463 TAVARES, S. A.
- Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment [INPE-2749-PRE/325] p 41 N84-19383

- TAYLOR, T. C. Low cost space science and astronomy platforms in orhit [AIAA PAPER 84-0297] p 4 A84-18005 TEASDALE, W. E. A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 TEMPLEMAN, A. B. A heuristic method for the design of minimum weight trusses using discrete member sizes p 15 A84-16841 TENNEN. L. I. Jurisprudential philosophies of the art of living in space The transnational imperative [IAF PAPER 82-IISL-38] p 68 A84-17054 TEREKHOVA, G. A. Geodetic control of the reflectors of large antennas p 31 A84-15785 TESTER, R. R. Space logistics [IAF PAPER 83-24] p 64 A84-11719 THIEL, E. D. Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary p 59 N84-10582 [NASA-CR-3736] Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583 Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications [NASA-CR-3735] p 59 N84-10584 THOMPSON, B. S. A variational theorem for the viscoelastodynamic analysis of high-speed linkage machinery fabricated from composite materials [ASME PAPER 83-DET-6] p 55 A84-29101 THORNTON, E. A. Self-shadowing of orbiting trusses [NASA-CR-173215] p 25 N84-16565 THYFAULT, D. V. Decentralized control of a large space structure using direct output feedback p 41 N84-19464 [AD-A136781] TILTON, E. L., III Overview of NASA space station activities p 1 A84-11726 [IAF PAPER 83-48] TODD, M. J. Thermal conductance and torque of thin section four-point contact ball bearings in vacuum p 25 N84-15562 [ESA-ESTL-54] TONG, D. Time phased introduction of advanced technologies -Its impact on orbit/spectrum conservation p 74 A84-25254 [AIAA PAPER 84-0653] TSANG, C. S. User manual of the CATSS system (version 1.0) communication analysis tool for space station [NASA-CR-171728] p 51 N84-17431 TU, K. A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 TUNG, F. C. ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181 TURNER, J. D.
- p 36 A84-29471 constraints TUTTLE, J.
- p 2 A84-13330 space stations
- ultraheavy nuclei p 72 A84-23440

UEDA. N.

New fabric structures of carbon fiber p 52 A84-17108

- VALENTIAN, D.
- Utilization of electric propulsion for communication satellites
- [AIAA PAPER 84-0729] p 62 A84-25293 VAN GRIETHUYSEN, V. J.
- Weight characteristics of future spacecraft thermal management systems
 - [AIAA PAPER 84-0054] p 23 A84-17850

Closed-form solutions for feedback control with terminal

Potential military applications of space platforms and

TUZZOLINO, A. J. Pyroelectric materials as electronic pulse detectors of

U

PERSONAL AUTHOR INDEX

VAN SPAENDONK, R. A. C. M. Improved orbit utilization using auxilia	arv feer	ls in existina
earth terminals		A84-20647
VANDERVELDE, W. E.		
Reliability issues in active control of structures	large th	exable space
[NASA-CR-175341]	p 39	N84-16248
VANHEMS, M. M.	•	
The contract VANVALKENBURG, C. N.	p 2	A84-15304
Space telescope		
[NASA-CR-170948]	p 78	N84-16097
VEIT, A.		
Space telescope: Solar array prin mechanism		N84-18458
VELMAN, J. R.		
A design strategy for multiple paylo	ad poi	nting from a
three axis stabilized spacecraft [AIAA PAPER 84-0566]	n 33	A84-18168
VELUPILLAI, D.	p 00	707 10100
Space 1991	p 71	A84-21720
VENDURA, G. J. Welded solar cell interconnection	a 10	A84 22065
VENERI, R.	h ia	A84-22965
The thermal design of L-SAT large	telecor	mmunication
satellite	p 27	N84-19414
VENKAYYA, V. B. Optimization of shallow trusses	anaine	st limit ooint
instability		A84-23366
VESTEWIG, R.		
A voice interactive system for aiding of space-based tasks	and do	cumentation
[AIAA PAPER 83-2355]	p 43	A84-10025
VIGERON, F. R.		
Flight test of a synthetic aperture n STEP		N84-17237
VIGNERON, F. R.		
Simulation of the motion of a Shut		
manipulator arm VILKE, V. G.	p 57	A84-11935
Motion of a symmetric satellite abour	t the ce	nter of mass
in circular orbit in the presence of f	lexible	viscoelastic
in circular orbit in the presence of f rods		
in circular orbit in the presence of f	lexible p 35	viscoelastic A84-26977
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs	texible p 35 solar sa	viscoelastic A84-26977 uil spacecraft
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447]	texible p 35 solar sa	viscoelastic A84-26977
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs	lexible p 35 solar sa p 44	viscoelastic A84-26977 iil spacecraft A84-11823
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems	iexible p 35 solar sa p 44 on scer	viscoelastic A84-26977 uil spacecraft A84-11823 narios to use
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201]	iexible p 35 solar sa p 44 on scer	viscoelastic A84-26977 iil spacecraft A84-11823
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatio regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect	texible p 35 solar sa p 44 on scer p 76	viscoelastic A84-26977 ul spacecraft A84-11823 harios to use A84-29854
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect [AIAA PAPER 84-0548]	texible p 35 solar sa p 44 on scer p 76 cts on s	viscoelastic A84-26977 ul spacecraft A84-11823 harios to use A84-29854
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect [AIA PAPER 84-0548] VISWANATHAN, C. N.	texible p 35 solar sa p 44 on scer p 76 p 76 cts on s p 53	viscoelastic A84-26977 uil spacecraft A84-11823 harios to use A84-29854 surfaces A84-19912
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect [AIAA PAPER 84-0548]	iterns iterns iterns iterns iterns	viscoelastic A84-26977 ull spacecraft A84-11823 narios to use A84-29854 surfaces A84-19912 Fundamental
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability definin concepts and application to modal systems	texible p 35 solar sa p 44 on scer p 76 p 76 cts on s p 53 tion - f	viscoelastic A84-26977 uil spacecraft A84-11823 harios to use A84-29854 surfaces A84-19912
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatio regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T.	itexible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f sterns p 34	viscoelastic A84-26977 A84-11823 harios to use A84-29854 surfaces A84-19912 Fundamental A84-24991
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability definin concepts and application to modal syst VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns	texible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f sterns p 34 mping	viscoelastic A84-26977 A84-11623 narios to use A84-29854 surfaces A84-19912 =undamental A84-24991 of partially
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatio regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [INSA-TM-85697]	itexible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f sterns p 34	viscoelastic A84-26977 A84-11823 harios to use A84-29854 surfaces A84-19912 Fundamental A84-24991
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportati regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K.	texible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f sterns p 34 mping	viscoelastic A84-26977 A84-11623 narios to use A84-29854 surfaces A84-19912 =undamental A84-24991 of partially
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatio regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [INSA-TM-85697]	itexible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f stems p 34 mping p 37	viscoelastic A84-26977 A84-11623 narios to use A84-29854 surfaces A84-19912 =undamental A84-24991 of partially
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatic regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program. [AIAA PAPER 83-2685] VON PUTTKAMER, J.	lexible p 35 solar sa p 44 p 76 p 76 cts on s p 53 tion - f stems p 34 mping p 37 p 66	viscoelastic A84-26977 ull spacecraft A84-11823 narios to use A84-29854 surfaces A84-19912 - undamental A84-24991 of partially N84-13608 A84-13376
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportation regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effect (AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability definin concepts and application to modal syst VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685]	lexible p 35 solar sacar p 44 p 76 p 76 p 76 p 76 p 76 p 76 p 76 p 76	viscoelastic A84-26977 A84-26977 A84-11823 narios to use A84-29854 surfaces A84-19912 Fundamental A84-24991 of partially N84-13608 A84-13376 ustrialization
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatic regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program. [AIAA PAPER 83-2685] VON PUTTKAMER, J.	lexible p 35 solar sacar p 44 p 76 p 76 p 76 p 76 p 76 p 76 p 76 p 76	viscoelastic A84-26977 ull spacecraft A84-11823 narios to use A84-29854 surfaces A84-19912 - undamental A84-24991 of partially N84-13608 A84-13376
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportati regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685] VON PUTTKAMER, J. With the Space Shuttle towards spa	lexible p 35 solar sa p 44 p 76 p 76 p 76 p 53 tion - F stems p 34 mping p 37 p 66 ace indi p 75	viscoelastic A84-26977 A84-26977 A84-26977 A84-11823 aarios to use A84-29854 surfaces A84-19912 Fundamental A84-24991 of partially N84-13608 A84-13376 ustrialization A84-28975 og in space.
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAFER 83-447] VINOPAL, T. Probable missions and transportatic regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sys VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685] VON PUTTKAMER, J. With the Space Shuttle towards spa VONALT, C. Feasibility of remotely manipulated A step in the development of novel J	lexible p 35 solar sa p 44 p 53 p 44 p 53 p 53 tion - f stems p 34 mping p 37 p 66 ace indi p 75 l weldin ioining	viscoelastic A84-26977 A84-26977 A84-26977 A84-11823 aarios to use A84-19812 Fundamental A84-24991 of partially N84-13376 A84-13376 ustrialization A84-28975 ng in space. technologies
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatic regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685] VON PUTTKAMER, J. With the Space Shuttle towards spa VONALT, C. Feasibility of remotely manipulated A step in the development of novel j [NASA-CR-175437]	lexible p 35 solar sa p 44 p 53 p 44 p 53 p 53 tion - f stems p 34 mping p 37 p 66 ace indi p 75 l weldin ioining	viscoelastic A84-26977 A84-26977 A84-26977 A84-11823 aarios to use A84-29854 surfaces A84-19912 Fundamental A84-24991 of partially N84-13608 A84-13376 ustrialization A84-28975 og in space.
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-47] VINOPAL, T. Probable missions and transportati regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec (AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DET LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685] VON PUTTKAMER, J. With the Space Shuttle towards spa VONALT, C. Feasibility of remotely manipulated A step in the development of novel] [NASA-CR-175437] VONTIESENHAUSEN, G. Tethers in space: Birth and growth	lexible p 35 solar sa p 44 on scer p 76 cts on s p 53 tion - f sterns p 34 mping p 37 p 66 ace indi p 75 I welding p 60	viscoelastic A84-26977 A84-26977 A84-26977 A84-21823 aarios to use A84-29854 surfaces A84-19912 Fundamental A84-24991 of partially N84-13608 A84-13376 ustrialization A84-28975 ng in space. technologies N84-20857
in circular orbit in the presence of f rods VILLAEYS, J. Management of the radiolink of the s by radio-amateurs [IAF PAPER 83-447] VINOPAL, T. Probable missions and transportatii regenerative life support systems [AAS PAPER 83-201] VISENTINE, J. T. Low earth orbit atomic oxygen effec [AIAA PAPER 84-0548] VISWANATHAN, C. N. A degree of controllability defini concepts and application to modal sy VOLAND, R. T. Stability, vibration and passive da restrained imperfect columns [NASA-TM-85697] VON DER LIPPE, J. K. The Spacelab test program [AIAA PAPER 83-2685] VON PUTTKAMER, J. With the Space Shuttle towards spa VONALT, C. Feasibility of remotely manipulated A step in the development of novel] [NASA-CR-175437] VONTIESENHAUSEN, G.	lexible p 35 solar se p 44 on scer p 76 cts on s p 53 tion - f stems p 34 mping p 37 p 66 ace indd p 75 l weldin ioining p 60 h of a	viscoelastic A84-26977 A84-26977 A84-26977 A84-21823 aarios to use A84-29854 surfaces A84-19912 Fundamental A84-24991 of partially N84-13608 A84-13376 ustrialization A84-28975 ng in space. technologies N84-20857

W

WADA,	В.	K.
-------	----	----

Technology requirements for structures	large fle	xible space
[IAF PAPER 83-404]	p 2	A84-11811
The 55-meter-structure flight expe	eriment	
_	p 8	N84-17233
WAGNER-BARTAK, C. G.		
Remote manipulators in space	p 57	A84-22336
WAGNER-BARTAK, C. G. J.		
The Shuttle remote manipulator	system: (CANADARM

A robot arm in space p 57 A84-21486
WAGNER, D.
Intentity control of carbon fiber reinforced plastics

integrity control of carbon liber	remore	eo plasucs
structural elements, phase 1 report		
[TB-TS-11-01/82-A]	p 56	N84-18416

WALKER, D. H. Prediction of solar cell performance in space p 48 A84-22997 WALKER, J. B. Spacecraft thermal balance testing using infrared lamps on a dummy spacecraft n 26 N84-19399 WALKER R. Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949 Matrix(X) - Application to large space structure control p 16 A84-19129 design problems WALKLET, D. C. Alternative strategies for space station financing p 80 N84-21437 [NASA-CR-175412] WALLSOM, R. E. Synchronously deployable truss structure [NASA-CASE-LAR-13117-1] p 59 p 59 N84-16250 A manned-machine space station construction concept [NASA-TM-85762] p 21 N84-19395 WANG, S. J. Dynamics and control of a large space antenna p 32 A84-17361 WEEKS, G. E. Finite element analysis of a deployable space p 38 N84-16056 structure WEIGELT, G. Coherent arrays of separate optical telescopes in space p 3 A84-15363 project Trio WEIJERS, G. A. Experiment data communications (48 Mbit/s) between Spacelab, the Space Shuttle and the ground p 44 A84-10396 WELLS, R. Molecular contamination math model support [NASA-CR-170899] p 77 N84-10174 WESTPHAL, W. Photovoltaic solar arrays leading to a candidate space power system in the regime beyond 100 kW [IAF PAPER 83-422] p 44 p 44 A84-11817 WHITE, F. Understanding space settlements as human system [AAS PAPER 83-204] p 76 A84-2985 p 76 A84-29856 WHITE, K. P., III Systems considerations in mosaic focal planes p 75 A84-28576 WHITT. A. S. Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, p 76 A84-29852 1983 WIBERLEY, S. E. Composite structural materials [NASA-CR-173259] p 56 N84-17293 WIGHTMAN, J. P. Surface analysis of graphite fiber reinforced polyimide composites [NASA-TM-85700] p 55 N84-11220 WIGOTSKY, V. Higher temperature composite joints survive elimination p 55 A84-29565 tests Graphite/polyimide joints extend temperature limits p 55 A84-29572

WILLIAMS, F. W. Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an p 23 A84-14050 arbitrary supporting structure bitrary supporting structure provide the provided by the provi columns for use in space WINKLER, H. E. Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 WOLLENHAUPT, H. A deployable 30/20 GHz multibeam offset antenna [AIAA PAPER 84-0658] p 20 A84-25258 WOODCOCK, G. R. Space solar power in perspective p 71 A84-21489 Systems/operations technology WOODOOCK, G. R. p 11 N84-18278 Manufacturing space systems in space p 71 A84-22338 WOODS, A. The 55-meter-structure flight experiment p 8 N84-17233 WRIGHT, C. J. Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure p 23 A84-14050 WRIGHT, R. L. Space Station Technology, 1983 [NASA-CP-2293] p 11 N84-18277 WYNVEEN, R. A. Environmental Control and Life Support for an

evolutionary Space Station [SAE PAPER 831108] p 5 A84-29043 X

XU. D. M.

On modeling and simulation of the dynamics of tether connected satellite systems p 30 A84-11933

Y

YATES, D. F.

- A heuristic method for the design of minimum weight trusses using discrete member sizes p 15 A84-16841 YEDAVALLI, R. K.
- Determination of critical parameters in large flexible space structures with uncertain modal data
- p 33 A84-20047 Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian) regulators

[AD-A137760]	p 43	N84-21172
VOUNG L F		

Solar array Shuttle flight experiment - Hardware development and testing p 47 A84-22961

Ζ

ZHUKHOVITSKIY, Y. M.

Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents

[NASA-TM-77534] p 26 N84-18576 ZILANI, M.

- Design and development of the INTELSAT V graphite-epoxy central thrust tube p 19 A84-22153 ZIMCIK, D. G.
- Flight test of a synthetic aperture radar antenna using STEP p 9 N84-17237 ZIMMERMAN, R. J.

A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 ZINNER, E.

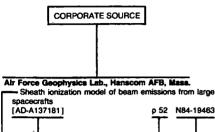
Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949

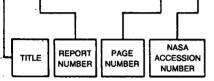
CORPORATE SOURCE INDEX

TECHNOLOGY FOR LARGE SPACE SYSTEMS / A Bibliography (Supplement 11)

JANUARY 1985

Typical Corporate Source Index Listing





Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

Δ

- Aeritalia S.p.A., Torino (Italy),
- Development of a spacecraft infrared test technique as an alternative to solar simulation. First steps on L-SAT p 26 N84-19398 thermal mode
- Heat pipes for the L-SAT communications module radiators p 26 N84-19405
- The thermal design of L-SAT large telecommunication p 27 N84-19414 satellite Design and manufacturing of a heat rejection system
- p 27 N84-19434 for advanced thermal control Thermal control of tethered satellite in a very low altitude
- p 27 N84-19444 aerodynamic mission Aerojet-General Corp., Sacramento, Calif.
- p 11 N84-18283 Auxiliary propulsion Aerospace Corp., Los Angeles, Calif.
- A review of SCATHA satellite results: Charging and scharging p 50 N84-17254 discharging Air Force Academy, Colo.
- Parameter identification in continuum models p 16 A84-25525 Scale model testing for control system parameters of
- large structures [AD-A135652] p 41 N84-18313 Air Force Geophysics Lab., Hanscom AFB, Mass.
- Sheath ionization model of beam emissions from large spacecrafts p 52 N84-19463 [AD-A137181]
- Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Selection of noisy sensors and actuators for regulation of linear systems [AD-A135442] p 51 N84-17931
- Decentralized control of a large space structure using direct output feedback
- [AD-A136781] p 41 N84-19464 The effect of mass and stiffness changes on the damping factor in a large space structure as represented by the CSDL 2 model
- [AD-A136984] p 42 N84-19465

Discontinuous low thrust orbit transfer p 63 N84-19474 [AD-A136908]

- Alabama Univ., Huntsville. Finite element analysis of a deployable space
- p 38 N84-16056 structure Applied Physics Lab., Johns Hockins Univ., Laurel, Md. Large space instrumentation to measure the interaction between space structures and the environment
- p 77 N84-10179 [AD-A129990] Applied Solar Energy Corp., City of Industry, Calif. Large area, low cost space solar cells
- p 47 A84-22979 Arizona State Univ., Tempe.
- Feasibility study to conduct windblown sediment experiments aboard a space station [NASA-CR-175434] p 15 N84-21586
- Astro Research Corp., Carpinteria, Calif. The STEP/STACBEAM experiment technology
- p 8 N84-17220
- Maintenance and operational enhancement of the flexible spacecraft dynamics program

В

- Bendix Corp., Teterboro, N.J. Modular design attitude control system p 41 N84-19392 [NASA-CR-170996] Exhibit D modular design attitude control system study [NASA-CR-170993] p 42 N84-20625 Boeing Aerospace Co., Houston, Tex. Integrated water management system - Description and
- toet roculte [SAE PAPER 831111] p 6 A84-29046
- Hyperfiltration wash water recovery subsystem Design and test results p 6 A84-29047 [SAE PAPER 831112]
- Boeing Aerospace Co., Seattle, Wash.
- Study of auxiliary propulsion requirements for large space systems. Volume 1: Executive summary p 63 N84-12226 [NASA-CR-168193-VOL-1]
- Study of auxiliary propulsion requirements for large space systems, volume 2
- [NASA-CR-168193-VOL-2] p 63 N84-13218 Space station needs, attributes and architectural options
- study. Volume 1: Executive study [NASA-CR-173334] o 9 N84-18265 Space station needs, attributes and architectural options
- study. Volume 2: Mission analysis [NASA-CR-173333] p 9 N84-18266 Space station needs, attributes and architectural options
- study. Volume 3: Requirements [NASA-CR-173332] p 10 N84-18267
- Space station needs, attributes and architectural options study. Volume 4: Architectural options, subsystems, technology and programmatics [NASA-CR-173331]
- p 10 N84-18268 Space station needs, attributes and architectural options tudy. Final executive review [NASA-CR-173335]
- p 10 N84-18269 p 11 N84-18278 Systems/operations technology
- Boeing Scientific Research Labs., Seattle, Wash. Simulated space radiation effects on dielectrics and p 54 A84-20682 coatings
- British Aerospace Dynamics Group, Stevenage (England).
- Design and development of an advanced solar array p 17 N84-18457 drive mechanism p 17 N84-18475 BAe reaction wheels for Olympus
- British Aerospace Public Ltd. Co., Bristol (England). Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure p 23 A84-14050
- Brown Univ., Providence, R. I.
 - Parameter identification in continuum models p 16 A84-25525

С

- California Univ., Los Angeles Approximations method for space frame synthesis
- p 19 A84-10141
- Active control of large flexible space structures p 37 N84-14235 Research on boundary feedback and control theories,
- 1978 1983 p 41 N84-18987 [AD-A136531]
- CAP Sogeti Logiciel, Toulouse (France). Software production in a large space project: The SPOT
- p 78 N84-14752 mission center Carnegie-Mellon Univ., Pittsburgh, Pa
- Recursive lagrangian dynamics of flexible manipulator arms via transformation matrices [AD-A137345] p 60 N84-20316
- Case Western Reserve Univ., Cleveland, Ohio. Gravitational biology on the space station
- [SAE PAPER 831133] p 75 A84-29063 Centre National d'Etudes Spatiales, Toulouse (France). A Maltese cross shaped mobile thermal control
- p 27 N84-19454 shutter Chicago Univ., Ili.
- Pyroelectric materials as electronic pulse detectors of ultraheavy nuclei p 72 A84-23440 Clemson Univ., S.C.
- Hyperfiltration wash water recovery subsystem Design and test results
- [SAE PAPER 831112] p 6 A84-29047 Colorado State Univ., Fort Collins. Current collection from the space plasma through defects in high voltage solar array insulation
- p 49 N84-15970 Columbia Univ., New York. A degree of controllability definition - Eurodamental
- concepts and application to modal systems
- p 34 A84-24991 Actuator placement considerations for the control of p 20 large space structures N84-11199
- Committee on Appropriations (U. S. Senate).
- Urban Department of Housing and Development-independent agencies appropriations for 1984: National Aeronautics and Space Administration p 80 N84-21440
- Committee on Commerce, Science, and Transportation (U. S. Senate). Civil space station
- [S-REPT-98-523] p 79 N84-20613 National Aeronautics and Space Administration uthorization Act, 1985 p 80 N84-21443
- Authorization Act. 1985 Committee on Science and Technology (U. S. House). NASA's space station activities
 - (GPO-27-393) p 7 N84-14234 National Aeronautics and Space Administration Act,
- 1985 p 9 N84-18116 Authorizing appropriations to the National Aeronautics and Space Administration for fiscal year 1985
- [H-REPT-98-6291 p 80 N84-21441 Review of the National Aeronautics and Space Act of
- 1958 [GPO-28-915] p 80 N84-21442
- National Aeronautics and Soace Administration Authorization Act, 1985
- [H-REPT-98-629] p 80 N84-21444 Communications Satellite Corp., Washington, D.C.
- Space station needs, attributes and architectural options. Part 1: Summary [NASA-CR-175382] p 10 N84-18270
- Concordia Univ., Montreal (Quebec).
- Computer aided synthesis of a satellite antenna structure p 21 N84-19899 with probabilistic constraints Dynamic behaviour of a satellite antenna structure in
- p 42 N84-19900 random vibration environment Consulenze Generali Roma (Italy).
- Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 1 p 43 N84-21611 [ESA-CR(P)-1779-VOL-3]
- The solution of the dynamic problem of the periodic structures by cyclosymmetric technique
 - p 43 N84-21612

S O U R C Ξ

- development for very large solar array deployers Avco Systems Div., Lowell, Mass.
- p 41 N84-19394 [NASA-CR-175211]

Contraves Corp., Zurich (Switzerland).

Computing the radiation pressure forces by adapting thermal design verification softwares p 28 N84-21613 Simplified models and computational schemes of the aerodynamic load p 28 N84-21614 Finite element formulations for tensioned members

p 21 N84-21615 Study on synthesis and characterization of large space systems, phase 2. Part 2: Proposals for additions, modifications and new analytical methods, volume 2 [ESA-CR(P)-1779-VOL-4] p 29 N84-21616

Thermal design verification of the large open truss structures. The local approach and the shadow problem p 29 N84-21617

Computational savings in view factor evaluation on mode prescreening p 29 N84-21618 Interactive structural-thermal-control analytical formulations p 29 N84-21619

Study on synthesis and characterization of large space systems, phase 2. Part 3: Experimental design verification techniques

- [ESA-CR(P)-1779-VOL-5] p 18 N84-21620 Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Experimental techniques in structural analysis p 29 N84-21621
- Assessment of the existing ground test technology and confronting with the Large Space Structures (LSS) requirements. Thermal test techniques

p 29 N84-21622 Proposals for additions, modifications, and new experimental methods. Part 1: Ground tests. Part 2 p 15 N84-21623 Flight tests

Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 1: Mechanical design

[ESA-CR(P)-1779-VOL-1] p 18 N84-21624 Study on synthesis and characterization of large space systems, phase 2. Part 1: Assessment of design verification analytical methods. Volume 2: Thermal

[ESA-CR(P)-1779-VOL-2] p 18 N84-21625 Contraves Corp., Zurich (Switzerland).

Study on large, ultralight long-life structures in space,

p 17 N84-17284 [TM-EKB3] Space telescope: Solar array primary development p 51 N84-18458 mechanism

D

Dayton Univ., Ohio

The effects of the space environment on damping materials and damping designs on flexible structures p 56 N84-17217

Department of Communications, Ottawa (Ontario). Canadian Attitude Sensing Experimental Package (CASEP) p 79 N84-17223

Flight test of a synthetic aperture radar antenna using STEP p 9 N84-17237 Deutsche Forschungs- und Versuchsanstatt fuer Luft-

und Raumfahrt, Goettingen (West Germany). Development of procedures for component mode

Synthesis [DFVLR-IB-232-82-C-09] p 30 N84-21626

Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

Modern software development tools in space projects on the example of a Spacelab experiment p 49 N84-14761

Study on damping representation related to spacecraft structural design

[EMSB-18/83] p 38 N84-15182 The complementary roles of existing and advanced environmental, thermal control and life support technology

for space stations p 79 N84-19429 aper (Charles Stark) Lab., Inc., Cambridge, Mass.

- p 36 A84-29471 Constraints ACOSS eleven (Active Control Of Space Structures), volume 1 [AD-A135675] p 40 N84-18311
- ACOSS eleven (Active Control Of Space Structures), volume 2 [AD-A135676] p 41 N84-18312

E

- Engineering and Economics Research, Inc., Vienna, Va.
- Starlab Ground System guidelines document p 14 N84-20435 [NASA-CR-175192]

An Attached Payload Operations Center (APOC) at the Goddard Space Flight Center (GSFC), volume 1 p 79 N84-20605 [NASA-CR-175160] p 79 N8-Erno Raumfahrttechnik G.m.b.H., Bremen (West

Germany).

Software quality assurance Spacelab experience and n 17 N84-14759 future trends Integrity control of carbon fiber reinforced plastics structural elements, phase 1 report (TB-TS-11-01/82-A1 p 56 N84-18416 Essex Corp., Huntsville, Ala. Analysis of large space structures assembly: Man/machine assembly analysis [NASA-CR-3751] p 59 N84-13208 Space telescope [NASA-CR-170948] p 78 N84-16097 European Space Agency, Paris (France). Spacecraft/plasma interactions and their influence on field and particle measurements [ESA-SP-198] p 56 N84-17253 Spacelab data book [ESA-BR-14] p 79 N84-18315 Environmental and thermal control systems for space vehiclos [ESA-SP-200] p 26 N84-19396 Thermal cycling tests in space environ nment simulatio chambers p 26 N84-19401 Introduction to geostationary orbits p 80 N84-21590 [ESA-SP-1053] Derivation and combination of impedance matrices for flexible satellites p 43 N84-21604 [ESA-STR-209] European Space Research and Technology Center, Noordwijk (Netherlands). Spacecraft thermal balance testing using infrared lamps p 26 N84-19399 on a dummy spacecraft

IRSIM: A program for the calculation of infrared flux intensity incident on a spacecraft inside a test chamber p 26 N84-19400

The Large Space Simulator (LSS) at ESA/ESTEC (a summary of the main characteristics) p 27 N84-19458

F

- Fondazione Ugo Bordoni, Rome (Italy). The small transmitter receiver stations in the Sirio
- experiment [FUB-50-1982] p 49 N84-15386 Fulmer Research Inst. Ltd., Stoke Poges (England).

Review report of the third year's activities on the study survey of advanced materials [R878] p 56 N84-21675

G

- General Dynamics/Convair, Fort Worth, Tex.
- Space station needs, attributes and architectural options. Summary of major study activities and results. Space station program observations [NASA-CR-173345] p 11 N84-18275

Definition of technology development missions for early space stations orbit transfer vehicle serving. Phase 2, task 1: Space station support of operational OTV servicing

p 14 N84-19377 [NASA-CR-170984] General Dynamics Corp., San Diego, Calif.

- Photovoltaic concentrator pointing dynamics and plasma interaction study p 50 N84-17224 Crew and life support: ECLSS p 11 N84-18280
- General Electric Co., Fairfield, Conn. Space station needs, attributes and architectural options. Part 1: Summary
- [NASA-CR-175382] p 10 N84-18270 General Electric Co., Philadelphia, Pa.
- Investigation of articulated panel dynamics p 40 N84-17230
- p 21 N84-18286 Structures and mechanisms Space Station needs, attributes and architectural options. Volume 2, book 2, part 2, Task 2: Information
- management system [NASA-CR-173317] p 13 N84-18301
- General Research Corp., Santa Barbara, Calif. RF systems in space. Volume 2: Space-based radar analyses
- [AD-A133735] p 49 N84-14394 RF systems in space. Volume 1: Space antennas
- frequency (SARF) simulation p 49 N84-14395 [AD-A133734]
- Grumman Aerospace Corp., Bethpage, N.Y. Orbiter-based construction equipment study. The HPA/DTA technology advancement plan
- p 17 N84-14233 [NASA-CR-174605]

Space station needs, attributes and architectural options. Part 1: Summary

[NASA-CR-175382] p 10 N84-18270 p 25 N84-18289 Thermal control Space Station needs, attributes and architectural Volume 2, book 1, part 1: options. Mission

requirements [NASA-CR-173312] p 13 N84-18296 Space Station needs, attributes and architectural

options. Volume 2, book 1, part 2, task 1: Mission requirements [NASA-CR-173313] p 13 N84-18297

Space Station needs, attributes and architectural options. Volume 2, book 1, part 3: Manned Space Station relevance to commercial telecommunications satellites [NASA-CR-173314] p 13 N84-18298

Space Station needs, attributes and architectural options. Volume 2, book 1, part 4: Payload element mission data sheets [NASA-CR-173315] p 13 N84-18299

Space Station needs, attributes and architectural options. Volume 2, book 2, part 1: Mission implementation concepts [NASA-CR-173316]

p 13 N84-18300 Space Station needs, attributes and architectural options. Volume 2, book 2, part 2, Task 2: Information management system

[NASA-CR-173317] p 13 N84-18301 Space Station needs, attributes and architectural options. Volume 2, book 2, part 3: Communication system [NASA-CR-173318]

p 14 N84-18302 Space Station needs, attributes and architectural options, volume 2, book 2, part 4: International reports p 14 N84-18303 [NASA-CR-173319]

Space Station needs, attributes and architectural options, volume 2, book 3: Cost and programmatics [NASA-CR-173320] p 14 N84-1 p 14 N84-18304

Ы

Honeywell, Inc., Clearwater, Fla.

Manipulator interactive design with interconnected flexible elements p 58 A84-25484

Howard Univ., Washington, D. C. The dynamics and control of large flexible space

structures, 6 p 36 N84-10173 [NASA-CR-174450]

Environmental effects on the dynamics and control of an orbiting large flexible antenna system

- p 42 N84-20627 [NASA-CR-175448]
- Hughes Alrcraft Co., Los Angeles, Calif. Welded solar cell interconnection p 19 A84-22965

1

Indian Inst. of Science, Bangalore. Control structure interactions in large space structures p 35 A84-27934 Analysis using energy approach Institut National de Recherche d'Informatique et d'Automatique, Rocquencourt (France).

Validation methods for mathematical models of flexible satellite dynamics

[ESA-CR(P)-1794] p 40 N84-17241 stitute of Space and Astronautical Science, Tokyo (Japan).

Thermofluidynamics of heat pipes p 27 N84-19423 Instituto de Pesquisas Espaciais, Sao Jose dos

Campos (Brazil).

Sensitivity analysis of the influence of the flexibility of solar panels on the attitude dynamics of artificial satellites

p 39 N84-16232 [INPE-2763-PRE/337]

Capture of satellite stabilized by gravity gradient with a flexible mast during and after deployment p 41 N84-19383 [INPE-2749-PRE/325]

Iowa Univ., Iowa City. Interpretation of STS-3/plasma diagnostics package

results in terms of large space structure plasma interactions

p 78 N84-16991 [NASA-CR-173266]

Istituto di Ricerca e Tecnologia per lo Studio del Plasma Nello Spazio, Frascati (Italy). Orbiting wire as a dynamo: Auxiliary power possibilities

for space platforms [IFSI-83-3] p 49 N84-12653

J

Jet Propulsion Lab., California Inst. of Tech., Pasadena

Technology requirements for large flexible space [IAF PAPER 83-404]

p 2 A84-11811

C-2

Closed-form solutions for feedback control with terminal

CORPORATE SOURCE

- Simulation of the Galileo spacecraft axial Delta-V algorithm p 66 A84-11938 Model error estimation for distributed systems described by elliptic equations p 15 A84-11946 Large Deployable Reflector (LDR) - A concept for an orbiting submillimeter-infrared telescope for the 1990s p 66 A84-14586
- An advanced generation land mobile satellite system and its critical technologies p 3 A84-15634 Science platform and attitude subsystem in-flight
- calibration for the Galileo spacecraft p 32 A84-17355 Dynamics and control of a large space antenna p 32 A84-17361
- Simulated space radiation effects on dielectrics and coatings p 54 A84-20682 New directions in solar array development
- p 47 A84-22958 Use of electromagnetic models in the optimal control
- of large space antennas p 35 A84-25552 Evaluation of spacecraft materials and processes for
- optical degradation potential p 54 A84-28458 Electrically conductive black optical paint p 55 A84-28553
- p 55 A84-28553 Space manufacturing 1983; Proceedings of the Sixth Conference, Princeton University, Princeton, NJ, May 9-12, 1983 p 76 A84-29852
 - The 55-meter-structure flight experiment
 - p 8 N84-17233

L

- La Jolla Inst., Calif.
- Identification of new potential scientific and technology areas for DoD application. Summary of activities [AD-A134372] p 78 N84-17050
- A degree of controllability definition Fundamental concepts and application to modal systems
- p 34 A84-24991 Manipulator interactive design with interconnected flexible elements p 58 A84-25484
- Life Systems, Inc., Cleveland, Ohio. Environmental Control and Life Support for an
- evolutionary Space Station [SAE PAPER 831108] p 5 A84-29043
- LinCom Corp., Los Angeles, Calif. User manual of the CATSS system (version 1.0) communication analysis tool for space station
- [NASA-CR-171728] p 51 N84-17431 Little (Arthur D.), Inc., Cambridge, Mass. Human capabilities p 11 N84-18282
- Lockheed Alrcraft Corp., Burbank, Calif. On-orbit spacecraft/stage servicing during STS life cycle
- [NASA-CR-171775] p 79 N84-20617 Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
- A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 Knowledge based systems for intelligent robotics p 57 A84-15667
- Lockheed Missiles and Space Co., Palo Atto, Calif. Hyperfiltration wash water recovery subsystem - Design and test results
- [SAE PAPER 831112] p 6 A84-29047 Effects of combined ultraviolet and oxygen plasma environment on spacecraft thermal control materials
- p 27 N84-19449 Lockheed Missiles and Space Co., Sunnyvale, Calif. Technology requirements for large flexible space structures
- surcures

 [IAF PAPER 83-404]
 p 2
 A84-11811

 Solar array Shuttle flight experiment Hardware development and testing
 p 47
 A84-22961

 New component development for multi-100 kW low-cost solar array applications
 p 47
 A84-22963

 Attitude, control and stabilization
 p 40
 N84-18281

 Power
 p 12
 N84-18288

 Space station needs, attributes and architectural
- options. Volume 4, attachment 1: Task 2 and 3 mission implementation and cost [NASA-CR-173330] p 12 N84-18290
- Space station needs, attributes and architectural options. Volume 2, attachment 2: Supporting data and analysis reports [NASA-CR-173329] p.12 N84-18291
- [NASA-CR-173329] p 12 N84-18291 Space station needs, attributes and architectural options. Volume 1: Executive summary NASA
- (NASA-CR-172792) p12 N84-18292 Space station needs, attributes and architectural options. Volume 1, attachment 1: Executive summary NASA
- [NASA-CR-173337] p 12 N84-18293

Space station needs, attributes and architectural options. Volume 1, attachment 2: Supporting data and analysis reports (NASA-CR-173336) p 13 N84-18294

М

Martin Marietta Aerospace, Bethesda, Md.

- Space station needs, attributes and architectural options study. Briefing material: Final review and executive summary [NASA-CR-173321] p 10 N84-18273 Martin Marletta Áerospace, Denver, Colo. Static shape forming for an electrostatically controlled p 16 A84-25551 membrane mirror Technology needs of advanced Earth observation snacecraft p9 N84-17248 (NASA-CR-3698) Martin Marietta Corp., Denver, Colo. Molecular contamination math model support [NASA-CR-170899] p 77 N84-10174 Evaluation and prediction of long-term environmental effects of nonmetallic materials, second phase p 56 N84-11595 [NASA-CR-170915] p 11 N84-18284 Fluid management
- Massachusetts Inst. of Tech., Cambridge. Space applications of Automation, Robotics And Machine Intelligence Systems (ARAMIS). Volume 3, phase 2: Executive summary [NASA-CR-3736] p 59 N84-10582
- Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 1: Telepresence technology base development [NASA-CR-3734] p 59 N84-10583
- Space Applications of Automation, Robotics and Machine Intelligence Systems (ARAMIS), phase 2. Volume 2: Telepresence project applications
- [NASA-CR-3735] p 59 N84-10584 Reliability issues in active control of large flexible space structures
- [NASA-CR-175341] p 39 N84-16248 General requirements for Shuttle flight experiments p 8 N84-17221
- Feasibility of remotely manipulated welding in space. A step in the development of novel joining technologies [NASA-CR-175437] p 60 N84-20857 Implementation of MACLISP on a large address space
- computer [DE84-005042] p 79 N84-21145
- Max-Planck-Inst. fuer Kemphysik, Heidelberg (West Germany).
- Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636] p 52 A84-10949 McDonnell-Douglas Astronautics Co., Huntington
- Beach, Calif. STEP flight experiments Large Deployable Reflector
- (LDR) telescope
 p 8
 N84-17231

 Space Station needs, attributes and architectural options: Summary briefing
 [NASA-CR-173328]
 p 10

 [NASA-CR-173328]
 p 10
 N84-18271

 Data management
 p 12
 N84-18287
- McDonnell-Dougias Technical Services Co., Inc., Huntsville, Ala.
- A definition of STS accommodations for attached payloads
- [NASA-CR-172223] p 17 N84-10114 Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn
- (West Germany). Spacecraft thermal control selection for seven years of
- lifetime in synchronous orbit [MBB-UR-584-82-OE] p 25 N84-11200
- MIchigan State Univ., East Lansing. The Alpha-Helix Concept: Innovative utilization of the Space Station Program. A report to the National Aeronautical and Space Administration requesting establishment of a Sensory Physiology Laboratory on the Space Station [NASA-CR-175436] p 14 N84-20610
- [NASA-CR-175436] p 14 N84-20610 Mission Research Corp., Santa Barbara, Calif.
- The effects of apenure antennas after signal propagation through anisotropic ionized media [AD-A138286] p 52 N84-21781
- Mississippi State Univ., State College. An evaluation of Techroli seal flexible joint material
- p 56 N84-16037 Monsanto Research Corp., St. Louis, Mo.
- Erosion of mylar and protection by thin metal films [AtAA PAPER 83-2636] p 52 A84-10949

N

- National Aeronautics and Space Administration, Washington, D. C.
- Space station autonomy requirements [AIAA PAPER 83-2352] p 63 A84-10024
- NASA priority technologies [IAF PAPER 83-345] p 1 A84-11793
- High capacity power systems for space [IAF PAPER 83-421] p 44 A84-11816
- Space Shuttle, private enterprise and intellectual properties in the context of space manufacturing
 - p 72 A84-22341 Architectural options and development issues
- p 4 A84-24633
- Space station architectural issues as viewed by the user community Applications p 4 A84-24634
- Lessons learned during the first year of the TDRSS [AIAA PAPER 84-0687] p 74 A84-25319 NASA research in teleoperation and robotics
- p 58 A84-28523 International aspects of commercial space activities [AAS PAPER 83-222] p 77 A84-29866
- [AAS PAPER 83-222] p 77 A84-29866 The US space station: Potential base for a spaceborne microwave facility p 78 N84-16420
- Second All-Union Seminar on Hydromechanics and Heat-Mass Transfer in Weightlessness. Abstracts of reports: Table of contents
- (NASA-TM-77534) p 26 N84-18576 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
- Research Center, Moffett Field, Calif. Large Deployable Reflector (LDR) - A concept for an orbiting submillimeter-infrared telescope for the 1990s
- orbiting submillimeter-infrared telescope for the 1990s p 66 A64-14586 Environmental Control and Life Support for an evolutionary Space Station
- evolutionary Space Station [SAE PAPER 831108] p 5 A84-29043 National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
 - Resources Labs., Bay St. Louis, Miss. Overview of NASA space station activities
- [IAF PAPER 83-48] p 1 A84-11726 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbeit, Md. Data system architecture considerations for a space
- station [AIAA PAPER 83-2346] p 63 A84-10066 Assessment of potential for batteries in space
- applications p 48 N84-12246 NASA needs and trends in cryogenic cooling
- p 25 N84-15329 Thermally induced spin rate ripple on spacecraft with
- long radial appendages [NASA-TM-85058] p 39 N84-16249
- Thermal energy management process experiment p 25 N84-17222 Spacelab Data Processing Facility
- [NASA-TM-85556] p 51 N84-19382
- Recent and planned developments at the Goddard Space Flight Center in thermal control technology p 26 N84-19402

p 26 N84-19402 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

- Space station communications and tracking equipment anagement/control system p 45 A84-15639 management/control system Communications, tracking, and docking on the Space tation p 45 A84-15640 Station Application of beam power technology to a space p 45 A84-15642 station A communications system conceptual design for a low earth orbiting Manned Space Station p 45 A84-15643 Low earth orbit atomic oxygen effects on surfaces [AIAA PAPER 84-0548] p 53 A84-19912 A system study of the solar power satellite concept p 70 A84-21480 p 72 A84-24627 The role of man in space Control structure interactions in large space structures Analysis using energy approach p 35 A84-27934 Thermal management system technology development or space station applications Systems engineering aspects of a preliminary noceptual design of the [SAE PAPER 831097] conceptual design of the space station environmental control and life support system p 5 A84-29044 [SAE PAPER 831109] Integrated water management system - Description and test results [SAE PAPER 831111] p 6 A84-29046 Hyperfiltration wash water recovery subsystem - Design and test results [SAE PAPER 831112] p 6 A84-29047 Regenerable non-venting thermal control subsystem for
- extravehicular activity [SAE PAPER 831151] p 24 A84-29076
- Habitability design elements for a space station

 [AAS PAPER 83-200]
 p 7

 AB4-29853

 Space station energy sizing
 p 48

NASA. John F. Kennedy Space Center, Cocoa Beach, Fla.

N

N

IASA. John F. Kennedy Sj	bace Center, Cocoa
The Boeing flywheel study	p 37 N84-12235
Space station control requirement	
weights for combined momentum a	nd energy storage
lational Aeronautics and Space Ac	p 37 N84-12236 Iministration, John
F. Kennedy Space Center, Cocoa	Beach, Fla.
STS-9: Orbital workshop spacelal	o to fly on ninth Shuttle
mission [NASA-TM-85497]	p 78 N84-16242
lational Aeronautics and Space Ac	iministration.
Langley Research Center, Hampt A system for intelligent teleopera	
[AIAA PAPER 83-2376]	p 57 A84-10070
Overview of NASA space station	
[IAF PAPER 83-48] Buckling and vibration of any prism	p 1 A84-11726 atic assembly of shear
and compression loaded anisol	ropic plates with an
arbitrary supporting structure Vertical ascent from earth to	p 23 A84-14050
[AIAA PAPER 84-0509]	p 61 A84-18141
Integrated requirements for a spa	
Static shape forming for an elect	p 4 A84-24628 trostatically controlled
membrane mirror	p 16 A84-25551
NASA research in teleoperation a	and robotics p 58 A84-28523
Closed-form solutions for feedbac	
constraints	p 36 A84-29471
Surface analysis of graphite fiber composites	r reintorcea polytimide
[NASA-TM-85700]	p 55 N84-11220
Research and technology, 1983 [NASA-TM-85702]	p 7 N84-12026
Integrated Flywheel Technology,	
[NASA-CP-2290]	p 78 N84-12228
Advanced Control and Powe technology program	r System (ACAPS) p 37 N84-12243
Stability, vibration and passive	
restrained imperfect columns	- 07 No / 10000
[NASA-TM-85697] An alternate concept for expandi	p 37 N84-13608 ng man's presence in
space	
[NASA-TM-84617] Capture-ejector satellites	p 7 N84-15172
[NASA-TM-85686]	p 7 N84-15179
Thermal analysis research applic	able to space station
technology needs [NASA-TM-84658]	p 25 N84-15426
Synchronously deployable truss s	structure
[NASA-CASE-LAR-13117-1] Surface accuracy measureme	p 59 N84-16250
50-meter antenna surface model	
[NASA-TM-85689] STEP Experiment Requirements	p 17 N84-16427
[NASA-CP-2294]	p7 N84-17211
Space Technology Experimen	ts Platform (STEP)
overview STEP mechanical systems	р8 N84-17212 р8 N84-17213
STEP experiment integration	p 8 N84-17215
Deployable beam flight experime	nt (MAST) ρ8 N84-17218
Erectable beam experiment	p 60 N84-17219
Vibration isolation technology exp	periment
Integrated Power/Attitude Cont	p 39 N84-17228 rol System (IPACS)
technology experiment	p 39 N84-17229
Large deployable antenna flig Space Technology Experiments Pla	
opade recinicity Experimenta re	p 8 N84-17232
Large inflated-antenna system	p 9 N84-17234
Adaptive microwave reflector Microwave reflector character	p 50 N84-17235 ization using simple
instruments in EVA	p 50 N84-17236
Spline-based estimation technique elliptic distributed systems	ues for parameters in
[NASA-TM-85439]	p 9 N84-17947
Space Station Technology, 1983	- 11 NO4 40077
[NASA-CP-2293] A manned-machine space	p 11 N84-18277 station construction
concept	
[NASA-TM-85762] Construction concept for ere	p 21 N84-19395
antenna	-
[NASA-TM-85774]	p 60 N84-20626
Static and dynamic structural calculations in the finite-element	
Analysis Language (EAL) system	
[NASA-TM-85743] Operational modules for space	p 42 N84-20880
Operational modules for space [NASA-TM-85772]	p 21 N84-21608
Computer-Aided Geometry Mode	ling
[NASA-CP-2272] Interactive geometry modeling	p 18 N84-22179 of space station
conceptual designs	p 18 N84-22191
Mathematical synthesization of c	omplex structures

Mathematical synthesization of complex structures p 19 N84-22224

Geometric modeling of large space antenna p 22 N84-22225 deployment National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

NASA priority technologies

[IAF PAPER 83-3451 p 1 A84-11793 NASA's geostationary communications platform rogram

[AIAA PAPER 84-0702] p 5 A84-25326 On modeling dilution jet flowfields

[AIAA PAPER 84-1379] p 58 A84-44183 Resistojet propulsion for large spacecraft systems [NASA-TM-83489] p 63 N84-11206

Radiating dipole model of interference induced in spacecraft circuitry by surface discharges p 50 N84-16247 [NASA-TP-2240]

The role of potential barrier formation in spacecraft harging p 50 N84-17269 charging

National Aeronautics and Space Administration. Marshail Space Flight Center, Huntsville, Ala.

Launch processing for Spacelab 1 [AIAA PAPER 83-2622]

p 64 A84-10965 A programmable power processor for high power space pplications p 46 A84-18394 applications

Space platform accommodations p 16 A84-22131 Solar array Shuttle flight experiment - Hardware evelopment and testing p 47 A84-22961 development and testing NASA's geostationary communications platform

program [AIAA PAPER 84-0702] p 5 A84-25326

Self-locking telescoping manipulator arm [NASA-CASE-MFS-25906-1] p 55 p 59 N84-11761 Space station attitude control system concept and

requirements p 37 N84-12234 IPACS attitude control technology considerations p 37 N84-12238

p 37 N84-12238 IPACS guidance navigation and considerations and test activities p 37 N84-12245 Significant scientific and technical results at Marshal Space Flight Center

[NASA-TM-82562] p 78 N84-16075 Tethers in space: Birth and growth of a new avenue space utilization

[NASA-TM-82571] n 18 N84-21607 National Centre of Tribology, Risley (England).

Thermal conductance and torque of thin section four-point contact ball bearings in vacuum

[ESA-ESTL-54] p 25 N84-15562 National Space Development Agency, Tokyo (Japan). Evaluation of modal testing techniques for spacecraft

p 28 N84-19906 structures National Telecommunications and Information

Administration, Annapolis, Md. Assessment of satellite power flux-density limits in the

2025-2300 MHz frequency range, part 1 p 51 N84-18532 [PB84-129402]

Naval Academy, Annapolis, Md. Stability enhancement of a flexible robot manipulator p 59 N84-16807 [AD-A1341851 Nebraska Univ., Lincoln.

New elements for analysis of space frames with tapered p 20 N84-14561 members

Ο

Old Dominion Univ., Norfolk, Va.

Self-shadowing of orbiting trusses p 25 N84-16565 [NASA-CR-173215] Airborne antenna pattern calculations

[NASA-CR-173284] p 51 N84-17436 Component mode synthesis and large deflection vibrations of complex structures [NASA-CR-173338] p 21 N84-18680

Ρ

Perkin-Elmer Corp., Danbury, Conn. Optical coating in space [NASA-CR-175441] p 56 N84-21290 Purdue Univ., Lafayette, Ind. Analysis of large space structures p 18 N84-20621

R

RAND Corp., Santa Monica, Calif.

The flexural behavior of communication satellite) in orbit PACSAT (passive [AD-A131406] p 36 N84-11195

RCA Astro-Electronics Div., Princeton, N. J. A degree of controllability definition - Fundamental

concepts and application to modal systems p 34 A84-24991 Rensselaer Polytechnic Inst., Troy, N. Y. The spatial order reduction problem and its effect on adaptive control of distributed parameter systems p 33 A84-19056 Some applications of direct adaptive control to large structural systems p 34 A84-25496 Direct multivariable model reference adaptive control with applications to large structural systems p 38 N84-15840 Composite structural materials [NASA-CR-173259] p 56 N84-17293 Rockwell International Corp., Downey, Calif. Development of deployable structures for large space platform systems. Volume 1: Executive summary [NASA-CR-170913] p 20 N84-10175 Development of deployable structures for large space platforms. Volume 2: Design development [NASA-CR-170914] p 20 p 20 N84-10176 Development of Test Article Building Block (TABB) for p 21 N84-17226 deployable platform systems A deployable structure and solar array controls p 39 N84-17227 experiment for STEP Space Station needs, attributes, and architectural options study p 11 N84-18274 [NASA-CR-173327] Shuttle interaction study [NASA-CR-173400] p 80 N84-21592 Shutter interaction study extension [NASA-CR-173401] p 81 N84-21593 Shuttle interaction study extension [NASA-CR-173398] p 81 N84-21594 Shutter Interaction Study [NASA-CR-173402] p 81 N84-21595 Shuttle interaction study extension p 81 N84-21596 [NASA-CR-173403] Rockwell International Corp., Seal Beach, Calif.

N84-17225 configuration p 17 Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. A Variable Conductance Heat Pipe (VCHP) radiator

array structural

system for communications payloads p 27 N84-19406

S

Sandia Labs., Livermore, Calif.

Sodium heat transfer system modeling

Low concentration ratio solar

[DE84-002051] p 25 N84-16509 Smithsonian Astrophysical Observatory, Cambridge, Mass.

Investigation of electrodynamic stabilization and control of long orbiting tethers

[NASA-CR-170972] p 40 N84-17251 A large-area gamma-ray imaging telescope system [NASA-CR-175435] p 14 N84-20604

Southern Methodist Univ., Dailas, Tex. Parameter identification in continuum models

p 16 A84-25525 Space Communications Co., Gaithersburg, Md.

Study of a tracking and data acquisition system for the 1990's. Volume 3: TDAS Communication Mission Model p 79 N84-19371 [NASA-CR-175195]

Spire Corp., Bedford, Mass.

Large area space solar cell assemblies

p 61 A84-22980 Stanford Telecommunications, Inc., McLean, Va.

Study of a tracking and data acquisition system for the 1990's. Volume 3: TDAS Communication Mission Model p 79 N84-19371 [NASA-CR-175195]

Stanford Univ., Calif.

Control of flexible spacecraft by optimal model following p 36 N84-12222 Precise control of flexible manipulators

p 60 N84-20175 [NASA-CR-175389]

State Univ. of New York, Stony Brook. Gravitational biology on the space station [SAE PAPER 831133] p 75

p 75 A84-29063 Stevens Inst. of Tech., Hoboken, N. J.

Time domain analysis and synthesis of robust controllers for large scale LQG (Linear Quadratic Gaussian) regulators [AD-A137760]

[AD-A137760] p 43 N84-21172 Systems Science and Software, La Jolla, Calif. Plasma sheath structure surrounding a large powered

spacecraft [AIAA PAPER 84-0329] p 46 A84-18025

Т

Technische Univ., Darmstadt (West Germany).

Geodetic aspects of ESA projects, studies and p 78 N84-16677 investigations

CORPORATE SOURCE

- Technische Univ., Hanover (West Germany). Geometrically nonlinear analysis of beam-in-space structures [MITT-28] p 22 N84-21914
- Teledyne Brown Engineering, Huntsville, Ala. Space platform accommodations p 16 A84-22131
- Payload missions integration [NASA-CR-170949] p 7 N84-15171 Terra-Mar, Mountain View, Calif.
- Alternative strategies for space station financing [NASA-CR-175412] p 80 N84-21437 Texas Woman's Univ., Houston.

Crew and life support: EVA p 11 N84-18279 TRW Electronic Systems Group, Redondo Beach, Calif.

- Commications p 12 N84-18285 TRW Space Technology Labs., Redondo Beach, Calif. Study of multi-kilowatt solar arrays for Earth orbit
- applications p 49 N84-12634 [NASA-CR-170939] p 49 N84-12634 ACOSS Fourteen (Active Control of Space Structures) [AD-A133411] p 38 N84-15181 Space station needs, attributes and architectural options the field projem second the cummany history
- study. Final review executive summary briefing [NASA-CR-173674] p 10 N84-18272

U

United Technologies Corp., Windsor Locks, Conn. Regenerable non-venting thermal control subsystem for extravehicular activity [SAE PAPER 831151] p 24 A84-29076

V

Virginia Polytechnic Inst. and State Experimental study of active vibration		
[AD-A133818]	p 38	N84-14546
Control of large flexible spacecraft	by the	independent
modal-space control method	•	•
[NASA-CR-3760]	p 40	N84-18262
Virginia Univ., Charlottesville.	•	
Digital control system for space	structu	ral dampers
[NAŠA-CR-175355]	p 39	N84-16246
Vought Corp., Dallas, Tex.	•	
Flexible radiator thermal vacuum te	st repo	rt
[NASA-CR-171764]	p 28	N84-20622
Flexible radiator system	•	
[NASA-CR-171765]	p 28	N84-20623
Flexible radiator system: Executive	summa	ary
[NASA-CR-171766]		N84-20624

W

 Wates Univ. Inst. of Science and Technology, Cardiff. Buckling and vibration of any prismatic assembly of shear and compression loaded anisotropic plates with an arbitrary supporting structure p 23 A84-14050

 Washington Univ., Seattle. Radiation-conduction interaction in large space structures
 p 23 A84-14050

 [AIAA PAPER 84-0144]
 p 23 A84-17911

 Washington Univ., St. Louis, Mo. Erosion of mylar and protection by thin metal films [AIAA PAPER 83-2636]
 p 52 A84-10949

.

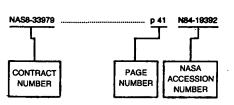
Washington Univ., St. Louis, Mo.

CONTRACT NUMBER INDEX

TECHNOLOGY FOR LARGE SPACE SYSTEMS / A Bibliography (Supplement 11)

JANUARY 1985

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

AF PROJ. C654	p 38	N84-15181
AF PROJ. C655	p 40	N84-18311
	p 41	N84-18312
AF PROJ. 2304	p 9	N84-17947
	p 41	N84-18987
	p 43	N84-21172
AF PROJ. 2307	p 38	N84-14546
AF PROJ. 2308	p 41	N84-18313
AF PROJ. 4506	p 49	N84-14394
	p 49	N84-14395
AF PROJ. 7661	p 77	N84-10179
	p 52	N84-19463
AF-AFOSR-0198-81	p 9	N84-17947
AF-AFOSR-0217-82	p 38	N84-14546
AF-AFOSR-3550-78	p 41	N84-18987
AF-AFOSR-81-0198	p 16	A84-25525
AF-F04701-82-C-0083	p 50	N84-17254
AF-83-0139	p 43	N84-21172
ARPA ORDER 3584-7	p 36	N84-11195
ARPA ORDER 3710	p 78	N84-17050
DAAG29-79-C-0161	p 16	A84-25525
DAAG29-81-K-0131	p 35	A84-25516
DARPA ORDER 3654	p 38	N84-15181
DE-AC02-79ER-10357	p 79	N84-21145
DE-AC04-76DP-00789	p 25	N84-16509
DFVLR-232-11	p 30	N84-21626
DFVLR-3-719-101	p 30	N84-21626
DNA001-81-C-0006	D 52	N84-21781
ESA-4389/80/NL-AK(SC)	p 56	N84-21675
ESA-4442/80/NL-AK(SC)	D 56	N84-18416
ESTEC-2991/76/NL-AK(SC)	p 40	N84-17241
ESTEC-4099/79/NL-PP(SC)	D 25	N84-15562
ESTEC-4348/80/NL-AK(SC)	p 43	N84-21611
	p 29	N84-21616
	p 18	N84-21620
	p 18	N84-21624
ESTEC-4348/80/NL-AL(SC)	p 18	N84-21625
ESTEC-4350/80/NL-PP	p 30	N84-21626
ESTEC-4435/80/NL-AK(SC)	p 38	N84-15182
ESTEC-5156/82/NL-PB(SC)	p 17	N84-17284
F04701-82-C-0083	p 32	A84-17359
F30602-81-C-0119	p 49	N84-14394
	p 49	N84-14395
F30602-81-C-0180	p 40	N84-18311
	p 41	N84-18312
F30602-81-C-0194	р 38	N84-15181
F33615-79-C-5114	p 55	A84-28900
JPL-955426	p 54	A84-28458
JPL-956038	p 19	A84-22965
MDA903-82-C-0068	p 19 p 36	N84-11195
MDA903-82-C-0376	p 78	N84-17050

MIPR-FY7121-82-00007 NAGW-122 NAG1-126		
NAGW-122	p 77	N84-10179
	p 52	A84-10949
	p 39	N84-16248
NAG1-171	p 33	A84-19056
	p 34	A84-25496
NAG1-225	p 40	N84-18262
NAG1-225	p 55	N84-112202
NAG1-257	p 25	N84-16565
NAG1-301	p 21	N84-18680
NAG1-322	p 60	N84-20175
NAG1-349	p 39	N84-16246
NAG1-41	p 23	A84-17911
NAG3-449	p 78	N84-16991
NASW-3542	p 26	N84-18576
NASW-3680	p 9	N84-18265
	p 9	N84-18266
	p 10	N84-18267
	p 10	N84-18268
	p 10	N84-18269
NASW-3681	p 10	N84-18272
NASW-3682	p <u>1</u> 1	N84-18275
NASW-3683	p 11	N84-18274
NASW-3684	p 12	N84-18290
	p 12	N84-18291
	p 12	N84-18292
	p 12	N84-18293
	p 13	N84-18294
NASW-3685	p 10	N84-18270
	p 13	N84-18296
	p 13	N84-18297
	p 13	N84-18298
	p 13	N84-18299
	p 13	N84-18300
	p 13	N84-18301 N84-18302
	p 14	
	р 14 р 14	N84-18303 N84-18304
NASW-3686	p 10	N84-18273
NASW-3687	· · · ·	N84-18271
NASW-3740	p 60	N84-20857
NASW-3741	p 15	N84-21586
NASW-3748	p 14	N84-20610
NASW-3750	p 80	N84-21437
NASW-3753	p 56	N84-21290
NAS1-15810	p 16	A84-25525
NAS1-16394	p 16	A84-25525
NAS1-16756	р9	N84-17248
NAS2-3743	p 14	N84-20604
NAS3-22236	p 61	A84-22980
NAS3-23058	p 46	A84-18025
NAS3-23248	p 63	N84-12226
	p 63	N84-13218
NAS5-26546	p 79	N84-19371
NAS5-26962	p 79	N84-20605
NAS5-27466	p 41	N84-19394
NAS5-27617	p 14	N84-20435
NAS7-100	p 66	A84-11938
NAS8-31352	p 47	A84-22961
NAS8-32212 NAS8-32350	p 34	A84-24991 N84-10114
	р 17 р 7	N84-10114
	p 47	A84-22963
NAS8-32981	p 59	N84-13208
	p 78	N84-16097
114.00 00070		N84-11595
NAS8-33578	p 41	N84-19392
	p 42	N84-20625
NAS8-34131	p 49	N84-12634
NAS8-34381	p 59	N84-10582
	p 59	N84-10583
	p 59	N84-10584
NAS8-34677	p 20	N84-10175
	p 20	N84-10176
	p 77	N84-10174
NAS8-34945	p 40	N84-17251
NAS8-34945 NAS8-35036		N84-19377
	p 14	
NAS8-35036	р 14 р 28	N84-20622
NAS8-35036		
NAS8-35036	p 28	N84-20622 N84-20623 N84-20624
NAS8-35036	p 28 p 28	N84-20623
NAS8-35036 NAS8-35039 NAS9-14776	p 28 p 28 p 28	N84-20623 N84-20624
NAS8-35036 NAS8-35039 NAS9-14776	p 28 p 28 p 28 p 28 p 57	N84-20623 N84-20624 A84-15667

	p 81	N84-21594
	p 81	N84-21595
	p 81	N84-21596
NAS9-16440	p 47	A84-22979
NAS9-16468	p 17	N84-14233
NAS9-16609	p 24	A84-29076
NAS9-16868	p 51	N84-17431
NCCW-000002	p 23	A84-14050
NGL-14-001-006	p 72	A84-23440
NGL-14-001-258	p 72	A84-23440
NGL-33-018-003	p 56	N84-17293
NSERC-A-0967	p 36	A84-29143
NSERC-A-2181	p 36	A84-29143
NSERC-A-4183	p 31	A84-12489
NSERC-G-0662	p 36	A84-29143
NSF ECS-80-16173	p 33	A84-19056
	p 33	A84-19118
	p 34	A84-25496
NSF MCS-82-05335	p 16	A84-25525
NSF MEA-81-01110	p 36	A84-29145
NSF MEA-81-20211	p 54	A84-21775
NSF MEA-82-16777	p 55	A84-29101
NSG-1414	p 36	N84-10173
	p 42	N84-20627
NSG-1490	p 19	A84-10141
NSG-1655	p 51	N84-17436
N00014-76-C-0139	p 36	A84-29145
S99-QAXH	p 52	N84-21781
505-31-83-02	p 18	N84-22179
506-51-13-02	p7	N84-15179
506-53-23-06	p 55	N84-11220
506-53-43-01	p 37	N84-13608
	p 21	N84-19395
	p 60	N84-20626
506-53-43-12	p 17	N84-16427
506-53-43	p 21	N84-21608
506-53-53-07	p 42	N84-20880
506-55-22	p 63	N84-11206
506-55-72	p 50	N84-16247
506-57-13-02	p 36	N84-10173
506-57-13-10	p 78	N84-12228
506-62-43-04	p.17	N84-10114
506-62-43-91	p7	N84-17211
506-64-13	p 11	N84-18277

REPORT NUMBER INDEX

TECHNOLOGY FOR LARGE SPACE SYSTEMS / A Bibliography (Supplement 11)

###########

###

####################

#

#

#

#

ź # #

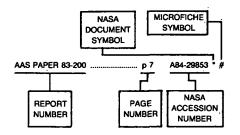
ŧ

#

#

JANUARY 1985

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

AAS PAPER 83-200	p 7	A84-29853 *
AAS PAPER 83-201	p 76	A84-29854
AAS PAPER 83-202	p 76	A84-29855
	p 76	A84-29856
	p 76	A84-29857
		A84-29858
	p 7	
AAS PAPER 83-216	p 48	A84-29861
AAS PAPER 83-217	p 20	A84-29862
AAS PAPER 83-221	р 77	A84-29865
AAS PAPER 83-222	p 77	A84-29866 *
AAS PAPER 83-225	p 77	A84-29868
AAS PAPER 83-226	p 62	A84-29869
AAS PAPER 83-244	p 77	A84-29883
AD-A129990	p 77	N84-10179
AD-A131406	р 36	N84-11195
AD-A132533	р 36	A84-29145
AD-A133411	p 38	N84-15181
AD-A133734	p 49	N84-14395
AD-A133735	p 49	N84-14394
AD-A133818	p 38	N84-14546
AD-A134185	p 59	N84-16807
AD-A134372	p 78	N84-17050
AD-A135109	p 9	N84-17947
AD-A135442	p 51	N84-17931
AD-A135652	p 41	N84-18313
AD-A135675	p 40	N84-18311
AD-A135676	p 41	N84-18312
AD-A136531	p 41	N84-18987
AD-A136781	p 41	N84-19464
AD-A136908	p 63	N84-19474
40 4400004	p 42	N84-19465
AD-A136984	p 52	N84-19463
AD-A137345	p 60	N84-20316
10 1407700		N84-21172
	p 43	
AD-A138286	p 52	N84-21781
10 5001000	- 60	NO4 04704
AD-E301332	p 52	N84-21781
4501 TD 00 0000		NO4 40470
AFGL-TR-83-0059	p 77	N84-10179
AFGL-TR-83-0331	p 52	N84-19463
AFIT/CI/NR-83-59D	- 54	NO4 17004
AFIT/G/NH-83-59D	p 51	N84-17931
	- 00	NO4 40474
AFIT/GA/AA/83D-1	p 63	N84-19474
AFIT/GA/AA/83D-8	p 41	N84-19464
AFIT/GSO/AA/83D-2	p 42	N84-19465
	-	
AFOSR-83-0855TR	р 38	N84-14546
AFOSR-83-0926TR	p 9	N84-17947
AFOSR-83-1240TR	p 41	N84-18987
	p 43	N84-21172
AFOSR-84-0040TR	p 43	109-211/2
AIAA PAPER 83-2338	p 43	A84-10016

AIAA PAPER 83-2346	.р63	A84-10066 * #
AIAA PAPER 83-2352	. p 63	A84-10024 * #
AIAA PAPER 83-2355	.р43	A84-10025 #
AIAA PAPER 83-2376	. p 57	A84-10070 * #
AIAA PAPER 83-2622	. p 64	A84-10965 * #
AIAA PAPER 83-2636		A84-10949 * #
AIAA PAPER 83-2654	.p.30	A84-10956 #
AIAA PAPER 83-2685	.p66	A84-13376 #
AIAA PAPER 84-0054		A84-17850 #
AIAA PAPER 84-0056	p 23	A84-21284 #
AIAA PAPER 84-0060	. p 23	A84-17853 #
AIAA PAPER 84-0061		A84-21285 #
AIAA PAPER 84-0062	. p 32	A84-17854 #
AIAA PAPER 84-0069	. p 16	A84-19887 #
AIAA PAPER 84-0081		A84-17866 #
AIAA PAPER 84-0143	·	
AIAA PAPER 84-0144		A84-17911 * #
AIAA PAPER 84-0297	.р4	A84-18005 #
AIAA PAPER 84-0329	. p 46	A84-18025 * #
AIAA PAPER 84-0392	•	A84-18060 #
	• • •	A84-18141 * #
AIAA PAPER 84-0548		A84-19912 * #
AIAA PAPER 84-0549		A84-18159 #
AIAA PAPER 84-0566	. p 33	A84-18168 #
AIAA PAPER 84-0651		A84-25318 #
AIAA PAPER 84-0652	. p 73	A84-25253 #
AIAA PAPER 84-0653	. р 74	A84-25254 #
AIAA PAPER 84-0658	.p20	A84-25258 #
AIAA PAPER 84-0659	.p.16	A84-25259 #
AIAA PAPER 84-0661		A84-25260 #
AIAA PAPER 84-0687	· _ ·	A84-25319 * #
AIAA PAPER 84-0702	.p5	A84-25326 * #
AIAA PAPER 84-0703	.р75	A84-25327 #
AIAA PAPER 84-0704	.p74	A84-25281 #
AIAA PAPER 84-0706	. p 4	A84-25282 #
AIAA PAPER 84-0713		A84-25287 #
		A84-25291 #
AIAA PAPER 84-0727		A84-25292 #
AIAA PAPER 84-0729	.p62	A84-25293 #
AIAA PAPER 84-0730		A84-25294 #
		A84-25304 #
	. p 74	A84-25304 #
AIAA PAPER 84-0751	. p74 . p48	A84-25306 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753	.р74 .р48 .р5	A84-25306 # A84-25308 #
AIAA PAPER 84-0751	. p74 . p48	A84-25306 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753	.р74 .р48 .р5	A84-25306 # A84-25308 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379	. p74 . p48 . p5 . p58	A84-25306 # A84-25308 # A84-44183 * #
AIAA PAPER 84-0751 AIAA PAPER 84-0753	. p 74 . p 48 . p 5 . p 58	A84-25306 # A84-25308 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758	. p74 . p48 . p5 . p58 . p74	A84-25306 # A84-25308 # A84-44183 * # A84-25309 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379	. p74 . p48 . p5 . p58 . p74	A84-25306 # A84-25308 # A84-44183 * #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758	. p74 . p48 . p5 . p58 . p74	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55	A84-25306 # A84-25308 # A84-44183 * # A84-25309 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25	A84-25306 # A84-25308 # A84-44183 * A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40	A84-25306 # A84-25308 # A84-44183 * A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 AIAA 84-0758 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25	A84-25306 # A84-25308 # A84-24183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25	A84-25306 # A84-25308 # A84-24183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79	A84-25306 # A84-25308 # A84-24183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002042	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-18509 # N84-11455 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002051 DE84-002051 DE84-002051	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 21 . p 25 . p 79 . p 30	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-16509 # N84-2145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002054 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 21 . p 30 . p 30 . p 75	A84-25306 # A84-25308 # A84-44183 * # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18512 # N84-16509 # N84-21145 # N84-21626 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002051 DE84-002051 DE84-002051	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79 . p 30 . p 75	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-16509 # N84-2145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79 . p 30 . p 76 . p 6	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-16509 # N84-21626 # A84-29658 # A84-29658 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79 . p 30 . p 76 . p 6	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-16509 # N84-21626 # A84-29658 # A84-29658 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002052 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 79 . p 30 . p 76 . p 6	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-16509 # N84-21626 # A84-29658 # A84-29658 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002052 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-091	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 79 . p 30 . p 75 . p 76 . p 76 . p 76	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29657 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 79 . p 30 . p 75 . p 76 . p 76 . p 76	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29657 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-102 DGLR PAPER 83-90 DGLR PAPER 83-90 DGLR PAPER 83-90	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 21 . p 30 . p 76 . p 76 . p 52	A84-25306 # A84-25308 # A84-44183 * # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-18311 # N84-18312 # N84-18312 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29657 # N84-21781 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002052 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-091	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 21 . p 30 . p 76 . p 76 . p 52	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29657 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-0ET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 75 . p 76 . p 79	A84-25306 # A84-25308 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-20316 # N84-20316 # N84-18311 # N84-18312 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29657 # N84-21781 # N84-21145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-0ET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 75 . p 76 . p 79	A84-25306 # A84-25308 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-20316 # N84-20316 # N84-18311 # N84-18312 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29657 # N84-21781 # N84-21145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-102 DGLR PAPER 83-90 DGLR PAPER 83-90 DGLR PAPER 83-90	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 75 . p 76 . p 79	A84-25306 # A84-25308 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-20316 # N84-20316 # N84-18311 # N84-18312 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29657 # N84-21781 # N84-21145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-002052 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 41 . p 25 . p 79 . p 30 . p 75 . p 76 . p 52 . p 52 . p 79 . p 52 . p 79	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # N84-21781 # N84-21781 # N84-21145 # N84-21781 # N84-2133 *
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-0ET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 41 . p 25 . p 79 . p 30 . p 75 . p 76 . p 52 . p 52 . p 79 . p 52 . p 79	A84-25306 # A84-25308 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-20316 # N84-20316 # N84-18311 # N84-18312 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29657 # N84-21781 # N84-21145 #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102 DRL-T-1701	. p 74 . p 48 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 60 . p 25 . p 40 . p 41 . p 25 . p 70 . p 71 . p 70 . p 75 . p 76 . p 76 . p 76 . p 76 . p 76 . p 79 . p 79 . p 79 . p 79 . p 79 . p 71	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # A84-25309 # N84-20316 # N84-10509 # N84-18311 # N84-18312 # N84-18312 # N84-18312 # N84-18312 # N84-18312 # N84-21145 # N84-21626 # A84-29658 # A84-29656 # N84-21781 # N84-21145 # N84-21145 # N84-14233 * N84-14233 *
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T D180-27477-1-VOL-1	. p 74 . p 74 . p 5 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 41 . p 25 . p 30 . p 76 . p 76 . p 76 . p 79 . p 52 . p 17 . p 17 . p 9	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-21145 # N84-29656 # A84-29656 # A84-29656 # A84-29656 # A84-29657 # N84-21145 # N84-14233 ° # N84-14233 ° #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T DRL-T-1701 D180-27477-1-VOL-1 D180-27477-1-VOL-1	. p 74 . p 74 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 25 . p 79 . p 30 . p 76 . p 76 . p 76 . p 76 . p 76 . p 79 . p 9 . p 9	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # N84-21145 # N84-21145 # N84-14233 * N84-14233 * N84-14265 * K84-18265 * K84-18265 *
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T DRL-T-1701 D180-27477-1-VOL-1 D180-27477-1-VOL-1	. p 74 . p 74 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 25 . p 79 . p 30 . p 76 . p 76 . p 76 . p 76 . p 76 . p 79 . p 9 . p 9	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # A84-29658 # N84-21145 # N84-21145 # N84-14233 * N84-14233 * N84-14265 * K84-18265 * K84-18265 *
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83-102 DBL-7-1701 DRU-27477-1-VOL-1 D180-27477-2-VOL-2 D180-27477-3-VOL-3	. p 74 . p 74 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 60 . p 25 . p 40 . p 21 . p 74 . p 55 . p 70 . p 71 . p 74 . p 55 . p 74 . p 75 . p 76 . p 76 . p 75 . p 76 . p 76 . p 77 . p 79 . p 79 . p 71 . p 79 . p 79 . p 79 . p 9 . p 10	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-18312 # N84-18312 # N84-21626 # A84-29656 # A84-29656 # A84-29656 # A84-29657 # N84-21781 # N84-14233 ° # N84-14233 ° #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DFVLR-IB-232-82-C-09 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T D180-27477-2-VOL-2 D180-27477-3-VOL-3 D180-27477-4-VOL-4	. p 74 . p 74 . p 5 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 79 . p 30 . p 75 . p 76 . p 76 . p 76 . p 76 . p 76 . p 75 . p 79 . p 79 . p 52 . p 17 . p 9 . p 10	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-21145 # N84-21145 # N84-29656 # A84-29656 # A84-29656 # A84-29656 # A84-29656 # A84-29657 # N84-14233 * N84-14233 * N84-14233 * N84-14233 *
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-0753 ASME PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83	. p 74 . p 74 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 25 . p 74 . p 50 . p 79 . p 70 . p 76 . p 76 . p 79 . p 17 . p 9 . p 10 . p 10	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29658 # N84-1233 * N84-14233 * N84-14233 * N84-14265 * # N84-18266 * # N84-18269 * #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T DRL-T-1701 D180-27477-1-VOL-1 D180-27477-4-VOL-2 D180-27477-4-VOL-3 D180-27477-4 D180-27477-6 D180-27728-1	. p 74 . p 74 . p 5 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 70 . p 70 . p 70 . p 71 . p 55 . p 60 . p 55 . p 60 . p 25 . p 70 . p 71 . p 55 . p 70 . p 70 . p 71 . p 70 . p 70 . p 70 . p 70 . p 71 . p 70 . p 70	A84-25306 # A84-25308 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29657 # N84-21781 # N84-14233 * N84-14233 * N84-14233 * N84-14233 * N84-14233 * N84-14265 * N84-18266 * N84-1826 * N84
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-0753 ASME PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-089 DGLR PAPER 83-089 DGLR PAPER 83-091 DGLR PAPER 83	. p 74 . p 74 . p 5 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 70 . p 70 . p 70 . p 71 . p 55 . p 60 . p 55 . p 60 . p 25 . p 70 . p 71 . p 55 . p 70 . p 70 . p 71 . p 70 . p 70 . p 70 . p 70 . p 71 . p 70 . p 70	A84-25306 # A84-25308 # A84-25308 # A84-25309 # A84-29101 # N84-20316 # N84-20316 # N84-16509 # N84-16509 # N84-18312 # N84-16509 # N84-21145 # N84-21626 # A84-29656 # A84-29656 # A84-29658 # N84-1233 * N84-14233 * N84-14233 * N84-14265 * # N84-18266 * # N84-18269 * #
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T DRL-T-1701 D180-27477-1-VOL-1 D180-27477-4-VOL-2 D180-27477-4-VOL-3 D180-27477-4 D180-27477-6 D180-27728-1	. p 74 . p 74 . p 5 . p 5 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 41 . p 25 . p 70 . p 70 . p 70 . p 70 . p 70 . p 71 . p 55 . p 60 . p 55 . p 60 . p 25 . p 70 . p 71 . p 55 . p 70 . p 70 . p 71 . p 70 . p 70 . p 70 . p 70 . p 71 . p 70 . p 70	A84-25306 # A84-25308 # A84-25308 # A84-25309 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-18312 # N84-18312 # N84-21626 # A84-29656 # A84-29656 # A84-29656 # N84-21781 # N84-21781 # N84-214233 * N84-14233 * N84-18266 # N84-18266 * N84-18267 * N84-18267 * N84-18266 * N84-18267 * N84-18266 * N84-18267 * N84-18266 * N
AIAA PAPER 84-0751 AIAA PAPER 84-0753 AIAA PAPER 84-0753 AIAA PAPER 84-1379 AIAA 84-0758 ASME PAPER 83-DET-6 CMU-RI-TR-83-23 CONF-831111-9 CSDL-R-1598-VOL-1 CSDL-R-1598-VOL-2 DE84-002051 DE84-002051 DE84-002051 DE84-005042 DFVLR-IB-232-82-C-09 DGLR PAPER 83-091 DGLR PAPER 83-90 DNA-TR-81-254 DOE/ER-10357/1 DRD-SE957T DRL-T-1701 D180-27477-1-VOL-1 D180-27477-4-VOL-2 D180-27477-4-VOL-3 D180-27477-4 D180-27477-6 D180-27728-1	. p 74 . p 74 . p 55 . p 58 . p 74 . p 55 . p 60 . p 25 . p 40 . p 25 . p 40 . p 41 . p 25 . p 79 . p 79 . p 76 . p 76 . p 79 . p 76 . p 79 . p 70 . p 63 . p 63	A84-25306 # A84-25308 # A84-25308 # A84-25309 # N84-20316 # N84-16509 # N84-18312 # N84-18312 # N84-18312 # N84-18312 # N84-21626 # A84-29656 # A84-29656 # A84-29656 # N84-21781 # N84-21781 # N84-214233 * N84-14233 * N84-18266 # N84-18266 * N84-18267 * N84-18267 * N84-18266 * N84-18267 * N84-18266 * N84-18267 * N84-18266 * N

E-1813	p 63	N84-11206 * #
EMSB-18/83	p 38	N84-15182 #
ER-591	p 56	N84-21290 * #
ESA-BR-14	p 79	N84-18315 #
ESA-CR(P)-1770	p 38	N84-15182 #
ESA-CR(P)-1772	p 25	N84-15562 #
ESA-CR(P)-1778	p 56	NB4-18416 #
ESA-CR(P)-1779-VOL-1 ESA-CR(P)-1779-VOL-2	p 18	N84-21624 #
ESA-CR(P)-1779-VOL-2	p 18	N84-21625 #
ESA-CR(P)-1779-VOL-3		N84-21611 #
ESA-CR(P)-1779-VOL-4 ESA-CR(P)-1779-VOL-5	p 29	N84-21616 # N84-21620 #
ESA-CR(P)-1779-VOL-5		N84-17241 #
ESA-CR(P)-1794		N84-17284 #
ESA-CR(P)-1796		N84-21626 #
ESA-CR(P)-1838		N84-21675 #
ESA-ESTL-54		N84-15562 #
ESA-SP-1053		N84-21590 #
ESA-SP-198	p 56	N84-17253 #
ESA-SP-200	p 26	N84-19396 #
ESA-STR-209	p 43	N84-21604 #
FJSRL-TR-83-0011	p 41	N84-18313 #
FUB-50-1982	•	N84-15386 #
GDC-SP-83-067	•	N84-19377 * #
GPO-27-393		
		N84-14234 # N84-21442 #
GPO-28-915 GPO-29-426		N84-20613 #
GPO-31-451		N84-21441 #
di 0-01-401	p 00	1104-21441 #
H-REPT:98-629	n 80	N84-21441 #
H-REPT-98-629		N84-21444 #
11 00 00		
H-83-03		N84-13208 * # N84-16097 * #
H-83-06	p / 0	N84-16097 * #
IAF PAPER 82-IISL-38	n 68	A84-17054 #
IAF PAPER 82-IISL-44	n 68	A84-17057 #
IAF PAPER 82-IISL-45	n 68	A84-17058 #
IAF PAPER 83-232		A84-11773 #
IAF PAPER 83-24		A84-11719 #
IAF PAPER 83-272		A84-11779 #
IAF PAPER 83-30		A84-11722 #
IAF PAPER 83-316		A84-11787 #
IAF PAPER 83-345	p 1	A84-11793 * #
IAF PAPER 83-38	p 64	A84-11723 #
IAF PAPER 83-401	p 61	A84-13397 #
IAF PAPER 83-404		A84-11811 * #
IAF PAPER 83-417	p 22	A84-11814 #
IAF PAPER 83-418	p 30	A84-11815 #
IAF PAPER 83-421	p 44	A84-11816 * #
IAF PAPER 83-422		A84-11817 #
IAF PAPER 83-447	p 44	A84-11823 #
IAF PAPER 83-44	p 1	A84-11724 #
IAF PAPER 83-48		A84-11726 * #
IAF PAPER 83-54	p 64	A84-11727 #
IAF PAPER 83-55	p 65	A84-11728 #
IAF PAPER 83-60 IAF PAPER 83-82		A84-11731 # A84-11737 #
IAF PAPER 83-86		A84-11739 #
IFSI-83-3	p 49	N84-12653 #
INPE-2749-PRE/325		N84-19383 #
INPE-2763-PRE/337		N84-16232 #
ISBN-0-8330-0490-5	-	N84-11195 #
ISSN-0073-0300		N84-21914 #
ISSN-0250-1589	p 79	N84-18315 #
ISSN-0379-4067	p 43	N84-21604 #
ISSN-0379-6566		N84-17253 #
ISSN-0379-6566		N84-19396 #
		-

ISSN-0379-6566

REPORT NUMBER INDEX

ISSN-0379-6566					
	p 80	N84-21590 #	NAS 1.26:173329		N84-18291
1/00 001 00			NAS 1.26:173330 NAS 1.26:173331		N84-18290
KSC-231-83	b (s	N84-16242 * #	NAS 1.26:173331		N84-18268 N84-18267
L-15618	o 18	N84-22179 * #	NAS 1.26:173333		N84-18266
L-15659		N84-20880 * #	NAS 1.26:173334		N84-18265
L-15707		N84-12228 * #	NAS 1.26:173335		N84-18269
L-15732		N84-18277 * #	NAS 1.26:173336		N84-18294
L-15733		N84-17211 * #	NAS 1.26:173337		N84-18293
	•		NAS 1.26:173338		N84-18680
LC-83-570	p 36	N84-11195 #	NAS 1.26:173345		N84-18275
			NAS 1.26:173398		N84-21594
LCDS-83-22	p 9	N84-17947 #	NAS 1.26:173400		N84-21592
			NAS 1.26:173401		N84-21593
	p /8	N84-17050 #	NAS 1.26:173402 NAS 1.26:173403		N84-21595 N84-21596
LMSC-D889718-VOL-1-ATTACH-1	- 12	N84-18293 * #	NAS 1.26:173674		N84-18272
LMSC-D889718-VOL-1-ATTACH-2		N84-18293 #	NAS 1.26:174450		N84-10173
LMSC-D889718-VOL-1		N84-18292 * #	NAS 1.26:174605		N84-14233
LMSC-D889718-VOL-2-ATTACH-2		N84-18291 * #	NAS 1.26:175160	p 79	N84-20605
LMSC-D889718-VOL-4-ATTACH-1		N84-18290 * #	NAS 1.26:175192		N84-20435
LMSC-D931673	p 79	N84-20617 * #	NAS 1.26:175195		N84-19371
			NAS 1.26:175211		N84-19394
MBB-UD-381-83-OE	p 19	A84-22859 #	NAS 1.26:175341	p 39	N84-16248
	- 05	NO4 44000 //	NAS 1.26:175355		N84-16246
MBB-UR-584-82-OE		N84-11200 # A84-22862 #	NAS 1.26:175382 NAS 1.26:175389		N84-18270 N84-20175
MBB-UR-628-83-OE	p /2	A84-22862 #	NAS 1.26:175369 NAS 1.26:175412		N84-20175 N84-21437
MCR-81-630	0.9	N84-17248 * #	NAS 1.26:175434		N84-21586
MCR-83-640		N84-10174 * #	NAS 1.26:175435		N84-20604
MCR-83-643		N84-11595 * #	NAS 1.26:175436		N84-20610
	•	• • • •	NAS 1.26:175437		N84-20857
MDC-H0180A	p 10	N84-18271 * #	NAS 1.26:175441		N84-21290
			NAS 1.26:175448		N84-20627
MITT-28	p 22	N84-21914 #	NAS 1.26:3698		N84-17248
		NO4 04500 1 "	NAS 1.26:3734		N84-10583
MPR-3		N84-21593 * # N84-21595 * #	NAS 1.26:3735 NAS 1.26:3736		N84-10584 N84-10582
MPR-3	p o i	1184-21595 #	NAS 1.26:3751		N84-13208
MRC-R-744	n 52	N84-21781 #	NAS 1.26:3760		N84-18262
	POL	10+21101 #	NAS 1.55:2272		N84-22179
NAS 1.15:77534	p 26	N84-18576 * #	NAS 1.55:2290		N84-12228
NAS 1.15:82562		N84-16075 * #	NAS 1.55:2293		N84-18277
NAS 1.15:82571	p 18	N84-21607 * #	NAS 1.55:2294		N84-17211
NAS 1.15:83489		N84-11206 * #	NAS 1.60:2240	p 50	N84-16247
NAS 1.15:84617		N84-15172 * #		- 50	NO4 40050
NAS 1.15:84658		N84-15426 * #	NASA-CASE-LAR-13117-1	b 29	N84-16250
NAS 1.15:85058 NAS 1.15:85439		N84-16249 * # N84-17947 #	NASA-CASE-MFS-25906-1	n 59	N84-11761
NAS 1.15:85497		N84-16242 * #		P 00	110
NAS 1.15:85556		N84-19382 * #	NASA-CP-2272	p 18	N84-22179
NAS 1.15:85686	p7	N84-15179 * #	NASA-CP-2290		N84-12228
NAS 1.15:85689		N84-16427 * #	NASA-CP-2293		N84-18277
NAS 1.15:85697		N84-13608 * #	NASA-CP-2294	р/	N84-17211
NAS 1.15:85700		N84-11220 * #	NASA-CR-168193-VOL-1	n 62	N84-12226
NAS 1.15:85702 NAS 1.15:85743		N84-12026 * # N84-20880 * #	NASA-CR-168193-VOL-2		N84-13218
NAS 1.15:85762		N84-19395 * #	NASA-CR-170899		N84-10174
NAS 1.15:85772		N84-21608 #	NASA-CR-170913		N84-10175
NAS 1.15:85774		N84-20626 * #	NASA-CR-170914	p 20	N84-10176
NAS 1.26:168193-VOL-1	p 63	N84-12226 * #	NASA-CR-170915		N84-11595
NAS 1.26:168193-VOL-2	p 63	N84-13218 * #	NASA-CR-170939	p 49	N84-12634
NAS 1.26:170899		N84-10174 * #	NASA-CR-170948		
					N84-16097
NAS 1.26:170913		N84-10175 * #	NASA-CR-170949	. p7	N84-15171
NAS 1.26:170913 NAS 1.26:170914	p 20	N84-10176 * #	NASA-CR-170949 NASA-CR-170972	р7 р40	N84-15171 N84-17251
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915	р20 р56	N84-10176 * # N84-11595 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984	р7 р40 р14	N84-15171 N84-17251 N84-19377
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939	р 20 р 56 р 49	N84-10176 * # N84-11595 * # N84-12634 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993	p7 p40 p14 p42	N84-15171 N84-17251 N84-19377 N84-20625
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948	p 20 p 56 p 49 p 78	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984	p7 p40 p14 p42 p42	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170949	p 20 p 56 p 49 p 78 p 7	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * # N84-15171 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993 NASA-CR-170996	p7 p40 p14 p42 p41 p51	N84-15171 N84-17251 N84-19377 N84-20625
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170942	p 20 p 56 p 49 p 78 p 7 p 40	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993 NASA-CR-170993 NASA-CR-171728	p7 p40 p14 p42 p41 p51 p28	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-17431
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170972 NAS 1.26:170972	p 20 p 56 p 49 p 78 p 7 p 40 p 14	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-17251 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170983 NASA-CR-170996 NASA-CR-170996 NASA-CR-171728 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766	p 7 p 40 p 14 p 42 p 41 p 51 p 51 p 28 p 28	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-17431 N84-20622 N84-20623 N84-20623
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170994 NAS 1.26:170993 NAS 1.26:170993	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41	N84-10176 * # N84-11595 * # N84-16097 * # N84-16097 * # N84-15171 * # N84-17251 * # N84-19377 * # N84-20625 * # N84-19392 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993 NASA-CR-170996 NASA-CR-171728 NASA-CR-171728 NASA-CR-171764 NASA-CR-171765 NASA-CR-171775	p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 28 p 79	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-19392 N84-17431 N84-20623 N84-20623 N84-20623 N84-20624 N84-20617
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170972 NAS 1.26:170984 NAS 1.26:170984 NAS 1.26:170996 NAS 1.26:171728	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51	N84-10176 * # N84-12634 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-17251 * # N84-19377 * # N84-20625 * # N84-1932 * # N84-17431 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170973 NASA-CR-170993 NASA-CR-170993 NASA-CR-170996 NASA-CR-171728 NASA-CR-171778 NASA-CR-171764 NASA-CR-171765 NASA-CR-171775 NASA-CR-1717223	p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 28 p 79 p 17	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-19392 N84-20625 N84-20625 N84-20625 N84-20627 N84-20617 N84-10114
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170972 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:171096 NAS 1.26:171728 NAS 1.26:171728	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-17251 * # N84-19377 * # N84-19377 * # N84-19392 * # N84-17431 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170972 NASA-CR-170993 NASA-CR-170993 NASA-CR-170996 NASA-CR-171728 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766 NASA-CR-171775 NASA-CR-172792	 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 79 p 17 p 12 	N84-15171 N84-17251 N84-17251 N84-20625 N84-19392 N84-17431 N84-20622 N84-20622 N84-20622 N84-20617 N84-10114 N84-18292
NAS 1.26:170913	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28	N84-10176 * # N84-12634 * # N84-12634 * # N84-15077 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-19392 * # N84-20622 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993 NASA-CR-170996 NASA-CR-171728 NASA-CR-171764 NASA-CR-171766 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-1717292 NASA-CR-172215	 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 79 p 17 p 12 p 25 	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-20625 N84-20623 N84-20623 N84-20624 N84-20617 N84-10514 N84-18292 N84-16555
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170972 NAS 1.26:170984 NAS 1.26:170984 NAS 1.26:170986 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171765	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28	N84-10176 * # N84-12634 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-19377 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-17431 * # N84-20622 * # N84-20624 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170994 NASA-CR-170993 NASA-CR-170996 NASA-CR-171798 NASA-CR-171775 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-172223 NASA-CR-172223 NASA-CR-172253 NASA-CR-173215 NASA-CR-173259	p 7 p 40 p 14 p 22 p 41 p 51 p 28 p 28 p 28 p 28 p 79 p 17 p 12 p 25 p 56	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-17431 N84-20622 N84-20622 N84-20622 N84-20624 N84-20617 N84-1014 N84-18292 N84-16555 N84-17293
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170972 NAS 1.26:170984 NAS 1.26:170993 NAS 1.26:171996 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171766 NAS 1.26:171765 NAS 1.26:171775	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 28 p 79	N84-10176 * # N84-11595 * # N84-12634 * # N84-15071 * # N84-15171 * # N84-19377 * # N84-19377 * # N84-20625 * # N84-19392 * # N84-20622 * # N84-20623 * # N84-20617 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170993 NASA-CR-170996 NASA-CR-171798 NASA-CR-171764 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-17175 NASA-CR-171728 NASA-CR-171729 NASA-CR-172223 NASA-CR-172259 NASA-CR-173266	p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 79 p 17 p 12 p 25 p 56 p 78	N84-15171 N84-17251 N84-19377 N84-20625 N84-1937 N84-20622 N84-20622 N84-20622 N84-20622 N84-20627 N84-20617 N84-10114 N84-18292 N84-16595 N84-17293 N84-16991
NAS 1.26:170913	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 79 p 17	N84-10176 * # N84-12634 * # N84-12634 * # N84-15077 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20617 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170994 NASA-CR-170993 NASA-CR-170996 NASA-CR-171798 NASA-CR-171775 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-172223 NASA-CR-172223 NASA-CR-172253 NASA-CR-173215 NASA-CR-173259	p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 28 p 79 p 17 p 12 p 25 p 56 p 78 p 51	N84-15171 N84-17251 N84-19377 N84-20625 N84-19392 N84-17431 N84-20622 N84-20622 N84-20622 N84-20624 N84-20617 N84-1014 N84-18292 N84-16555 N84-17293
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170972 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171766 NAS 1.26:171775 NAS 1.26:17223 NAS 1.26:17223	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 28 p 28 p 28 p 28 p 28 p 79 p 17 p 12	N84-10176 * # N84-12634 * # N84-12634 * # N84-15071 * # N84-1521 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-17431 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20617 * # N84-20617 * # N84-20617 * # N84-20617 * # N84-20617 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170996 NASA-CR-170996 NASA-CR-170996 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-1717292 NASA-CR-173215 NASA-CR-173259 NASA-CR-173259 NASA-CR-173284	p 7 p 40 p 14 p 42 p 41 p 28 p 28 p 28 p 28 p 79 p 17 p 12 p 256 p 78 p 51 p 13	N84-15171 N84-1925 N84-19377 N84-20625 N84-19372 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20623 N84-17435 N84-17435
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170972 NAS 1.26:170993 NAS 1.26:170996 NAS 1.26:171766 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171775 NAS 1.26:172792 NAS 1.26:172792 NAS 1.26:172792 NAS 1.26:173215	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 28 p 79 p 17 p 12 p 25	N84-10176 * # N84-12634 * # N84-12634 * # N84-15077 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20617 * # N84-16565 * # N84-16565 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170996 NASA-CR-170996 NASA-CR-171996 NASA-CR-17175 NASA-CR-171766 NASA-CR-171765 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171775 NASA-CR-173215 NASA-CR-173259 NASA-CR-173256 NASA-CR-173284 NASA-CR-173312 NASA-CR-173313 NASA-CR-173314	p 7 p 40 p 14 p 51 p 28 p 28 p 28 p 28 p 28 p 28 p 17 p 12 p 25 p 56 p 78 p 751 p 13 p 13 p 13	N84-15177 N84-17251 N84-19377 N84-20625 N84-19378 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-16565 N84-16565 N84-16599 N84-17436 N84-18297 N84-18297 N84-18297 N84-18297
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170996 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171775 NAS 1.26:171775 NAS 1.26:17223 NAS 1.26:17225 NAS 1.26:173255 NAS 1.26:173259 NAS 1.26	p 20 p 56 p 49 p 78 p 7 p 40 p 14 p 42 p 41 p 42 p 41 p 51 p 28 p 28 p 79 p 17 p 12 p 25 p 56	N84-10176 * # N84-11595 * # N84-12634 * # N84-15071 * # N84-1571 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20617 * # N84-16565 * # N84-16591 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171766 NASA-CR-171765 NASA-CR-171766 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-172223 NASA-CR-172225 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173313 NASA-CR-173314	P 7 P 40 P 41 P 41 P 51 P 28 P 28 P 28 P 28 P 79 P 17 P 12 P 256 P 78 P 51 P 551 P 551 P 13 P 13 P 13	N84-15177 N84-17251 N84-19377 N84-20625 N84-19332 N84-19332 N84-19372 N84-20622 N84-20622 N84-20622 N84-20617 N84-10114 N84-102057 N84-16555 N84-17293 N84-16555 N84-17433 N84-18299 N84-18299 N84-18299 N84-18295
NAS 1.26:170913	p 20 p 56 p 49 p 78 p 40 p 14 p 42 p 41 p 51 p 28 p 28 p 28 p 79 p 17 p 12 p 56 p 79 p 75 p 51	N84-10176 * # N84-11595 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-19377 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20622 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-10114 * # N84-16565 * # N84-16991 * # N84-17436 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170994 NASA-CR-170993 NASA-CR-170996 NASA-CR-171798 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-17175 NASA-CR-172223 NASA-CR-172259 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316	P 7 P 40 P 41 P 42 P 51 P 28 P 28 P 28 P 79 P 17 P 12 P 56 P 51 P 13 P 13 P 13 P 13	N84-15171 N84-17251 N84-19377 N84-20625 N84-19372 N84-20622 N84-20622 N84-20622 N84-20622 N84-20617 N84-10114 N84-1020627 N84-16565 N84-16565 N84-16565 N84-16590 N84-16590 N84-18200 N84-18200 N84-18200 N84-18200 N84-18200 N84-18200 N84-
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170996 NAS 1.26:170996 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171776 NAS 1.26:171775 NAS 1.26:17223 NAS 1.26:17223 NAS 1.26:173259 NAS 1.26:173266 NAS 1.26:173264 NAS 1.26:173240 NAS 1.26:173312	p 20 p 56 p 49 p 7 p 40 p 14 p 42 p 41 p 28 p 28 p 28 p 28 p 28 p 17 p 12 p 25 p 56 p 51 p 13	N84-10176 * # N84-12634 * # N84-12634 * # N84-12634 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-16565 * # N84-16591 * # N84-17293 * # N84-17293 * # N84-17293 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170996 NASA-CR-170996 NASA-CR-170996 NASA-CR-17175 NASA-CR-171766 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171775 NASA-CR-173215 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173284 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317	P 7 P 40 P 42 P 41 P 51 P 28 P 28 P 28 P 79 P 17 P 25 P 56 P 78 P 75 P 751 P 13 P 13 P 13 P 13	N84-15177 N84-17251 N84-19377 N84-20625 N84-19377 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-16205 N84-16205 N84-16205 N84-16205 N84-18205 N84-18205 N84-18205 N84-18205 N84-18301
NAS 1.26:170913	р 20 р 56 р 49 р 77 р 40 р 14 р 42 р 41 р 28 р 28 р 77 р 12 р 25 р 78 р 77 р 12 р 25 р 77 р 13 р 13	N84-10176 * # N84-12634 * # N84-12634 * # N84-16097 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20622 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20617 * # N84-16565 * # N84-16565 * # N84-16591 * # N84-16296 * # N84-18297 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171786 NASA-CR-171766 NASA-CR-171765 NASA-CR-171766 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-17292 NASA-CR-173215 NASA-CR-173259 NASA-CR-173264 NASA-CR-173312 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317	P 7 P 40 P 41 P 42 P 41 P 51 P 28 P 28 P 28 P 28 P 28 P 28 P 12 P 25 P 56 P 51 P 56 P 51 P 13 P 13 P 13 P 13 P 13 P 14	N84-15171 N84-19377 N84-20625 N84-19377 N84-20625 N84-1938 N84-1937 N84-20622 N84-20617 N84-20617 N84-10114 N84-1820617 N84-16565 N84-17293 N84-16565 N84-17293 N84-18296 N84-18299 N84-18299 N84-18299 N84-18209 N84-18301 N84-18301
NAS 1.26:170913	р 20 р 56 р 7 р 7 р 40 р 41 р 41 р 41 р 51 р 28 р 28 р 79 р 17 р 56 р 79 р 14 2 р 56 р 79 р 14 2 р 56 р 79 р 71 р 40 р 41 8 р 7 р 70 р 40 р 75 р 70 р 40 р 75 р 71 р 40 р 75 р 71 р 71 р 71 р 71 р 71 р 71 р 71 р 71	N84-10176 * # N84-11595 * # N84-12634 * # N84-15071 * # N84-1521 * # N84-19377 * # N84-19377 * # N84-20622 * # N84-20622 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-10114 * # N84-16555 * # N84-16595 * # N84-16595 * # N84-16991 * # N84-18296 * # N84-18297 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171765 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-172223 NASA-CR-172259 NASA-CR-173259 NASA-CR-173264 NASA-CR-173312 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319	P 7 P 40 P 41 P 42 P 41 P 51 P 28 P 28 P 28 P 28 P 79 P 17 P 25 P 56 P 576 P 51 P 13 P 13 P 13 P 13 P 13 P 14 P 14	N84-15171 N84-17251 N84-19377 N84-20625 N84-19372 N84-20622 N84-20622 N84-20622 N84-20622 N84-20617 N84-10114 N84-18202 N84-16565 N84-17293 N84-16565 N84-17436 N84-18299 N84-18299 N84-18299 N84-18299 N84-18290 N84-18300 N84-18300 N84-18300 N84-18300
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170996 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171776 NAS 1.26:171775 NAS 1.26:173215 NAS 1.26:173215 NAS 1.26:173266 NAS 1.26:173264 NAS 1.26:173313 NAS 1.26:173314 NAS 1.26:173315 NAS 1.	р 20 р 56 р 78 р 77 р 40 р 42 р 41 р 51 р 28 р 28 р 79 р 12 р 25 р 76 р 79 р 12 р 56 р 79 р 13 р 13 р 13 р 13	N84-10176 * # N84-12634 * # N84-12634 * # N84-12634 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-18292 * # N84-16565 * # N84-16591 * # N84-16293 * # N84-18296 * # N84-18298 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170996 NASA-CR-170996 NASA-CR-170996 NASA-CR-171728 NASA-CR-171765 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171755 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173284 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319 NASA-CR-173319 NASA-CR-173320	P 7 P 40 P 41 P 42 P 41 P 58 P 28 P 28 P 28 P 78 P 78 P 51 P 56 P 78 P 513 P 13 P 13 P 13 P 13 P 14 P 14 P 14	N84-15177 N84-17251 N84-19377 N84-20625 N84-19377 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-10214 N84-10214 N84-1629 N84-16291 N84-18292 N84-18292 N84-18301 N84-18302 N84-183
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171223 NAS 1.26:17223 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173215 NAS 1.26:173215 NAS 1.26:173259 NAS 1.26:173215 NAS 1.26:173315 NAS 1.26:173315 NAS 1.26:173316 NAS 1.2	P 20 P 56 P 77 P 77 P 40 P 77 P 40 P 77 P 40 P 77 P 40 P 77 P 40 P 77 P 40 P 78 P 77 P 40 P 78 P 79 P 71225 66 P 79 P 71225 67 P 12256 P 78 P 79 P 12256 P 78 P 79 P 1422 P 158 P 79 P 1422 P 158 P 79 P 158 P 79 P 158 P 79 P 158 P 79 P 158 P 7 P 7 P 158 P 7 P 7 P 7 P 7 P 7 P 7 P 7 P 7 P 7 P 7	N84-10176 * # N84-12634 * # N84-12634 * # N84-15071 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-20625 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20623 * # N84-20624 * # N84-20627 * # N84-16565 * # N84-16565 * # N84-16591 * # N84-16299 * # N84-18299 * # N84-18299 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171784 NASA-CR-171775 NASA-CR-171766 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171775 NASA-CR-1717292 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173319 NASA-CR-173312 NASA-CR-173318 NASA-CR-173320 NASA-CR-173321	$\begin{array}{c} p \ 7 \\ p \ 40 \\ p \ 42 \\ p \ 41 \\ p \ 51 \\ p \ 28 \\ p \ 28 \\ p \ 28 \\ p \ 79 \\ p \ 17 \\ p \ 12 \\ p \ 51 \\ p \ 13 \\ p \ 14 \\ p \ 14 \\ p \ 10 \end{array}$	N84-15177 N84-19377 N84-19377 N84-20625 N84-19387 N84-20625 N84-20622 N84-20622 N84-20617 N84-20617 N84-10114 N84-18296 N84-16565 N84-17433 N84-16565 N84-17433 N84-18296 N84-18295 N84-18295 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300 N84-18300
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170944 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170993 NAS 1.26:170996 NAS 1.26:170998 NAS 1.26:170993 NAS 1.26:170996 NAS 1.26:171764 NAS 1.26:171766 NAS 1.26:171766 NAS 1.26:17223 NAS 1.26:17259 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173312 NAS 1.26:173313 NAS 1.26:173314 NAS 1.26:173316 NAS 1.26:173317	P 206 P 569 P 77 P 404 P 288 P 288 P 287 P 12 P 286 P 287 P 112 P 556 P 513 P 313 P 133 P	N84-10176 * # N84-11595 * # N84-12634 * # N84-15071 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-20622 * # N84-20622 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-16265 * # N84-16292 * # N84-16291 * # N84-16291 * # N84-18296 * # N84-18298 * # N84-18298 * # N84-18290 * # N84-18300 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-170996 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-171775 NASA-CR-172223 NASA-CR-172259 NASA-CR-173259 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319 NASA-CR-173320 NASA-CR-173321	$ \begin{array}{c} p \ 7 \\ p \ 40 \\ p \ 41 \\ p \ 51 \\ p \ 28 \\ p \ 28 \\ p \ 28 \\ p \ 79 \\ p \ 77 \\ p \ 52 \\ p \ 78 \\ p \ 13 \\ p \ 14 \\ p \ 14 \\ p \ 11 \\ \end{array} $	N84-15177 N84-17251 N84-19377 N84-20625 N84-19337 N84-20625 N84-19372 N84-20622 N84-20622 N84-20617 N84-10114 N84-102057 N84-16565 N84-17293 N84-16565 N84-17433 N84-18290 N84-18290 N84-18290 N84-18303 N84-1
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170919 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170996 NAS 1.26:170996 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171775 NAS 1.26:171775 NAS 1.26:171755 NAS 1.26:172223 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173266 NAS 1.26:173312 NAS 1.26:173313 NAS 1.26:173314 NAS 1.26:173315 NAS 1.26:173316 NAS 1.26:173317 NAS 1.26:173317	P 206 P 56 9 P 77 P 74 P 74 P 74 P 74 P 74 P 74 P 74	N84-10176 * # N84-12634 * # N84-12634 * # N84-12634 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-19392 * # N84-20623 * # N84-18292 * # N84-16565 * # N84-16591 * # N84-16293 * # N84-16299 * # N84-18298 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18300 * # N84-18300 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171784 NASA-CR-171775 NASA-CR-171766 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171775 NASA-CR-1717292 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173318 NASA-CR-173319 NASA-CR-173312 NASA-CR-173318 NASA-CR-173320 NASA-CR-173321	P 7 P 40 P 41 P 42 P 41 P 28 P 28 P 28 P 28 P 28 P 28 P 28 P 28	N84-15177 N84-17251 N84-19377 N84-20622 N84-17431 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-16202 N84-16565 N84-17235 N84-16591 N84-17235 N84-18290 N84-18290 N84-18300 N84-18300 N84-18300 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18302 N84-18271 N84-18271
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170919 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170994 NAS 1.26:170996 NAS 1.26:170996 NAS 1.26:171765 NAS 1.26:171766 NAS 1.26:172223 NAS 1.26:172223 NAS 1.26:17255 NAS 1.26:173255 NAS 1.26:173256 NAS 1.26:173264 NAS 1.26:173313 NAS 1.26:173314 NAS 1.26:173316 NAS 1.26:173317 NAS 1.26:173318 NAS 1.26:173319	р р 56 9 р 7 7 р 9 4 4 4 2 1 9 р 7 7 р 9 4 4 4 2 1 9 р 9 р 7 7 0 9 4 4 4 2 1 9 р 9 р 9 р 9 р 9 р 9 р 9 р 9 р 9 1 3 1 3 1 3 1 3 1 3 4 9 р 9 1 4 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4 1 4	N84-10176 * # N84-12634 * # N84-12634 * # N84-12634 * # N84-15171 * # N84-1377 * # N84-19377 * # N84-20625 * # N84-19392 * # N84-20623 * # N84-16365 * # N84-16365 * # N84-16365 * # N84-16391 * # N84-16295 * # N84-16296 * # N84-18298 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18300 * # N84-18302 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170984 NASA-CR-170993 NASA-CR-170996 NASA-CR-171972 NASA-CR-171728 NASA-CR-171765 NASA-CR-171766 NASA-CR-171766 NASA-CR-171765 NASA-CR-171755 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173284 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173319 NASA-CR-173320 NASA-CR-173327 NASA-CR-173328	$\begin{array}{c} p \ 7 \\ p \ 40 \\ p \ 41 \\ p \ 52 \\ p \ 28 \\ p \ 28 \\ p \ 28 \\ p \ 79 \\ p \ 17 \\ p \ 28 \\ p \ 79 \\ p \ 17 \\ p \ 12 \\ p \ 56 \\ p \ 51 \\ 13 \\ p \ 13 \\ p \ 13 \\ p \ 13 \\ p \ 14 \\ p \ 10 \\ p \ 12 \\ p$	N84-15177 N84-17251 N84-19377 N84-20625 N84-19337 N84-20625 N84-19372 N84-20622 N84-20622 N84-20617 N84-10114 N84-102057 N84-16565 N84-17293 N84-16565 N84-17433 N84-18290 N84-18290 N84-18290 N84-18303 N84-1
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170914 NAS 1.26:170939 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170996 NAS 1.26:170996 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171765 NAS 1.26:171775 NAS 1.26:172223 NAS 1.26:172223 NAS 1.26:172223 NAS 1.26:17225 NAS 1.26:173255 NAS 1.26:173259 NAS 1.26:173266 NAS 1.26:173264 NAS 1.26:173242 NAS 1.26:173244 NAS 1.26:173242 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173312 NAS 1.26:173342 NAS 1.26:17344 NAS 1.26:17344	P 206 P 56 9 9 77 P 7 49 P 7 7 P 7 42 P 51 P 28 8 28 P 7 7 P 12 256 77 7 11 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 255 77 11 21 21 21 21 21 21 21 21 21 21 21 21	N84-10176 * # N84-11595 * # N84-12634 * # N84-15071 * # N84-15171 * # N84-19377 * # N84-19392 * # N84-20622 * # N84-20622 * # N84-20623 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-20624 * # N84-162062 * # N84-16292 * # N84-16291 * # N84-16291 * # N84-16291 * # N84-18298 * # N84-18298 * # N84-18290 * # N84-18300 * # N84-18301 * # N84-18303 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170993 NASA-CR-170993 NASA-CR-170996 NASA-CR-171784 NASA-CR-171784 NASA-CR-171786 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171765 NASA-CR-171775 NASA-CR-171775 NASA-CR-172223 NASA-CR-17292 NASA-CR-173215 NASA-CR-173259 NASA-CR-173266 NASA-CR-173312 NASA-CR-173312 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173318 NASA-CR-173320 NASA-CR-173321 NASA-CR-173321 NASA-CR-173321 NASA-CR-173320 NASA-CR-173321 NASA-CR-173322 NASA-CR-173323 NASA-CR-173328 NASA-CR-173329	$\begin{array}{c} p \ 7 \\ p \ 40 \\ p \ 41 \\ p \ 42 \\ p \ 51 \\ p \ 52 \\ p \ 52$	N84-15177 N84-17251 N84-19377 N84-20625 N84-17431 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-20622 N84-16205 N84-18295 N84-18295 N84-18295 N84-18295 N84-18300 N84-18300 N84-18300 N84-18302 N84-18307 N84-18277 N84-18277 N84-18271 N84-18271 N84-18271 N84-18271
NAS 1.26:170913 NAS 1.26:170914 NAS 1.26:170915 NAS 1.26:170939 NAS 1.26:170948 NAS 1.26:170949 NAS 1.26:170949 NAS 1.26:170972 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:170993 NAS 1.26:170996 NAS 1.26:171764 NAS 1.26:171765 NAS 1.26:171766 NAS 1.26:17222 NAS 1.26:17222 NAS 1.26:17222 NAS 1.26:17252 NAS 1.26:17259 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173259 NAS 1.26:173312 NAS 1.26:173313 NAS 1.26:173316 NAS 1.26:173317 NAS 1.26:173318 NAS 1.26:173319 NAS 1.26:173319 NAS 1.26:173319 NAS 1.26:173319 NAS 1.26:173320	P 206 P 7 P 7 P 414 P 7 P 414 P 7 P 414 P 7 P 7 P 7	N84-10176 * # N84-12634 * # N84-12634 * # N84-12634 * # N84-15171 * # N84-1377 * # N84-19377 * # N84-20625 * # N84-19392 * # N84-20623 * # N84-16365 * # N84-16365 * # N84-16365 * # N84-16391 * # N84-16295 * # N84-16296 * # N84-18298 * # N84-18299 * # N84-18299 * # N84-18299 * # N84-18300 * # N84-18302 * #	NASA-CR-170949 NASA-CR-170972 NASA-CR-170994 NASA-CR-170993 NASA-CR-170996 NASA-CR-170996 NASA-CR-171728 NASA-CR-171728 NASA-CR-171764 NASA-CR-171765 NASA-CR-171766 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-171766 NASA-CR-171765 NASA-CR-171765 NASA-CR-172792 NASA-CR-173215 NASA-CR-173284 NASA-CR-173312 NASA-CR-173313 NASA-CR-173314 NASA-CR-173315 NASA-CR-173316 NASA-CR-173317 NASA-CR-173318 NASA-CR-173319 NASA-CR-173321 NASA-CR-173321 NASA-CR-173322 NASA-CR-173328 NASA-CR-173329 NASA-CR-173320	$\begin{array}{c} p \ 7 \\ p \ 40 \\ p \ 41 \\ p \ 42 \\ p \ 41 \\ p \ 42 \\ p \ 51 \\ p \ 51 \\ p \ 52 \\ p \ 52 \\ p \ 57 \\ p \ 51 \\ p \ 51$	N84-15177 N84-17251 N84-19377 N84-20625 N84-19377 N84-20625 N84-19372 N84-20622 N84-20622 N84-20622 N84-20622 N84-20617 N84-10114 N84-18296 N84-18296 N84-18297 N84-18201 N84-18277 N84-18277 N84-18277 N84-18277 N84-18271

ASA-CR-173334		p 9	N84-18265 * #
ASA-CR-173335		p 10	
ASA-CR-173336	••••••		N84-18294 * #
ASA-CR-173337	••••••	p 12	N84-18293 * #
ASA-CR-173338	••••••	p 21	N84-18680 * #
IASA-CR-173345		p 11	N84-18275 #
IASA-CR-173398	•••••		N84-21594 * #
ASA-CR-173400			N84-21592 * #
IASA-CR-173401			N84-21593 * #
IASA-CR-173402	••••••	p 81	N84-21595 * #
ASA-CR-173403	•••••••	p 81	N84-21596 * #
IASA-CR-173674		p 10	N84-18272 * #
IASA-CR-174450		p 36	N84-10173 * #
ASA-CR-174605	••••••		N84-14233 * #
ASA-CR-175160			N84-20605 * #
ASA-CR-175192		p 14	N84-20435 * #
ASA-CR-175195			N84-19371 * #
IASA-CR-175211			N84-19394 * #
IASA-CR-175341		p 39	N84-16248 * #
IASA-CR-175355			N84-16246 * #
IASA-CR-175382			N84-18270 * #
IASA-CR-175389			N84-20175 #
ASA-CR-175412		p ou	N84-21437 * #
ASA-CR-175434	••••••		N84-21586 * #
ASA-CR-175435	••••••		N84-20604 * #
ASA-CR-175436			N84-20610 * #
ASA-CR-175437	••••••		N84-20857 * #
ASA-CR-175441			N84-21290 * #
ASA-CR-175448			N84-20627 * #
ASA-CR-3698			N84-17248 * #
IASA-CR-3734			N84-10583 * #
	••••••	p 59	N84-10584 * #
	•••••	p 59	N84-10582 * #
	••••••	p 59	N84-13208 * #
IASA-CR-3760	••••••	р 40	N84-18262 * #
	••••••	p 26	N84-18576 * #
		p 78	N84-16075 * #
			N84-21607 * #
			N84-11206 * #
	••••••••••		N84-15172 * #
	••••••		N84-15426 * # N84-16249 * #
	•••••••		
	••••••	p 9	N84-17947 # N84-16242 * #
	•••••••		N84-19382 * #
	•••••••	p 7	N84-15179 * # N84-16427 * #
	•••••••		
	•••••••		N84-11220 * # N84-12026 * #
			N84-20880 * #
		p 21	N84-19395 * #
1404 THE 05770		p 21	N84-21608 * #
		p 60	N84-20626 * #
		•	N84-16247 * #
ITIA/REPT-83-13			N84-18532 #
B84-129402		p 51	N84-18532 #
D80-55		p 80	N84-21592 * #
D81-20A		p 81	N84-21596 * #
D82-1A			N84-21594 * #
MIC-MA03-469-29			N84-15171 * #
O-83-506		p 7	N84-15171 * #
)R-1		p 80	N84-21592 * #
ADC-TR-83-158-\	/OL-1	p 40	N84-18311 #
ADC-TR-83-158-\	/OL-2	p 41	N84-18312 #
ADC-TR-83-51		p 38	N84-15181 #
ADC-TR-83-91-V	DL-1	p 49	N84-14395 #
ADC-TR-83-91-V			N84-14394 #
AND/R-2936-AR	PA	p 36	N84-11195 #
			N84-20624 * #
EPT-2-19200/3R	1195B	0 28	N84-20623 * #
EPT-2-32300/IR-			N84-20622 * #
REPT-2983-81			N84-21290 * #
EPT-38172-6001-			N84-12634 * #
8878		p 56	N84-21675 #
-REPT-98-523		p 79	N84-20613 #
A-SPP-RP008-VC	L-2-8K-1-PT-2	p 13	N84-18297 * #
A-SSP-RP008-VC		p 13	N84-18296 * #
A-SSP-RP008-VC			N84-18298 * #
SA-SSP-RP008-VC			
SA-SSP-RP008-VC	L-2-BK-2-PT-1	p 13	N84-18300 * #
	L-2-BK-1-PT-4		N84-1

REPORT NUMBER INDEX

SA-SSP-RP008-VOL-2-BK-2-PT-2 SA-SSP-RP008-VOL-2-BK-2-PT-3 SA-SSP-RP008-VOL-2-BK-2-PT-4 SA-SSP-RP008-VOL-2-BK-3 SA-SSP-RP009-PT-1	p 13 p 14 p 14 p 14 p 14 p 10	N84-18301 * # N84-18302 * # N84-18303 * # N84-18304 * # N84-18270 * #
SAE PAPER 831097 SAE PAPER 831101 SAE PAPER 831108 SAE PAPER 831109 SAE PAPER 831109 SAE PAPER 831111 SAE PAPER 831112 SAE PAPER 831120 SAE PAPER 831122 SAE PAPER 831122 SAE PAPER 831133 SAE PAPER 831138 SAE PAPER 831138 SAE PAPER 831144	p 24 p 24 p 5 p 6 p 6 p 6 p 6 p 75 p 24 p 24 p 24	A84-29032 * # A84-29036 # A84-29043 * # A84-29046 * # A84-29046 * # A84-29056 # A84-29053 * # A84-29053 * # A84-29057 # A84-29076 * #
SAND-83-1631C	•	N84-16509 #
SAPR-45	p 56	N84-17293 * #
SOC-SE-02-02	p 10	N84-18273 * #
SSD-83-0037 SSD-83-0094-1-VOL-1 SSD-83-0094-2-VOL-2	p 20	N84-18274 * # N84-10175 * # N84-10176 * #
SSL-30-83 SSL-31-83 SSL-32-83-VOL-3-PHASE-2	p 59	N84-10583 * # N84-10584 * # N84-10582 * #
STI/E-TR-25066-VOL-3	p 79	N84-19371 * #
TB-TS-11-01/82-A	p 56	N84-18416 #
TM-EKR3	p 17	N84-17284 #
TR-1183-8314	p 51	N84-17431 * #
US-PATENT-APPL-SN-537757 US-PATENT-APPL-SN-556512		N84-11761 * # N84-16250 * #
USNA-T\$PR-126	p 59	N84-16807 #
UVA/52824/MAE84/101	p 39	N84-16246 * #

,

UVA/52824/MAE84/101

.

ACCESSION NUMBER INDEX

TECHNOLOGY FOR LARGE SPACE SYSTEMS / A Bibliography (Supplement 11)

p 66 •# # p 2 # p 66 # p 67 # p 67

p67 p2 p2 p2 p2 p3

P 67 P 3 P 3 P 67 P 44 P 3 P 45 P 45 P 45

P 45 P 45 P 57 P 45 P 31 P 31 P 31 P 32 P 67 P 68 P 68 P 68 P 68

p 68 p 68 p 68

P 68 P 52 P 53 P 53 P 53 P 53 P 53 P 32 P 32 P 32 P 32 P 32 P 32 P 46

p 69 р 69 р 53

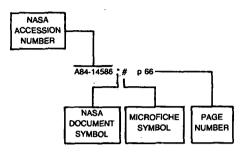
p 23 p 23 p 32

p 32 **JANUARY 1985**

4 A A A

> A A

Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A83-44602 #	p 57	A84-14586 *#
A84-10016 #	p 43	A84-14762 #
A84-10024 *#	p 63	A84-14764 #
A84-10025 #	p 43	A84-15092 #
A84-10066 *#	p 63	
A84-10070 *#	p 57	A84-15161 #
A84-10141 *#	p 19	A84-15189 #
A84-10224 #	p 22	A84-15301 #
A84-10396 #	D 44	A84-15303 #
A84-10440 #	p 22	A84-15304 #
A84-10883 #	p 64	A84-15305 #
A84-10949 *#	p 52	A84-15310 #
A84-10956 #	p 30	A84-15321 #
A84-10965 * #	p 64	A84-15325 #
A84-11719 #	p 64	A84-15363 #
A84-11722 #	0 64	A84-15381 #
A84-11723 #	p 64	A84-15623 #
A84-11724 #	p 1	A84-15634 *#
A84-11726 #	p 1	A84-15639 *#
A84-11727 #	p 64	A84-15640 *#
A84-11728 #	p 65	A84-15641 #
A84-11731 #	p 1	A84-15642 * #
A84-11737 #	p 65	A84-15643 *#
A84-11739 #	p 65	A84-15667 *#
A84-11753 #	p 65	A84-15671 #
A84-11773 #	p 65	A84-15695 #
A84-11779 #	p 65	A84-15785 #
A84-11787 #	p 65	A84-16116 #
A84-11793 * #	p 0.5	A84-16841 #
A84-11811 *#	p 2	A84-16885 #
A84-11814 #	p 22	A84-17026 #
A84-11815 #	p 30	A84-17054 #
A84-11815 #	p 44	A84-17057 #
A84-11817 #	p 44 p 44	A84-17058 #
A84-11823 #	p 44 p 44	A84-17074 #
A84-11922 #	p 44 p 19	AB4-17075 #
A84-11922 #		A84-17076 #
	p 15	A84-17077 #
A84-11932 # A84-11933 #	p 30	AB4-17108 #
	p 30	A84-17120 #
A84-11934 # A84-11935 #	p 31	A84-17151 #
	p 57	A84-17174 #
	p 66	A84-17200 #
A84-11945 #	p 31	A84-17355 * #
A84-11946 *#	p 15	A84-17359 #
A84-12483 #	p 31	A84-17361 *#
A84-12488 #	p 31	A84-17369 #
A84-12489 #	p 31	A84-17370 #
A84-13320 #	p 31	A84-17743 #
A84-13321 #	p 31	A84-17762 #
A84-13330 #	p 2	A84-17763 #
A84-13376 #	p 66	A84-17768 #
A84-13397 #	p 61	A84-17766 #
A84-13521 #	p 44	A84-17850 #
A84-13901 #	p 66	A84-17853 # A84-17854 #
A84-14050 *#	•	A84-17854 # A84-17866 #
no4-14030 #	p 23	A09-1/000 #

A84-17910 #	p 23
A84-17911 #	p 23
A84-18005 #	p 4
A84-18025 *#	p 46
A84-18060 #	p 32
A84-18141 *#	p 61
A84-18159 #	p 53
A84-18168 # A84-18394 *#	р33 р46
A84-19056 * #	р46 р33
A84-19108 #	p 15
A84-19118 #	p 33
A84-19127 #	p 33
A84-19128 #	p 33
A84-19129 #	p 16
A84-19169 #	p 46
A84-19675 # A84-19728 #	р33 р33
A84-19850 #	p 69
A84-19887 #	p 16
A84-19912 *#	p 53
A84-20047 #	p 33
A84-20583 #	p 46
A84-20647 #	p 46
A84-20682 * #	p 54
A84-20709 # A84-21237 #	р47 р34
A84-21284 #	p 23
AB4-21285 #	p 34
A84-21344 #	p 69
A84-21476 #	p 69
A84-21477 #	p 69
A84-21478 #	p 70
A84-21479 # A84-21480 *#	р70 р70
A84-21480 #	р70 р70
A84-21482 #	p 70
A84-21483 #	p 70
A84-21484 #	p 61
A84-21485 #	p 61
A84-21486 #	p 57
A84-21487 # A84-21488 #	р70 р71
A84-21489 #	р71 р71
A84-21497 #	p 71
A84-21499 #	p 71
A84-21517 #	p 19
A84-21564 #	p 16
A84-21573 #	p 4
A84-21720 # A84-21775 #	р71 р54
A84-22131 * #	p 16
A84-22153 #	p 19
A84-22327 #	p 71
AB4-22336 #	p 57
A84-22337 #	p 58
A84-22338 #	p 71
A84-22341 * # A84-22859 #	р72 р19
A84-22862 #	р 19 р 72
A84-22958 * #	p 47
A84-22959 #	p 47
A84-22961 *#	p 47
A84-22962 #	p 47
A84-22963 * #	p 47
A84-22965 * # A84-22979 * #	р 19 р 47
A84-22980 *#	p 61
A84-22982 #	p 48
A84-22997 #	p 48
A84-23366 #	p 20
A84-23440 *#	p 72
A84-24501 # A84-24508 #	p 54
A84-24508 # A84-24626 *#	р 54 р 72
A84-24627 * #	р72 р72
A84-24628 *#	p 4
A84-24629 #	p 72
A84-24631 #	p 72
A84-24632 #	p 73
A84-24633 *#	p 4
A84-24634 *#	p 4
A84-24635 #	p 73

A84-24636	# `	p 73	
A84-24637	#	p 73	
A84-24980	#	p 61	
A84-24981	#	p 62	
A84-24990 A84-24991	# •#	р 34 р 34	
A84-24995	#	p 34	
AB4-25251	#	p 73	
A84-25253 A84-25254	# #	р73 р74	
A84-25258	#	p 20	
A84-25259	#	p 16	
A84-25260 A84-25281	# #	р4 р74	
A84-25282	#	p 4	
A84-25287	#	p 4	
A84-25291 A84-25292	# #	р 34 р 62	
A84-25293	#	p 62	
A84-25294	#	p 62	
A84-25304 A84-25306	# #	р74 р48	
A84-25308	#	p 5	
A84-25309	#	p 74	
A84-25318 A84-25319	•#	р74 р74	
A84-25326	•#	p 5	
A84-25327	# #	p 75	
A84-25344 A84-25484	•#	р 62 р 58	
A84-25496	•#	p 34	
A84-25516 A84-25525	# *#	р 35 р 16	
A84-25531	#	ρ16 ρ58	
A84-25551	•#	p 16	
A84-25552 A84-25586	•# #	р 35 р 35	
A84-25828	#	p 58	
A84-26516	#	p 48	
A84-26717 A84-26845	# #	р 35 р 35	
A84-26926	#	p 5	
A84-26977 A84-27443	# #	р 35 р 62	
A84-27934	•#	p 35	
A84-27945	#	p 5	
A84-28067 A84-28237	# #	р 48 р 24	
A84-28242	#	p 54	
A84-28458	*#	p 54	
A84-28523 A84-28541	*# #	р 58 р 58	
A84-28553	*#	p 55	
A84-28576	# #	p 75	
A84-28579 A84-28900	# #	р 75 р 55	
A84-28975	#	p 75	
A84-29032 A84-29036	•# #	р 24 р 24	
A84-29043	•# #	p 5	
A84-29044	•#	p 5	
A84-29046 A84-29047	*# *#	р6 рб	
A84-29054	#	p 6	
A84-29056	#	p6	
A84-29063 A84-29067	•# #	р 75 р 24	
A84-29071	#	p 24	
A84-29076 A84-29101	•# #	р 24 р 55	
A84-29101 A84-29126	#	ρ 55 ρ 75	
A84-29143	#	p 36	
A84-29145 A84-29471	# •#	р 36 р 36	
A84-29565	#	р 55 р 55	
A84-29572	#	p 55	
AB4-29656 A84-29657	# #	р75 р76	
A84-29658	#	p 76	
A84-29666	#	p 6	
A84-29852 A84-29853	•# •#	р76 р7	
A84-29854	#	p 76	

84-2	9855	#	p 76
84-2	9856	#	p 76
84-2	9857 9858	#	p 76
84-2	9858	# #	р7 р48
84-2	9858 9861 9862 9865 9865	#	ρ48 ρ20
84-2	9865	#	p 77
84-2	9866	*# ####	ρ77
84-2	9868 9869	#	p 77
184-2	9883	#	o 77
84-4	4183	•#	p 58
			- 47
184-1 184-1	0114	• • • • • • # # # # # # # #	р 17 р 36
184-1	0173 0174	•#	p 77
184-1	0175	•# •#	p 20
184-1	0175 0176 0179	•#	p 20 p 77
	0582	•#	p 59
184-1	0583	•#	n 59
184-1	0582 0583 0584 1195 1199 1200 1206	•#	p 59
184-1	1195	# #	p 36 p 20
184-1	1200	#	n 25
N84- 1	1206	•#	p 63 p 55
	1220	*#	p 55
184-1	1595	•#	p 56
184-1	2026	•#	07
N84-1	2026 2222 2226	#	p 59 p 7 p 36
N84-1	2226	*#	p 63 p 78
N84-1	2228	•#	p /8 p 48
V84-1	2233 2234	•#	
N84- 1	2235 2236 2238	*#	p 37 p 37 p 37 p 37
N84-1	2236	*#	p 37
N84-1	2230	*#	D 37
N84-1	2243 2245	•#	p 37
V84-1	2246	*#	p 48
N84-1	2634 2653	-# #	p 49 p 49
N84-1	3208	• • • • • • • • • • • • • • • • • • •	p 59
N84-1	3208 3218	•#	р 63 р 37
N84-1	3608	•# •#	
N84-1	4234	#	р 17 р 7
N84-1	4235	#	0.37
N84-1	4394	"# #	p 49
N84-1	4395 4546	# #	p 49
N84-1	4561	#	p 20
N84-1	4561 14752	#	p 78
N84-	4759	#	p 17
NB4-	14/01	# •#	p 49 n 7
N84-	15172	•#	p7
N84-	14752 14759 14761 15171 15172 15179 15181 15182 15329 15386 15426	`###############	P 49 P 49 P 38 P 20 P 78 P 77 P 7 P 38 P 25 P 49 P 38 P 25 P 49
N84-1	15181	# #	p 38
N84-1	15329	•#	p 25
N84-	15386	 #	p 49
N84-	5426	•#	ρ 25
N84-'	15562 15840	# #	р 25 р 38
N84-	15970	т #	p 49
N84-	15970 16037	•#	p 56
	16056	*#	р 38 р 78
	16075 16097	•# •#	р 78 р 78
N84-	16232	#	p 39
N84-	16242	•#	p 78
	16246	•# •#	p 39 p 50
	16247 16248	•#	ρ 50 ρ 39
N84-	16249	•#	p 39
	16250 16420	•#	p 59
		•#	p 76
	16427	•#	p 17
	16509 16565	# •#	р 25 р 25
	16677	-# #	p 78
		π	

· N

F-1

N84-16807

N84-16807 #	p 59	N84-19392 *#	p 41
N84-16991 *#	p 78	N84-19394 *#	
N84-17050 #	p 78	N84-19395 *#	p 21
N84-17211 *#	p 7	N84-19396 #	p 26
N84-17212 *#	p 8	N84-19398 # N84-19399 #	р 26 р 26
N84-17213 * #	p 8	N84-19399 #	p 26
N84-17215 * #	p 8	N84-19401 #	p 26
N84-17217 * #	p 56	N84-19402 *#	p 26
	p 8	N84-19405 #	p 26
	р60 р8	N84-19406 #	p 27
N84-17221 * #	p8	N84-19414 #	p 27
N84-17222 * #	p 25	NB4-19423 #	p 27
N84-17223 * #	р 79 р 50	N84-19429 # N84-19434 #	р79 р27
N84-17224 *#	p 50	N84-19444 #	p 27
N84-17225 #	p 1/	N84-19449 #	p 27
N84-17226 * #	p 21 p 39	N84-19454 #	p 27
N84-17227 * # N84-17228 * #	p 39 p 39	N84-19458 #	p 27
N84-17229 * #	p 39	N84-19463 #	p 52
N84-17230 * #	p 40	N84-19464 #	p 41
N84-17231 * #	p 8	N84-19465 # N84-19474 #	р42 р63
N84-17232 * #	p 8 p 8	N84-19899 #	p 21
		N84-19900 #	p 42
N84-17234 * #	p 9	N84-19906 #	p 28
N84-17235 * # N84-17236 * #	p 50 p 50	N84-20175 * #	p 60
N84-17230 #	n 9	N84-20316 #	p 60
N84-17241 #	p 40	N84-20435 * #	p 14
N84-17248 * #	p 40 p 9	N84-20604 * #	p 14
N84-17251 *#	p 40	N84-20605 * # N84-20610 * #	р79 р14
N84-17253 #	p 56	N84-20613 #	p 79
	p 50	N84-20617 * #	p 79
N84-17269 * # N84-17284 #	p 50 .	N84-20621 #	p 18
N64-17264 # N84-17293 * #	p 17 p 56 p 51	N84-20622 * #	p 28
N84-17431 * #	p 50	N84-20623 #	p 28
N84-17436 * #	p 51	N84-20624 * #	p 28
N84-17931 # N84-17947 #	p 51	N84-20625 * # N84-20626 * #	р42 р60
N84-17947 #	p 9	N84-20627 * #	p 42
N84-18116 #	p 9 p 40	N84-20857 * #	p 60
N84-18262 * #	p 40	N84-20880 *#	p 42
N84-18265 * # N84-18266 * #	p 9	N84-21145 #	р79
N84-18267 * #	р9 р10	N84-21172 #	p 43
	p 10	N84-21290 * #	p 56
N84-18269 * #	p 10	N84-21437 * #	p 80
N84-18270 * #	p 10	N84-21440 # N84-21441 #	р80 р80
	p 10	N84-21442 #	p 80
N84-18272 * #	p 10	N84-21443 #	p 80
N84-18273 * # N84-18274 * #	р 10 р 11	N84-21444 #	р 80
	p 11	N84-21586 * #	p 15
N84-18277 * #	p 11	N84-21590 #	p 80
N84-18278 * #	p 11	N84-21592 * # N84-21593 * #	p 80
N84-18279 * #	p 11	N84-21593 #	р 81 р 81
N84-18280 * #	p 11	N84-21595 * #	p 81
N84-18281 * #	p 40	N84-21596 * #	p 81
	p 11	N84-21604 #	p 43
N84-18284 * #	p 11 p 11	N84-21607 *#	p 18
N84-18285 * #	p 12	N84-21608 * #	p 21
N84-18286 * #	p 21	N84-21611 # N84-21612 #	p 43
N84-18287 * #	p 12	N84-21612 # N84-21613 #	р43 р28
N84-18288 * #	p 12	N84-21614 #	p 28
N84-18289 * #	p 25	N84-21615 #	p 21
N84-18290 *# N84-18291 *#	p 12 p 12	N84-21616 #	p 29
N84-18292 * #	p 12	N84-21617 #	p 29
N84-18293 * #	p 12	N84-21618 #	p 29
N84-18294 * #	p 13	N84-21619 # N84-21620 #	р 29 р 18
N84-18296 * #	p 13	N84-21621 #	p 29
N84-18297 * #	p 13	N84-21622 #	p 29
N84-18298 * # N84-18299 * #	p 13 p 13	N84-21623 #	p 15
N84-18300 * #	p 13	N84-21624 #	p 18
N84-18301 * #	p 13	N84-21625 #	p 18
N84-18302 * #	p 14	N84-21626 # N84-21675 #	р30 р56
N84-18303 * #	p 14	N84-21781 #	p 50 p 52
N84-18304 * #	p 14	N84-21914 #	p 22
N84-18311 # N84-18312 #	p 40 p 41	N84-22179 * #	p 18
N84-18313 #	р 41 р 41	N84-22191 * #	p 18
N84-18315 #	p 79	N84-22224 * #	p 19
N84-18416 #	p 56	N84-22225 * #	p 22
N84-18457 #	p 17		
N84-18458 #	p 51		
N84-18475 #	p 17		
N84-18532 # N84-18576 * #	p 51 p 26		
N84-18680 * #	p 20 p 21		
N84-18987 #	p 41		
N84-19371 * #	p 79		
N84-19377 * #	p 14		
N84-19382 * #	p 51		
N84-19383 #	р 41		

1. Report No. NASA SP-7046 (11)	2. Government Access	sion No.	3. Recipient's Catalog	No.
4. Title and Subtitle TECHNOLOGY FOR LARGE SPACE S			5. Report Date January 1985	5
A Bibliography with Indexes	13,15,15	F	6. Performing Organiz	
7. Author(s)			8. Performing Organiz	ation Report No.
9. Performing Organization Name and Address			10. Work Unit No.	
National Aeronautics and Spa Washington, D.C. 20546	ce Administrati	on	11. Contract or Grant	No.
12. Sponsoring Agency Name and Address			13. Type of Report an	nd Period Covered
			14. Sponsoring Agency	/ Code
15. Supplementary Notes	<u> </u>			
Report prepared, in part, by Office and the Technical Lib			y Flight Experi	iments
16. Abstract	<u> </u>	······································		
This bibliography lists into the NASA scientifi 1984 and December 31, 1 researcher, manager, an in the area of Large Sp according to system, in analysis and design, st advanced materials, ass systems.	c and technical 984. Its purpos d designer in to ace System Techn teractive analys ructural concept	information system se is to provide h echnology developm nology. Subject m sis and design, st ts and control sys	m between Janua elpful informat ent and mission atter is groupe ructural and th tems, electroni	ary 1, tion to the design ed mermal .cs,
17. Key Words (Suggested by Author(s)) Large Space Systems Large Space Structures Large Space Antenna		18. Distribution Statement Unclassified -		
19. Security Classif. (of this report)	20. Security Classif. (c	of this page)	21. No. of Pages	22. Price*
Unclassified	Unclassified	1	146	\$14.50 HC

FEDERAL DEPOSITORY LIBRARY PROGRAM

- The Federal Depository Library Program provides Government publications to designated libraries throughout the United States. The Regional Depository Libraries listed below receive and retain at least one copy of nearly every Federal Government publication, either in printed or microfilm form, for use by the general public. These libraries provide reference services and inter-library loans; however, they are *not* sales outlets. You may wish to ask your local library to contact a Regional Depository to help you locate specific publications, or you may contact the Regional Depository yourself.

ARKANSAS STATE LIBRARY One Capitol Mall Little Rock, AR 72201 (501) 371-2326

AUBURN UNIV. AT MONTGOMERY LIBRARY Documents Department Montgomery, AL 36193 (205) 279-9110, ext. 253

UNIV. OF ALABAMA LIBRARY Documents Dept.—Box S University, AL 35486 (205) 348-7369

DEPT. OF LIBRARY, ARCHIVES AND PUBLIC RECORDS Third Floor—State Cap. 1700 West Washington Phoenix, AZ 85007 (602) 255-4121

UNIVERSITY OF ARIZONA LIB. Government Documents Dept. Tucson, AZ 85721 (602) 626-5233

CALIFORNIA STATE LIBRARY Govt. Publications Section P.O. Box 2037 Sacramento, CA 95809 (916) 322-4572

UNIV. OF COLORADO LIB. Government Pub. Division Campus Box 184 Boulder, CO 80309 (303) 492-8834

DENVER PUBLIC LIBRARY Govt. Pub. Department 1357 Broadway Denver, CO 80203 (303) 571-2131

CONNECTICUT STATE LIBRARY Government Documents Unit 231 Capitol Avenue Hartford, CT 06106 (203) 566-4971

UNIV. OF FLORIDA LIBRARIES Library West Documents Department Gainesville, FL 32611 (904) 392-0367

UNIV. OF GEORGIA LIBRARIES Government Reference Dept. Athens, Ga 30602 (404) 542-8951

UNIV. OF HAWAII LIBRARY Govt. Documents Collection 2550 The Mall Honolulu, HI 96822 (808) 948-8230

UNIV. OF IDAHO LIBRARY Documents Section Moscow, ID 83843 (208) 885-6344 ILLINOIS STATE LIBRARY Information Services Branch Centennial Building Springfield, IL 62706 (217) 782-5185

INDIANA STATE LIBRARY Serials Documents Section 140 North Senate Avenue Indianapolis, IN 46204 (317) 232-3686

UNIV. OF IOWA LIBRARIES Govt. Documents Department Iowa City, IA 52242 (319) 353-3318

UNIVERSITY OF KANSAS Doc. Collect—Spencer Lib. Lawrence, KS 66045 (913) 864-4662

UNIV. OF KENTUCKY LIBRARIES Govt. Pub. Department Lexington, KY 40506 (606) 257-3139

LOUISIANA STATE UNIVERSITY Middleton Library Govt. Docs. Dept. Baton Rouge, LA 70803 (504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY Documents Department Ruston, LA 71272 (318) 257-4962

UNIVERSITY OF MAINE Raymond H. Fogler Library Tri-State Regional Documents Depository Orono, ME 04469 (207) 581-1680

UNIVERSITY OF MARYLAND McKeldin Lib.—Doc. Div. College Park, MD 20742 (301) 454-3034

BOSTON PUBLIC LIBRARY Government Docs. Dept. Boston, MA 02117 (617) 536-5400 ext. 226

DETROIT PUBLIC LIBRARY Sociology Department 5201 Woodward Avenue Detroit, MI 48202 (313) 833-1409

MICHIGAN STATE LIBRARY P.O. Box 30007 Lansing, MI 48909 (517) 373-0640

UNIVERSITY OF MINNESOTA Government Pubs. Division 409 Wilson Library 309 19th Avenue South Minneapolis, MN 55455 (612) 373-7813 UNIV. OF MISSISSIPPI LIB. Documents Department University, MS 38677 (601) 232-5857

UNIV. OF MONTANA Mansfield Library Documents Division Missoula, MT 59812 (406) 243-6700

NEBRA3KA LIBRARY COMM. Federal Documents 1420 P Street Lincoln, NE 68508 (402) 471-2045 In cooperation with University of Nebraska-Lincoln

UNIVERSITY OF NEVADA LIB. Govt. Pub. Department Reno, NV 89557 (702) 784-6579

NEWARK PUBLIC LIBRARY 5 Washington Street Newark, NJ 07101 (201) 733-7812

UNIVERSITY OF NEW MEXICO Zimmerman Library Government Pub. Dept. Albuquerque, NM 87131 (505) 277-5441

NEW MEXICO STATE LIBRARY Reference Department 325 Don Gaspar Avenue Santa Fe, NM 87501 (505) 827-2033, ext. 22

NEW YORK STATE LIBRARY Empire State Plaza Albany, NY 12230 (518) 474-5563

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL Wilson Library BA/SS Documents Division Chapel Hill, NC 27515 (919) 962-1321

UNIVERSITY OF NORTH DAKOTA Chester Fritz Library Documents Department Grand Forks, ND 58202 (701) 777-2617, ext. 27 (In cooperation with North Dakota State Univ. Library)

STATE LIBRARY OF OHIO Documents Department 65 South Front Street Columbus, OH 43215 (614) 462-7051 OKLAHOMA DEPT. OF LIB. Government Documents 200 NE 18th Street Oklahoma City, OK 73105 (405) 521-2502

OKLAHOMA STATE JNIV. LIB. Documents Department Stillwater, OK 74078 (405) 624-6546

PORTLAND STATE UNIV. LIB. Documents Department P.O. Box 1151 Portland, OR 97207 (503) 229-3673

STATE LIBRARY OF PENN. Government Pub. Section P.O. Box 1601 Harrisburg, PA 17105 (717) 787-3752

TEXAS STATE LIBRARY Public Services Department P.O. Box 12927—Cap. Sta. Austin, TX 78753 (512) 471-2996

TEXAS TECH UNIV. LIBRARY Govt. Documents Department Lubbock, TX 79409 (806) 742-2268

UTAH STATE UNIVERSITY Merrill Library, U.M.C. 30 Logan, UT 84322 (801) 750-2682

UNIVERSITY OF VIRGINIA Alderman Lib.—Public Doc. Charlottesville, VA 22901 (804) 924-3133

WASHINGTON STATE LIBRARY. Documents Section Olympia, WA 98504 (206) 753-4027

WEST VIRGINIA UNIV. LIB. Documents Department Morgantown, WV 26506 (304) 293-3640

MILWAUKEE PUBLIC LIBRARY 814 West Wisconsin Avenue Milwaukee, WI 53233 (414) 278-3000

ST. HIST LIB. OF WISCONSIN Government Pub. Section 816 State Street Madison, WI 53706 (608) 262-4347

• WYOMING STATE LIBRARY Supreme Ct. & Library Bld. Cheyenne, WY 82002 (307) 777-6344

National Aeronautics and Space Administration	SPECIAL FOURTH CLASS FATE	ronautics and ronautics and ronautics and	
Washington, D.C. 20546	BOCKS		U.S.MAIL
Official Business Penalty for Private Use, \$300			
	6 3 CP-LOW, 850425 S95488AS	R	
. · ·	SCIEN & TECH INFO FACILITY ATTN: ACCESSIONING DEPT P O BOX 8757 BWI ARPRT		
· · ·	BALTIMORE MD 21240	A	
· • • • • • • • •	· .)	

NASA

POSTMASTER:

If Undeliverable (Section 158 Postal Manual) Do Not Return