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APPLICATIONS TECHNOLOGY SATELLITES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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MARCH 1972

GSFC — GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND

339

APPLICATIONS

TECHNOLOGY SATELLITES

A CONTINUING BIBLIOGRAPHY
WITH INDEXES

March 1972

GODDARD SPACE FLIGHT CENTER
Greenbelt, Maryland

APPLICATIONS TECHNOLOGY SATELLITES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

ABSTRACT

A selection of ATS 1-5 annotated references to unclassified reports and journal articles that were introduced into the NASA Information System during the period 1965 - 1971.

FOREWORD

A large number of documents have been prepared by the scientific and technological community associated with the ATS-I through V program and it has long been recognized that a bibliography of those documents would be necessary. This is the initial release of that bibliography.

The bibliography is a listing of ATS documentation published since 1965. The usefulness of this document is readily apparent as a tool for the engineer or scientist who is seeking information on the ATS program. It should help to save valuable research time and to eliminate costly redundant efforts.

During the next twelve months the bibliography will be updated to its final form. User's comments on corrections and omissions are requested.

TABLE OF CONTENTS

INTRODUCTION

This publication is a scientific and technical bibliography related to the Applications Technology Satellites (ATS) 1 through 5. It assembles within single bibliographic announcement, groups of technical references contained in separate journals, and provides a convenient compilation of abstracts for reports, papers and articles written about the ATS since 1965. It is published for scientists, engineers, and interested parties to keep abreast of current developments and to refresh and cover gaps in their knowledge of previous discoveries and achievements pertaining to the Applications Technology Satellites. At present, an updating supplement is planned during the next 12-month period.

The ATS Bibliography contains bibliographic citations and informative abstracts for the ATS related references selected from the Scientific and Technical Aerospace Reports (STAR), the International Aerospace Abstracts (IAA), and Westinghouse written abstracts. The abstracts from STAR cover worldwide report literature relative to space and aeronautics. The abstracts from IAA provide a similar coverage of scientific and trade journals, books, and papers presented at symposiums and conferences on aerospace research. The Westinghouse (W) written abstracts are included to provide information on those publications not cited in STAR or IAA. The abstracts included in this publication have been reproduced from STAR, IAA, and the Transactions of the American Geophysical Union with the approval of those publishers.

This bibliography is divided into four sections and identified as follows:

1. Introduction
2. Abstracts
3. Category/Title Index
4. Author/Affiliation Index

The Introduction acquaints the user with the contents and organization of the ATS Bibliography, describes how to fully and effectively utilize the bibliography, and tells how to obtain the complete desired document, if available.

The Abstract Section contains ATS abstracts separated into the three divisions (IAA abstracts, STAR abstracts, and Westinghouse written abstracts), subdivided by year, and arranged numerically within the subdivision. Each abstract contains a brief summary of the report, paper, or article written and tells where the complete documentation can be obtained.

The ATS Technical Data Report (TDR), maintained by NASA, contains Progress Reports and Experimental data collected during the ATS 1 through 5 Program. To maintain continuity within the ATS 1-5 Program, the Category/Title Index is arranged in the same numerical sequence as the ATS TDR Table of Contents. Additional information related to a TDR subject, can be obtained by utilizing the TDR section numbering system for entry into the Category/Title Index. Listings contained in this Index, located at the end of the Bibliography, provides the following information:

1. TDR Category
2. Coded subsection number
3. Article title
4. Author or affiliation
5. Abstract number
6. IAA/STAR category number

A TDR Category List and an IAA/STAR Category List are included at the end of this introduction section to assist the Bibliography user.

The Author/Affiliation Index provides the user with an alphabetical index of authors and/or contracting corporations and government agencies along with STAR/IAA category codes, abstract numbers, and TDR category codes of the authors' articles contained within this publication.

EFFECTIVE USE OF THE ATS BIBLIOGRAPHY

This ATS Bibliography provides five methods of entry.

1. TDR Category List
2. Category/Title Index
3. Author/Affiliation Index
4. IAA/STAR Category List
5. Keyword

The user could utilize the TDR Category List to obtain the paragraph number from the section or category of interest. This number provides him entrance to the Category/Title Index which furnishes the accession identification number of a related document abstract. For example, a user's interest might lie in the subject area of "SHF Communications Experiments". By obtaining the TDR paragraph number, 7.1.0, the user then enters the Category/Title Index and looks for the paragraph number coded as follows:

070100

Section number — subparagraph number

paragraph number

At this point the user will find several documents listed pertaining to the particular category of interest. A typical entry is as follows.

TDR Section/Paragraph Number — Chronological Serial No.

TDR Category → SHF Communications Experiments - 070100 13

Title → A TDMA/PCM EXPERIMENT ON APPLICATIONS TECHNOLOGY SATELLITES

Author(s) → Y. Suguri, H. Doi, E. Metzger

c07 A69-42510

STAR/IAA Category Code — Accession Number

When the desired article title is found, the Accession Number is utilized to locate the particular abstract in the Abstract Section. The letter designator of the Accession number indicates the abstract location. For example, "A" indicates IAA written abstracts, "N" indicates STAR written abstracts, and "W" indicates those abstracts not written by IAA or STAR. The following two numbers indicate the year and the last five digits (three for (W) abstracts) the numerical sequence.

The desired abstract, once located, will provide enough information to the reader to determine if the full document will supply the sought-after data. Although three different formats are used in the abstract section, the information contained therein is similar. The following are examples of each format.

TYPICAL CITATION FROM IAA

NASA SPONSORSHIP — AVAILABLE ON MICROFICHE

AIAA ACCESSION NUMBER → A71-16573 * # **Acceleration patterns in quasi-steady MPD arcs.** ← TITLE

AUTHOR → Robert G. Jahn, Kenn E. Clark (Princeton University, Princeton, N.J.), Ronald C. Oberth, and Peter J. Turchi. ← AUTHOR'S AFFILIATION

(American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 8th, New York, N.Y., Jan. 19-21, 1970, Paper 70-165.) ← PREVIOUSLY ISSUED AS:

TITLE OF PERIODICAL → *AIAA Journal*, vol. 9, Jan. 1971, p. 167-172. 29 refs. ← PUBLICATION DATE

CONTRACT, GRANT, OR SPONSORSHIP → Grant No. NGL-31-001-005.

(For abstract see issue 06, page 1132, Accession no. A70-18208)

TYPICAL CITATION AND ABSTRACT FROM STAR

NASA SPONSORED DOCUMENT — **AVAILABLE ON MICROFICHE**

NASA ACCESSION NUMBER → N71-10429*# Lockheed Missiles and Space Co., Sunnyvale, Calif. ← **CORPORATE SOURCE**

TITLE → **LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969**

AUTHORS → R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969 ← **PUBLICATION DATE**

245 p refs

CONTRACT OR GRANT → (Contract NAS8-21153)

REPORT NUMBER → (NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS ← **AVAILABILITY SOURCE** CSCL 20M ← **COSATI CODE**

An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

TYPICAL CITATION AND ABSTRACT OTHER THAN IAA AND STAR

ACCESSION NUMBER → W71-020

NOISE CHARACTERISTICS OF AN SSB-FDMA/PhM MULTIPLE ACCESS SYSTEM ← TITLE

AUTHOR(S) → E. E. Crampton, Jr., and S. J. Andrzejewski

Westinghouse Electric Corporation ← AFFILIATION

REPORT NUMBER DATE OF PUBLICATION → May 1971

Contract NAS 5-21598 ← GRANT OR CONTRACT

This report describes the results of a 3.5-year communication experiment to determine the magnitude and spectral characteristics of three basic types of noise in an SSB-FDMA/PhM multiple access system. The types of noise are identified as thermal, intermodulation, and threshold noise. The experiment, part of the NASA Applications Technology Satellite program, employed two spin-stabilized satellites (ATS-1 and ATS-3) and ground stations at Mojave, California; Rosman, North Carolina; and Cooby Creek, Australia. Noise measurements were made in six test loops to investigate the noise characteristics in the three basic subsystems: the single-sideband transmitter, the single-sideband phase modulation spacecraft unit, and the ground receiver. Equipment configurations are illustrated, noise levels and components are shown, and the results of the study are summarized.

(52 pages, 16 illustrations)

c07 ← IAA/STAR CATEGORY CODE

070100 ← TDR SECTION/CATEGORY NUMBER

18 ← CHRONOLOGICAL SERIAL NUMBER

If papers or articles by a particular author are desired, the Author/Affiliation Index provides IAA/STAR Category codes, Accession Numbers, and TDR Section and Serial Numbers. The TDR Section and Serial Number, when applied to the Categorv/ Title Index will supply a quick reference to paper or article titles and their related accession number.

When information pertaining to a general subject area (e.g. Meteorology) is desired, a code number (c20) can be obtained from the IAA/STAR Category List. A search, utilizing this code number, can then be made in either the Category/Title Index for document titles or throughout the Abstract Section for related summaries.

Keywords are supplied at the beginning of each section of the Category/Title Index to aid the user in identifying the topic areas of interest within the section.

AVAILABILITY OF ATS RELATED DOCUMENTS

Since Abstracts contained in the ATS Bibliography are derived from three sources, the following availability lists apply.

PUBLIC AVAILABILITY OF DOCUMENTS ANNOUNCED IN IAA (AXX-10000 Series)

Documents abstracted are available from the AIAA Technical Information Service as follows:

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Documents that cannot be microfiched but for which one-to-one facsimile can be provided are indicated by a plus (+) instead of the # sign. Documents for which neither the + nor # symbol is shown, and for which no availability other than the issuing activity is given, may present unusual problems of reproducibility. The originator of such a document should be consulted as to its availability.

A source from which a document announced in STAR is available to the public is ordinarily given on the last line of the citation. The NASA accession number is sufficient when ordering NASA and NASA-sponsored documents from NTIS. When ordering non-NASA documents (no asterisk) from the issuing agency or other sources, particularly NTIS, it is essential that additional bibliographic information such as the report number be given.

The following are the most commonly indicated sources (full addresses of these organizations are listed at the end of this introduction):

Avail: NTIS. Sold by the National Technical Information Service at a standard price of $3.00 for hard copy (printed, facsimile, or reproduced from microcopy) of 300 pages or less. Documents in the 301 to 600 page range are sold for $6.00 in hard copy, and those in the 601 to 900 page range are sold at $9.00. Documents exceeding 900 pages are priced by NTIS on an individual basis. These prices apply retroactively to all documents in the NTIS collection, but in addition, documents of 300 pages or less that are over two years old (from date of announcement in Government Reports Announcements, or STAR for those items announced only in STAR) will have a surcharge of $3.00 added for a total price of $6.00. No additional surcharge will be added for documents over 300 pages. Microfiche is available from NTIS at a standard price of 95 cents (regardless of age) for those documents identified by the # sign following the accession number (e.g. N71-10411 #) and having an NTIS availability shown in the citation. Standing orders for microfiche of (1) the full collection of NTIS-available documents announced in STAR with the # symbol, (2) NASA reports only (identified by an asterisk(*), (3) NASA-accessioned non-NASA reports only (see paragraph below), or (4) any of these classes within one or more STAR categories, also may be placed with NTIS at greatly reduced prices per title (e.g. 35 cents) over individual requests. Inquiries concerning NTIS Selective Dissemination of Microfiche (SDM) should be addressed to the Subscription Unit, National Technical Information Service, Springfield, Virginia 22151.

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Avail: NASA Scientific and Technical Information Office. Documents with this availability are usually news releases or informational brochures available without charge in paper copy.

Avail: AEC Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of U.S. Atomic Energy Commission reports, usually in microfiche form, are listed in Nuclear Science Abstracts. Services available from the USAEC and its depositories are described in a booklet. Science Information Available from the Atomic Energy Commission (TID-4550), which may be obtained without charge from the USAEC Division of Technical Information.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from Dissertation Abstracts and are sold by University Microfilms as xerographic copy (HC) at $10.00 each and microfilm at $4.00 each, regardless of the length of the manuscript. Handling and shipping charges are additional. 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 timely availability of specific documents and the possible utilization of local copying services (e.g. color reproduction).

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by British Information Services (BIS), New York City. The U.S. price (including a service charge) is given, or a conversion table may be obtained from BIS.

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Avail: ZLDI. Sold by the Zentralstelle fur Luftfahrtdokumentation und Information. Munich, 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 Office. Sold by Commissioner of Patents, U.S. Patent Office, at the standard price of 50 cents each, postage free. (See discussion of patents and patent applications below.)

EUROPEAN AVAILABILITY OF NASA AND AGARD DOCUMENTS

Facsimile copy or microfiche of NASA and NASA-sponsored documents identified by both the symbols "#" and "*" and those AGARD reports that are on microfiche may be purchased from:

ESRO/ELDO Space Documentation Service
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92-Neuilly-sur-Seine, France

AVAILABILITY OF DOCUMENTS TO REGISTERED NASA INFORMATION USERS

In addition to the common availability of all documents through the above sources, a limited number of information services are provided by NASA to those having a contractual or cooperative relation to NASA or whose scientific and engineering activities relate to space and aeronautics research. Organizations qualified to receive STAR without charge also may qualify for one or more of these services. Organizations that are not registered with NASA and wish to consider registering should request Form 713. Registration Form - Technical Publications, from the NASA Scientific and Technical Information Facility. Subject to the conditions of the approved registration forms, the following services may be made available:

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Department of Defense documents (identified by the "AD" prefix) are generally available as microfiche on secondary distribution to (DDC) registered users at no cost from Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314.

PUBLIC AVAILABILITY OF WXX-100 SERIES DOCUMENTS

Since the abstracts cited in this series are from various sources, it is suggested that the sources cited be contacted for the complete documentations if available.

TDR CATEGORY LIST

000000 REFERENCE ONLY

010000 ATS GENERAL INFORMATION

020000 SPACECRAFT
020100 General
020200 Power System
020300 Telemetry and Command Systems
020400 Hydrogen Peroxide
020500 Resistojet
020600 Subliming Solid
020700 Active Nutation Control
020800 Spacecraft Spin Control
020900 Ion Engine
021000 Thermal Control System
021100 Hydrazine System
021200 Microwave Comm System
021300 Special Spacecraft Tests

030000 LAUNCH VEHICLE
030100 ATS-1 Flight Analysis
030200 ATS-2 Flight Analysis
030300 ATS-3 Flight Analysis
030400 ATS-4 Flight Analysis
030500 ATS-5 Flight Analysis

040000 OPERATIONS
040100 ATS Operations Control Center (ATSOCC)
040200 NIMBUS/ATS Data Utilization Center (NADUC)

050000 ORBIT PARAMETERS
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050200 ATS-2
050300 ATS-3
050400 ATS-4
050500 ATS-5

060000 GROUND STATIONS
060100 Rosman
060200 Mojave
060300 Cooby Creek
060400 Japan
060500 India
060600 Small Aperture Ground Station

070000 COMMUNICATIONS EXPERIMENT
070100 SHF Communications Experiment
070200 VHF Communications Experiment
070300 Millimeter Wave Experiment
070400 Japan Experiment
070500 India Experiment
070600 Australia Experiment
070700 L-Band Experiment
070800 Spread Spectrum

080000 METEOROLOGY EXPERIMENTS
080100 Spin Scan
080200 Weather Facsimile (WEFAX)
080300 Advanced Videcon Camera System
080400 OMEGA Position Location Experiment (OPLE)
080500 Image Dissector Camera System
080600 Image Orthicon Day/Night Camera
080700 Line Island Experiment
080800 Barbados Oceanographic and Meteorological Experiment (BOMEX)
080900 National Environmental Satellite Center Applications (NESCA)
081000 Other Meteorological Data
081100 Tornado Alert
081200 Hurricane Alert

090000 GRAVITY GRADIENT EXPERIMENT

100000 OTHER SPACE TECHNOLOGY EXPERIMENTS
100100 Nutation Sensor
100200 Self Contained Navigation System
100300 Reflectometer
100400 Albedo
100500 Special Ionospheric Experiments
100600 Magnetic Field Monitor
100700 Solar Cell Experiment

110000 ENVIRONMENTAL MEASUREMENTS EXPERIMENT (EME)
110100 Omnidirectional Spectrometer (Aerospace)
110200 Omnidirectional Detector (USCD)
110300 Particle Detector (BTL)
110400 Electron Spectrometer (U. of Minn.)
110500 Solar Cell Damage (GSFC)
110600 Thermal Coatings (GSFC)
110700 Ion Detector (Rice Univ.)
110800 Magnetometer (UCLA)
110900 VLF Detector (BTL)
111000 Cosmic Radio Noise (GSFC)
111100 Electric Field Measurements (GSFC)
111200 Trapped Radiation Detector (UCB)
111300 Proton Electron Detector (Lockheed)
111400 Two-Direction, Low-Energy, Particle Detector (UCSD)

IAA/STAR CATEGORY LIST

01 Aerodynamics
02 Aircraft
03 Auxiliary Systems
04 Biosciences
05 Biotechnology
06 Chemistry
07 Communications
08 Computers
09 Electronic Equipment
10 Electronics
11 Facilities, Research and Support
12 Fluid Mechanics
13 Geophysics
14 Instrumentation and Photography
15 Machine Elements and Processes
16 Masers
17 Materials, Metallic
18 Materials, Nonmetallic
19 Mathematics
20 Meteorology
21 Navigation
22 Nuclear Engineering
23 Physics, General
24 Physics, Atomic, Molecular, and Nuclear
25 Physics, Plasma
26 Physics, Solid-State
27 Propellants
28 Propulsion Systems
29 Space Radiation
30 Space Sciences
31 Space Vehicles
32 Structural Mechanics
33 Thermodynamics and Combustion
34 General

ABSTRACTS

IAA ABSTRACT (A-)

A65-16421

GRAVITY-GRADIENT STABILIZATION

Richard J. Katucki (General Electric Co., Missile and Space Division., Spacecraft Dept., Valley Forge, Pa.).

Space/Aeronautics, vol. 42, Oct. 1964, p. 42-47.

Discussion of the advantages of gravity-gradient stabilization in getting a satellite to point continually toward the Earth. According to the author, the gravity-gradient state of the art has advanced enough in the past one or two years to assure the feasibility of stabilizing any spacecraft at altitudes from 100 n.m. up through synchronous orbit. Through the use of an extendible rod device, called Stem, it is possible to configure a satellite so that its moments of inertia about the three axes will be properly sized for gravity-gradient stabilization. The second essential ingredient in a gravity-gradient system is a damping mechanism to absorb the energy of oscillation. For this damping, relative motion between two parts of a damper is required, one part attached to the main satellite body, the other part anchored to an external force field. There are four basic force fields which can provide the anchor or referencing torque-magnetic, gravity, solar wind, or atmospheric drag. So far there have been three announced flight tests of gravity-gradient systems. The latest announced test occurred in January, 1964, and involved General Electric's magnetically anchored system. Results from this test in a nearly circular 500-n.m. polar orbit showed that oscillations were damped down to below five degrees within three days after deployment. A.B.K.

c31 090000 04

A65-35705

THE APPLICATIONS TECHNOLOGY SATELLITE.

Robert H. Pickard (NASA, Goddard Space Flight Center, Greenbelt, Md.)

International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 42 p.

Description of the Applications Technology Satellite (ATS), second-generation type of spacecraft capable of performing omnibus service at the synchronous altitude. Primary emphasis is placed on details of the spacecraft communications systems and planned communications experiments. Other systems are described in sufficient detail to provide an overall view of the ATS. (Author) B.B.

c31 070100 04

A66-10798 #
FLIGHT EXPERIENCE AND APPLICATION OF EARTH ORBITING GRAVITY GRADIENT STABILIZATION SYSTEMS.
H. W. Paige (General Electric Co., Missile and Space Div., Philadelphia, Pa.).
International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 37 p.
Use of the gravity gradient effect to develop systems for the orientation of spacecraft and for the damping of associated librations. The elimination of any sustained operating power, extreme simplicity, low weight, and inherent long life make the application of these types of stabilization systems to communication, meteorological, navigation, and scientific satellites very attractive. The salient design problems and constraints are discussed, and development progress is reviewed. The results from three flight experiments, and the continuous performance of a two-axis system orbited in Jan. 1964 are summarized. System types and related application criteria are categorized. Concepts for future application of gravity gradient stabilization systems are presented. F.R.L.

c31 090000 18

A66-24770 #
GRAVITY GRADIENT STABILIZATION OF COMMUNICATION SATELLITE SYSTEMS.
R. G. Moyer and R. J. Katucki (General Electric Co., Missile and Space Div., Spacecraft Dept., Philadelphia, Pa.).
American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, Washington, D.C., May 2-4, 1966, Paper 66-303. 16 p. 6 refs.
Members, $0.75; nonmembers, $1.50.
Description of the requirements for gravity gradient stabilization for medium and synchronous altitude (random and spaced) communication satellite systems. Communications satellite payloads launched to date have been spin stabilized with essentially zero gain antennas, and studies have shown that communication efficiency must be improved to be practical. Effective gains of 10 db at medium altitude and 14 db at synchronous altitude can be realized by using a directional antenna and stabilizing the satellite to the local vertical by gravity gradient. Stabilization accuracy, right-side-up capture, station keeping effects, and the effects of the various disturbance torques on system design are discussed. Flight test history of gravity gradient stabilized satellites and future flight plans are summarized. F.R.L.

c31 090000 12

A66-24771 #
SYNCHRONOUS SATELLITE STATIONKEEPING.
M. J. Neufeld and B. M. Anzel (Hughes Aircraft Co., Aerospace Group, Space Systems Div., El Segundo, Calif.).
American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, Washington, D.C., May 2-4, 1966, Paper 66-304. 20 p. 8 refs.
Members, $0.75; nonmembers, $1.50.
Synchronous orbit stationkeeping techniques are described with emphasis on spin-stabilized spacecraft. Thrust control requirements resulting from system position tolerance and natural perturbations are discussed. Control techniques and propulsion systems suitable for long term stationkeeping are described. Finally, a typical control sequence for a spin-stabilized spacecraft using pulse-jet control is described. (Author)

c31 020800 01

A66-25858
SPACE SCIENCE AND COMMUNICATIONS SATELLITES [WELTRAUMFORSCHUNG - NACHRICHTENSATELLITEN].
W. Nestel (Telefunken AG, Berlin, West Germany).
(Technische Hochschule Hannover, Hochschultag, Hanover, West Germany, Oct. 30, 1965, Vortrag.)
Flugwelt, vol. 18, Mar. 1966, p. 189-193. In German.
Review of the design and principles of operation of the Relay, Telstar, Syncom, Early Bird, and project-ATC communications satellites. The electronics involved in the launching and operation of a communications satellite are discussed and illustrated. The subminiaturization, micromodule, integral thin-film, and integral semiconductor techniques and their applications in communications-satellite design are examined. The warning is sounded that a country which does not place sufficient emphasis on space research and development is bound to lag behind the leading countries and be unable to compete with these even in fields that are not directly associated with space science. V.P.

c31 010000 05

A66-38838
AIAA/JACC GUIDANCE AND CONTROL CONFERENCE, SEATTLE, WASH., AUGUST 15-17, 1966. TECHNICAL PAPERS.
New York, American Institute of Aeronautics and Astronautics, 1966. 756 p.
Members, $10.00; nonmembers, $20.

CONTENTS:

THE MECHANIZATION OF A STRAPDOWN INERTIAL SYSTEM BASED ON TIME-MODULATED TORQUING. Andrew E. Scoville and Joseph Yamron (United Aircraft Corp., Farmington, Conn.), p. 136-148. [See A66-38849 21-21]

A GENERALIZED DESIGN CRITERION FOR STRAPPED-DOWN INERTIAL SENSOR LOOPS. James P. Roantree and Nicholas J. Kormanik (United Aircraft Corp., Farmington, Conn.), p. 149-162. 5 refs. [See A66-38850 21-21]

FLIGHT TEST EVALUATION AND COMPARISON OF SEVERAL NO-GIMBAL ALGORITHMS. Albert R. Turley and John A. Carnaghie (USAF, Systems Command, Wright-Patterson AFB, Ohio), p. 163-171. [See A66-38851 21-21]

ATTITUDE CONTROL.

DESIGN OF A STANDARD LAUNCH VEHICLE CONTROL SYSTEM. R. B. Schroer (Martin Marietta Corp., Denver, Colo.), p. 172-178. [See A66-38852 21-31]

DIGITAL ATTITUDE REFERENCE - REDUNDANCY AND TEMPERATURE CONTROL CONSIDERATIONS. D. H. Barnhill and D. C. Susens (Honeywell, Inc., Minneapolis, Minn.), p. 179-194. [See A66-38853 21-21]

THE AOSO STABILIZATION AND CONTROL SYSTEM - A HIGH PERFORMANCE SATELLITE CONTROLLER. G. T. Broucek, p. 195-207. [See A66-38854 21-31]

PSEUDO-RATE SAWTOOTH-PULSE RESET CONTROL SYSTEM ANALYSIS AND DESIGN. E. D. Scott (Lockheed Aircraft Corp., Sunnyvale, Calif.), p. 208-214. 5 refs. [See A66-38855 21-31]

DEVELOPMENT AND APPLICATION OF THE BOEING SPACE-FLIGHT SIMULATOR. Beaman W. Brockway and David G. Tubb (Boeing Co., Seattle, Wash.), p. 215-225. [See A66-38856 21-11]

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STABILIZATION SYSTEM ANALYSIS AND PERFORMANCE OF THE GEOS-A GRAVITY-GRADIENT SATELLITE (EXPLORER XXIX). Vincent L. Pisacane, Peter P. Pardoe, and B. Joy Hook (Johns Hopkins University, Silver Spring, Md.), p. 226-237. 11 refs. [See A66-38857 21-31]

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ATTITUDE CONTROL SYSTEM FOR THE GRAVITY GRADIENT STABILIZED APPLICATIONS TECHNOLOGY SATELLITE (ATS). E. M. Mazur (General Electric Co., Valley Forge, Pa.), p. 249-255. [See A66-38859 21-31]

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A HYDRAULIC SUPPORT FOR FREE-FLIGHT SIMULATION WITH THE SATURN-V APOLLO VEHICLE. George L. von Pragenau (NASA, Marshall Space Flight Center, Ala.), p. 413-440. 15 refs. [See A66-38876 21-11]

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INS - A MARINE STELLAR-INERTIAL SYSTEM WITH OPTIMUM DATA PROCESSING. Robert Carlstrom, Edward Gold (Sperry Rand Corp., Great Neck, N.Y.), and Andrew Reilly (U.S. Navy, Washington, D.C.), p. 607-617. [See A66-38891 21-21]

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AN ULTRA-RELIABLE ATTITUDE REFERENCE SYSTEM FOR A MANNED ORBITING LABORATORY WITH LIMITED SPARING CAPABILITY. R. Weiss (General Precision, Inc., Wayne, N.J.) and I. Nathan (Anathon, Inc., New York, N.Y.), p. 618-632. 8 refs. [See A66-38892 21-21]

ANALYSIS OF GEMINI 7-STAR SIGHTINGS UTILIZING A HANDHELD SPACE SEXTANT IN GEMINI 6. T. B. Murtagh, C. R. Price, and H. E. Smith (NASA, Manned Spacecraft Center, Tex.), p. 633-639. 5 refs. [See A66-38893 21-21]

TRANS-STELLAR SPACE NAVIGATION. Saul Moskowitz and William P. Devereux (Kollsman Instrument Corp., Elmhurst, N.Y.), p. 640-659. [See A66-38894 21-21]

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THE ACTIVE DAMPING OF FREE-ROTOR GYROSCOPES DURING INITIAL SPIN-UP. Bradford Parkinson (USAF, Systems Command, Edwards AFB, Calif.) and Benjamin Lange (Stanford University, Stanford, Calif.), p. 673-687. 7 refs. [See A66-38896 21-14]

AIRCRAFT AND VEHICLE SYSTEMS.

DEVELOPMENT OF THE ITERATIVE GUIDANCE MODE WITH ITS APPLICATION TO VARIOUS VEHICLES AND MISSIONS. Doris C. Chandler (NASA, Marshall Space Flight Center, Ala.) and Isaac E. Smith (Northrop Corp., Hawthorne, Calif.), p. 688-696. 5 refs. [See A66-38897 21-21]

SATURN V GUIDANCE, NAVIGATION, AND TARGETING. Daniel T. Martin, Robert M. O'Brien, Alvin F. Rice, and Russell F. Sievers (Boeing Co., Huntsville, Ala.), p. 697-712. 9 refs. [See A66-38898 21-21]

A MANUALLY RETARGETED AUTOMATIC DESCENT AND LANDING SYSTEM FOR LEM. Allan R. Klumpp (Massachusetts Institute of Technology, Cambridge, Mass.), p. 713-727. [See A66-38899 21-21]

FLIGHT TESTS OF A MANNED ROCKET-POWERED VEHICLE UTILIZING THE LANGLEY LUNAR LANDING RESEARCH FACILITY. Thomas C. O'Bryan (NASA, Langley Research Center, Va.), p. 728-734. [See A66-38900 21-31]

A HOVER AUGMENTATION SYSTEM FOR HELICOPTERS. R. S. Buffum and W. T. Robertson (Sperry Rand Corp., Phoenix, Ariz.), p. 735-748. [See A66-38901 21-02]

A FLUIDIC APPROACH TO CONTROL OF VTOL AIRCRAFT. Jimmy L. Haugen (Honeywell, Inc., Minneapolis, Minn.), p. 749-756. [See A66-38902 21-03]

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A66-38859 #

ATTITUDE CONTROL SYSTEM FOR THE GRAVITY GRADIENT STABILIZED APPLICATIONS TECHNOLOGY SATELLITE (ATS).

E. M. Mazur (General Electric Co., Missile and Space Div., Spacecraft Dept., Valley Forge, Pa.).

IN: AIAA/JACC GUIDANCE AND CONTROL CONFERENCE, SEATTLE, WASH., AUGUST 15-17, 1966. TECHNICAL PAPERS. [A66-38838 21-21]

New York, American Institute of Aeronautics and Astronautics, 1966, p. 249-255.

Discussion of the gravity-gradient stabilization system and the sensor subsystem used for attitude determination and for obtaining flight test data on the gravity-gradient components for the applications technology satellite (ATS). The specific requirements of the gravity-gradient orientation system components that are uniquely associated with the experimental objectives of ATS but which are not required for gravity-gradient stabilization as such are discussed. The capability to reconfigure the ATS gravity-gradient spacecraft in orbit is a unique requirement associated with the experimental objectives of ATS. By changing the primary boom lengths, the magnitudes of the spacecraft moment of inertia can be varied; by changing the X-boom half-angle, the spacecraft moment-of-inertia ratios can be varied. Thus, with the capability for retraction, reextension, and scissoring of the primary boom system configuration, the spacecraft can essentially be reconfigured in orbit. M.M.

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A66-40055 #

OPERATIONAL PROCESSING OF SATELLITE CLOUD PICTURES BY COMPUTER.

C. L. Bristor, W. M. Callicott, and R. E. Bradford (ESSA, National Environmental Satellite Center, Washington, D.C.).

Monthly Weather Review, vol. 94, Aug. 1966, p. 515-527. 15 refs.

Survey of current procedures used to form operational products from digitized satellite cloud pictures. Satellite vidicon cameras provide full-resolution rectified orbital mosaics for direct visual use and full-resolution rectified multipass montages for generating meso-scale descriptors. These are used for machine-generated nephanalyses and are the source of output products (displays and digital forms for further operational and archival use). The sheer volume of data obtained precludes adequate manual processing. The present system is a practical real-time operation, but projected higher-resolution (and possibly color) imaging devices, plus the incorporation of infrared data, will probably require a parallel network computer, as they would saturate the largest existing system. Numerous line drawings, photographic mosaics, and digitized cloud pictures illustrate the data processing techniques used. W.A.E.

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A67-10665
A SPLIT PERSONALITY VHF COM SYSTEM.
Brendan Spratt (Bendix Corp., Bendix Radio Div., Baltimore, Md.).
IN: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, REGION III CONVENTION, ATLANTA, GA., APRIL 11-13, 1966, PROCEEDINGS. [A67-10664 01-10]
New York, Institute of Electrical and Electronics Engineers, Inc., 1966. 5 p.
Consideration of the possibilities inherent in the launching proposed for November 1966 of the Applications Technology Satellite B for improved aircraft-to-ground communications facilities. This satellite will furnish 200 watts of effective radiated power as a repeater in the vhf COM band. In order that the full advantages offered by such a communications link are obtainable certain modifications must be made in the conventional vhf systems. The design parameters and system for the new requirements are described and include (1) greatly increased rf output, (2) PM/FM instead of AM modulation, (3) improved sensitivity, and (4) provision for AM modulation when required. D. P. F.

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A67-11426 * #
THE AUTOMATIC ANTENNA POSITION CONTROL SYSTEM FOR THE ATS SYNCHRONOUS ORBIT SPIN-STABILIZED SATELLITE.
O. Mahr (Sylvania Electric Products, Inc., Sylvania Electronic Systems Div., Waltham, Mass.).
International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, Oct. 9-15, 1966, Paper. 19 p.
Contract No. NAS 5-9521.
Description of a high-gain directive-antenna positioning system for a spin-stabilized satellite. A narrow-beam antenna must be positioned properly for the antenna beam to stand still with respect to the earth while the satellite rotates. The system provides the required positioning and control by means of a mechanically despun antenna, with the antenna reflector driven in the opposite direction to the satellite rotation by a synchronous motor rotating at exactly the spin rate of the satellite. A direct-drive motor is used to eliminate gear trains. An evaporative liquid lubricating system with an integral lubricant reservoir is provided. In the normal mode, the gain is 17 db in elevation and in azimuth, a considerable improvement over the low-gain omnidirectional antennas now used for the down link in satellite communications systems. W.A.E.

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A67-11430 * #
SPACE APPLICATIONS RESEARCH AND DEVELOPMENT.
Leonard Jaffe (NASA, Office of Space Science and Applications, Space Applications Programs Office, Washington, D.C.).
International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, Oct. 9-15, 1966, Paper. 35 p.
Survey of the implications of remote sensors mounted in spacecraft for the purpose of gathering data on earth resources. The earth-resources survey satellites are a natural outgrowth of previous satellites orbited for communications, meteorological, geodetic, and navigation purposes. The four major areas related to the earth's resources in which space technology can be profitably applied are (1) agriculture and forestry, (2) geography and cartography, (3) geology and hydrology, and (4) oceanography and marine technology. The instruments needed to gather data for these surveys include various types of cameras, radars, altimeters, infrared imagers, infrared radiometers and spectrometers, microwave radiometers, and magnetometers. The resolution required to observe each phenomenon is still under study. W.A.E.

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A67-15723 *
A FLUXGATE MAGNETOMETER FOR THE APPLICATIONS TECHNOLOGY SATELLITE.
J. Dale Barry and Robert C. Snare (California, University, Institute of Geophysics and Planetary Physics, Los Angeles, Calif.).
(Institute of Electrical and Electronics Engineers, Annual Conference on Nuclear and Space Radiation Effects, Stanford University, Palo Alto, Calif., July 18-21, 1966, Paper.)
IEEE Transactions on Nuclear Science, vol. NS-13, Dec. 1966, p. 326-332.
Research supported by the University of California; Contract No. NAS 5-9570; Grant No. NsG-249-62.
Description of a satellite-borne magnetometer used to detect MHD wave propagation within the magnetosphere. The instrument is a biaxial, closed-loop, fluxgate magnetometer. The unit consists of the basic magnetometer plus additional sections, including a data processor, a field nulling section, and sensitivity selection logic. The basic magnetometer is discussed briefly, the additional sections in greater detail. It is shown that the use of sum and difference amplifiers in the data processor enable the derivation of magnetic field vectors transverse and parallel to the spacecraft spin axis. An in-flight calibration section is discussed and referenced to instrument stability and sensitivity. A brief discussion of the applications technology satellite (ATS) mentions the advantages of its orbit, which is favorable for the study of long-term magnetic field variations and for correlation with plasma and particle experiments also onboard. M. F.

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A67-20669
AUTOMATIC, REAL TIME DATA ACQUISITION AND PROCESSING FOR ATS COMMUNICATIONS EXPERIMENTS.
Gerold E. Dehm and Robert W. Donaldson (Westinghouse Electric Corp., Baltimore, Md.).
(Institute of Electrical and Electronics Engineers, Aerospace and Electronic Systems Convention, Washington, D.C., Oct. 3-5, 1966, Paper.)
IEEE Transactions on Aerospace and Electronic Systems, Supplement vol. AES-2, Nov. 1966, p. 174-186.
Description of the hardware and software methods used in the development of an automatic data handling system for the ATS communications experiments. This system is considered a forerunner of a new generation of highly sophisticated automated data systems of the future. The eight experiment groups involved in these studies are specified and the operational philosophy of the experiments is outlined. A data processing block diagram is given. V. Z.

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A67-23367 * #
ATS-I CAMERA EXPERIMENT SUCCESSFUL.
Robert H. McQuain (NASA, Space Applications Program Office, Washington, D.C.).
American Meteorological Society, Bulletin, vol. 48, Feb. 1967, p. 74-79.
Description of photographs obtained on board the ATS-I satellite with the aid of a camera equipped with a reflecting telescope. A sequence of seven pictures showing the changing cloud patterns during daylight over about 1/4 of the globe is analyzed. It is concluded that detailed viewing of short-lived weather systems and phenomena from synchronous altitude is feasible, that such mesoscale phenomena as thunderstorms, possibly even tornadoes, can be identified and tracked, and that the cloud systems comprising the Intertropical Convergence Zone can be observed and studied. A. B. K.

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A67-23696
AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, AND AMERICAN SOCIETY OF MECHANICAL ENGINEERS, STRUCTURES, STRUCTURAL DYNAMICS AND MATERIALS CONFERENCE, 8TH, PALM SPRINGS, CALIF., MARCH 29-31, 1967, TECHNICAL PAPERS.
New York, American Institute of Aeronautics and Astronautics, Inc., 1967. 749 p.
Members, $12.; nonmembers, $24.

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STRESS CORROSION CRACKING OF TITANIUM ALLOYS. T. R. Beck and M. J. Blackburn (Boeing Co., Seattle, Wash.), p. 39-47. 17 refs. [See A67-23701 10-17]

DIFFUSION BONDING OF TITANIUM SANDWICH STRUCTURE FOR SATURN TANK WALL APPLICATION. J. W. Huffman (North American Aviation, Inc., Los Angeles, Calif.) and F. La Iacona (NASA, Marshall Space Flight Center, Ala.), p. 48-53. [See A67-23702 10-15]

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COMBINED BENDING AND AXIAL LOADING OF A LAYERED CYLINDER EXHIBITING MULTILINEAR MATERIAL BEHAVIOR. D. R. Doner and D. F. Adams (Philco Corp., Newport Beach, Calif.), p. 88-97. [See A67-23706 10-32]

ON THE CONCEPT OF MATCHED PULSES FOR TWO-LAYER LAMINATES. Willem Stuiver (Hawaii, University, Honolulu, Hawaii), p. 98-111. 5 refs. [See A67-23707 10-32]

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A FINITE ELEMENT APPROACH FOR THE ANALYSIS OF RANDOMLY EXCITED COMPLEX ELASTIC STRUCTURES. C. D. Newsom (Boeing Co., Seattle, Wash.; Tracor, Inc., Austin, Tex.), J. R. Fuller (Boeing Co., Seattle, Wash.), and R. E. Sherrer (Washington, University, Seattle, Wash.), p. 125-134. 6 refs. [See A67-23710 10-32]

DYNAMIC SNAP-THROUGH OF SHALLOW ARCHES UNDER STOCHASTIC LOADS. S. T. Ariaratnam and T. S. Sankar (Waterloo, University, Waterloo, Ontario, Canada), p. 135-141. 10 refs. [See A67-23711 10-32]

ON THE PRESSURE LOADING FUNCTIONS FOR OSCILLATING WINGS WITH CONTROL SURFACES. M. Landahl (Massachusetts Institute of Technology, Cambridge, Mass.), p. 142-147. [See A67-23712 10-01]

DISCRETE ELEMENT METHODS FOR THE PLASTIC ANALYSIS OF STRUCTURES SUBJECTED TO CYCLIC LOADING. H. Armen, Jr., A. Pifko, and G. Isakson (Grumman Aircraft Engineering Corp., Bethpage, N.Y.), p. 148-161. 17 refs. [See A67-23713 10-32]

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ANALYSIS OF ELASTIC STABILITY OF SHELLS OF REVOLUTION BY THE FINITE ELEMENT METHOD. D. R. Navaratna, T. H. H. Pian, and E. A. Witmer (Massachusetts Institute of Technology, Cambridge, Mass.), p. 175-185. 20 refs. [See A67-23715 10-32]

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FINITE DEFLECTION STRUCTURAL ANALYSIS USING PLATE AND CYLINDRICAL SHELL DISCRETE ELEMENTS. L. A. Schmit, Jr., R. L. Fox (Case Institute of Technology, Cleveland, Ohio), and F. K. Bogner, p. 197-211. 16 refs. [See A67-23717 10-32]

A COMPARATIVE STUDY OF NUMERICAL METHODS OF ELASTIC-PLASTIC ANALYSIS. Pedro V. Marcal (Bell Aerospace Corp., Buffalo, N.Y.), p. 212-216. 11 refs. [See A67-23718 10-32]

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ASYMPTOTIC SOLUTION FOR SHORT RING-REINFORCED OVAL CYLINDERS. N. B. Nissel (Fairchild Hiller Corp., Farmingdale, N.Y.) and W. P. Vafakos (Brooklyn, Polytechnic Institute, Brooklyn, N.Y.), p. 684-694. 16 refs. [See A67-23766 10-32]

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THE EFFECT OF FIBER SPACING IN COMPOSITES ON MODULUS OF LAMINATE CONFIGURATIONS USED IN AEROSPACE

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A67-23757 * #

SYSTEMS CONSTRAINTS IMPOSED ON SPACECRAFT UTILIZING LONG EXTENDABLE RODS WITH ATTACHED TIP MASSES.

A. T. Josloff (General Electric Co., Missile and Space Div., Spacecraft Dept., Valley Forge, Pa.).

IN: AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, AND AMERICAN SOCIETY OF MECHANICAL ENGINEERS, STRUCTURES, STRUCTURAL DYNAMICS AND MATERIALS CONFERENCE, 8TH, PALM SPRINGS, CALIF., MARCH 29-31, 1967, TECHNICAL PAPERS. [A67-23696 10-32]

New York, American Institute of Aeronautics and Astronautics, Inc., 1967, p. 581-586. 5 refs.

Contract No. NAS 5-9042.

The influences or rod strength on spacecraft separation rates, deployment rates and retraction rates are discussed. The solutions to the problems are not rigorous, but can be classified as "engineering solutions" applicable in identifying the magnitude of significant problems and aiding in the establishment of system constraints. In general numerical rather than closed form solutions are presented since the problems are nonlinear in nature. The deployment of rods from a spacecraft having angular rates imposes bending moments on the rod due to centrifugal, Coriolis, and angular accelerations. Solutions are obtained that relate the tolerable combinations of spacecraft rate and rod extension rate based on the other physical parameters of the system. The problems associated with extension and retraction rates are generally related to the buckling phenomena that exist when a long slender rod with a tip mass is stopped or started at a finite length. The technique used to investigate this problem is to assume transfer of the kinetic energy of the tip mass into flexural strain energy of the rod in its buckled mode as determined by utilizing the differential equation of the deflection shape along with boundary conditions of axial and transverse inertial forces of the tip mass at the free end. Expressions are developed for determining the maximum bending moments and excursions. The results of the investigation indicate that careful consideration must be given when specifying allowable spacecraft separation rate errors, and erection and retraction rates in order to preclude structural problems. (Author)

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A67-26047 * #

PRE-FLIGHT TESTING OF THE ATS-1 THERMAL COATINGS EXPERIMENT.

Penelope J. Reichard and Jack J. Triolo (NASA, Goddard Space Flight Center, Greenbelt, Md.).

American Institute of Aeronautics and Astronautics, Thermophysics Specialist Conference, New Orleans, La., Apr. 17-20, 1967, Paper 67-333. 12 p. 8 refs.

Members, $0.75; nonmembers, $1.50.

In an effort to accurately measure the solar absorptance over thermal emittance (α_s/ε) of thermal design coatings in the space environment, a rigorous preflight test procedure was incorporated in the Goddard Thermal Coatings Experiment (TCE) program. This procedure is described along with the problems which were encountered and points which were considered. The importance of performing these tests is emphasized rather than the specific tests used. An error analysis of the preflight testing and flight experiments is discussed. Results of sensor and cup calibrations are presented, and initial flight data from the TCE on the first Applications Technology Satellite, ATS-1, and laboratory values of α_s/ε are compared. Since the initial flight points were measured 48 hours after launch, not all flight values agree with preflight laboratory values; however, the four (of the nine) sample values in disagreement can be explained by rapid degradation in space which have been qualitatively verified by laboratory tests. The necessity of preflight testing is discussed indicating that, if a sensor cup or sample mount has a relatively large heat loss, relative changes in α_s/ε can be meaningless when preflight testing is ignored. On the other hand, when even moderately inaccurate calibrations are performed, flight α_s/ε measurements are more accurate than those performed in the laboratory. (Author)

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A67-26305 * #

BEHAVIOR OF THE NIGHTTIME IONOSPHERE.

A. V. da Rosa and F. L. Smith, III (Stanford University, Stanford Radioscience Laboratory, Stanford, Calif.).

Journal of Geophysical Research, vol. 72, Apr. 1, 1967, p. 1829-1836. 16 refs.

Grant No. NsG-30-60.

Measurements of columnar electron contents made at frequent time intervals throughout the night permit the determination of the rate at which the total content decays. It is found that at midlatitudes this rate is correlated with the geomagnetic activity index K_p, while such correlation is negligible at lower latitudes. An annual variation of the decay rate is observed, with a maximum around June. These results are consistent with the theory that the nighttime ionosphere is maintained in part by the downward flux of electrons from the protonosphere. (Author)

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A67-30649

GUIDANCE AND CONTROL; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 16TH, ATHENS, GREECE, SEPTEMBER 13-18, 1965, PROCEEDINGS. VOLUME 2.

Congress supported by the United Nations Educational, Scientific and Cultural Organization.

Edited by Michał Łunc.

Paris, Gauthier-Villars, Dunod; New York, Gordon and Breach; Warsaw, Państwowe Wydawnictwo Naukowe, 1966. 320 p.

In English and French.

$14.

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FLIGHT EXPERIENCE AND APPLICATION OF EARTH-ORBITING GRAVITY GRADIENT STABILIZATION SYSTEMS. R. V. Davis, R. J. Katucki, and H. W. Paige (General Electric Co., Philadelphia, Pa.), p. 293-300. [See A67-30663 16-31]

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FLIGHT EXPERIENCE AND APPLICATION OF EARTH-ORBITING GRAVITY GRADIENT STABILIZATION SYSTEMS.

R. V. Davis, R. J. Katucki, and H. W. Paige (General Electric Co., Missile and Space Div., Philadelphia, Pa.).

(International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper.)

IN: GUIDANCE AND CONTROL; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 16TH, ATHENS, GREECE, SEPTEMBER 13-18, 1965, PROCEEDINGS. VOLUME 2. [A67-30649 16-21]

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Paris, Gauthier-Villars, Dunod; New York, Gordon and Breach; Warsaw, Państwowe Wydawnictwo Naukowe, 1966, p. 293-300.

[For abstract see issue 01, page 143, Accession no. A66-10798]

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A67-30684

METEOROLOGICAL AND COMMUNICATION SATELLITES; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 16TH, ATHENS, GREECE, SEPTEMBER 13-18, 1965, PROCEEDINGS. VOLUME 4.

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Paris, Gauthier-Villars, Dunod; New York, Gordon and Breach; Warsaw, Państwowe Wydawnictwo Naukowe, 1966. 212 p.

In English and French.

$10.00.

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A67-30694 *

THE APPLICATIONS TECHNOLOGY SATELLITE.

R. H. Pickard (NASA, Goddard Space Flight Center, Greenbelt, Md.).

(International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper.)

IN: METEOROLOGICAL AND COMMUNICATION SATELLITES; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 16TH, ATHENS, GREECE, SEPTEMBER 13-18, 1965, PROCEEDINGS. VOLUME 4. [A67-30684 16-31]

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Paris, Gauthier-Villars, Dunod; New York, Gordon and Breach; Warsaw, Państwowe Wydawnictwo Naukowe, 1966, p. 123-137.

[For abstract see issue 23, page 3516, Accession no. A65-35705]

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A67-31972

SURVEY OF REACTION CONTROL SYSTEMS FOR SYNCHRONOUS SATELLITES.

M. Edmund Ellion, H. DiCristina, and L. M. Wolf (Hughes Aircraft Co., Aerospace Group, Space Systems Div., El Segundo, Calif.).

IN: SOCIETY OF AUTOMOTIVE ENGINEERS, AEROSPACE SYSTEMS CONFERENCE, LOS ANGELES, CALIF., JUNE 27-30, 1967, PROCEEDINGS. [A67-31967 17-03]

New York, Society of Automotive Engineers, Inc., 1967, p. 91-109. 27 refs.

The analysis performed in the selection of a reaction control system for a spinning synchronous satellite is presented. A 2000-lb satellite is chosen as an illustrative example and the detailed steps followed in defining a tradeoff study leading to the selection of a preferred propulsion system are described. A "genesis" of the propulsion systems requirements is presented, followed by a definition of those criteria used in the selection of the optimum reaction control system. The paper then reviews a list of candidate propulsion systems and carefully examines their performance potential, state of development, and limitations. Finally, a tradeoff study is effected for the illustrative satellite in which total reaction control system weights are compared. Other criteria used in real system evaluation, such as availability, reliability, state of development, etc., not developed in detail, are though governing factors in the overall comparison. (Author)

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A67-32435

TIMETABLE FOR ION PROPULSION.

George R. Brewer and Jerome H. Molitor (Hughes Aircraft Corp., Research Laboratories, Ion Physics Dept., Malibu, Calif.).

Space/Aeronautics, vol. 47, June 1967, p. 92-101. 14 refs.

Outline of the state of development of the electrostatic ion engine. Two types of ion engines which are being developed - the contact ion engine and the electron bombardment engine - are discussed, and the planned use in 1968, 1969, and 1970 of ion engines using cesium-contact thrusters for station-keeping in NASA's Applications Technology Satellite series is described. Two types of propulsion systems, distinguished according to their primary power sources (either a solar cell array, or a nuclear reactor) are evaluated. The modularization of ion-propulsion systems is discussed, and the use of nuclear-electric engines to increase the payload capabilities and sharply reduce the number of launch vehicles required for a space mission is considered. B.B.

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A67-34788

EME - THE ENVIRONMENTAL EXPERIMENT PACKAGE FOR THE APPLICATIONS TECHNOLOGY SATELLITES.

L. W. Rustad (Westinghouse Electric Corp., Atomic, Defense and Space Group, Aerospace Div., Space and Information Systems Dept., Defense and Space Center, Baltimore, Md.).

Westinghouse Engineer, vol. 27, July 1967, p. 116-121.

Discussion of the Environmental Measurements Experiment (EME) designed to enhance our knowledge of the earth's ambient characteristics, to verify theoretical information, and to confirm or refine previous measurements. The purpose of the Applications Technology Satellite Program ATS/EME missions is to learn more about the earth's environment in the 6500- to 22,400-mi altitude range. The basic functional components of the EME package are listed. The basic function of the EME encoder is described, and the role of the command-interface control is discussed. Other topics discussed include power supply, EME structure, component packaging, ground-support equipment, and reliability. M.F.

c14 110000 07

A67-35172 #

STUDIES OF IRREGULAR ATMOSPHERIC REFRACTION USING STATIONARY SATELLITES.

Terence J. Elkins, Michael D. Papagiannis (Boston University, Boston, Mass.), and Jules Aarons (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Space Physics Laboratory, Bedford, Mass.).

COSPAR, Plenary Meeting, 10th, London, England, July 24-29, 1967, Paper. 16 p. 8 refs.

Contract No. F-19628-67-C-0018.

Studies have been made at Sagamore Hill 42°37'; 70°48'W) of the propagation characteristics of the transmissions from a number of stationary and near-stationary satellites. In particular, propagation at very low elevation angles has been studied at 136 and 401 MHz. The measurements featured high sensitivity, due to the use of large antennas and low noise receivers. Fading, attributable to both ionospheric and tropospheric sources, was observed. Both the amplitude and angular components of the fading were measured at 136 MHz, at which frequency the fading was predominantly due to ionospheric irregularities. These were found, in many cases, to be fairly large refracting inhomogeneities and to occur in patches having a typical dimension of 100-200 km. At 401 MHz, very long period (~15 min) fading was observed, often with large amplitude, below about 2° elevation. The characteristics of this fading have been found to be consistent with periodically varying refraction due to tropospheric gravity waves, traveling across the propagation path. (Author)

c07 100500 05

A67-35485 #

COMMENTS AND SPECULATIONS CONCERNING THE RADIATION BELTS.

C. E. McIlwain (California, University, La Jolla, Calif.).

International Quiet Sun Year and COSPAR, International Quiet Sun Year Assembly, 4th, London, England, July 17-22, 1967, Paper. 4 p.

Description of the possible nature of the earth's radiation belts. Several comments concerning the optimization of studies of the radiation-belt plasma are proposed. The formation of radiation belts is discussed, and processes involved in the heating of magnetospheric plasma by various energy sources are considered. An attempt is made to give a composite picture of the magnetospheric phenomena by describing the particle acceleration processes, beginning with conditions just prior to a large magnetic storm. Various levels of plasma activity are discussed, together with the accompanying phenomena throughout the duration of the disturbance. Diffusion of the particles during the quiescent periods between the storms is explained by currently available concepts. T. M.

c29 110200 02

A67-35634

PRACTICAL SPACE APPLICATIONS; AMERICAN ASTRONAUTICAL SOCIETY, NATIONAL MEETING, SAN DIEGO, CALIF., FEBRUARY 21-23, 1966, PROCEEDINGS.

Edited by L. L. Kavanau (North American Aviation, Inc., Space and Information Systems Div., Downey, Calif.).

Washington, American Astronautical Society, Inc.; Sun Valley, Calif., Scholarly Publications, Inc. (Advances in the Astronautical Sciences. Volume 21), 1967. 504 p.

Members, $11.75; nonmembers, $15.75.

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c30 010000 02

A67-35635
A RETROSPECTIVE LOOK AT THE APPLICATION SATELLITE PROGRAM.
Harry J. Goett (Philco-Ford Corp., WDL Div., Palo Alto, Calif.).
IN: PRACTICAL SPACE APPLICATIONS; AMERICAN AERONAUTICAL SOCIETY, NATIONAL MEETING, SAN DIEGO, CALIF., FEBRUARY 21-23, 1966, PROCEEDINGS. [A67-35634 19-30]
Edited by L. L. Kavanau.
Washington, American Astronautical Society, Inc.; Sun Valley, Calif., Scholarly Publications, Inc. (Advances in the Astronautical Sciences. Volume 21), 1967, p. 3-15.
Retrospective view of the steps that have lead to our present position in the use of satellites for practical space applications. Important successes have been achieved in the two areas of communication satellites and weather satellites. The first truly operational weather satellite was ESSA 1, launched early in 1966. The advances in space technology since the launching of Tiros I, on Apr. 1, 1960, are striking. A parallel development of communications satellites led to the launching of the Syncom and to a study of the advantages of synchronous or near-synchronous satellites. The question of an extended useful lifetime for satellites is discussed, as well as the possibility of carrying out "maintenance and repair" on a spacecraft from the ground. It is assumed that a phase of the space program is being reached where the emphasis will shift to the development of instrumentation that will bring back the data in a manner such as to make them useful in new applications areas. P.v.T.

c31 010000 03

A67-35934 #
ATTITUDE DETERMINATION AND CONTROL OF THE SYNCOM, EARLY BIRD, AND APPLICATIONS TECHNOLOGY SATELLITES.
W. H. Sierer and W. A. Snyder (Hughes Aircraft Co., Aerospace Group, Space Systems Div., El Segundo, Calif.).
American Institute of Aeronautics and Astronautics, Guidance, Control and Flight Dynamics Conference, Huntsville, Ala., Aug. 14-16, 1967, Paper 67-532. 6 p. 5 refs.
Members, $0.75; nonmembers, $1.50.
Discussion of attitude determination, including the data types and the estimation process, and the use of the hydrogen peroxide control system in changing spacecraft orientation. A normal launch sequence is covered, and the interrelation between attitude determination and control during critical mission phases, including real time analysis during reorientation is explained. The determination of control for final orbit operations, including the long-term effect of solar radiation pressure precession, is discussed. The accuracies achieved by current methods as indicated by operational experience and new techniques in attitude determination are covered. P. v. T.

c31 020000 06

A67-36591 * #
THE ATS VHF EXPERIMENT FOR AIRCRAFT COMMUNICATION.
J. P. Corrigan (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Canaveral Council of Technical Societies, Space Congress on the Challenge of the 1970's, 4th, Cocoa Beach, Fla., Apr. 3-6, 1967, Paper. 17 p.
Description of the vhf repeater experiment involving an active frequency translation repeater launched as a part of the experimental payload of the Applications Technology Satellite ATS-1. A follow-on experiment is planned for ATS-C. The vhf repeater experiment using an eight-element, electronically despun, phased-array antenna, will demonstrate the feasibility of providing a continuous voice communication link between ground control stations and aircraft anywhere within an area covered by the satellite. Both government and civilian air carriers will be active participants in the experiment. It is anticipated that the qualitative and quantitative data resulting from the vhf experiment will contribute to the development of future large scale satellite relay air control communication systems. P.v.T.

c07 070200 05

A67-36595 * #
THE MASER EXPERIMENT.
C. Curtis Johnson (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Canaveral Council of Technical Societies, Space Congress on the Challenge of the 1970's, 4th, Cocoa Beach, Fla., Apr. 3-6, 1967, Paper. 8 p.
Description of a functional maser system consisting of an amplifier, a low noise header assembly, and a superconducting magnet. The system described is used with the ATS series of satellites. The antenna-mounted support equipment includes the microwave pump, pump modulator, pump monitor, transfer switches, tunnel diode amplifier, and a noise source, as well as a closed-cycle helium refrigerator. The equipment for controlling and monitoring the system is located in the operations building. The power supplies for all the components (with the exception of the closed cycle refrigerator which is supplied with its own 440-v, 3 phase, 10-kva supply directly at the antenna) are located here. P.v.T.

c16 060100 02

A67-36610 * #
THE ATS-1 SPIN SCAN CAMERA EXPERIMENT.
Wendell S. Sunderlin (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Canaveral Council of Technical Societies, Space Congress on the Challenge of the 1970's, 4th, Cocoa Beach, Fla., Apr. 3-6, 1967, Paper. 12 p.
NASA-supported research.
Experimental investigation of the possibility of obtaining more realistic data on weather motions by means of a spin scan camera for the ATS-1 satellite. In this experiment, a high-resolution picture of the earth's disk is made, covering the earth's disk from latitude 50°N to 50°S where the earth subtends an angle of 17.3°. The pictures are essentially instantaneous as far as meteorological constants are concerned, each picture being completed in 20 minutes. The data are transmitted to ground receiving stations upon acquisition, and so no data storage is required in the satellite. With the synchronous orbit of the satellite it is thus possible to obtain a synoptic picture of the existing meteorological situation, and by proper manipulation of the received data, to obtain sequential pictures, or even simulate time-lapse photography. M.M.

c14 080100 05

A67-41505
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, PHOTOVOLTAICS SPECIALISTS CONFERENCE, 6TH, COCOA BEACH, FLA., MARCH 28-30, 1967, CONFERENCE RECORD. VOLUME 2 - SPACECRAFT POWER SYSTEMS, SOLAR CELL MATHEMATICAL MODEL.
New York, Institute of Electrical and Electronics Engineers, Inc., 1967. 250 p.
Price of three volumes: members, $10.00; nonmembers, $15.

CONTENTS:

THE DEVELOPMENT OF A FLEXIBLE DEPLOYABLE SOLAR ARRAY. Eiji L. Suenaga and Kenneth A. Ray (Hughes Aircraft Co., El Segundo, Calif.), p. 162-179. [See A67-41511 23-03]
MULTIKILOWATT SOLAR ARRAYS. D. W. Ritchie and J. D. Sandstrom (California Institute of Technology, Pasadena, Calif.), p. 180-198. [See A67-41512 23-03]

SOLAR CELL MATHEMATICAL MODEL.
A METHOD FOR PREDICTING SOLAR CELL CURRENT-VOLTAGE CURVE CHARACTERISTICS AS A FUNCTION OF INCIDENT SOLAR INTENSITY AND CELL TEMPERATURE. J. D. Sandstrom (California Institute of Technology, Pasadena, Calif.), p. 199-208. [See A67-41513 23-03]
CALCULATION OF 1-MEV ELECTRON FLUX AND IRRADIATION DEGRADATION OF SOLAR CELL I-V CURVES BY COMPUTER. Randolph Rasmussen (Radio Corporation of America, Princeton, N.J.), p. 209-232. 5 refs. [See A67-41514 23-03]
COMPUTER SIMULATION OF SOLAR ARRAY PERFORMANCE. W. D. Brown, G. W. Hodgman, and A. T. Spreen (Hughes Aircraft Co., El Segundo, Calif.), p. 233-250. [See A67-41515 23-03]

c03 020201 01

A67-41506 *
SOLAR POWER SYSTEMS FOR SATELLITES IN NEAR-EARTH ORBITS.
Charles M. MacKenzie (NASA, Goddard Space Flight Center, Space Power Technology Branch, Greenbelt, Md.).
IN: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, PHOTOVOLTAICS SPECIALISTS CONFERENCE, 6TH, COCOA BEACH, FLA., MARCH 28-30, 1967, CONFERENCE RECORD. VOLUME 2 - SPACECRAFT POWER SYSTEMS, SOLAR CELL MATHEMATICAL MODEL. [A67-41505 23-03]
New York, Institute of Electrical and Electronics Engineers, Inc., 1967, p. 1-31. 7 refs.

Description of several types of solar-conversion/energy-storage power systems used at Goddard Space Flight Center on satellites and other missions to provide a continuous power supply by interconnecting energy sources, power storage, and spacecraft load. The systems discussed include those of the IMP, Nimbus 1, and ATS 1. Block diagrams are given to show the key features of each system, together with its solar configuration. The mission objective, solar array, battery, power control and distribution, and performance of each of these systems are considered. V. Z.

c03 020201 02

A67-42028
AMERICAN SOCIETY FOR TESTING AND MATERIALS, INSTITUTE OF ENVIRONMENTAL SCIENCES, AND AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, SPACE SIMULATION CONFERENCE, 2ND, PHILADELPHIA, PA., SEPTEMBER 11-13, 1967, TECHNICAL PAPERS.
Philadelphia, American Society for Testing and Materials, 1967. 223 p.
Members, $7.00; nonmembers, $10.00.

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FACILITIES AND PROPULSION.
THEORY AND EXPERIMENTAL RESULTS OF A DETONATION TUBE TECHNIQUE FOR SIMULATING ROCKET PLUMES IN A SPACE ENVIRONMENT. Jarvis Leng, Richard A. Oman, and Harold B. Hopkins (Grumman Aircraft Engineering Corp., Bethpage, N.Y.), p. 1-14. 20 refs. [See A67-42029 24-33]
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ADHESION OF LUNAR SOIL SIMULATED BY ROCK COMMINUTED IN VACUUM. P. Blum, J. R. Roehrig, and M. J. Hordon (National Research Corp., Cambridge, Mass.), p. 63-68. 10 refs. [See A67-42034 24-30]
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SIMULATED MARTIAN SAND AND DUST STORMS AND EFFECTS ON SPACECRAFT COATINGS. Gary R. Dyhouse (McDonnell Douglas Corp., St. Louis, Mo.), p. 97-103. 8 refs. [See A67-42038 24-30]
A TRANSIENT TECHNIQUE FOR SPECIFIC HEAT MEASUREMENTS OF NON-CONDUCTIVE COATINGS. Carl R. Maag, Jr. (General Electric Co., Philadelphia, Pa.), p. 104-109. [See A67-42039 24-14]
SOLAR WIND-PLUS-ULTRAVIOLET EXPOSURE STUDIES ON SPACECRAFT THERMAL CONTROL COATINGS USING IN-SITU OPTICAL PROPERTY MEASUREMENT TECHNIQUES. N. J. Douglas, R. A. Breuch, M. McCargo (Lockheed Aircraft Corp., Palo Alto, Calif.), and R. E. Starkey (Philco-Ford Corp., Palo Alto, Calif.), p. 110-122. 12 refs. [See A67-42040 24-18]
NEW ASPECTS OF THERMOPHYSICS IN ADVANCED PLANETARY EXPLORATION. J. E. Gilligan (IIT Research Institute, Chicago, Ill.), p. 123-131. 10 refs. [See A67-42041 24-30]

SOLAR SIMULATION.
SPACE ENVIRONMENT SIMULATION WITH CONCEPTUALLY NEW SOLAR SIMULATOR. Allan D. Le Vantine, James E. Norris, and George A. Harter (TRW Systems Group, Redondo Beach, Calif.), p. 132-140. [See A67-42042 24-11]
THERMAL TESTING TECHNIQUES AT HIGH SOLAR INTENSITIES. R. E. Rolling, K. N. Marshall (Lockheed Aircraft Corp., Palo Alto, Calif.), and J. P. Kirkpatrick (NASA, Ames Research Center, Moffett Field, Calif.), p. 141-150. 9 refs. [See A67-42043 24-11]
A GIMBAL SYSTEM FOR SOLAR SIMULATION TESTING. R. G. Hertzler and A. G. Burke (McDonnell Douglas Corp., St. Louis, Mo.), p. 151-161. [See A67-42044 24-14]

THE BOEING 20-FOOT SOLAR SIMULATOR - PROGRESS REPORT. A. R. Lunde, J. W. Yerkes, and R. L. Haslund (Boeing Co., Seattle, Wash.), p. 162-177. 19 refs. [See A67-42045 24-11]

SYSTEMS APPLICATIONS.
THE SPECTRAL REFLECTANCE OF WATER AND CARBON DIOXIDE CRYODEPOSITS FROM 0.36 TO 1.15 MICRONS. B. E. Wood, A. M. Smith (ARO, Inc., Arnold Air Force Station, Tenn.), B. A. McCullough (Brown and Root, Inc., Houston, Tex.), and R. C. Birkebak (Kentucky, University, Lexington, Ky.),

p. 178-186. 11 refs. [See A67-42046 24-33]
SORPTION OF HELIUM BY 4.2°K CRYODEPOSITS.
Ronald Dawbarn and J. D. Haygood (ARO, Inc., Arnold Air Force Station, Tenn.), p. 187-191. 7 refs. [See A67-42047 24-05]
RESULTS OF AN IONIZATION GAUGE CALIBRATED IN THREE SYSTEMS. R. G. Camarillo (McDonnell Douglas Corp., Huntington Beach, Calif.), p. 192-195. 8 refs. [See A67-42048 24-14]
MANNED TESTING OF EXTRAVEHICULAR ACTIVITY EQUIPMENT IN A SIMULATED SPACE ENVIRONMENT.
Orvis E. Pigg (NASA, Manned Spacecraft Center, Houston, Tex.), p. 196-204. [See A67-42049 24-05]
MANNED CHAMBER TESTING OF THE LUNAR MODULE ENVIRONMENTAL CONTROL SUBSYSTEM. G. J. Frankel (Grumman Aircraft Engineering Corp., Bethpage, N.Y.), p. 205-216. [See A67-42050 24-11]
ANALYSIS OF THE TEMPERATURE VARIATIONS OF SATELLITE WITH INNER POWER DISSIPATION. T. Hayashi and T. Izumi (Tokyo, University, Tokyo, Japan), p. 217-219. [See A67-42051 24-33]

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A67-42033
A COLD WELDING INVESTIGATION OF THE ATS DAMPER BOOM.
H. Kaplan and J. H. Jones (General Electric Co., Missile and Space Div., Valley Forge, Pa.).
IN: AMERICAN SOCIETY FOR TESTING AND MATERIALS, INSTITUTE OF ENVIRONMENTAL SCIENCES, AND AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, SPACE SIMULATION CONFERENCE, 2ND, PHILADELPHIA, PA., SEPTEMBER 11-13, 1967, TECHNICAL PAPERS. [A67-42028 24-11]
Philadelphia, American Society for Testing and Materials, 1967, p. 50-62.

A study was conducted to determine whether the ATS silver-plated beryllium copper damper boom would cold-weld under flight conditions. The boom is a rolled tubular member which must be retracted and deployed in space. Special apparatus was developed which consisted of an ultrahigh vacuum enclosure and a cold-weld test device. This device is unique in that it is used in conjunction with a conventional high-vacuum chamber. D'Arsonval's principle is used to introduce oscillatory motion to the test sample. The extent of cold welding is monitored using strain gage techniques. The equipment, test techniques, and test results are discussed. Test factors include ultrahigh vacuum, temperature, load, and time. (Author)

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A67-42405 * #
THE SPIN SCAN CAMERA SYSTEM ON APPLICATION TECHNOLOGY SATELLITE-I.
Wendell S. Sunderlin (NASA, Goddard Space Flight Center, Greenbelt, Md.).
(Canaveral Council of Technical Societies, Space Congress on the Challenge of the 1970's, 4th, Cocoa Beach, Fla., Apr. 3-6, 1967, Paper.)
International Astronautical Federation, International Astronautical Congress, 18th, Belgrade, Yugoslavia, Sept. 24-30, 1967, Paper. 23 p.
[For abstract see issue 20, page 3446, Accession no. A67-36610]

c14 080100 06

A68-10994 *#
GROSS LOCAL-TIME PARTICLE ASYMMETRIES AT THE SYNCHRONOUS ORBIT ALTITUDE.
J. W. Freeman, Jr. and J. J. Maguire (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
Journal of Geophysical Research, vol. 72, Nov. 1, 1967, p. 5257-5264. 8 refs.
Contract No. NAS 5-9561.
Preliminary study of the data obtained from a low-energy charged-particle detector flown aboard the geostationary ATS 1 satellite. Large local-time variations in the particle fluxes observed during geomagnetically disturbed times are revealed. The salient features of the observed variations are: (1) during periods of moderate magnetic activity a high particle flux is seen near local midnight; this flux shows a strong pre/postmidnight asymmetry with the particle intensities being higher in the postmidnight quadrant; (2) during periods of high magnetic activity the enhanced particle-flux distribution broadens out in local time to cover a larger fraction of the night-side portion of the synchronous orbit; the pre/postmidnight asymmetry is generally still present, but less striking; (3) during periods of enhanced magnetic activity the local-time distribution of the particle fluxes shows a remarkable similarity to the local-time distribution of high-latitude magnetic-substorm activity. It is suggested that the observed particle distribution is indicative of an influx of energetic plasma from the magnetospheric tail. Implications relating to magnetic storm models are discussed. (Author)

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A68-11719
DEVELOPMENT TECHNIQUES OF THE INTEGRATED ENVIRONMENTAL MEASUREMENTS EXPERIMENT OF THE APPLICATIONS TECHNOLOGY SATELLITE (ATS).
L. W. Rustad and James Brown (Westinghouse Electric Corp., Aerospace,Defense and Marine Group, Aerospace Div., Baltimore, Md.).
(Deutsche Gesellschaft für Raketentechnik und Raumfahrt, Fortschrittliche Systemtechnik Symposion, Munich, West Germany, June 9, 1967, Vortrag.)
Raumfahrtforschung, vol. 11, Oct.-Dec. 1967, p. 183-188.
Description of the Environmental Measurement Experiment (EME), representing one of the major experiments carried on board the ATS-1 which was launched from Cape Kennedy in December 1966. The EME is a self-contained structural and experimental entity, fully integrating a group of from five to eight Governmental-furnished-equipment (GFE) experiments, with their attendant encoding, command, and power supply circuitry. The spacecraft interface consists of bus power, commands, and telemetry. The prime objectives at the inception of the EME program were to develop techniques for achieving the following: (1) a design which is easily manufacturable; (2) a repairable system during the initial development and test phases; (3) a lightweight, rugged construction which would withstand the launch phase; (4) a thermal design which would be adequate under all operating conditions in space; and (5) a highly reliable system during space operation. The testing phases have proven the first two objectives. Results from the launched ATS-1 system have conclusively proven that the latter three objectives have been achieved. P.v.T.

c14 110000 06

A68-13323 *#
COMMERCIAL SPACECRAFT TECHNOLOGY SURVEY.
Leonard Jaffe (NASA, Washington, D.C.).
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 4th, Anaheim, Calif., Oct. 23-27, 1967, Paper 67-877. 13 p.
Members, $1.00; nonmembers, $1.50.
Brief, general survey of automated-spacecraft development experience. New technology requirements are outlined for the following types of satellites: navigation/traffic control satellites, voice broadcast, earth-resources survey, and Applications Technology Satellites. R.B.S.

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A68-13449 #
TEMPORAL VARIATIONS IN THE ELECTRON FLUX AT SYNCHRONOUS ALTITUDES.
L. J. Lanzerotti, C. S. Roberts, and W. L. Brown (Bell Telephone Laboratories, Inc., Murray Hill, N.J.).
Journal of Geophysical Research, vol. 72, Dec. 1, 1967, p. 5893-5902. 11 refs.
A six-element solid-state detector telescope sensitive to electrons and heavier particles has been flown on the synchronous orbit ATS-1 satellite. The paper discusses the electron data from the experiment for the time period from day 351, 1966, through day 2, 1967. The electron data for electron energies ranging from about 0.4 to 2 Mev show a diurnal effect in the intensity with a minimum near local midnight. The electron spectrum is generally softer on the night side. The magnitude of the diurnal effect is frequently a factor of 10 for 1.5-Mev electrons and appears to increase with an increase in the magnetic index K_p. The diurnal effect in the electron flux is qualitatively explained by considering a distorted dipole model of the earth's magnetic field. On several occasions electron oscillations with 7 to 25-min periods have been observed in the data. From a simplified analysis of the oscillation periods as a function of electron energy the oscillations are attributed to the longitudinal drift of bunches of electrons. (Author)

c13 110300 03

A68-13468 *#
SOLAR FLARE EFFECTS IN THE IONOSPHERE.
Owen K. Garriott (Stanford University, Stanford Radioscience Laboratory, Stanford, Calif.; NASA, Manned Spacecraft Center, Houston, Tex.), Aldo V. da Rosa, Michael J. Davis, and O. G. Villard, Jr. (Stanford University, Stanford Radioscience Laboratory, Stanford, Calif.).
Journal of Geophysical Research, vol. 72, Dec. 1, 1967, p. 6099-6103. 12 refs.
Grants No. NsG-30-60; No. NsG-377; Contract No. NAS 5-10102.
Brief analysis of an electron-content increase of approximately 2×10^{16} electrons/m^2 which has been observed at a five-station network coincident with the occurrence of several bright solar flares. The time history of the flare events is examined by correlating optical brightness curves in the center of the $H\alpha$ line, sudden frequency deviations, radio noise, absorption, and sudden phase anomalies. The electron-content increase can be explained by a 300% enhancement of EUV radiation from the whole disk for an interval of about 100 sec. R.B.S.

c13 100503 01

A68-14881 *#
AN ANALYTICAL REPRESENTATION OF TEMPERATURE DISTRIBUTIONS IN GRAVITY GRADIENT RODS.
Francis A. Florio and Robert B. Hobbs, Jr. (General Electric Co., Missile and Space Div., King of Prussia, Pa.).
AIAA Journal, vol. 6, Jan. 1968, p. 99-102.
Contracts No. NAS 7-234; No. NAS 5-9042.
A closed-form analytical solution is presented for a steady-state thermal balance analysis of temperature distributions in a discontinuous cylindrical tube. The tube is considered to model a gravity gradient passive attitude control rod and as such, is isolated in space at a significant distance from the spacecraft structure. Heating of the tube is achieved by direct solar insolation, whereas cooling occurs by means of infrared radiation to deep space. The discontinuity of the tube results from a uniform cleavage, or separation, in the lateral surface. Solution to the thermal analysis is given for three position ranges of the sun vector as referenced to the location of the discontinuity. Results of tests conducted at NASA Goddard Space Flight Center show the analysis to be accurate in the prediction of thermal gradients. (Author)

c33 090000 43

A68-17340 *
AN IMAGE DISSECTOR CAMERA SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE.
G. A. Branchflower (NASA, Goddard Space Flight Center, Greenbelt, Md.), R. H. Foote, and D. Figgins (International Telephone and Telegraph Corp., ITT Industrial Laboratories, Fort Wayne, Ind.).
(Institute of Electrical and Electronics Engineers, Aerospace and Electronic Systems Technical Convention, Washington, D.C., Oct. 16-18, 1967, Paper.)
IEEE Transactions on Aerospace and Electronic Systems, Supplement, vol. AES-3, Nov. 1967, p. 63-71.
This paper describes a daylight cloud cover camera system which utilizes an image dissector tube as a sensing device. This camera will be one of the experiments tested aboard the synchronous altitude, spin stabilized Applications Technology Satellite-C. The camera traces one line of video information each time the satellite spins. In its primary scanning mode sweep deflection within the camera provides line scan while satellite rotational motion yields line to line displacement. The unit contains an internal clock whose output remains proportional to the spacecraft spin speed to within 3 parts in 10^6 for spin rates from 60 to 140 rpm. The timing and logic control portion of the camera implements the various system commands and provides a means of synchronizing sweep initiation with camera earth viewing. It also provides time of day corrections to compensate for the earth's 15° per hour rotation. This compensation is necessary because the system timing reference is the output pulse from the camera sun sensor, and the delay between sun and earth viewing changes with time of day. Ground support equipment, including signal processing and display, is also discussed.
(Author)

c14 080500 03

A68-20443
INSTITUTE OF NAVIGATION, NATIONAL AIR MEETING ON SUPERSONIC NAVIGATION, SEATTLE, WASH., NOVEMBER 15, 16, 1967, PROCEEDINGS.
Meeting sponsored by the Institute of Navigation and the Federal Aviation Administration.
Washington, D.C., Institute of Navigation, 1967. 291 p.
Members, $8.00; nonmembers, $12.

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OPERATIONAL METEOROLOGY FOR SST OPERATIONS. James K. Thompson (Federal Aviation Administration, Washington, D.C.), p. 23-35. [See A68-20444 08-20]
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FIRST GENERATION SUPERSONIC TRANSPORT NAVIGATION.
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AVIONICS SYSTEMS FOR THE SST ERA. G. L. Benning, G. T. Bergemann, J. M. Holt, and H. M. Schweighofer (Collins Radio Co., Cedar Rapids, Iowa), p. 184-198. [See A68-20453 08-21]
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SUMMATION. Larry Trenary (Federal Aviation Administration, Washington, D.C.), p. 291.

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A68-20449 #
AN INTERNATIONAL AIRLINE VIEWS SST NAVIGATION REQUIREMENTS.
B. F. McLeod (Pan American World Airways, Inc., New York, N.Y.).
IN: INSTITUTE OF NAVIGATION, NATIONAL AIR MEETING ON SUPERSONIC NAVIGATION, SEATTLE, WASH., NOVEMBER 15, 16, 1967, PROCEEDINGS. [A68-20443 08-21]
Meeting sponsored by the Institute of Navigation and the Federal Aviation Administration.
Washington, D.C., Institute of Navigation, 1967, p. 152-157.
Review of the rapid buildup of the air transport fleet, and discussion of the problem of increasing congestion. Airline desires are predicted for both short- and long-range navigation facilities for subsonic and SST aircraft. Considerable improvement in the flow of long-range air traffic is projected through the use of satellites.
F. R. L.

c21 070200 15

A68-20726
STUDIES OF RECEPTION BY MEANS OF THE ATS-C (APPLICATION TECHNOLOGY SATELLITE C) [EMPFANGSSTUDIEN MITTELS ATS-C (APPLICATION TECHNOLOGY SATELLITE C)].
Heinz Kaminski (Bochum, Sternwarte, Bochum, West Germany).
Raumfahrtforschung, vol. 12, Jan.-Mar. 1968, p. 29-32. 5 refs.
In German.

Evaluation of the broadcasting reception obtained by the Institute for Satellite and Space Research, Bochum, Germany, via the Application Technology Satellite C (ATS-C) during the period from Nov. 7 to Dec. 1, 1967. These tests were carried out with the aid of a 20-m parabolic antenna. In particular, simultaneous reception in the GHz and ultrashort-wave regions were tested. Two Pan American flights from New York to Europe were contacted. The results obtained proved that the antenna operated satisfactorily under the program assigned to it. P.v.T.

c31 070212 01

A68-21360 *
PREFLIGHT TESTING OF THE ATS-1 THERMAL COATINGS EXPERIMENT.
Penelope J. Reichard (NASA, Goddard Space Flight Center, Greenbelt, Md.) and Jack J. Triolo (NASA, Goddard Space Flight Center, Optical Measurements Section, Greenbelt, Md.).
(American Institute of Aeronautics and Astronautics, Thermophysics Specialist Conference, New Orleans, La., Apr. 17-20, 1967, Paper 67-333.)
IN: THERMOPHYSICS OF SPACECRAFT AND PLANETARY BODIES: RADIATION PROPERTIES OF SOLIDS AND THE ELECTROMAGNETIC RADIATION ENVIRONMENT IN SPACE.
Edited by G. B. Heller.
New York, Academic Press, Inc. (Progress in Astronautics and Aeronautics. Volume 20), 1967, p. 491-513. 8 refs.
[For abstract see issue 12, page 2038, Accession no. A67-26047]

c33 110600 02

A68-24442 *#
THE FIRST COLOR PICTURE OF THE EARTH TAKEN FROM THE ATS-3 SATELLITE.
Guenter Warnecke (NASA, Goddard Space Flight Center, Planetary Radiations Branch, Greenbelt, Md.) and Wendell S. Sunderlin (NASA, Goddard Space Flight Center, Greenbelt, Md.).
American Meteorological Society, Bulletin, vol. 49, Feb. 1968, p. 75-83.

Discussion of the ATS-3 space project, which resulted in a high-resolution color picture of the complete disk of the earth. Data were transmitted to ground receiving stations upon acquisition, and no data storage was required in the satellite. With the synchronous orbit of the satellite it is thus possible to obtain a synoptic picture of the existing meteorological situation. It is pointed out that the main advantage of cloud photographs from synchronous altitudes is the possibility of producing time series in 20 to 30-min steps. The ATS-3 spacecraft and the camera system are described. R.B.S.

c13 080100 10

A68-25454 *#
ATS ELECTROMECHANICALLY DESPUN ANTENNA.
R. Rubin, L. Blaisdell, and O. Mahr (Sylvania Electric Products, Inc., Sylvania Electronic Systems Div., Antenna and Microwave Laboratory, Waltham, Mass.).
American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 2nd, San Francisco, Calif., Apr. 8-10, 1968, Paper 68-425. 13 p.
Members, $1.00; nonmembers, $1.50.
Contract No. NAS 5-9521.

Description of a despun antenna using a line-source feed illuminating a parabolic cylindrical reflector to achieve a linearly polarized gain over 17 db. The antenna is positioned by means of a vernier-type stepping-motor drive system that points the antenna beam toward earth within approximately ±0.7° in accordance with instructions received on the satellite from the ground control station. Confidence in desired 5-yr life in orbit of the motor-drive system was obtained by testing the lubrication system and bearings for 7800 hr at temperatures ranging from -80 to +120°F at vacuum pressures as low as 1×10^{-8} torr. The antenna system is one of the experiments on NASA's ATS 3 spin-stabilized satellite launched on Nov. 5, 1967. M.G.

c09 020000 11

A68-25483 #
A SIMPLIFIED APPROACH FOR CORRECTION OF PERTURBATIONS ON A STATIONARY ORBIT.
Richard E. Balsam and Bernard M. Anzel (Hughes Aircraft Co., El Segundo, Calif.).
American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 2nd, San Francisco, Calif., Apr. 8-10, 1968, Paper 68-456. 12 p. 7 refs.
Members, $1.00; nonmembers, $1.50.

Description of a simplified method for exactly determining the impulsive velocity corrections that are required for precise stationkeeping of a stationary satellite. To determine the proper corrections, it is first necessary to analyze in detail the perturbed motion of a stationary satellite. With a set of vector elements, the motion is represented as a superposition of many periodic terms. This permits separation of the higher-frequency terms from osculating elements, and the elimination of perturbing effects of lower-frequency terms. Simple vectorial expressions are then derived that may be used to determine the magnitude, direction, and time of application of impulsive corrections to minimize the relative satellite motion. A suggested stationkeeping procedure is described and is illustrated using an ATS 1 orbit with a correction cycle of two weeks. R.B.S.

c30 050100 01

A68-27202 *#
AN ONBOARD, CLOSED-LOOP, NUTATION CONTROL SYSTEM FOR A SPIN-STABILIZED SPACECRAFT.
Lynn H. Grasshoff (Hughes Aircraft Co., Aerospace Group, Space Systems Div., Applications Technology Satellite Project Office, Systems Analysis Dept., El Segundo, Calif.).
Journal of Spacecraft and Rockets, vol. 5, May 1968, p. 530-535.
Contract No. NAS 5-3823.

The objective of the paper is to make available a detailed analysis and description of automatic (onboard) nutation control for unstable spin-stabilized spacecraft having unequal transverse moments of inertia larger than the spin inertia. The basic system under consideration consists of an accelerometer for sensing nutation and a signal conditioning unit (filter, amplifier, and switch) for providing power to a thrustor system which may or may not be a part of the normal spacecraft equipment. The thrustor imparts transverse axis torque pulses appropriately phased to reduce or remove nutation which, without control, would increase without reasonable limit. The analysis derives the equations and relationships necessary for defining system requirements and for establishing basic performance requirements of the major components. Treated at length is the matter of phasing the control torque pulses so that nutation is effectively reduced. The essence of the phasing problem is the placement of the accelerometer and the treatment of various phase angles and time delays inherent in the system design. The treatment of the asymmetrical spacecraft, insofar as its effect on control system design is concerned, is apparently not available in the literature. The paper provides the basis for a complete quantitative evaluation of automatic nutation control system design and performance. (Author)

c31 020700 01

A68-28932 *
ON THE VARIETY OF PARTICLE PHENOMENA DISCERNIBLE AT THE GEOSTATIONARY ORBIT VIA THE ATS-1 SATELLITE.
J. W. Freeman, Jr. and J. J. Maguire (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
(International Association of Geomagnetism and Aeronomy, Birkeland Symposium on Aurora and Magnetic Storms, Sandefjord, Norway, Sept. 18-22, 1967.)
Annales de Géophysique, vol. 24, Jan.-Mar. 1968, p. 295-303.
Contract No. NAS 5-9561.

Brief catalog of the three most salient phenomena that have been observed with the Rice University ion detector aboard the ATS-1 synchronous orbit satellite. These phenomena are a gross pre- and postmidnight asymmetry in the enhanced energetic charged particle fluxes observed on the night side of the earth, a magnetopause penetration to 6.5 $R_{\oplus}$ with the subsequent detection of discrete clouds of energetic particles executing repeated longitudinal drift about the earth, and bursts of very low energy ($E < 50$ ev), highly directional positive ions tentatively associated with hydromagnetic transients. Each of these phenomena is described in sufficient detail to illustrate the prominent facts. (Author)

c13 110700 06

A68-29401
SPACE RESEARCH VIII; PROCEEDINGS OF THE TENTH COSPAR PLENARY MEETING, IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, ENGLAND, JULY 24-29, 1967.
Edited by A. P. Mitra, L. G. Jacchia, and W. S. Newman. Amsterdam, North-Holland Publishing Co., 1968. 1111 p. In English and French.
$38.

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RESULTS OF STUDIES OF THERMAL GRADIENT EFFECTS ON CERAMIC TRANSDUCER SENSORS USED IN COSMIC DUST EXPERIMENTS. J. Lloyd Bohn, W. M. Alexander, and William F. Simmons (Temple University, Philadelphia, Pa.), p. 588-595. 5 refs. [See A68-29467 14-14]

RESULTS OF RECENT MICROPARTICLE HYPERVELOCITY IMPACT STUDIES RELATED TO SENSORS OF COSMIC DUST EXPERIMENTS. J. Lloyd Bohn, W. M. Alexander, and Albrecht Wever (Temple University, Philadelphia, Pa.), p. 596-605. 17 refs. [See A68-29468 14-14]

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ROCKET SAMPLING OF NOCTILUCENT CLOUD PARTICLES DURING 1964 AND 1965. Robert K. Soberman, Stanley A. Chrest, and Ralph F. Carnevale (USAF, Office of Aerospace Research, Bedford, Mass.), p. 617-626. [See A68-29470 14-13]

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OBSERVATIONS OF MESOSPHERIC OZONE DENSITY IN JAPAN. T. Nagata, T. Tohmatsu, and H. Tsuruta (Tokyo, University, Tokyo, Japan), p. 639-646. 22 refs. [See A68-29473 14-13]

THE FEATURES OF THE OZONE PLANETARY DISTRIBUTION ACCORDING TO OBSERVATIONS FROM ARTIFICIAL EARTH SATELLITES. V. A. Iozenas, V. A. Krasnopolskii, A. P. Kuznetsov, and A. I. Lebedinskii, p. 647-654. 11 refs. [See A68-29474 14-13]

WINDS IN THE EQUATORIAL UPPER ATMOSPHERE. P. D. Bhavsar and K. Ramanujarao (Physical Research Laboratory, Ahmedabad, India), p. 655-662. 11 refs. [See A68-29475 14-13]

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IONOSPHERIC WINDS - A STATISTICAL ANALYSIS. N. W. Rosenberg (USAF, Office of Aerospace Research, Cambridge, Mass.), p. 673-678. 11 refs. [See A68-29477 14-13]

NEW EXPERIMENTAL DATA CONCERNING THE VARIOUS WIND COMPONENTS BY MEANS OF A METEORIC RADAR AND DISCUSSION OF THE RESULTS OBTAINED BY MEANS OF ROCKETS [NOUVELLES DONNEES EXPERIMENTALES SUR LES DIFFERENTES COMPOSANTES DU VENT AU MOYEN D'UN RADAR METEORIQUE ET DISCUSSION DES RESULTATS OBTENUS AU MOYEN DE FUSEES]. A. Spizzichino (Centre National de la Recherche Scientifique, Saint-Maur-des-Fossés, Val-de-Marne, France) and I. Revah (Centre National d'Etudes des Télécommunications, Issy-les-Moulineaux, Hauts-de-Seine, France), p. 679-682. [See A68-29478 14-13]

PHOTOGRAPHY OF THE NIGHT AIRGLOW FROM THE GEMINI SERIES OF MANNED SPACECRAFT. M. J. Koomen, R. T. Seal, Jr. (U.S. Navy, Office of Naval Research, Washington, D.C.), and J. Lintott (NASA, Manned Spacecraft Center, Houston, Tex.), p. 683-691. 8 refs. [See A68-29479 14-13]

LOW LATITUDE NIGHTGLOW ARCS. D. D. Elliott and S. R. LaValle (Aerospace Corp., El Segundo, Calif.), p. 692-698. 5 refs. [See A68-29480 14-13]

ROCKET OBSERVATIONS OF EMISSION HEIGHTS OF 6300 Å LINE IN NIGHT AIRGLOW. M. Huruhata and T. Nakamura (Tokyo, University, Tokyo, Japan), p. 699-704. 5 refs. [See A68-29481 14-13]

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p. 1012-1015. 8 refs. [See A68-29515 14-13]

OBSERVATIONS OF SEA SURFACE TEMPERATURES AND OCEAN CURRENTS FROM NIMBUS II. Guenter Warnecke, Lewis J. Allison, and Lonnie L. Foshee (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 1016-1023. [See A68-29516 14-13]

STRATOSPHERIC TEMPERATURE PATTERNS DERIVED FROM NIMBUS II MEASUREMENTS. Guenter Warnecke and Andrew W. McCulloch (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 1024-1032. 6 refs. [See A68-29517 14-13]

THE GLOBAL RADIATION BALANCE OF THE EARTH ATMOSPHERE SYSTEM OBTAINED FROM RADIATION DATA OF THE METEOROLOGICAL SATELLITE NIMBUS II. Ehrhard Raschke and Musa Pasternak (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 1033-1043. 17 refs. [See A68-29518 14-13]

THE ANGULAR AND SPECTRAL DISTRIBUTION OF THE EARTH'S INFRARED RADIATION INTO SPACE ACCORDING TO THE RESULTS OF MEASUREMENTS FROM ARTIFICIAL EARTH SATELLITES. A. I. Lebedinskii, Iu. G. Andrianov, G. N. Barkova, V. G. Boldyrev, I. I. Karavaev, T. A. Leliakina, T. G. Poliakova, Iu. P. Safronov, and V. I. Tulupov, p. 1044-1062. 14 refs. [See A68-29519 14-13]

THEORETICAL INVESTIGATIONS IN THE 4.5 MICRON REGION WITH REGARD TO INVERSION EXPERIMENTS. I. O. Tannhäuser (München, Universität, Munich, West Germany), p. 1063-1068. 8 refs. [See A68-29520 14-13]

ASTRONOMICAL REFRACTION AT THE PIC-DU-MIDI OBSERVATORY [REFRACTION ASTRONOMIQUE A L'OBSERVATOIRE DU PIC-DU-MIDI]. F. Link (Československá Akademie Věd, Prague, Czechoslovakia), p. 1069-1072. [See A68-29521 14-13]

CONTRIBUTION OF IIOE AND WEATHER SATELLITES TO MONSOON-METEOROLOGY. P. R. Pisharoty (Physical Research Laboratory, Ahmedabad, India), p. 1073-1079. 8 refs. [See A68-29522 14-20]

MEASUREMENT OF ATMOSPHERIC TEMPERATURE AND WIND BY SOUNDING ROCKET IN INDONESIA. Karjoto (Indonesian National Aeronautics and Space Institute, Djakarta, Indonesia), p. 1080-1087. 12 refs. [See A68-29523 14-13]

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A68-29448

STUDIES OF IRREGULAR ATMOSPHERIC REFRACTION USING STATIONARY SATELLITES.

Terence J. Elkins, Michael D. Papagiannis (Boston University, Boston, Mass.), and Jules Aarons (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Space Physics Laboratory, Bedford, Mass.).

(COSPAR, Plenary Meeting, 10th, Imperial College of Science and Technology, London, England, July 24-29, 1967, Paper.)

IN: SPACE RESEARCH VIII; PROCEEDINGS OF THE TENTH COSPAR PLENARY MEETING, IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, ENGLAND, JULY 24-29, 1967. [A68-29401 14-13]

Edited by A. P. Mitra, L. G. Jacchia, and W. S. Newman. Amsterdam, North-Holland Publishing Co., 1968, p. 405-412. 8 refs.

Contract No. AF 19(628)-67-C-0018.

[For abstract see issue 19, page 3182, Accession no. A67-35172]

c07 **100500 05**

A68-29833 *

THE IMAGE DISSECTOR CAMERA - A NEW APPROACH TO SPACECRAFT SENSORS.

Gilbert A. Branchflower (NASA, Goddard Space Flight Center, Greenbelt, Md.) and Edward W. Koenig (International Telephone and Telegraph Corp., ITT Industrial Laboratories, Applied Electronics Dept., Fort Wayne, Ind.).

Information Display, vol. 5, Mar.-Apr. 1968, p. 55-60.

The Image Dissector Camera, using a newly adapted sensing technique, provides capabilities heretofore unattainable in spacecraft television systems. Based on the Image Dissector Tube, a nonstoring scanned detector, these cameras can add the versatility to meet the challenge of new and unusual requirements. Two cameras have now been developed for spacecraft use, one for the Nimbus B satellite utilizing the slow scan capability of the tube and one for the ATS-C spacecraft, using the versatile scan format capabilities of the tube. A general discussion of the tube itself and its application to these two cameras is given, with emphasis on the variety of applications where such a system may have distinct advantages. (Author)

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A68-31037
ASTRONAUTICS - ITS DEVELOPMENT DURING THE SECOND CENTURY OF THE RAeS (1966-2066).
A. V. Cleaver (Rolls-Royce, Ltd., Derby, England).
Aeronautical Journal, vol. 72, May 1968, p. 373-384.
Attempt to make reasonable forecasts of the future of astronautics, particularly for the next 20 years. It is considered that economic and social conditions will exert far more influence on the technical progress of astronautics than they have ever done on aeronautics. Many more applications satellites will be established for telecommunications, TV, educational, and propaganda purposes, for air traffic control and navigational aids, etc. All this will ensure the continued development of improved rocket vehicles. Fairly large manned space stations will be established. It is likely that men will reach Mars by the mid-1980s. Progress in the late 20th and early 21st centuries should be continuous, unless some extremely difficult technical barrier is encountered. For progress to continue, the first requirement will be the employment of nuclear energy in some form for the propulsion of interplanetary vehicles.
F.R.L.

c30 010000 38

A68-31922 #
OBSERVATIONS OF SOLAR PROTONS ABOARD OV3-3 AND ATS-1.
J. B. Blake, G. A. Paulikas, and S. C. Freden (Aerospace Corp., El Segundo, Calif.).
COSPAR, Plenary Meeting, 11th, Tokyo, Japan, May 9-21, 1968, Paper. 17 p. 7 refs.
Description of observations of energetic solar protons which have been regularly made since August 1966 aboard the USAF/OAR spacecraft OV3-3 and the NASA spacecraft ATS-1. OV3-3 data showing that nonuniform access of low-energy solar protons to the polar caps occurs in general with the intensity variations exhibiting both smooth changes and abrupt discontinuities are given with ATS-1 data for the flare of Jan. 28, 1967. In particular, diffusion calculations for this event are given. M.M.

c29 110100 05

A68-31964 #
A PROPOSED INDEX FOR MEASURING IONOSPHERIC SCINTILLATIONS.
H. E. Whitney, C. Malik, and J. Aarons (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Bedford, Mass.).
COSPAR, Plenary Meeting, 11th, Tokyo, Japan, May 9-21, 1968, Paper. 10 p.
Description of an experiment designed to correlate various methods of making ionospheric scintillation measurements. Observations were made at 40 MHz using the ionospheric beacon, S-66. It is shown that when the law of the receiver detector is known, a conversion method allows the comparison of data and statistics on the scintillation index. A simplified method of scaling the scintillation index is described. The accuracy of the simplified method is determined by a comparison with measurements of the scintillation index by machine computation. M.M.

c13 000000 04

A68-32168 #
ELECTRICAL PERFORMANCE OF THE 30 M CASSEGRAIN ANTENNA AT THE KASHIMA EARTH STATION.
Tsuyoshi Takahashi, Yoshihiro Ishizawa, Toshio Nakajima, and Minoru Kajikawa.
Radio Research Laboratories, Journal, vol. 15, Jan. 1968, p. 31-58.
Description of the electrical performance of the 30-m Cassegrain antenna at the Kashima Station after modification of the feed system for experiments involving the Applications Technology Satellite. The system is now set up for reception in the band from 4.1 to 4.2 GHz, transmission in the band from 6.25 to 6.35 GHz, rough tracking in the 136-MHz band, vernier tracking in the range from 4.17 to 4.19 GHz, and polarization tracking in both the transmission and reception bands. R.A.F.

c09 060400 02

A68-32425 *#
ANALYSIS OF FUTURE MISSIONS WHICH REQUIRE LOW THRUST SOLID AND HYBRID PROPULSION SYSTEMS.
H. T. Hahn and H. M. Kindsvater (Lockheed Aircraft Corp., Lockheed Missiles and Space Co., Sunnyvale, Calif.).
Interagency Chemical Rocket Propulsion Group and American Institute of Aeronautics and Astronautics, Solid Propulsion Conference, 3rd, Atlantic City, N.J., June 4-6, 1968, AIAA Paper 68-514. 9 p. 10 refs.
Members, $1.00; nonmembers, $1.50.
Contract No. NAS 7-517.
Several missions in the post-1968 period were examined to determine potential requirements for propulsion systems of 1 lbf or less. Based on estimated number and type of requirements, availability of reference material and funding possibilities, the missions selected were ATS-4 (unmanned satellite), Voyager (unmanned probe), the Apollo Telescope Mount experiment (manned satellite), and extravehicular activities on a manned interplanetary vehicle. Requirements are expressed in terms of the broadest acceptable range, rather than as specific values selected by a particular contractor. Characteristics of solid and hybrid low-thrust systems are given, together with equivalent characteristics of competitive systems. Comparison with mission requirements permits elimination of certain low-thrust systems from further contention. However, a relatively large number of systems remain in contention, and these must be further evaluated by reliability and weight analysis.
(Author)

c31 020000 12

A68-33091 *
SATELLITE OBSERVATIONS OF RADIO NOISE IN THE MAGNETOSPHERE.
S. J. Bauer and R. G. Stone (NASA, Goddard Space Flight Center, Laboratory for Space Sciences, Greenbelt, Md.).
Nature, vol. 218, June 22, 1968, p. 1145-1147. 12 refs.
Results of observations on the ATS 2 satellite concerning enhanced noise bands in the ionosphere and magnetosphere, to altitudes of about 8000 km. Noise observations were made with a radiometer at frequencies of 450 kHz, 700 kHz, 1.6 MHz, and

2.2 MHz. It is considered likely that the origin of the noise enhancements is a result of the interaction of energetic particles with the ambient plasma. In any case, the conditions for generation of plasma waves and coupling into EM waves are met in the regions where the principal magnetospheric noise enhancements are observed. It is shown that observations of radio noise in the magnetosphere may be an important method not only for the study of wave-particle interaction phenomena but also for the determination of local plasma density. R.A.F.

c13 111000 03

A68-33752 *#

AN ADVANCED CONTACT ION MICROTHRUSTER SYSTEM.

R. Worlock (Electro-Optical Systems, Inc., Ion Thruster Systems Dept., Pasadena, Calif.), J. J. Davis, P. Ramirez (Electro-Optical Systems, Inc., Thruster Electronics Section, Pasadena, Calif.), E. James (Electro-Optical Systems, Inc., Thruster Section, Pasadena, Calif.), and O. Wood (Electro-Optical Systems, Inc., Engineering Mechanics Dept., Pasadena, Calif.).

American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-552. 11 p.
Members, $1.00; nonmembers, $1.50.
Contracts No. AF 33(615)-1530; No. NAS 5-10380.

This paper describes a cesium contact ion microthruster system developed as an experiment for the ATS-D satellite. The microthruster may also be used as a backup system for east-west stationkeeping of the satellite. The thruster employs a single button porous tungsten ion source; maximum thrust is 20 micropounds at a nominal specific impulse of 6700 sec. Thrust vectoring to any point within a cone of 10° half-angle is accomplished by electrostatic deflection of the ion beam. The propellant feed system is a zero-g surface-tension type and carries enough cesium for two years of full-thrust operation of a 60% duty cycle. Twelve command channels provide for independent operation of each major portion of the thruster and 12 telemetry channels provide operational and diagnostic information. Details of system design and fabrication are presented along with test data and flight qualification results. (Author)

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A68-33753 *#

ATS-III RESISTOJET THRUSTOR SYSTEM PERFORMANCE.

T. Kent Pugmire (Avco Corp., Avco Missiles, Space and Electronics Group, Avco Space Systems Div., Lowell, Mass.) and William Lund (NASA, Goddard Space Flight Center, Greenbelt, Md.).

American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-553. 8 p.
Members, $1.00; nonmembers, $1.50.
Contract No. NAS 5-10342.

Description of an ammonia-fueled resistojet engine, and the results of its testing on the ATS-III spacecraft. The 8-lb 10-W engine consists of a self-pressurized ammonia storage with a feed system; two thrustors with nominal thrust levels of 10×10^{-6} lb; and an electronic package for command control, power conditioning, and telemetry conditioning of the system's performance monitoring equipment. The flight tests were designed to demonstrate the operation and function of the resistojet in a space environment and to obtain millipound thrust measurements in space. Except for problems encountered with the solenoid valves, both objectives were successfully met. Space measurements for both cold flow and electrically heated flow compared well with ground measurements. V.Z.

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A68-34015

PARTICIPATION IN THE EXPERIMENTS WITH THE U.S. NAVIGATION SATELLITE ATS-3 [BETEILIGUNG AN DEN VERSUCHEN MIT DEM AMERIKANISCHEN NAVIGATIONSSATELLITEN ATS-3].

Walter Goebel (Deutsche Versuchsanstalt für Luft- und Raumfahrt, Institut für Satellitenelektronik, Oberpfaffenhofen, West Germany).

DVL-Nachrichten, June 1968, p. 342-345. In German.

Outline of the joint U.S.-German space project in which the U.S. Applications Technology Satellite (ATS) and the German communications ship Meteor were used to investigate meteorological phenomena, low-power satellite thrust systems, and communications in the microwave and ultrashort-wave regions. Special emphasis is given to the rotatable antenna system of the satellite. Also described is the communications instrumentation on board the Meteor, including a computerized communications receiving system. R. B. S.

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A68-34238

EARTH'S PARTICLES AND FIELDS; PROCEEDINGS OF THE NATO ADVANCED STUDY INSTITUTE, FREISING, WEST GERMANY, JULY 31-AUGUST 11, 1967.

Institute supported by the North Atlantic Treaty Organization, the Advanced Research Projects Agency, the Office of Aerospace Research of the U.S. Air Force, the Research Office of the U.S. Army, the Defense Atomic Support Agency, and the Office of Naval Research of the U.S. Navy.

Edited by B. M. McCormac (IIT Research Institute, Physics Div., Chicago, Ill.).

New York, Reinhold Book Corp., 1968. 471 p.
$27.50.

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A68-34242

ENERGETIC OUTER BELT ELECTRONS AT SYNCHRONOUS ALTITUDE.

W. L. Brown (Bell Telephone Laboratories, Inc., Murray Hill, N.J.).

IN: EARTH'S PARTICLES AND FIELDS; PROCEEDINGS OF THE NATO ADVANCED STUDY INSTITUTE, FREISING, WEST GERMANY, JULY 31-AUGUST 11, 1967. [A68-34238 17-29]

Institute supported by the North Atlantic Treaty Organization, the Advanced Research Projects Agency, the Office of Aerospace Research of the U.S. Air Force, the Research Office of the U.S. Army, the Defense Atomic Support Agency, and the Office of Naval Research of the U.S. Navy.

Edited by B. M. McCormac.

New York, Reinhold Book Corp., 1968, p. 33-43. 9 refs.

Observations have been made of the temporal variation in the energetic electron flux at synchronous altitude with a multielement semiconductor detector telescope on the ATS 1 satellite. Systematic diurnal changes and more rapid oscillations that are attributable to the longitudinal drift of bunches of electrons have been studied. The diurnal variations on a magnetically quiet day have been compared with the calculations of adiabatic motion in a distorted field, assuming simple radial and pitch angle distributions of electrons in the noon meridian. This model is too simple to explain the observations satisfactorily and several modifications are considered. The electron flux oscillations have periods approximately inverse with electron energy as expected. The absolute magnitudes of the periods, while close to the values calculated following Roederer (1967), differ enough to indicate the need for alteration of the model of the distorted field. (Author)

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A68-34534 *

DEVELOPMENT OF A DOUBLE LAYERED SCINTILLATOR FOR SEPARATING AND DETECTING LOW ENERGY PROTONS AND ELECTRONS.

F. S. Mozer, F. H. Bogott (California, University, Dept. of Physics and Space Sciences Laboratory, Berkeley, Calif.), and C. W. Bates, Jr. (Varian Associates, Central Research Laboratories, Palo Alto, Calif.).

(Scintillation and Semiconductor Counter Symposium, 11th, Washington, D.C., Feb. 28-Mar. 1, 1968.)

IEEE Transactions on Nuclear Science, vol. NS-15, June 1968, p. 144-146.

Contract No. NAS 5-10362.

Description of a scintillator system consisting of a thin (5000 Å to 15,000 Å) CsI(Tl) layer evaporated onto a plastic scintillator (NE-102), developed for the purpose of distinguishing low-energy protons from electrons and measuring the energy of each species. Evaporations in a high vacuum (10^{-8} torr) produced layers of CsI(Tl) that scintillate with an efficiency comparable to optimally doped bulk material. If the CsI(Tl) layer thickness is 15,000 Å, it stops protons with energies below 170 keV and electrons with energies below 18 keV. Thus protons with energies between about 25 and 250 keV can be distinguished from electrons with energies above 18 keV by examining the shape of the light pulse generated in the dual scintillator. (Author)

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A68-34777

INTERNATIONAL SYMPOSIUM ON SPACE TECHNOLOGY AND SCIENCE, 7TH, TOKYO, JAPAN, MAY 15-22, 1967, PROCEEDINGS.

Edited by Yasuhiro Kuroda (Science and Technology Agency, National Aerospace Laboratory, Rocket Div., Tokyo, Japan).

Tokyo, AGNE Publishing, Inc., 1968. 868 p.

$40.

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A68-34826 *
MICROELECTRONICS ON THE APPLICATIONS TECHNOLOGY SATELLITE.
R. L. Van Allen (NASA, Goddard Space Flight Center, Flight Data Systems Branch, Greenbelt, Md.).
IN: INTERNATIONAL SYMPOSIUM ON SPACE TECHNOLOGY AND SCIENCE, 7TH, TOKYO, JAPAN, MAY 15-22, 1967, PROCEEDINGS. [A68-34777 17-30]
Edited by Yasuhiro Kuroda.
Tokyo, AGNE Publishing, Inc., 1968, p. 493-500.

Description of the reliability aspects, method of handling, and packaging factors associated with the use of Texas Instruments series-51 integrated circuits in the Environmental Measurements Experiment package which was chosen to fly on three of the Applications Technology Satellites. As many as 110 submodules per system were used with up to 16 integrated circuits per submodule. Good mechanical integrity and excellent heat dissipation are achieved by mounting the submodules on a fluidized aluminum sheet with submodule leads extending through precisely positioned holes for interconnection on the underside of the sheet. M. G.

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A68-34851
THE EVOLUTION OF STATIONARY SATELLITES.
J. D. Tuttle (Hughes Aircraft Co., Aerospace Group, Space Systems Div., El Segundo, Calif.).
IN: INTERNATIONAL SYMPOSIUM ON SPACE TECHNOLOGY AND SCIENCE, 7TH, TOKYO, JAPAN, MAY 15-22, 1967, PROCEEDINGS. [A68-34777 17-30]
Edited by Yasuhiro Kuroda.
Tokyo, AGNE Publishing, Inc., 1968, p. 725-739.

Account of the development of several of the stationary satellites. The beginnings of the stationary-satellite program are summarized. The Syncom satellite and spacecraft are described, their performance is summarized, and the modifications made on them are outlined. The Early Bird, Intelsat 2 series, and ATS 1 spacecraft are described. The ATS 1 experiments are sketched, and their performance is summarized. Some of the future developments expected in the field are discussed. R. A. F.

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A68-34852
DEVELOPMENT TECHNIQUES FOR INTEGRATED EXPERIMENT PACKAGES FOR THE APPLICATION TECHNOLOGICAL SATELLITE (ATS) MISSIONS.
L. W. Rustad (Westinghouse Electric Corp., Baltimore, Md.).
IN: INTERNATIONAL SYMPOSIUM ON SPACE TECHNOLOGY AND SCIENCE, 7TH, TOKYO, JAPAN, MAY 15-22, 1967, PROCEEDINGS. [A68-34777 17-30]
Edited by Yasuhiro Kuroda.
Tokyo, AGNE Publishing, Inc., 1968, p. 741-749.

Description of the Environmental Measurements Experiment (EME) on board the ATS 1 satellite. The experiments (magnetometer, suprathermal ion detector, omnidirectional particle detector, particle detector, electron spectrometer, solar-cell radiation damage, and thermal coating), structure, encoder design, and environmental testing of the ATS 1 are described. The results of the experiments are summarized. All five of the prime design objectives were achieved. R.A.F.

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A68-35418
STRUCTURE AND DEVELOPMENT OF SOLAR ACTIVE REGIONS; INTERNATIONAL ASTRONOMICAL UNION, SYMPOSIUM, BUDAPEST, HUNGARY, SEPTEMBER 4-8, 1967, PROCEEDINGS.
Edited by K. O. Kiepenheuer (Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung, Freiburg im Breisgau, West Germany).
Dordrecht, D. Reidel Publishing Co. (International Astronomical Union Symposium No. 35), 1968. 622 p. In English and French.

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CHROMOSPHERIC EXPLOSIONS AND SATELLITE SUNSPOTS. David M. Rust (Carnegie Institution of Washington and California Institute of Technology, Pasadena, Calif.), p. 77-83. [See A68-35427 18-30]

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OSCILLATORY MODES OF ENERGY TRANSPORT IN SOLAR MAGNETIC REGIONS. R. E. Danielson and B. D. Savage (Princeton University, Princeton, N.J.), p. 112-125. 23 refs. [See A68-35431 18-30]

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CRITICAL STUDY OF A "CURRENT-FREE" FIELD IN THE SOLAR ATMOSPHERE [ETUDE CRITIQUE D'UN CHAMP "CURRENT-FREE" DANS L'ATMOSPHERE SOLAIRE]. J. Rayrole and M. Semel (Meudon, Observatoire, Meudon, Hauts-de-Seine, France), p. 134-141. 7 refs. [See A68-35434 18-30]

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CORRELATIONS BETWEEN BRIGHTNESS FIELDS AND MAGNETIC FIELDS ON THE SUN. G. A. Chapman (Arizona, University; Kitt Peak National Observatory, Tucson, Ariz.) and N. R. Sheeley, Jr. (Kitt Peak National Observatory, Tucson, Ariz.), p. 161-173. 8 refs. [See A68-35437 18-30]

THE SUPERGRANULAR PATTERN AND THE STABLE STAGES OF SUNSPOT GROUPS. M. G. Dmitrieva, M. Kopecký, and G. V. Kuklin (Akademiia Nauk SSSR, Irkutsk, USSR), p. 174-177. 11 refs. [See A68-35438 18-30]

THE INTENSITY, VELOCITY, AND MAGNETIC STRUCTURE IN AND AROUND A SUNSPOT. J. M. Beckers (USAF, Office of Aerospace Research, Sunspot, N. Mex.) and E. H. Schröter (Göttingen, Universität, Sternwarte, Göttingen, West Germany), p. 178-186. 6 refs. [See A68-35439 18-30]

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ON THE MAGNETIC-FIELD CONFIGURATION IN SUNSPOTS. O. Kjeldseth Moe (Oslo, University, Oslo, Norway), p. 202-210. [See A68-35442 18-30]

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ON SOME SPECTROGRAPHIC OBSERVATIONS RELATED TO THE STRUCTURE WITH HEIGHT OF ACTIVE REGIONS AND PARTICULARLY SOLAR FLARES. Yngve Öhman (Stockholm Observatory, Saltsjobaden, Sweden), p. 240-246. 8 refs. [See A68-35447 18-29]

CHROMOSPHERIC HEIGHTS IN ACTIVE REGIONS. M. K. V. Bappu and K. R. Sivaraman (Astrophysical Observatory, Kodaikanal, India), p. 247-254. 6 refs. [See A68-35448 18-30]

THE STRUCTURE OF THE LOWER SOLAR CHROMOSPHERE IN UNDISTURBED AND ACTIVE REGIONS. E. Dubov (Akademiia Nauk SSSR, Nauchny, Ukrainian SSR), p. 255-258. [See A68-35449 18-30]

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ON THE MAGNETIC-FIELD STRUCTURE AROUND FILAMENTS. B. A. Ioshpa (Akademiia Nauk SSSR, Krasnaya Pakhra, USSR), p. 261-266. 6 refs. [See A68-35451 18-30]

THE FORMATION, STRUCTURE AND CHANGES IN FILAMENTS IN ACTIVE REGIONS. Sara F. Smith (Lockheed Aircraft Corp., Burbank, Calif.), p. 267-279. 7 refs. [See A68-35452 18-30]

PROMINENCES IN ACTIVE REGIONS. J. Kleczek (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 280, 281. [See A68-35453 18-30]

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LOOP-PROMINENCE SYSTEMS AND PROTON-FLARE ACTIVE REGIONS. Z. Švestka (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 287-292. 6 refs. [See A68-35455 18-30]

BRIGHT POINTS (MOUSTACHES) AND ARCH FILAMENTS IN YOUNG ACTIVE REGIONS. A. Bruzek (Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung, Freiburg im Breisgau, West Germany), p. 293-298. 18 refs. [See A68-35456 18-30]

SOLAR ACTIVE REGIONS IN Mg II LIGHT. Kerstin Fredga (Kungl. Tekniska Högskola, Stockholm, Sweden), p. 299-303. [See A68-35457 18-30]

COOPERATIVE STUDY OF SOLAR ACTIVE REGIONS (CSSAR).

COOPERATIVE STUDY OF SOLAR ACTIVE REGIONS (INTRODUCTORY REPORT). R. Michard (Paris, Observatoire, Meudon, Hauts-de-Seine, France), p. 307-310. [See A68-35458 18-30]

FLARE ACTIVITY AND SPOTGROUP DEVELOPMENT. V. Bumba, L. Křivský (Československá Akademie Věd, Ondřejov, Czechoslovakia), M. J. Martres, and I. Soru-Iscovici (Paris, Observatoire, Meudon, Hauts-de-Seine, France), p. 311-317. [See A68-35459 18-29]

A STUDY OF THE LOCALIZATION OF FLARES IN SELECTED ACTIVE REGIONS. M. J. Martres, R. Michard, I. Soru-Iscovici, and T. Tsap (Paris, Observatoire, Meudon, Hauts-de-Seine, France; Akademiia Nauk SSSR, Nauchny, Ukrainian SSR), p. 318-325. 8 refs. [See A68-35460 18-29]

EVOLUTION OF Ca PLAGES OF THE CSSAR ACTIVE REGIONS. G. Godoli (Catania Astrophysical Observatory, Catania, Italy) and B. C. Monsignori Fossi (Consiglio Nazionale delle Ricerche, Arcetri, Italy), p. 326-337.

CORRELATION BETWEEN Ca PLAGES AND LONGITUDINAL MAGNETIC FIELDS OF THE CSSAR ACTIVE REGIONS. V. Bumba (Československá Akademie Věd, Ondřejov, Czechoslovakia) and G. Godoli (Catania Astrophysical Observatory, Catania, Italy), p. 338-345. 6 refs. [See A68-35461 18-30]

DEVELOPMENT OF CORONAL EMISSIONS DURING THE LIFETIME OF AN ACTIVE CENTER [EVOLUTION DES EMISSIONS CORONALES AU COURS DE LA VIE D'UN CENTRE ACTIF]. J. L. Leroy, J. Rösch, and M. Trellis (Toulouse, Université, Bagneres-de-Bigorre, Hautes-Pyrénées; Nice, Observatoire, Nice, France), p. 346-355. 5 refs. [See A68-35462 18-30]

CORONAL AND INTERPLANETARY STRUCTURE OF AN ACTIVE REGION.

OBSERVATION OF CORONA STREAMERS AND CONCENTRATIONS BELOW THE ACTIVE REGIONS [OBSERVATION DES JETS ET CONCENTRATIONS DE LA COURONNE-AU-DESSUS DES REGIONS ACTIVES]. Audouin Dollfus (Paris, Observatoire, Meudon, Hauts-de-Seine, France), p. 359-378. 17 refs. [See A68-35463 18-30]

INFLUENCE OF MAGNETIC FIELDS ON THE STRUCTURE OF THE SOLAR CORONA. G. Newkirk, M. D. Altschuler, and J. Harvey (National Center for Atmospheric Research, Boulder, Colo.), p. 379-384. 5 refs. [See A68-35464 18-30]

PHOTOGRAPHS OF CORONAL STREAMERS FROM A ROCKET ON MAY 9, 1967. R. Tousey, G. D. Sandlin, and M. J. Koomen (U.S. Navy, Office of Naval Research, Washington, D.C.), p. 385-388. [See A68-35465 18-30]

NEW ASPECTS OF THE ROLE OF DEVELOPMENT AND STRUCTURE OF SOLAR ACTIVE REGIONS IN THE ARRANGEMENTS OF THE CORONA BASED ON ITS GEOMAGNETIC DISPLAYS. B. Bednářová-Nováková and J. Halenka (Československá Akademie Věd, Prague, Czechoslovakia), p. 389.

ACTIVE REGIONS AND THE INTERPLANETARY MAGNETIC FIELD. John M. Wilcox, Kenneth H. Schatten (California, University, Berkeley, Calif.), and Norman F. Ness (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 390-394. [See A68-35466 18-30]

EXTREME ULTRAVIOLET OBSERVATIONS OF ACTIVE REGIONS IN THE SOLAR CORONA. W. M. Burton (United Kingdom Atomic Energy Authority, Atomic Energy Research Establishment, Culham, Berks., England), p. 395-402. 5 refs. [See A68-35467 18-30]

PROTONS ASSOCIATED WITH CENTRES OF SOLAR ACTIVITY AND THEIR PROPAGATION IN INTERPLANETARY MAGNETIC-FIELD REGIONS CO-ROTATING WITH THE SUN. M. Pick (Meudon, Observatoire, Meudon, Hauts-de-Seine, France), C. Y. Fan, R. Ryle, J. A. Simpson, and D. R. Smith, p. 403.

THE SOLAR CORONA ABOVE ACTIVE REGIONS - A COMPARISON OF EXTREME ULTRAVIOLET LINE EMISSION WITH RADIO EMISSION. Werner M. Neupert (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 404-410. 7 refs. [See A68-35468 18-30]

ON SOME ASPECTS OF XUV SPECTROHELIOGRAMS. R. Tousey, G. D. Sandlin, and J. D. Purcell (U.S. Navy, Office of Naval Research, Washington, D.C.), p. 411-419. 5 refs. [See A68-35469 18-30]

SLOWLY VARYING COMPONENT OF SOLAR X RAYS IN RELATION TO THE STRUCTURE OF ACTIVE CENTERS [LA COMPOSANTE LENTEMENT VARIABLE DES RAYONS X SOLAIRES EN RELATION AVEC LA STRUCTURE DES CENTRES D'ACTIVITE]. R. Michard and E. Ribes (Meudon, Observatoire, Meudon, Hauts-de-Seine, France), p. 420-430. 11 refs. [See A68-35470 18-29]

X-RADIATION STUDIES OF THE CORONA. K. A. Pounds, K. Evans, and P. C. Russell (Leicester, University, Leicester, England), p. 431.

OBSERVATIONS OF ENERGETIC X-RAYS FROM QUIESCENT SOLAR ACTIVE REGIONS. Loren W. Acton and Philip C. Fisher (Lockheed Aircraft Corp., Palo Alto, Calif.), p. 432-438. 12 refs. [See A68-35471 18-29]

X-RAY PICTURE OF THE SUN TAKEN WITH FRESNEL ZONE PLATES. G. Elwert (Tübingen, Universität, Tübingen, West Germany), p. 439-443. [See A68-35472 18-29]

THE SIGNIFICANCE OF THE POLARIZATION OF SOLAR SHORT-WAVELENGTH X-RAYS. G. Elwert (Tübingen, Universität, Tübingen, West Germany), p. 444-448. 5 refs. [See A68-35473 18-29]

TRANSIENT PHENOMENA.

ANALYSIS OF SOME SOLAR FLARES FROM OPTICAL, X-RAY, AND RADIO OBSERVATIONS. R. Falciani, M. Landini, A. Righini, and M. Rigutti (Consiglio Nazionale delle Ricerche, Florence, Italy), p. 451-464. 15 refs. [See A68-35474 18-29]

INTERACTION OF MAGNETIC FIELDS AND THE ORIGIN OF PROTON FLARES. L. Křivský (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 465-470. 29 refs. [See A68-35475 18-29]

A MODEL OF SOLAR FLARES. P. A. Sturrock (Stanford University, Stanford, Calif.), p. 471-479. 21 refs. [See A68-35476 18-29]

THE HIGH-ENERGY FLARE PLASMA. C. de Jager (Utrecht, State University, Utrecht, Netherlands), p. 480-482. [See A68-35477 18-29]

THE OCCURRENCE AND POSSIBLE MEANING OF THE "NIMBUS." J. Houtgast (Utrecht, Rijksuniversiteit, Utrecht, Netherlands), p. 483, 484. [See A68-35478 18-29]

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PROTON FLARE PROJECT (PFP).

PROTON FLARE PROJECT (INTRODUCTION AND SUMMARY). Z. Švestka (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 513-535. 13 refs. [See A68-35481 18-29]

OBSERVATIONS OF THE SOLAR PROTON EVENT OF AUGUST 28, 1966. J. H. Kinsey and F. B. McDonald (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 536-542. 5 refs. [See A68-35482 18-29]

SUNSPOT CHANGES FOLLOWING PROTON FLARES. Constance Sawyer (ESSA, Boulder, Colo.), p. 543-550. 8 refs. [See A68-35483 18-29]

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PROPERTIES OF SOURCES OF THE SLOWLY VARYING COMPONENT OF 2 CM SOLAR RADIO EMISSION. V. G. Nagnibeda (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR), p. 575-580. 5 refs. [See A68-35488 18-30]

SOME PROPERTIES OF THE SOURCES OF SLOWLY VARYING COMPONENT AND OF BURSTS AT 612 MC/S. G. Swarup, M. R. Kundu, V. K. Kapahi, and J. D. Isloor (Tata Institute of Fundamental Research, Bombay, India), p. 581-584. [See A68-35489 18-30]

SATELLITE OBSERVATIONS OF SOLAR RADIO BURSTS. R. G. Stone, H. H. Malitson, J. K. Alexander, and C. R. Somerlock (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 585-587. [See A68-35490 18-30]

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THE EFFECT OF COMPRESSION AND EXPANSION OF PLASMA ON THE GENERATION OF SYNCHROTRON RADIATION. S. J. Gopasiuk, N. N. Erushev, and Y. I. Neshpor (Akademiia Nauk SSSR, Nauchny, Ukrainian SSR), p. 600.

THE GREAT BURST OF MAY 23, 1967. J. P. Castelli, J. Aarons (USAF, Office of Aerospace Research, Bedford, Mass.), and G. A. Michael (Air Weather Service, Ent AFB, Colo.), p. 601.

SUMMARIZING REVIEW.

THE DEVELOPMENT AND STRUCTURE OF AN ACTIVE REGION. C. de Jager (Utrecht, State University, Utrecht, Netherlands), p. 602-608. [See A68-35494 18-30]

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A68-35490 *

SATELLITE OBSERVATIONS OF SOLAR RADIO BURSTS.

R. G. Stone, H. H. Malitson, J. K. Alexander, and C. R. Somerlock (NASA, Goddard Space Flight Center, Greenbelt, Md.).

IN: 'STRUCTURE AND DEVELOPMENT OF SOLAR ACTIVE REGIONS: INTERNATIONAL ASTRONOMICAL UNION, SYMPOSIUM, BUDAPEST, HUNGARY, SEPTEMBER 4-8, 1967, PROCEEDINGS. [A68-35418 18-30]

Edited by K. O. Kiepenheuer.

Dordrecht, D. Reidel Publishing Co. (International Astronomical Union Symposium No. 35), 1968, p. 585-587.

Preliminary description of the results expected from the radio-astronomy experiment on board the second Advanced Technology Satellite (ATS 2), launched on Apr. 6, 1967. The experiment was designed to perform radio-noise measurements in the frequency range from 0.5 to 3.0 MHz, from above the earth's ionosphere. R.A.F.

c30 111000 02

A68-36621 *#

OBSERVATION OF FLOW OF LOW-ENERGY IONS AT SYNCHRONOUS ALTITUDE AND IMPLICATIONS FOR MAGNETOSPHERIC CONVECTION.

J. W. Freeman, Jr. (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).

Journal of Geophysical Research, vol. 73, July 1, 1968, p. 4151-4158. 19 refs.

Contract No. NAS 5-9561.

The Rice University suprathermal ion detector aboard the ATS 1 synchronous orbit satellite has established the existence of occasional bulk motion of the magnetospheric thermal ions. This conclusion is based on the observation of a highly directional flux of positive ions, moving with a flow velocity of approximately 30 km/sec with a thermal energy substantially less than the flow velocity energy. The flow direction and magnitude observed are generally consistent with present theories of magnetospheric convection. The electric field required to account for the observed flow velocity is 5 mV/meter, and the electric field direction is across the magnetosphere from the dawn to dusk side. A gross pattern of magnetospheric convection that is consistent with this, as well as previously reported ATS 1 data, is presented. Implications of the requisite electric field for the energetic trapped radiation in the outer portion of the outer zone of the Van Allen radiation belt are briefly discussed. (Author)

c29 110700 11

A68-37541 *#

EXPLICITY EQUATIONS FOR OAO, ATS, AND MARINER.

D. H. Flowers (General Dynamics Corp., Convair Div., San Diego, Calif.).

American Institute of Aeronautics and Astronautics, Guidance, Control, and Flight Dynamics Conference, Pasadena, Calif., Aug. 12-14, 1968, Paper 68-841. 16 p. 5 refs.

Members, $1.00; nonmembers, $1.50.

NASA-supported research.

Review of the development and discussion of the performance of explicit guidance equations for the Atlas/Centaur launch vehicle. The equations provide steering and engine cutoff commands for the OAO (Orbiting Astronomical Observatory), ATS (Applications Technology Satellite), and Mariner interplanetary missions. Storage requirements on the airborne computer are limited to 2240 (24 bit) words, or less. The guidance method is similar to that used by Teren (1966). Steering coefficient stability was also studied, since the airborne computer storage constraint necessitated long cycle times. The study resulted in the improvement of the range angle to go prediction computation. It is noted that steering coefficient stability and point accuracy improved. Briefly summarized simulation performance data demonstrate that the equations meet all mission performance objectives. P.v.T.

c21 050000 02

A68-37762

CANAVERAL COUNCIL OF TECHNICAL SOCIETIES, SPACE CONGRESS, 5TH, COCOA BEACH, FLA., MARCH 11-14, 1968, PROCEEDINGS. VOLUME 2.
Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1968. 452 p.
Price of three volumes, $20.

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A68-37770 *#

A MULTIPLEXER/DEMULTIPLEXER SYSTEM FOR THE MULTI-COLOR SPIN SCAN CLOUD CAMERA ON ATS-C.
F. W. Van Kirk and D. G. Kovar (Hughes Aircraft Co., Culver City, Calif.).
IN: CANAVERAL COUNCIL OF TECHNICAL SOCIETIES, SPACE CONGRESS, 5TH, COCOA BEACH, FLA., MARCH 11-14, 1968, PROCEEDINGS. VOLUME 2. [A68-37762 19-31]
Cape Canaveral, Fla., Canaveral Council of Technical Societies,

1968, p. 11.4-1 to 11.4-13.
Contract No. NAS 5-9677.

The ATS 3 spacecraft has transmitted many high-quality color pictures of the full earth disk. This paper describes the design of the multiplexing/demultiplexing system for the multicolor camera. This system, which employs time division multiplexed pulse amplitude modulation (PAM), is described from a block diagram standpoint. Circuit design highlights and packaging details are also provided. Finally, the test results of the actual equipment are given. (Author)

c14 020000 10

A68-37938 *#
MEASUREMENT AND INTENSITY OF ENERGETIC ELECTRONS AT THE EQUATOR AT 6.6 R_e.
T. W. Lezniak, R. L. Arnoldy, G. K. Parks, and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
(Conjugate Point Symposium, Boulder, Colo., June 13-16, 1967.)
Radio Science, vol. 3, July 1968, p. 710-714.
Contract No. NAS 5-9542.

The paper presents preliminary results of measurements of 50 to 1000 keV electrons at the geomagnetic equator at 6.6 R_e. Quiet-day electron fluxes exhibit a diurnal dip in intensity at local midnight accompanied by a softening of the electron spectrum. During geomagnetically disturbed times the 50 to 150 keV electrons exhibit large fluctuations in intensity; we have denoted these fluctuations as "spikes." These spikes are largest just after local midnight and decrease in intensity as local time increases. They have a duration of about 1 hr and tend to recur with about a 2-hr period. The electron spectrum softens considerably during the spikes. Generally the variations in intensity of the electrons correlates excellently with the K_p index. (Author)

c29 110400 07

A68-37939 *#
CORRELATED EFFECTS OF ENERGETIC ELECTRONS AT THE 6.6 R_e EQUATOR AND THE AURORAL ZONE DURING MAGNETOSPHERIC SUBSTORMS.
G. K. Parks, R. L. Arnoldy, T. W. Lezniak, and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
(Conjugate Point Symposium, Boulder, Colo., June 13-16, 1967.)
Radio Science, vol. 3, July 1968, p. 715-719. 10 refs.
NSF Grant No. GA-487; Contract No. NAS 5-9542.

During magnetically disturbed times, large intensity variations are observed for electrons of energies 50 to 150-keV at the geostationary orbit of the ATS-1 satellite. Simultaneously, the correlation experiment at the magnetic conjugate region of the satellite has shown that large fluxes of bremsstrahlung X-rays from precipitated energetic electrons are observed on high-altitude balloons while magnetic bays are recorded on the ground. The conclusion reached is that the magnetospheric substorm is responsible for the simultaneous intensification of the trapped particle population at 6.6 R_e equatorial plane and of precipitated energetic electrons at the magnetic conjugate region. (Author)

c13 110400 06

A68-37944 *#
SIMULTANEOUS MAGNETIC FIELD VARIATIONS AT THE EARTH'S SURFACE AND AT SYNCHRONOUS, EQUATORIAL DISTANCE. I, II
W. D. Cummings (California, University, Dept. of Planetary and Space Science, Los Angeles, Calif.) and P. J. Coleman, Jr. (California, University, Dept. of Planetary and Space Science and Institute of Geophysics and Planetary Physics, Los Angeles, Calif.).
(Conjugate Point Symposium, Boulder, Colo., June 13-16, 1967.)
Radio Science, vol. 3, July 1968, p. 758-765. 5 refs.
Contract No. NAS 5-9570.

Preliminary results of the UCLA magnetometer experiment on board the ATS-1 spacecraft, a spin-stabilized satellite which corotates with the earth in the equatorial plane at a geocentric distance of 6.6 R_E and a longitude of 150°W. The satellite is maintained with a spin rate of 97 rpm and with its spin axis parallel to the earth's spin axis. The magnetometer experiment consists of two orthogonal flux gates, coplanar with the spin axis. By taking the difference and sum of the outputs of the two detectors, measurements were made of the magnetic field perpendicular and parallel to the spin axis. It is suggested that bay-associated disturbances observed are closely related to auroral substorms. Measurements of the H component of the field at ATS-1 are reported and a comparison of the H component at ATS-1 and the H component at Honolulu are made. M.G.

c13 110800 16

A68-38108
SATELLITE VHF TRANSPONDER TIME SYNCHRONIZATION.
J. L. Jespersen, George Kamas, Lawrence E. Gatterer (National Bureau of Standards, Time and Frequency Div., Frequency-Time Dissimination Research Section, Boulder, Colo.), and Peter F. MacDoran (ESSA, U.S. Coast and Geodetic Survey, Satellite Triangulation Div., Rockville, Md.).
IEEE, Proceedings, vol. 56, July 1968, p. 1202-1206. 7 refs.

The paper describes an experiment designed to transfer accurate time between two widely separated clocks using a vhf satellite transponder. The satellite used was the NASA Applications Technology Satellite, ATS-1. The experiment used atomic oscillators to maintain accurate time at each station, and the synchronization was accomplished by measuring the round-trip delay times between the stations. The goal of the experiment was to evaluate a vhf system, because of the low-cost ground equipment involved, in contrast to microwave systems. The paper discusses the results and the various factors that contributed to the timing errors. (Author)

c14 070207 03

A68-38430
OBSERVATIONS OF ENERGETIC ELECTRONS AT SYNCHRONOUS ALTITUDE. I - GENERAL FEATURES AND DIURNAL VARIATIONS.
G. A. Paulikas, J. B. Blake, S. C. Freden, and S. S. Imamoto (Aerospace Corp., El Segundo, Calif.).
Journal of Geophysical Research, vol. 73, Aug. 1, 1968, p. 4915-4925. 16 refs.
Contract No. AF 04(695)-67-C-0158.

Energetic electron fluxes above four integral thresholds ($E_e >$ 300 keV, >450 keV, 1.05 MeV, and 1.9 MeV) were measured at synchronous altitude ($R = 6.6\ R_\oplus$) during the first half of 1967 on board the ATS 1 satellite (1966-110A). The fluxes show a diurnal variation with the noon-to-midnight ratio being larger for the more energetic electron groups and being larger, on the average, for magnetically disturbed days. Magnetic storms produce a great deal of fine structure in the electron fluxes, with changes occurring on the time scale of minutes; the effect of such storms is to depress the fluxes. Recovery to prestorm level is an energy-dependent process that proceeds more slowly for more energetic electrons and apparently in a stepwise manner. (Author)

c29 110100 07

A68-41190
AN INTERNATIONAL AIRLINE VIEWS SST NAVIGATION REQUIREMENTS.
B. F. McLeod (Pan American World Airways, Inc., New York, N.Y.).
(INSTITUTE OF NAVIGATION, NATIONAL AIR MEETING ON SUPERSONIC NAVIGATION, SEATTLE, WASH., NOVEMBER 15, 16, 1967, PROCEEDINGS, p. 152-157.)
Navigation, vol. 15, Summer 1968, p. 205-208.
[For abstract see issue 08, page 1407, Accession no. A68-20449]

c21 070200 15

A68-41672 *
PLASMA FLOW IN THE MAGNETOSPHERE.
L. D. Kavanagh, Jr. (William Marsh Rice University, Dept. of Space Science, Houston, Tex.; NASA, Washington, D.C.), J. W. Freeman, Jr., and A. J. Chen (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5511-5519. 30 refs.
Contract No. NAS 5-9561; Grant No. NsG-673.
We have constructed a mathematical model of the magnetosphere in which a large-scale uniform electric field, representing plasma flow from the tail, is superimposed on the geomagnetic field. In addition, the model includes a corotation electric field and an electric field resulting from the conductivity of the plasmasphere. Drift paths of charged particles with various energies are traced out in the equatorial plane, assuming that these particles may enter the magnetosphere through the tail. It is found that an electric field of 0.3 mV/m (across the tail) forms a forbidden zone for thermal particles that is approximately the size and shape of the plasmasphere. The electric field model is also found to provide a qualitative explanation for such varied phenomena as asymmetric ring currents, field-aligned currents in the magnetosphere, and the existence of an abrupt inner termination to the plasma sheet. The presence of return flow of plasma near the magnetopause resulting from a viscous interaction with magnetosheath plasma is discussed, and it is argued that the return flow does not affect the electric field picture except very near the boundary. (Author)

c13 110700 14

A68-41686 *
PENETRATION OF THE MAGNETOPAUSE BEYOND 6.6 R_E DURING THE MAGNETIC STORM OF JANUARY 13-14, 1967 - INTRODUCTION.
Albert G. Opp (NASA, Washington, D.C.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5697, 5698.
During the magnetic storm of Jan. 13 and 14, 1967, the magnetopause was detected at 6.6 $R_\oplus$ by instruments on the ATS 1 satellite. This is believed to be the first case in which the magnetopause has been observed to penetrate within 6.6 $R_\oplus$ of the earth. ATS 1 was launched on Dec. 6, 1966, into an equatorial synchronous orbit. The satellite was positioned at 150°W and was located at 1400 local time when the magnetopause was first detected. (Author)

c13 100500 14

A68-41687 *
MAGNETIC FIELDS IN THE MAGNETOPAUSE AND VICINITY AT SYNCHRONOUS ALTITUDE.
W. D. Cummings (California, University, Dept. of Planetary and Space Science, Los Angeles, Calif.) and P. J. Coleman, Jr. (California, University, Dept. of Planetary and Space Science and Institute of Geophysics and Planetary Physics, Los Angeles, Calif.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5699-5718. 17 refs.
Contract No. NAS 5-9570.
Study of the magnetic fields in the magnetopause and on both sides of the boundary as observed by the ATS 1 satellite during a one-hour interval on Jan. 14, 1967. In general, the boundary normal was found to be nearly radial from the earth during most of the interval. The mean value of the magnetosheath field strength for a period is 123 γ. The magnetospheric field strength varied from 165 γ just before the first boundary crossing to 210 γ just after the last crossing. The measured quied-day field strength at this location is about 124 γ. The ratio of the particle kinetic density to the magnetic energy density just inside the boundary at the time of the first crossing is estimated to have been greater than 0.8. The power below 0.8 Hz in the magnetosheath fluctuations was about 50 times greater than in the magnetosphere just before the first crossing. The power in the fluctuations in the magnetospheric field also increased after this event by a factor of about 10. A discussion of these results is presented. Z.W.

c13 110800 18

A68-41688 *
PLASMA FLOW DIRECTIONS AT THE MAGNETOPAUSE ON JANUARY 13 AND 14, 1967.
J. W. Freeman, Jr., J. J. Maguire (William Marsh Rice University, Dept. of Space Science, Houston, Tex.), and C. S. Warren (William Marsh Rice University, Dept. of Space Science; NASA, Manned Spacecraft Center, Houston, Tex.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5719-5731. 10 refs.
Contract No. NAS 5-9561.
On Jan. 13 and 14, 1967, the ATS 1 synchronous orbit satellite was in close proximity to the magnetopause for a sustained period of time. In addition to the pure magnetosheath and pure magnetospheric ion flow patterns, a new component of ion flow was found immediately inside the magnetospheric boundary. This flow had characteristics nearly identical to the magnetosheath ion flow; the flow was parallel to the boundary in the downstream direction, and the total ion flux was nearly the same as that found across the boundary in the magnetosheath. Because of its persistence to substantial depths within the magnetosphere, this new flow component is thought to be the "return" flow (to the magnetotail) for the magnetospheric thermal plasma found to be convecting sunward more deeply within the magnetosphere. The magnetospheric flow pattern during this event then becomes generally consistent with that suggested by Axford and Hines (1961). (Author)

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A68-41689 *
STRUCTURE OF THE MAGNETOPAUSE AT 6.6 R_E IN TERMS OF 50- TO 150-KEV ELECTRONS.
T. W. Lezniak and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5733-5742. 10 refs.
Contract No. NAS 5-9542.
Measurements were made with a magnetic deflection electron spectrometer of electrons in the range 50 to 150 keV at the boundary of the magnetosphere on Jan. 14, 1967. At this time, the magnetopause was compressed inside the orbit of the ATS 1 geostationary satellite, which was located at 6.6 $R_\oplus$ in the subsolar region of the magnetosphere. The first crossing of the trapping boundary and magnetic field reversal was followed by many transient count rate increases and magnetic field variations. Owing to the rapid sampling of electrons on the spinning satellite it was possible to determine the azimuthal distribution associated with electron concentration gradients at the various boundaries and to determine the direction in space of the gradients and of the trapping boundary surfaces. In one case the trapping boundary was found to be approximately perpendicular to the earth's surface. In another case a transient region was found that appeared to be moving over the spacecraft from the solar direction. The energetic electron trapping boundary was usually separated from the magnetic field reversal by the order of four cyclotron radii. The electron flux dropped from 1.4×10^4 to 3.2×10^2 (electrons/cm^2-sec-ster-keV) in two cyclotron radii at one of these boundaries. (Author)

c13 110400 08

A68-41690
BOUNDARY OF ENERGETIC ELECTRONS DURING THE JANUARY 13-14, 1967, MAGNETIC STORM.
G. A. Paulikas, J. B. Blake, S. C. Freden, and S. S. Imamoto (Aerospace Corp., Space Physics Laboratory, El Segundo, Calif.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5743-5750. 13 refs.
Contract No. AF 04(695)-67-C-0158.
Measurements of energetic electron fluxes were made aboard

the synchronous satellite ATS I (1966-110A) during the magnetic storm of Jan. 13-14, 1967. Between 0007 and about 0105 UT (approximately 1400 to 1500 local time) on January 14, the electron fluxes dropped to background levels in a manner, which, when associated with the onboard magnetometer data, suggests that the boundary of the magnetosphere was compressed to less than 6.6 $R_{\oplus}$ on the day side of the magnetosphere. (Author)

c29 110100 09

A68-41691
ENERGETIC ELECTRONS AT 6.6 R_E DURING THE JANUARY 13-14, 1967, GEOMAGNETIC STORM.
L. J. Lanzerotti, W. L. Brown, and C. S. Roberts (Bell Telephone Laboratories, Inc., Murray Hill, N. J.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5751-5760. 8 refs.

The trapped, energetic (E_e > 0.4 to >3.0 MeV) electron fluxes at synchronous altitude are examined during the Jan. 13-14, 1967, geomagnetic storm. Except for a short period after the sudden commencement (SC) at 1202 UT, day 13 (0202 local time), the measured electrons were observed to be stably trapped for about the first twelve hours after the SC. However, the values of the electron fluxes in the local morning and at local noon were quite different from those generally observed during quiet periods. About two hours after local noon, at 2324 UT, day 13, the electron flux dropped sharply by two orders of magnitude in response to a sudden decrease in the magnetic field observed at the satellite. Recovery of the electron flux occurred in a few minutes. About 40 min later, 0007 UT, day 14, the electron fluxes were essentially wiped out at the time of an observed reversal in the magnetic field at the satellite. During two separate approximately 10-min periods after this 0007 UT, day 14, wipeout, the observed particle fluxes indicate that the satellite encountered a region of space with characteristics very different from the normal magnetospheric trapping region. The data during these times are consistent with the interpretation from the magnetic field observations that the satellite was outside the magnetopause. Correlation of the electron data during the storm is made with the satellite magnetometer data and with the magnetometer data from several ground stations. (Author)

c29 110300 06

A68-41692
SOLAR WIND AND MAGNETOSHEATH OBSERVATIONS DURING THE JANUARY 13-14, 1967, GEOMAGNETIC STORM.
S. J. Bame, J. R. Asbridge, A. J. Hundhausen, and I. B. Strong (California, University, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5761-5767. 16 refs.

The interplanetary, magnetosheath, and magnetotail plasmas were observed with electrostatic analyzers on the Vela 3A and 3B satellites at ~18 R_E during the Jan. 13-14, 1967, geomagnetic storm. Various parts of the storm phenomenology were observed. The sudden commencement at 1202 UT on January 13 was caused by an interplanetary shock that passed the earth with a speed of ~463 km/sec, considerably lower than the probable average propagation speed from the sun of ~720 km/sec. During the initial phase and main phase development, the magnetotail was either compressed or tilted up or both. Just before the inward movement of the magnetopause observed with ATS 1, the solar wind velocity decreased and suddenly increased again by ~55 km/sec. During the main phase development the solar wind plasma population as observed by the Vela satellites was distinctly different from the initial phase population, as shown by the arrival of plasma with substantially increased density and alpha particle abundance. Near the peak of the main phase and later, magnetopause crossings showed that the magnetosphere was inflated. (Author)

c29 110800 20

A68-41693 *
OGO 3 SEARCH COIL MAGNETOMETER DATA CORRELATED WITH THE REPORTED CROSSING OF THE MAGNETOPAUSE AT 6.6 R_E BY ATS 1.
Christopher T. Russell, John V. Olson, Robert E. Holzer (California, University, Institute of Geophysics and Planetary Physics, Los Angeles, Calif.), and Edward J. Smith (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5769-5775.

OGO 3 passed from the outer magnetosphere through the magnetosheath and into the interplanetary medium between 2200 UT, Jan. 13, and 0300 UT, Jan. 14, 1967. This interval includes the time during which the ATS 1 satellite reportedly encountered the magnetopause and magnetosheath at 6.6 R_E. Nearly two hours before the ATS 1 event, the OGO 3 search coil magnetometer recorded a normal magnetopause crossing. About half an hour later a sudden increase in the steady magnetic field to an unusually large amplitude for a magnetosheath field was observed. Then, within a minute of the first reported ATS 1 magnetopause crossing, an increase in the amplitude of the magnetic noise was noted. Finally, about 45 min after the first ATS 1 crossing, the bow shock was crossed at a position extremely close to the earth. An analysis of the OGO 3 search coil data fully supports the interpretation of the unusual ATS 1 records as displacements of the magnetopause inside of the ATS 1 orbit. (Author)

c13 110800 19

A68-41696 *
ACCELERATION OF ENERGETIC ELECTRONS OBSERVED AT THE SYNCHRONOUS ALTITUDE DURING MAGNETOSPHERIC SUBSTORMS.
G. K. Parks and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
Journal of Geophysical Research, vol. 73, Sept. 1, 1968, p. 5786-5791. 18 refs.
NSF Grant No. GA-487; Contract No. NAS 5-9542.

Discussion of the results of studies of the properties of energetic electron flux variations based on measurements at the 6.6 R_E equatorial plane by the University of Minnesota electron spectrometer on board the ATS 1 geostationary satellite. Among the more important features noted are: (1) an abrupt increase of energetic electron fluxes of approximately one hour duration and observable at any local time; (2) a pronounced increase near midnight correlated with magnetic bays on the ground at the satellite conjugate region; (3) the increases appear to occur every two to three hours; and (4) the increases are observed in all three energy channels simultaneously. R.M.

c29 110400 09

A68-41954
PENETRATION OF SOLAR PROTONS AND ALPHAS TO THE GEOMAGNETIC EQUATOR.
L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N. J.).
Physical Review Letters, vol. 21, Sept. 23, 1968, p. 929-933. 17 refs.

Simultaneous spectral observations of low-energy solar particles in interplanetary space and in the magnetosphere on the equator strongly imply that these particles have essentially free access to the outer magnetosphere through a very effective diffusion mechanism which preserves the spectral shapes and the flux magnitudes. These observations further imply that measurements of solar-particle arrival time over the polar caps are not sufficient to distinguish between open or closed magnetosphere models. (Author)

c29 110300 07

A68-42155
DESIGN TECHNIQUES USED ON THE "ENVIRONMENTAL MEASUREMENTS EXPERIMENT" - A NEW SPACECRAFT SUBSYSTEM.
F. E. England (Westinghouse Electric Corp., Aerospace, Defense and Marine Group, Defense and Space Center, Baltimore, Md.).
IN: SPACECRAFT SYSTEMS; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 17TH, MADRID, SPAIN, OCTOBER 9-15, 1966, PROCEEDINGS. VOLUME 1. [A68-42132 22-31]
Edited by Michał Łunc.
Paris, Dunod Editeur; New York, Gordon and Breach, Science Publishers, Inc.; Warsaw, PWN-Polish Scientific Publishers, 1967, p. 255-258.

Description of a number of design techniques used on the Environmental Measurements Experiment (EME), an advanced system of integrated multipurpose experiments plus support electronics used as a principal subsystem of the Applications Technology Satellite (ATS). The design requirements for the EME system were stringent, allowing a minimum of space and weight for the structure and modules and requiring a moderate thermal and vibrational environment be provided for the experimental units. It also had to be easily accessible, reliable, and easily repaired if necessary. The methods employed in construction to meet these requirements are described. P. G. M.

c31 **110000 01**

A68-42434
APPLICATION SATELLITES; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 17TH, MADRID, SPAIN, OCTOBER 9-15, 1966, PROCEEDINGS. VOLUME 2.
Edited by Michał Łunc.
Paris, Dunod Editeur; New York, Gordon and Breach, Science Publishers, Inc.; Warsaw, PWN-Polish Scientific Publishers, 1967. 315 p. In English and French.
$22.

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SATELLITE PRESSURE TOPOGRAPHY MAPPING. T. Y. Palmer and M. D. Pearson (Boeing Co., Seattle, Wash.), p. 269-273. [See A68-42458 22-20]
WEATHER SATELLITE OBSERVATIONAL SYSTEMS. B. B. Lusignan (Stanford University, Stanford, Calif.), p. 275-287. [See A68-42459 22-11]
LINE SCAN TELEVISION FOR EARTH OBSERVATION SATELLITES. C. J. Swet (Johns Hopkins University, Silver Spring, Md.), p. 289-300. 5 refs. [See A68-42460 22-14]
THE OVERLAPPING OF THE BANDS OF N_2O, CO AND CO_2 IN THE 4.5 MICRON REGION WITH REGARD TO INVERSION EXPERIMENTS. I. O. Tannhäuser (München, Universität, Munich, West Germany), p. 301-308. 12 refs. [See A68-42461 22-13]

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A68-42439 *
SPACE APPLICATIONS RESEARCH AND DEVELOPMENT.
L. Jaffe (NASA, Space Applications Programs Office, Washington, D.C.).
(International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, Oct. 9-15, 1966, Paper.)
IN: APPLICATION SATELLITES; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 17TH, MADRID, SPAIN, OCTOBER 9-15, 1966, PROCEEDINGS. VOLUME 2. [A68-42434 22-20]
Edited by Michał Łunc.
Paris, Dunod Editeur; New York, Gordon and Breach, Science Publishers, Inc.; Warsaw, PWN-Polish Scientific Publishers, 1967, p. 59-71.
[For abstract see issue 01, page 152, Accession no. A67-11430]

c30 010000 11

A68-42442 *
THE AUTOMATIC ANTENNA POSITION CONTROL SYSTEM FOR THE ATS SYNCHRONOUS ORBIT SPIN-STABILIZED SATELLITE.
O. Mahr (Sylvania Electric Products, Inc., Sylvania Electronic Systems Div., Waltham, Mass.).
(International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, Oct. 9-15, 1966, Paper.)
IN: APPLICATION SATELLITES; INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 17TH, MADRID, SPAIN, OCTOBER 9-15, 1966, PROCEEDINGS. VOLUME 2. [A68-42434 22-20]
Edited by Michał Łunc.
Paris, Dunod Editeur; New York, Gordon and Breach, Science Publishers, Inc.; Warsaw, PWN-Polish Scientific Publishers, 1967, p. 97-104.
Contract No. NAS 5-9521.
[For abstract see issue 01, page 156, Accession no. A67-11426]

c31 020000 02

A68-42507
IECEC '68; INTERSOCIETY ENERGY CONVERSION ENGINEERING CONFERENCE, UNIVERSITY OF COLORADO, BOULDER, COLO., AUGUST 13-17, 1968, RECORD. VOLUME 1.
New York, Institute of Electrical and Electronics Engineers, Inc. (IEEE Publication 68 C 21-Energy), 1968. 1069 p.
Members, $25.; nonmembers, $35.

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RADIATION DAMAGE SHIELDING OF SOLAR CELLS ON A SYNCHRONOUS SPACECRAFT. Ramond C. Waddel (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 128-137. 16 refs. [See A68-42521 22-03]

ELECTRICAL CHARACTERISTICS OF SILICON SOLAR CELLS AS A FUNCTION OF CELL TEMPERATURE AND SOLAR INTENSITY. Jerome D. Sandstrom (California Institute of Technology, Pasadena, Calif.), p. 138-147. 6 refs. [See A68-42522 22-03]
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A METHOD TO ARREST WEIGHT LOSS OF LEAD-TELLURIDE AT ELEVATED TEMPERATURES IN VACUUM. J. W. Killian (U.S. Naval Material Command, Annapolis, Md.), p. 272-276. 7 refs. [See A68-42533 22-03]

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ELECTRICAL COMPONENT TECHNOLOGY FOR 1/4 TO 10 MEGAWATT SPACE POWER. A. E. King, J. B. Fanger (Westinghouse Electric Co., Lima, Ohio), and G. S. Leighton (U.S. Atomic Energy Commission, Washington, D.C.), p. 277-289. 13 refs. [See A68-42534 22-03]

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EVALUATION OF EXPANDED PYROLYTIC GRAPHITE RADIATORS FOR NUCLEAR SPACE POWER SYSTEMS. J. V. Coggi (McDonnell Douglas Corp., Santa Monica, Calif.) and J. Madsen (McDonnell Douglas Corp., Richland, Wash.), p. 539-548. 7 refs. [See A68-42559 22-22]

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THIN-FILM MULTIKILOWATT SOLAR ARRAYS. W. Luft and R. A. Boring (TRW Systems Group, Redondo Beach, Calif.), p. 560-570. 7 refs. [See A68-42561 22-03]

LUNAR SURFACE SOLAR ARRAY CHARACTERISTICS. R. Boring (TRW Systems Group, Redondo Beach, Calif.), p. 571-579. 7 refs. [See A68-42562 22-03]

LARGE SOLAR ARRAYS FOR MULTI-MISSION LUNAR SURFACE EXPLORATION. J. E. Boretz (TRW Systems Group, Redondo Beach, Calif.) and J. L. Miller (NASA, Marshall Space Flight Center, Huntsville, Ala.), p. 580-591. 9 refs. [See A68-42563 22-03]

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POWER NEEDS FOR ELECTRIC PROPULSION. William R. Mickelsen (Colorado State University, Fort Collins, Colo.), p. 1033-1043. 27 refs. [See A68-42583 22-28]

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A68-42521 *

RADIATION DAMAGE SHIELDING OF SOLAR CELLS ON A SYNCHRONOUS SPACECRAFT.

Ramond C. Waddel (NASA, Goddard Space Flight Center, Spacecraft Technology Div., Thermal Systems Branch, Greenbelt, Md.).

IN: IECEC '68; INTERSOCIETY ENERGY CONVERSION ENGINEERING CONFERENCE, UNIVERSITY OF COLORADO, BOULDER, COLO., AUGUST 13-17, 1968, RECORD. VOLUME 1. [A68-42507 22-03]

New York, Institute of Electrical and Electronics Engineers, Inc. (IEEE Publication 68 C 21-Energy), 1968, p. 128-137. 16 refs.

The ATS 1 synchronous spacecraft carried a group of conventional n-on-p, 10 ohm-cm, silicon, boron-doped solar cells with various radiation shields. The hields were, mostly, of Corning type 7940 artificial fused silica, of thicknesses from zero to 60 thousandths of an inch. The solar cell damage observed, as deduced from voltage-current curves, was larger than expected. The maximum power from cells bearing shields of 0, 1, 6, 15, 30, and 60 thousandths of an inch in thickness fell, during 416.8 days in orbit, to 11.4, 84.9, 92.5, 88.7, 86.9, and 83.5% of initial values, respectively. The short-circuit currents fell to 41.4, 90.1, 91.7, 92.7, 92.6, and 93.9%, respectively. The open-circuit voltages fell to 55.0, 97.2, 98.9, 98.7, 98.7, and 98.3%, respectively. (Author)

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A68-44237 *

A SUBLIMING SOLID REACTION CONTROL SYSTEM.

J. D. Shepard (Lockheed Aircraft Corp., Lockheed Missiles and Space Co., Sunnyvale, Calif.) and R. P. Routt (Lockheed Aircraft Corp., Lockheed-California Co., Burbank, Calif.).

International Astronautical Federation, Congress, 19th, New York, N.Y., Oct. 13-19, 1968, Paper P 26. 7 p.

New York, American Institute of Aeronautics and Astronautics, $1.00.

NASA-supported research.

Description of the design, operation, and testing of a subliming solid reaction control system that was developed for use on the Applications Technology Satellite. A description of the design features including propellant, on-off control, thrust-level control, and thermal-balance control is given. The measurement of thrust axis alignment and thrust level is discussed, and typical results obtained are presented. (Author)

c28 020600 01

A68-44255 *
A CASE FOR THE TIME SHARED REMOTE COMPUTER AS A BASIC TOOL FOR SYSTEM DESIGN.
F. E. England (Westinghouse Electric Corp., Aerospace, Defense and Marine Group, Aerospace Div., Baltimore, Md.).
International Astronautical Federation, Congress, 19th, New York, N. Y., Oct. 13-19, 1968, Paper SD 3. 7 p.
New York, American Institute of Aeronautics and Astronautics, $1.00.
Contract No. NAS 5-9526.

A timed-shared remote computer facility was used in the design of the Environmental Measurements Experiment (EME), the primary payload of the NASA Applications Technology Satellite. The EME, which consisted of a number of radiation experiment packages and other electronic modules integrated within a structure, was represented by a vibration model having between 9 and 11 degrees of freedom in each of three axes and a thermal model having 39 nodes. By processing preliminary and then updated information from the individual experiment designers and from the structure designer with the time-shared remote computer, the system performance could be evaluated quickly and the numerous mechanical and thermal interfaces could be optimized. Equipment test data in general demonstrate the validity of the computer analyses. The time-shared remote computer proved to be an effective economical, flexible, and facile design tool. (Author)

c08 110000 08

A68-44303 *
EXPERIMENT DESCRIPTION, INTEGRATION PROCESS AND SUPPORT EQUIPMENT DEVELOPMENT FOR AN ENVIRONMENTAL MEASUREMENTS EXPERIMENT PACKAGE OF THE APPLICATIONS TECHNOLOGY SATELLITE.
L. W. Rustad and W. C. King (Westinghouse Electric Corp., Baltimore, Md.).
International Astronautical Federation, Congress, 19th, New York, N. Y., Oct. 13-19, 1968, Paper AS 114. 4 p.
New York, American Institute of Aeronautics and Astronautics, $1.00.
Contract No. NAS 5-9526.

Description of the systems development and the individual radiation-belt experiments conducted by the Environmental Measurements Experiment Package of the ATS satellite. The instruments contained in the package will primarily study electron and proton fluxes, solar-cell damage, thermal coatings efficiency, radio noise, and electric and magnetic fields. After selecting experiments for a particular mission, an integration process is conducted beginning with a review of the experiment proposal and ending with a qualification of the design. Coordination is the key function of this process, and it is the most important role of the systems integrator. The final stage of development involves the necessary support equipment and preparation for launch. T. M.

c11 110000 09

A68-44943 #
EFFECTS OF ORBIT ELLIPTICITY ON SPACECRAFT FLEXIBLE MOTION.
R. E. Roach, Jr. and R. E. Kazares (General Electric Co., Philadelphia, Pa.).
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 5th, Philadelphia, Pa., Oct. 21-24, 1968, Paper 68-1118. 12 p.
Members, $1.00; nonmembers, $1.50.

The ATS 2 vehicle was intended to achieve a circular orbit. Due to a malfunction of the final booster stage, the actual orbit was highly elliptical. The effect of flexibility gravity gradient stabilization rods was expected, in the desired orbit, to be of small importance. In the actual orbit, violent motion of the rods was observed by on-board instrumentation. The equations of motion indicate the manner in which flexible dynamic motions are induced. The results of computations are given to illustrate the rapid build-up of motion with no stimulus other than orbit ellipticity. (Author)

c30 090000 46

A68-44980 #
GEOSYNCHRONOUS METEOROLOGICAL SATELLITE.
V. E. Suomi and T. H. Vonder Haar (Wisconsin, University, Space Science and Engineering Center, Madison, Wis.).
American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 5th, Philadelphia, Pa., Oct. 21-24, 1968, Paper 68-1094. 7 p.
Members, $1.00; nonmembers, $1.50.

Description of results obtained from the NASA Applications Technology synchronous meteorological satellites (ATS), which add the time dimension to the study and use of measurements. Nearly continuous observations of the same area of the earth from the Spin Scan Camera experiments on ATS-1 and ATS-III spacecraft have provided this new perspective. The camera and data flow from spacecraft to final product are described, and the meteorological application of the ATS observations in the form of time-lapse movies of "weather in motion" is demonstrated. Quantitative results extracted from special studies of the data are discussed. The success of these experiments, and prospects for improved sensors on similar spacecraft show that the geosynchronous satellite has a key role in the global observing system. F. R. L.

c14 080100 48

A69-10472 *#
OVERVIEW OF SPACE APPLICATIONS PROGRAMS.
Leonard Jaffe (NASA, Office of Space Science and Applications, Washington, D.C.).
United Nations, Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, Austria, Aug. 14-27, 1968, Paper 68-95437. 21 p.

Discussion of aspects of the Space Applications program - including communications and navigation, meteorology, earth resources survey, and geodesy. The objective of the U.S. Navigation and Traffic/Control program is to develop the needed space technology to provide (1) more accurate position-finding for ships and aircraft, (2) a basis for an improved means of traffic control, and (3) emergency aids. The daytime meteorological requirements are currently fulfilled by the TIROS Operational Satellite (TOS) System. Two versions of the same spacecraft are used, one to carry the Automatic Picture Transmission system and the other to carry the global cloud cover storage system called the Advanced Vidicon Camera System (AVCS). The TIROS-M, now under development, will combine the APT and AVCS systems in one single spacecraft. At the moment, there are no satellites specifically devoted to Earth Resources Survey. Current efforts are devoted to analyzing imagery and other data obtained from other spacecraft for the purpose of surveying. In geodesy, the objects of the Program are: (1) to establish a unified world datum which will permit connecting existing local datum systems within ±10 m to a common geocentric reference frame; and (2) to provide refined description of the world-wide variations of the earth's gravitational field. P.v.T.

c33 080300 02

A69-10474 *#
INTERNATIONAL EXPERIMENTATION WITH COMMUNICATIONS SATELLITES.
Leonard Jaffe (NASA, Office of Space Science and Applications, Washington, D.C.).
United Nations, Conference on the Exploration and Peaceful Uses of Outer Space, Vienna, Austria, Aug. 14-27, 1968, Paper 68-95421. 22 p.

Summary of the international experimentation with U.S. satellites during the last ten years. Fourteen experimental communications satellites have been launched by the U.S. since December 1958. Two of these were passive reflecting satellites, Echo 1 and Echo 2; seven were medium-altitude active satellites: Score, Courier, Telstar 1 and 2, Relay 1 and 2, and ATS 2. Five satellites were synchronous altitude satellites, and three of these five were geostationary satellites. The UK and France participated in experiments with the first passive satellite, Echo 1. As the program went on, additional countries became involved, including the Federal Republic of Germany, Brazil, Italy, the USSR, Japan, Canada, the Scandinavian countries, Spain, and India. Still other countries were involved from time to time. Each participating nation followed its own theories in the mechanical and electrical design, and all participants exchanged technical information with other participants without restraint. P.v.T.

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A69-11225 *
MAGNETOSPHERIC SUBSTORMS OBSERVED AT THE SYNCHRONOUS ORBIT.
W. D. Cummings, J. N. Barfield (California, University, Dept. of Planetary and Space Science, Los Angeles, Calif.), and P. J. Coleman, Jr. (California, University, Dept. of Planetary and Space Science and Institute of Geophysics and Planetary Physics, Los Angeles, Calif.).
Journal of Geophysical Research, vol. 73, Nov. 1, 1968, p. 6687-6698. 26 refs.
Contract No. NAS 5-9570.

The behavior of the magnetic field at the synchronous orbit during magnetospheric substorms is discussed for several events during December 1966 and January 1967. The vector measurements of the field were made with magnetometers on board the geostationary satellite ATS 1. The field was observed to be depressed and inclined radially outward in the dusk-to-midnight quadrant while substorms were in progress. Similar distortions of the magnetosphere were not observed in other local-time sectors. When the satellite was near local midnight, the onset of the expansive phase of an auroral substorm was coincident with the recovery of the field at ATS 1. When the satellite was further toward the dusk meridian similar recoveries were observed, but they were followed by a renewed depression in the field. An interpretation of the data in terms of partial ring currents in the dusk-to-midnight quadrant is discussed. (Author)

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A69-11660 #
DETERMINATION OF THE TOTAL NUMBER OF ELECTRONS IN THE IONOSPHERE FROM THE FARADAY EFFECT WITH THE AID OF SIGNALS FROM THE ATS-3 SATELLITE [OPREDELENIE OBSHCHEGO CHISLA ELEKTRONOV IONOSFERY PO EFFEKTU FARADEIA S POMOSHCH'IU SIGNALOV SPUTNIKA ATS-3].
D. Fel'ske and G. Bardei (Observatoriia Issledovanii Ionosfery, Kühlungsborn; Institut Solnechno-Zemnoi Fiziki, East Germany).
Geomagnetizm i Aeronomiia, vol. 8, no. 5, 1968, p. 835-839. 6 refs. In Russian.

Description of a technique for determining the total number of electrons contained in the ionosphere by measuring the angle of rotation of the polarization plane of radio signals from the ATS-3 satellite. The technique is based on the assumption that the frequency of the radio signals is substantially higher than that of the maximum plasma oscillation frequency along their path. The satellite, launched on Nov. 5, 1967, was at 47°E over the equator at a distance of 36,050 km from the earth's surface during the measurements. A "wave channel" antenna rotating about its axis in roughly 13 min was used to measure the angle of rotation of the oscillation plane. V.Z.

c13 100500 11

A69-13176
EASCON '68; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, ELECTRONICS AND AEROSPACE SYSTEMS CONVENTION; WASHINGTON, D.C., SEPTEMBER 9-11, 1968, RECORD.
New York, Institute of Electrical and Electronics Engineers, Inc., 1968. 624 p.
Members, $12.50; nonmembers, $17.50.

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APOLLO LUNAR FAR-SIDE MISSION. B. L. McQuaid (Hughes Aircraft Co., Culver City, Calif.), p. 35-46. 9 refs. [See A69-13180 03-07]

RADAR SYSTEMS. I.

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IMPROVED MULTIFUNCTION ARRAY RADAR PERFORMANCE WITH MULTIFREQUENCY OPERATIONS. D. E. Hunt (Texas Instruments, Inc., Dallas, Tex.), p. 52-59. 10 refs. [See A69-13182 03-07]

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GEODESIC LENSES FOR RADAR ANTENNAS. R. C. Johnson and R. M. Goodman, Jr. (Georgia Institute of Technology, Atlanta, Ga.), p. 64-69. 6 refs. [See A69-13184 03-09]

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OPTICAL CORRELATION FOR FAST ACQUISITION OF PSEUDO RANDOM RANGING CODES. J. L. de Montlivault (Centre National d'Etudes Spatiales, Paris, France), p. 79-82. 7 refs. [See A69-13186 03-07]

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A COMPARISON OF OPTICAL RECEIVERS FOR DEEP SPACE COMMUNICATIONS. J. I. Bowen and J. N. Lahti (Bell Telephone Laboratories, Inc., Whippany, N.J.), p. 134-141. 10 refs. [See A69-13194 03-07]

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AN AUTOMATIC SEQUENTIAL DETECTOR FOR NONCOHERENT MTI RADAR. D. N. Thomson (General Atronics Corp., Philadelphia, Pa.), p. 160-167. 12 refs. [See A69-13197 03-07]

MTI PERFORMANCE DEGRADATION CAUSED BY LIMITING. H. R. Ward and W. W. Shrader (Raytheon Co., Wayland, Mass.), p. 168-174. 7 refs. [See A69-13198 03-07]

COMPUTER GENERATION OF RADAR RETURN SIGNALS. C. E. Suyo (McDonnell Douglas Corp., St. Louis, Mo.), p. 175-180. 6 refs. [See A69-13199 03-14]

ECM/ECCM SYSTEM SIMULATION PROGRAM. D. H. Cook (Vitro Corporation of America, West Orange, N.J.), p. 181-186. [See A69-13200 03-08]

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A DIGITAL SIMULATION OF A CARRIER DEMODULATOR/TRACKING PHASE-LOCKED LOOP IN A NOISY, MULTIPATH ENVIRONMENT. A. E. Smith and R. S. Johnson (Radio Corporation of America, Moorestown, N.J.), p. 206-216. 14 refs. [See A69-13204 03-07]

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XX CENTURY NAVIGATION. P. V. H. Weems, p. 233, 234. [See A69-13207 03-21]

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WORLD'S MOST POWERFUL VHF TRANSMITTING STATION. L. D. Breetz (U.S. Navy, Office of Naval Research, Washington, D.C.), p. 247-251. [See A69-13209 03-11]

AN ADVANCED LONG-RANGE NAVIGATION CAPABILITY CONCEPT FOR A 1979 INITIAL OPERATIONAL CAPABILITY. W. B. Wrigley (Lockheed Aircraft Corp., Marietta, Ga.), p. 252-254. 5 refs. [See A69-13210 03-21]

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ON OPTIMIZING THE OMEGA RADIONAVIGATION SYSTEM. D. W. Haney (General Precision Systems, Inc., Silver Spring, Md.), p. 263-270. [See A69-13212 03-21]

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K. L. Reinhard (Ohio State University, Columbus, Ohio), p. 296-305. 9 refs. [See A69-13216 03-07]

A 10,000:1 PULSE COMPRESSION FILTER USING A TAPPED DELAY LINE LINEAR FILTER SYNTHESIS TECHNIQUE. R. D. Haggarty, L. A. Hart, and G. C. O'Leary (Mitre Corp., Bedford, Mass.), p. 306-314. 11 refs. [See A69-13217 03-09]

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OPTIMIZATION OF THE REPRESENTATION OF SAMPLED DATA SIGNALS ON ORTHONORMAL BASES. M. T. Clark (Department of Defense, Washington, D.C.), p. 414-421. 7 refs. [See A69-13231 03-07]

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AN AIRBORNE VIDEO TAPE NAVIGATIONAL DISPLAY. W. G. Mulley (U. S. Naval Material Command, Johnsville, Pa.) and J. J. Stein (Pennsylvania State University, University Park, Pa.), p. 537-542. [See A69-13246 03-21]

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SIGNAL PROCESSING. IV - ANALYTIC TECHNIQUES.

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THE FAST FOURIER-HADAMARD TRANSFORM AND ITS USE IN SIGNAL REPRESENTATION AND CLASSIFICATION. J. E. Whelchel, Jr. and D. F. Guinn (Melpar, Inc., Falls Church, Va.), p. 561-573. 29 refs. [See A69-13249 03-07]

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THE TWO-INPUT ERF CORRELATOR. M. H. Burke (Communications Satellite Corp., Washington, D.C.) and J. S. Lee (George Washington University, Washington, D.C.), p. 593-599. 12 refs. [See A69-13253 03-09]
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RESULTS OF AN EXPERIMENTAL STUDY OF COHERENT PSK IN A MULTIPATH ENVIRONMENT. J. F. Balcewicz (Radio Corporation of America, Princeton, N.J.) and J. C. Blair, p. 607-614. 7 refs. [See A69-13255 03-07]
ABSTRACTS, p. 615-618.

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A69-13236
TRANSOCEANIC AIR TRAFFIC CONTROL USING SATELLITES.
R. E. Anderson (General Electric Co., Research and Development Center, Schenectady, N.Y.).
IN: EASCON '68; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, ELECTRONICS AND AEROSPACE SYSTEMS CONVENTION, WASHINGTON, D.C., SEPTEMBER 9-11, 1968, RECORD. [A69-13176 03-07]
New York, Institute of Electrical and Electronics Engineers, Inc., 1968, p. 456-464.

Discussion of a traffic control system, with independent surveillance of aircraft positions, a decision-making agency, and undelayed communications, which can reduce the incidence of gross navigation or "blunder" errors and permit a safe reduction in the separation of transoceanic aircraft. Satellites can provide the large-area coverage, position references, and reliable communications needed to implement traffic control. It is estimated that the combined use of present-day navigation aids with a surveillance system having a 4-n-mi, one-sigma error probability, positioning each aircraft once each five minutes, will permit a reduction of lateral spacing from the present 120 to 90 n mi. Position fixes are determined by range measurements from two geostationary satellites. The range interrogation is a tone-code transmission, a short transmission of a single audio-frequency tone followed by a digital address in which audio cycles are inhibited for zeros and transmitted for ones. The tone is used to adjust the phase of an oscillator aboard all the craft, and the code addresses the desired craft and resolves range ambiguity. A fixed delay is inserted between reception and retransmission by the craft to avoid the need for an antenna diplexer. M.M.

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A69-13239 *
DESIGN EVOLUTION OF MECHANICALLY DESPUN ANTENNAS FROM ATS TO INTELSAT.
Leonard Blaisdell, Frank Donnelly, John Killian, and Otto Mahr (Sylvania Electric Products, Inc., Sylvania Electronic Systems Div., Waltham, Mass.).
IN: EASCON '68; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, ELECTRONICS AND AEROSPACE SYSTEMS CONVENTION, WASHINGTON, D.C., SEPTEMBER 9-11, 1968, RECORD. [A69-13176 03-07]
New York, Institute of Electrical and Electronics Engineers, Inc., 1968, p. 485-495.
Research supported by TRW Systems Group; Contract No. NAS 5-9521.

Description of the development of mechanically despun antenna systems from ATS to Intelsat. Both the ITS-3 and ATS-3 antennas operate in the 4-GHz and 6-GHz bands. The difference in the rf design of the ITS-3 was required to meet the needs of a commercial system as opposed to the experimental requirements of the ATS-3. Major added requirements for the ITS-3 were the needs for circular polarization, increased bandwidth, and the addition of a separate 4/6 GHz telemetry and command antenna. The rf and control systems of the ATS-3 and ITS-3 antennas and their performance are described. M.M.

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A69-13240 *
WEFAX - WEATHER DATA RELAY COMMUNICATIONS EXPERIMENT.
Sheldon Wishna (NASA, Goddard Space Flight Center, Greenbelt, Md.).
IN: EASCON '68; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, ELECTRONICS AND AEROSPACE SYSTEMS CONVENTION, WASHINGTON, D.C., SEPTEMBER 9-11, 1968, RECORD. [A69-13176 03-07]
New York, Institute of Electrical and Electronics Engineers, Inc., 1968, p. 496-500.

Description of WEFAX (abbreviation for Weather Facsimile), an experiment designed to explore the operational feasibility of direct transmission, via a satellite relay, of meteorological data from a central weather station source to widely scattered remote weather stations or receiving units. The transmission media used for the experiment are the vhf communication facilities of the ATS-1 (Applications Technology Satellite), while the receiving stations cooperating in this program are the network of APT (Automatic Picture Transmission) ground stations. The WEFAX experiment has been highly successful in demonstrating the feasibility of transmitting weather data via a synchronous satellite. Usable receptions can be assured nearly 95% of the time. M.M.

c11 080200 03

A69-13427 *
NASA'S DEVELOPING STRATEGY OF SPACE APPLICATIONS.
Donald P. Rogers (NASA, Office of Space Science and Applications, Washington, D.C.).
TRW Space Log, vol. 8, Fall 1968, p. 3-11.

Discussion of the Space Application Program of NASA, emphasizing the need for various teams of experts to develop specific objectives of applications missions. Following the successful single-purpose Echo, Relay, Telstar, and Syncom Programs, the communications R&D program broadened its base in the Applications Technology Satellite (ATS) Program. The trend of the NASA R&D program has obviously been toward more complexity and more versatility, and toward multidisciplinary use of the larger spacecraft classes that an increased launch vehicle capability has made possible. The sequential technology development stages from Relay through Syncom to Early Bird and from Tiros to ESSA satellites have established a possible pattern for future evolution from R&D to operational systems. P.v.T.

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A69-13429
APPLICATIONS SATELLITES - AN INTRODUCTORY BIBLIOGRAPHY.
TRW Space Log, vol. 8, Fall 1968, p. 23-48.
Listing of a representative bibliography of works dealing with the design, development, and uses of applications satellites. The titles include subjects dealing with communication satellites, satellite development technology, astronautical sciences, photography, and observation from satellites, as well as meteorological data obtained by means of satellites. P.v.T.

c34 010000 43

A69-14016 *
ELECTRON PRODUCTION AND LOSS RATES IN THE F REGION.
F. L. Smith, III (Stanford University, Radioscience Laboratory, Stanford, Calif.).
Journal of Geophysical Research, vol. 73, Dec. 1, 1968, p. 7385-7398. 29 refs.
Grant No. NsG-30-60.
Accurate measurements of the amount of Faraday rotation imposed on vhf telemetry transmissions from a geostationary satellite have been analyzed to study rates of production and loss of electrons in the F region of the ionosphere. The rate of photoionization of atomic oxygen, integrated with respect to height through the ionosphere, was determined at sunrise over Hawaii. The analysis also yielded the magnitude of the linear loss coefficient at an altitude of 300 km. The integrated rate of production of O^+ ions at sunrise was used to deduce the total flux of solar EUV radiation in the 165 to 911 Å wavelength range incident on the earth's atmosphere. Atomic oxygen photoionization rates and solar EUV flux values were obtained on a daily basis, and loss coefficients were obtained on a monthly average basis, over the 2-year period extending from September 1964 through August 1966. The integrated rate of production of O^+ was found to average 1.7×10^9 ions/cm^2-sec at sunrise over Hawaii. The flux of solar EUV radiation incident on the atmosphere was found to average 4.5×10^{10} photons/cm^2-sec. The loss coefficient averaged 1.4×10^{-5} sec^{-1} at an altitude of 300 km. No seasonal variation was observed in the integrated O^+ production rate, but the loss coefficient had a winter-to-summer variation of about 2:1. (Author)

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A69-14030
MIDLATITUDE NIGHTTIME TOTAL ELECTRON CONTENT BEHAVIOR DURING MAGNETICALLY DISTURBED PERIODS.
J. A. Klobuchar, J. Aarons, and H. Hajeb Hosseinieh (USAF, Cambridge Research Laboratories, Bedford, Mass.).
Journal of Geophysical Research, vol. 73, Dec. 1, 1968, p. 7530-7534.
Discussion of nearly continuous measurements of the total electron content (TEC) of the ionosphere at Sagamore Hill, Massachusetts (42.6°N, 70.8°W) made from the geostationary satellites Canary Bird and ATS 3. Faraday rotation measurements were made of the plane of polarization of vhf radio waves in order that two oblique, stationary paths from the same ground location could be determined. The winter nighttime behavior along the two paths (particularly the anomalous observed increases in TEC during the night) is discussed. M.G.

c13 100500 19

A69-14690
WEATHER SATELLITES. II.
Arthur W. Johnson (ESSA, U.S. Weather Bureau, National Environmental Satellite Center, Suitland, Md.).
Scientific American, vol. 220, Jan. 1969, p. 52-68.
Discussion of the major contributions to meteorology made by weather satellites since July 1961. The evolution of the Tiros Operational System of weather satellites and of their successors, the ESSA satellites, is outlined. Plans for improving weather satellites to make them still more useful are described, and a few predictions about the future of weather observation by satellite are ventured. M.M.

c20 080900 09

A69-16259
ORIGIN OF DRIFT-PERIODIC ECHOES IN OUTER-ZONE ELECTRON FLUX.
H. R. Brewer (Bell Telephone Laboratories, Inc., Murray Hill, N.J.; Georgia Institute of Technology, School of Physics, Atlanta, Ga.), Michael Schulz, and Aharon Eviatar (Bell Telephone Laboratories, Inc., Murray Hill, N.J.).
Journal of Geophysical Research, vol. 74, Jan. 1, 1969, p. 159-167. 8 refs.
The time-dependent flux of equatorial electrons (0.4 MeV $\lesssim$ E $\lesssim$ 2.2 MeV) observed on ATS 1 often exhibits drift-periodic structures that can be traced back to a sudden expansion or compression of the magnetosphere. The magnetospheric disturbance redistributes the energetic electrons among drift shells in an asymmetrical manner, and this spatial asymmetry between noon and midnight reveals itself as a temporal variation in particle flux as the electrons subsequently drift past the observer. A mathematical model for the dynamics of this azimuthal bunching of energetic electrons reveals the microstructure of the redistribution of electrons among drift shells and indicates qualitatively the relation of this microstructure to the diffusion of particles across L. (Author)

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A69-16716
RADIO TECHNICAL COMMISSION FOR AERONAUTICS, ANNUAL ASSEMBLY MEETING, WASHINGTON, D.C., SEPTEMBER 25, 26, 1968, PROCEEDINGS.
Washington, D.C., Radio Technical Commission for Aeronautics, 1968. 156 p.
$2.00.

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AERONAUTICAL SATELLITE COMMUNICATIONS - A PROGRESS REVIEW. W. W. Buchanan (Aeronautical Radio, Inc., Annapolis, Md.). 10 p. [See A69-16721 05-21]
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CLOSING REMARKS. T. H. Taylor (Aeronautical Radio, Inc., Annapolis, Md.). 3 p.

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A69-16721 #
AERONAUTICAL SATELLITE COMMUNICATIONS - A PROGRESS REVIEW.
W. W. Buchanan (Aeronautical Radio, Inc., Annapolis, Md.).
IN: RADIO TECHNICAL COMMISSION FOR AERONAUTICS, ANNUAL ASSEMBLY MEETING, WASHINGTON, D.C., SEPTEMBER 25, 26, 1968, PROCEEDINGS. [A69-16716 05-21]
Washington, D.C., Radio Technical Commission for Aeronautics, 1968. 10 p.

Review of some of the more significant developments of the past two years in the field of aeronautical satellite communications, with discussion of obstacles remaining. Results obtained with the NASA ATS-1 satellite are described. Much of the effort throughout the early portion of the ATS-1 program was devoted to the testing of airborne antennas. Attention was also given to measurement and identification of propagation effects peculiar to the earth-satellite-aircraft link. The questions of whether the satellite system should provide for communications only, or communications plus surveillance by automatic transmission of aircraft-derived position information, or communications plus an independent satellite surveillance system are studied, as well as the question of whether or not to operate in the present vhf band or in the uhf L-band. Brief attention is given to system costs. F.R.L.

c21 070204 02

A69-18038 *#
ATMOSPHERIC MEASUREMENTS FROM SATELLITES.
Robert M. Rados (NASA, Goddard Space Flight Center, Greenbelt, Md.).
American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 7th, New York, N.Y., Jan. 20-22, 1969, Paper 69-158. 10 p.
Members, $1.00; nonmembers, $1.50.

Brief survey of atmospheric measurements from satellites. A chronology of satellites which have provided atmospheric measurements and the specific sensors which were flown, a listing of planned satellites with their atmospheric sensors, and some vital statistics on the sensors which have been flown or which are under development, are tabulated. It is noted that recent exploration of the ATS-1 images of cloud cover on an hourly basis has demonstrated the potential of defining winds in the tropical areas and the movement of vorticity patterns from the Southern to the Northern Hemisphere. The use of WEFAX through the ATS 1 and 2 satellites has demonstrated the practicality of transmitting data collected and analyzed to a central location to users in remote or distant locations which either cannot provide facilities of their own or cannot obtain these analyses more efficiently. Satellites can also be used to measure sferics and sea state through the use of microwave radiometers, lasers, etc. M.M.

c20 080000 14

A69-18325 #
EFFECT OF THERMAL FLUTTER ON GRAVITY GRADIENT STABILIZED SPACECRAFT.
H. Foulke (General Electric Co., Philadelphia, Pa.).
U.S. Air Force Systems Command and Aerospace Corp., Symposium on Gravity Gradient Attitude Stabilization, El Segundo, Calif., Dec. 3-5, 1968, Paper. 15 p.

Analyses at NASA/Goddard and flight results from OGO 4 have indicated that long extendible rods of the overlap type are thermally unstable and oscillate or cone in the presence of sunlight. This phenomenon, termed "thermal flutter" has appeared on several gravity gradient spacecraft, with serious consequences. The paper presents attitude data taken from several orbiting gravity gradient spacecraft including NRL and OV1. The character of the performance is presented and correlated with digital simulations for identical conditions. The presence of high-frequency oscillations in the telemetry data is shown, and correlated with analyses of the structural modes of oscillation. The dependence of the oscillations on sunlight is pointed out, as is the phasing of the attitude performance anomalies with periods of high flutter activity. The apparent increase in flutter activity with time is also noted. Recommendations for avoiding the problem in future gravity gradient flights are made. (Author)

c31 090000 53

A69-18326 #
EFFECTS OF HIGH ACCURACY GRAVITY GRADIENT STABILIZATION.
H. Foulke (General Electric Co., Philadelphia, Pa.).
U.S. Air Force Systems Command and Aerospace Corp., Symposium on Gravity Gradient Attitude Stabilization, El Segundo, Calif., Dec. 3-5, 1968, Paper. 11 p. 5 refs.

Study of a low-altitude semipassive attitude control system capable of achieving pointing accuracies of one degree or better in all axes. The system consists of a two-axis gravity-gradient subsystem for pitch and roll control, and a momentum wheel for yaw and roll assist. Two modes of operation of the momentum wheel are discussed: a "fixed-speed" mode with the momentum wheel turning at constant speed, and a modulated mode, in which the wheel speed has a nominal bias but is modulated over a finite range of speed. The principles of operation of the system are presented with particular emphasis on optimizing the performance in all axes. F.R.L.

c31 090000 51

C.2

A69-18340 #
THE PARTICLE ENVIRONMENT AT SYNCHRONOUS ALTITUDE.
G. A. Paulikas (Aerospace Corp., Space Physics Laboratory, El Segundo, Calif.).
U.S. Air Force Systems Command and Aerospace Corp., Symposium on Gravity Gradient Attitude Stabilization, El Segundo, Calif., Dec. 3-5, 1968, Paper. 10 p. 14 refs.
Contract No. AF 04(701)-68-C-0200.

Review of the charged particle environment in the near-earth region of space, with particular emphasis on the synchronous orbit region. The electrons and protons which exist in this region of space and move under the influence of the earth's magnetic field are discussed. The properties of the thermal particles (the very low energy particles which may be thought of as an extension of the upper atmosphere) are outlined. These low-energy electrons and protons determine the propagation characteristics for low-frequency electromagnetic waves. The behavior of particles which have energies from thermal to 100 keV is examined. The energy density of these particles becomes comparable to the energy density in the magnetic field at some altitudes, so that because of diamagnetic effects, the particle flux may significantly perturb the ambient magnetic field. These particles constitute the so-called ring current, which during magnetically active periods depresses the earth's magnetic field at the surface of the earth. P.v.T.

c29 110100 10

A69-18343 *#
THE MAGNETIC FIELD AT THE SYNCHRONOUS, EQUATORIAL ORBIT.
Paul J. Coleman, Jr. (California, University, Dept. of Planetary and Space Science and Institute of Geophysics and Planetary Physics, Los Angeles, Calif.).
U.S. Air Force Systems Command and Aerospace Corp., Symposium on Gravity Gradient Attitude Stabilization, El Segundo, Calif., Dec. 3-5, 1968, Paper. 40 p. 36 refs.
Contract No. NAS 5-9570.

Summary of the results obtained from the analysis of the magnetometer data recorded by the ATS 1 satellite, which was launched into the synchronous, equatorial orbit on Dec. 6, 1966. These results include quantitative descriptions of the behavior of the magnetic field at the synchronous orbit during magnetic storms, during geomagnetic substorms, and during periods of little geomagnetic activity -i.e., during quiet times. Among the significant discoveries yielded by the analysis of the data are: (1) an asymmetry in the quiet-day geomagnetic cavity that is not accounted for by existing models; (2) a gradual decrease in the magnetic field on the nightside before the onset of an auroral breakup, which is empirical proof of the existance of an initial "growth" phase in a geomagnetic substorm; and (3) an abrupt recovery of the depressed nightside field at the onset of the breakup, which shows that the expansion phase of a substorm is simultaneous with the recovery of the geomagnetic cavity from a stressed state. P.v.T.

c13 110800 28

A69-18347 #
PASSIVE DAMPERS FOR GRAVITY GRADIENT STABILIZATION.
E. J. Buerger and R. S. Oxenreider (General Electric Co., Missile and Space Div., Valley Forge, Pa.).
U.S. Air Force Systems Command and Aerospace Corp., Symposium on Gravity Gradient Attitude Stabilization, El Segundo, Calif., Dec. 3-5, 1968, Paper. 12 p.

Passive dampers designed to dissipate the oscillatory energy of gravity gradient oriented satellites are described. Included are spherical dampers, which utilize the earth's magnetic field as a reference, and single-axis dampers, which use either the earth's gravity field or solar pressure. The energy dissipation techniques involving viscous fluids, eddy currents, and magnetic hysteresis effects are explained. Material selection for permanent magnets, diamagnetic suspension systems, viscous fluid, and eddy current mediums are discussed. Design considerations such as caging, thermal control, and the solution to the "sticking" problem peculiar to viscous fluid dampers are covered. A table of spherical dampers giving the significant functional characteristics as well as size and weight for several different designs is presented. Specialized test equipment used in the development, qualification, and flight acceptance phases is described. Finally, available flight history is presented. (Author)

c31 090000 57

A69-19199 *
A LOW-ENERGY CHANNEL-MULTIPLIER SPECTROMETER FOR ATS-E.
J. D. McDaniel (Lockheed Aircraft Corp., Lockheed Missiles and Space Co., Research Laboratories, Palo Alto, Calif.), R. D. Reed, E. G. Shelley, J. C. Bakke, and T. C. Sanders.
(Institute of Electrical and Electronics Engineers, Nuclear Science Symposium, 15th, Montreal, Canada, Oct. 23-25, 1968, Paper 3 C-5.)
IEEE Transactions on Nuclear Science, vol. NS-16, Feb. 1969, p. 359-370. 16 refs.
Research supported by the Lockheed Independent Research Program; Contract No. NAS 5-10392.

A compact channel-multiplier instrument has been designed and developed for spectral analysis of low-energy (0.5 to 500 keV) electrons and protons at synchronous altitude on the ATS-E satellite. The instrument package, which weighs 1.3 kg, contains 11 sensors and features a completely automatic in-flight calibration system for the interrogation of sensor and electronic performance. A detailed discussion of experimental objectives and design and calibration data for the instrument is presented. The results of studies of the long-term behavior of channel-multipliers are emphasized. (Author)

c14 111300 01

A69-19351
PHYSICS OF THE MAGNETOSPHERE; PROCEEDINGS OF THE CONFERENCE, BOSTON COLLEGE, CHESTNUT HILL, MASS., JUNE 19-28, 1967.
Conference sponsored by the U.S. Air Force and Boston College. Edited by R. L. Carovillano (Boston College, Chestnut Hill, Mass.), J. F. McClay (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Space Physics Laboratory, Bedford, Mass.), and H. R. Radoski (Boston College, Weston Observatory, Weston, Mass.).
Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 10), 1968. 686 p.
$35.10.

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PREFACE. R. L. Carovillano (Boston College, Chestnut Hill, Mass.), p. v, vi.

TUTORIAL LECTURES.

DYNAMICAL PROPERTIES OF THE MAGNETOSPHERE. E. N. Parker (Chicago, University, Chicago, Ill.), p. 3-64. 9 refs. [See A69-19352 07-13]

SOLAR WIND INTERACTIONS AND THE MAGNETOSPHERE. A. J. Dessler (William Marsh Rice University, Houston, Tex.), p. 65-105. 57 refs. [See A69-19353 07-29]

c29 110700 01

A69-19371
PARTICLE DYNAMICS AT THE SYNCHRONOUS ORBIT.
J. W. Freeman, Jr. and J. J. Maguire (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
IN: PHYSICS OF THE MAGNETOSPHERE; PROCEEDINGS OF THE CONFERENCE, BOSTON COLLEGE, CHESTNUT HILL, MASS., JUNE 19-28, 1967. [A69-19351 07-29]
Conference sponsored by the U.S. Air Force and Boston College. Edited by R. L. Carovillano, J. F. McClay, and H. R. Radoski. Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 10), 1968, p. 586-604.

A low-energy charged particle detector has been flown aboard the geostationary ATS 1 satellite. A preliminary study of the data has revealed large local time variations in the particle fluxes observed during geomagnetically disturbed times. During periods of moderate magnetic activity, a high particle flux is seen near local midnight. This flux shows a strong pre/post-midnight asymmetry with the particle intensities being higher in the midnight to dawn quadrant. During periods of high magnetic activity, the enhanced particle flux distribution broadens out in local time to cover a large fraction of the nightside portion of the synchronous orbit. The pre/post-midnight asymmetry is generally still present but less striking. During periods of enhanced magnetic activity, the local time distribution of the particle fluxes shows a remarkable similarity to the local time distribution of high-latitude magnetic substorm activity. It is suggested that the observed particle distribution is indicative of an influx of energetic plasma from the magnetospheric tail. Implications relating to magnetic storm models are discussed. The worldwide magnetic storm of Jan. 13-14, 1967 is analyzed. Data are presented which indicate a magnetospheric boundary crossing and the anisotropic injection of a cloud of monoenergetic protons. (Author)

c29 110700 10

A69-19715 *
COSMIC RADIO NOISE INTENSITY FROM 0.45 TO 3.0 MHz OBSERVED BY THE ATS II SATELLITE.
Richard R. Weber, Robert G. Stone, and C. Raymond Somerlock (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Astronomy and Astrophysics, vol. 1, Jan. 1969, p. 44-47. 18 refs.

Discussion of cosmic radio-noise measurements conducted by a satellite-borne Ryle-Vonberg radiometer with a 76-m wide angle V antenna. The measurements were obtained from 0.45 to 3.0 MHz for an altitude range of 180 to 11,000 km. The existence of some spacecraft radio interference allows establishment only of upper limits to the continuum spectrum, which shows a substantial decrease at the lower frequencies. Using this data and other low frequency observations in a two-component Galactic model, an emission measure of 1.2 cm^{-6} pc toward the Galactic poles is computed. G.R.

c30 111000 05

A69-21212 *#
AMMONIA RESISTOJET STATION KEEPING SUBSYSTEM ABOARD APPLICATIONS TECHNOLOGY SATELLITE (ATS) IV.
R. Shaw, T. K. Pugmire (Avco Corp., Avco Space Systems Div., Auxiliary Propulsion Dept., Lowell, Mass.), and R. A. Callens (NASA, Goddard Space Flight Center, Auxiliary Propulsion Branch, Greenbelt, Md.).
American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 7th, Williamsburg, Va., Mar. 3-5, 1969, Paper 69-296. 10 p.
Members, $1.00; nonmembers, $1.50.
Contract No. NAS 5-10394.
A 50-μ-lb thrust, ammonia fueled Resistojet system was on board the ATS-4 which was launched Aug. 10, 1968, into a decaying eliptical orbit. The Resistojet system was designed to provide 400 lb-sec total impulse for east-west station keeping and station changing in the planned geosynchronous orbit. The system weighed 16 lb, including 3 lb of ammonia, and used 11 w. During the two month satellite lifetime, the system operated 825 hr consuming 35% of its fuel, equivalent to one year maximum or two years minimum use rate if the spacecraft had been placed into a synchronous orbit. Flight test data, notably calibration measurements, leakage measurements, plenum depletion flow rates, and plenum pressure compared excellently with ground tests. Attention paid during design and ground test to valve selection, orifice sizing, porous plug flow techniques, ammonia-material compatibility, and contamination control contributed significantly to the flight success. (Author)

c28 020000 20

A69-21216 *#
REVIEW OF THE NASA PROGRAM IN ELECTRIC PROPULSION.
James Lazar (NASA, Office of Advanced Research and Technology, Washington, D.C.).
American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 7th, Williamsburg, Va., Mar. 3-5, 1969, Paper 69-248. 10 p. 23 refs.
Members, $1.00; nonmembers, $1.50.
The early application of electric propulsion for spacecraft position control and for small, automated interplanetary spacecraft continues to be a major goal of the electric propulsion program. The NASA-supported flight programs and laboratory efforts directed toward this goal are presented. The technology program aimed at auxiliary propulsion for application satellites and manned space stations, and prime propulsion for solar powered automated spacecraft is reviewed. The results from the Application Technology Satellite flights and the progress of the SERT 2 flight project are also summarized. (Author)

c28 020900 04

A69-21218 *#
CESIUM CONTACT ION MICROTHRUSTER EXPERIMENT ABOARD APPLICATIONS TECHNOLOGY SATELLITE (ATS) IV.
Robert E. Hunter, Robert O. Bartlett (NASA, Goddard Space Flight Center, Greenbelt, Md.), Robert M. Worlock, and Edmund L. James (Electro-Optical Systems, Inc., Pasadena, Calif.).
American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 7th, Williamsburg, Va., Mar. 3-5, 1969, Paper 69-297. 5 p.
Members, $1.00; nonmembers, $1.50.
On Aug. 10, 1968, ATS 4 was launched into a low-altitude parking orbit, remaining attached to the Centaur stage which failed to achieve a second burn. On board were two ion microthruster systems, and a spacecraft potential monitor which employed one of the gravity gradient booms as a Langmuir probe. The booms were deployed just prior to the last of five ion engine test periods. The large ram ion currents available from the relatively dense ambient plasma precluded the achievement of appreciable neutralizer emission current except for a few brief periods. During the last test, emission currents up to roughly half the beam current were obtained and spacecraft potentials as great as -133 volts were measured. Notable achievements, in addition to providing the first successful orbital test of an ion engine, include demonstration of the absence of detectable EMI and the satisfactory operation of the zero-g feed system. (Author)

c28 020901 02

A69-21268
SPACE SYSTEMS AND RADIOASTRONOMY; INTERNATIONAL RADIO CONSULTATIVE COMMITTEE, INTERIM MEETING OF STUDY GROUP IV, GENEVA, SWITZERLAND, SEPTEMBER 18-OCTOBER 7, 1968, CONCLUSIONS. PART 1.
Geneva, International Telecommunication Union, 1968. 305 p.

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c07 070100 10

A69-21272 #
ACTIVE COMMUNICATION-SATELLITE EXPERIMENTS - RESULTS OF TESTS AND DEMONSTRATIONS.
IN: SPACE SYSTEMS AND RADIOASTRONOMY; INTERNATIONAL

RADIO CONSULTATIVE COMMITTEE, INTERIM MEETING OF STUDY GROUP IV, GENEVA, SWITZERLAND, SEPTEMBER 18-OCTOBER 7, 1968, CONCLUSIONS. PART 1. [A69-21268 09-07]
Geneva, International Telecommunication Union, 1968, p. 111-118. 12 refs.
communication-satellite programs carried out with the aid of the satellites Score, Courier, Telstar, Relay, Syncom, Intelsat 1, and Molniya 1. The first phase of experimentation with these communication satellites has been concluded, and commercial transmission through them began in 1965. The Application Technology Satellite (ATS) program is discussed, which includes experiments in the areas of communications, nutation sensing, gravity-gradient and spin stabilization, attitude control at both high and low thrust levels, meteorology, navigation, and space-environment measurements.
P. v. T.

c30 070100 10

A69-21309 *
MAGNETOSPHERIC WIND.
John W. Freeman, Jr. (William Marsh Rice University, Dept. of Space Science, Houston, Tex.).
Science, vol. 163, Mar. 7, 1969, p. 1061, 1062. 9 refs.
Contract No. NAS 5-9561.

An experiment designed to detect the bulk flow of cool plasma within the magnetosphere has been flown on the ATS 1 synchronous satellite. This experiment has yielded evidence for gusts of streaming positive ions in the magnetospheric equatorial plane. This directed ion flow is interpreted as the result of large-scale electric fields of the order of several millivolts per meter. (Author)

c29 110700 18

A69-21988 #
ATTITUDE DETERMINATION AND CONTROL OF SYNCOM, EARLY BIRD, AND APPLICATIONS TECHNOLOGY SATELLITES.
W. H. Sierrer and W. A. Snyder (Hughes Aircraft Co., Space Systems Div., El Segundo, Calif.).
(American Institute of Aeronautics and Astronautics, Guidance, Control and Flight Dynamics Conference, Huntsville, Ala., Aug. 14-16, 1967, Paper 67-532.)
Journal of Spacecraft and Rockets, vol. 6, Feb. 1969, p. 162-166. 5 refs.
[For abstract see issue 19, page 3334, Accession no. A67-35934]

c31 020000 15

A69-22433
NATIONAL ELECTRONICS CONFERENCE, 24TH, CHICAGO, ILL., DECEMBER 9-11, 1968, PROCEEDINGS.
Conference sponsored by the Illinois Institute of Technology, the Institute of Electrical and Electronics Engineers, Northwestern University, and the University of Illinois.
Oak Brook, Ill., National Electronics Conference, Inc., 1968. 960 p.
$10.00.

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A SATELLITE COMMUNICATION SYSTEM USING PN CODES. D. R. Anderson and P. A. Wintz (Purdue University, Lafayette, Ind.), p. 427-430. 15 refs. [See A69-22460 09-07]

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POSSIBLE LARGE CAPACITY DOMESTIC SATELLITE SYSTEM. L. C. Tillotson (Bell Telephone Laboratories, Inc., Holmdel, N.J.), p. 485-487. [See A69-22467 09-07]

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CONSTANT ENVELOPE THRESHOLD DETECTOR. J. L. Sundry and W. F. Paul (Westinghouse Electric Corp., Baltimore, Md.), p. 533-538. [See A69-22474 09-07]

APPLICATION OF HELIUM-NEON LASER FOR PROCESS DIMENSIONAL CONTROL. S. Minkowitz (Perkin-Elmer Corp., Wilton, Conn.), p. 854-858. [See A69-22475 09-16]

EVAPORATION PROCESSES BY LASER BEAMS. P. D. Zavitsanos, L. E. Brewer, and W. E. Sauer (General Electric Co., King of Prussia, Pa.), p. 864-869. 11 refs. [See A69-22476 09-16]

ADAPTIVE SIGNAL TRACKING SYSTEM. J. E. Thompson (Westinghouse Electric Corp., Baltimore, Md.), p. 903-905. [See A69-22477 09-07]

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A69-22461

SCINTILLATION FADING OF VHF BEACONS ON SYNCHRONOUS SATELLITES.

H. E. Whitney, R. S. Allen, and J. Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.).

IN: NATIONAL ELECTRONICS CONFERENCE, 24TH, CHICAGO, ILL., DECEMBER 9-11, 1968, PROCEEDINGS. [A69-22433 09-09]

Conference sponsored by the Illinois Institute of Technology, the Institute of Electrical and Electronics Engineers, Northwestern University, and the University of Illinois.

Oak Brook, Ill., National Electronics Conference, Inc., 1968, p. 437-439.

Experimental study of scintillation fading observed on the vhf beacons of several synchronous satellites received at Hamilton, Mass. Data span the spring and summer of 1965 and 1967, and the period from the fall of 1967 to the spring of 1968. All records were reduced for an empirical index representing the depth of amplitude fluctuation. Selected periods were also assigned an index representing the fluctuation rate. Most severe fading occurred during short periods when the fluctuations seemed quasi-periodic, with enhancements up to 6 dB above and fading to at least 20 dB below the normal level. Such events were relatively rare. Otherwise, fading greater than 6 dB was associated with periods for which the scintillation index was greater than 60% only 3% of the total observation time.

M.M.

c07 100500 24

A69-22945 *#

COMPUTER CORRECTION OF DISTORTION IN ATS-SSCC PHOTOGRAPHS.

H. D. Ausfresser, A. C. Johnson, and R. A. Kowalski (Westinghouse Electric Corp., Defense and Space Center, Baltimore, Md.).

American Meteorological Society, Bulletin, vol. 50, Feb. 1969, p. 76-79.

Contract No. NAS 5-11513.

Illustration of some of the recent results in efforts to correct distortions in the spin scan cloud cover (SSCC) photographs taken by ATS satellites. These distortions are caused by nonnominal spacecraft position and spin axis orientation. Two programs have been written which produce photographs that are directly comparable - i.e., in which a fixed earth point appears in the same place in distinct pictures. The results of programs which produce ATS normal and Mercator projections from ATS digital data are presented. These results demonstrate the feasibility of mapping ATS data into standard projections. Each program requires from 20 to 30 min of Univac 1108 time. This time can be reduced if only a portion of the original picture is to be normalized.

P.v.T.

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A69-23831

OBSERVATIONS OF TRAVELLING IONOSPHERIC DISTURBANCES USING STATIONARY SATELLITES.

T. J. Elkins and F. F. Slack (USAF, Cambridge Research Laboratories, Bedford, Mass.).

Journal of Atmospheric and Terrestrial Physics, vol. 31, Mar. 1969, p. 421-439. 25 refs.

Description of observations, at a subauroral zone site, of transmissions from certain geostationary satellites. These observations have revealed an unusual regular type of fading, apparently due to diffraction from moving ionospheric formations. The velocity of movement of these electron-density irregularities was measured by means of a spaced receiver network, which in turn allowed their height to be computed in several instances, together with certain other parameters of interest. The fading is deduced to result from electron-density discontinuities (with linear gradients ~700 cm^{-3} m^{-1}, and located usually near the F-region maximum) which travel in a generally equatorward direction at ~50 to 120 m/sec. Apparent periodicity in many fading events, and an association with ionosonde-measured disturbance, suggest that the diffraction takes place at facets of traveling wavelike formations in the ionosphere. Additional observational evidence is presented to support a hypothesis of ducted acoustic-gravity waves, probably excited by impulsive auroral-zone events, and having horizontal wavelengths of ~50 to 100 km, with latitudinal extent, on occasion exceeding 1500 km. M.M.

c13 100500 26

A69-25161

SOLAR FLARES AND MAGNETIC STORM OF MAY 21 TO 28, 1967.
Harold D. Webb (Illinois, University, Urbana, Ill.).
Journal of Geophysical Research, vol. 74, Apr. 1, 1969, p. 1880-1882.
Contract No. DA-36-039-AMC-03703(E).

Discussion of solar flare and magnetic storm signals received from the ATS 1 geostationary satellite on May 28, 1967. The ground-based receiving antenna was a paraboloid 28 ft in diameter, with a continuously rotating plane polarized log-periodic feed. An equation is derived for the total electron content. The Faraday rotation and electron content data are plotted vs universal time. M.G.

c30 100500 29

A69-25492

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, STRUCTURAL DYNAMICS AND AEROELASTICITY SPECIALIST CONFERENCE, NEW ORLEANS, LA., APRIL 16, 17, 1969 AND AMERICAN SOCIETY OF MECHANICAL ENGINEERS AND AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, STRUCTURES, STRUCTURAL DYNAMICS, AND MATERIALS CONFERENCE, 10TH, NEW ORLEANS, LA., APRIL 14-16, 1969, PROCEEDINGS.
New York, American Institute of Aeronautics and Astronautics, Inc., 1969. 425 p.
Members, $15; nonmembers, $22.

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OPTIMIZATION OF STRUCTURES TO SATISFY FLUTTER REQUIREMENTS. M. J. Turner (Boeing Co., Seattle, Wash.), p. 1-8. 9 refs. [See A69-25493 11-32]

DYNAMIC OPTIMIZATION OF COMPLEX STRUCTURES. C. P. Rubin (Hughes Aircraft Co., El Segundo, Calif.), p. 9-14. 9 refs. [See A69-25494 11-32]

STRUCTURAL OPTIMIZATION IN THE DYNAMICS RESPONSE REGIME - A COMPUTATIONAL APPROACH. R. L. Fox (Case-Western-Reserve University, Cleveland, Ohio) and M. P. Kapoor (Institute of Higher Technology, Kanpur, India), p. 15-22. 9 refs. [See A69-25495 11-32]

OPTIMAL DESIGN OF STRUCTURES WITH CONSTRAINTS ON NATURAL FREQUENCY. B. R. McCart (Augustana College, Rock Island, Ill.), E. J. Haug, and T. D. Streeter (U.S. Army, Weapons Command, Rock Island, Ill.), p. 23-31. 8 refs. [See A69-25496 11-32]

SATURN V POGO AND A SOLUTION. R. L. Rich (Boeing Co., New Orleans, La.), p. 32-41. [See A69-25497 11-31]

THE USE OF HELIUM BUBBLES AS A POGO FIX IN LAUNCH VEHICLE PROPELLANT LINES. B. R. Hanks and D. G. Stephens (NASA, Langley Research Center, Hampton, Va.), p. 42-46. [See A69-25498 11-31]

DYNAMIC STABILITY OF CYLINDRICAL PROPELLANT TANKS. D. D. Kana and W.-H. Chu (Southwest Research Institute, San Antonio, Tex.), p. 47-57. 9 refs. [See A69-25499 11-32]

MINIMIZING SPACECRAFT STRUCTURE/CONTROL-SYSTEM INTERACTION. R. B. Noll (Kaman Corp., Burlington, Mass.) and C. H. Spenny (NASA, Electronics Research Center, Cambridge, Mass.), p. 58-65. 20 refs. [See A69-25500 11-31]

A METHOD FOR DIGITAL COMPUTATION OF SPACECRAFT RESPONSE IN THE DOCKING MANEUVER. C. Bodley, G. Morosow (Martin Marietta Corp., Denver, Colo.), and W. Holland (NASA, Marshall Space Flight Center, Huntsville, Ala.), p. 66-74. [See A69-25501 11-31]

DYNAMICS OF A LIBRATION-DAMPED DISCRETIZED CRUCIFORM STRUCTURE. J. L. Farrell, J. K. Newton, and D. A. Hedland (Westinghouse Electric Corp., Baltimore, Md.), p. 75-83. 21 refs. [See A69-25502 11-32]

A NEW METHOD FOR COMPUTING THE DYNAMIC RESPONSE OF AIRCRAFT TO THREE-DIMENSIONAL TURBULENCE. F. D. Eichenbaum (Lockheed Aircraft Corp., Marietta, Ga.), p. 84-94. 8 refs. [See A69-25503 11-02]

PROBLEMS IN THE USE OF THE EXPECTED NUMBER OF EXCEEDANCES IN ESTABLISHING DESIGN GUST LOADS. C. S. O'Hearne (Martin Marietta Corp., Orlando, Fla.), p. 95-101. 10 refs. [See A69-25504 11-02]

ON FIRST-EXCURSION FAILURE OF RANDOMLY EXCITED STRUCTURES. Y. K. Lin (Illinois, University, Urbana, Ill.), p. 102-111. 14 refs. [See A69-25505 11-32]

RANDOM ACOUSTIC RESPONSE OF A CYLINDRICAL SHELL. C. Hwang and W. S. Pi (Northrop Corp., Hawthorne, Calif.), p. 112-120. 6 refs. [See A69-25506 11-32]

DYNAMIC STABILITY OF THIN CIRCULAR PLATES SUBJECTED TO PURELY STOCHASTIC RADIAL EXCITATION. J. A. Lepore (Pennsylvania, University, Philadelphia, Pa.) and H. C. Shah (Stanford University, Stanford, Calif.), p. 121-130. 12 refs. [See A69-25507 11-32]

THE APPLICATION OF FILAMENT COMPOSITES TO AEROELASTIC MODELS. H. F. Hunter and J. B. Bailey (Lockheed Aircraft Corp., Marietta, Ga.), p. 131-143. 6 refs. [See A69-25508 11-32]

MODAL COUPLING IN THERMALLY STRESSED PLATES. C. D. Bailey (Ohio State University, Columbus, Ohio), p. 144-152. [See A69-25509 11-32]

THE STABILITY OF DYNAMIC SYSTEMS WITH PERIODICALLY VARYING PARAMETERS. P. Crimi (Rochester Applied Science Associates, Inc., Rochester, N.Y.), p. 153-161. 11 refs. [See A69-25510 11-32]

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VISCOUS FLOW-INDUCED VIBRATIONS OF A FLAT PLATE SUSPENDED IN A NARROW CHANNEL. F. T. Dodge and A. F. Muller (Southwest Research Institute, San Antonio, Tex.), p. 205-209. 5 refs. [See A69-25515 11-32]

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SERVO CONTROL OF FLUTTER. J. G. Theisen (Lockheed Aircraft Corp., Marietta, Ga.) and W. C. Robinette, p. 228-240. 17 refs. [See A69-25518 11-32]

AXISYMMETRIC VIBRATION OF CONICAL SHELLS. R. F. Hartung and W. A. Loden (Lockheed Aircraft Corp., Palo Alto, Calif.), p. 241-252. 6 refs. [See A69-25519 11-32]

EFFECTS OF INPLANE AND ROTARY INERTIA ON THE FREQUENCIES OF ECCENTRICALLY STIFFENED CYLINDRICAL SHELLS. S. Parthan and D. J. Johns (Loughborough University of Technology, Loughborough, Leics., England), p. 253-261. 9 refs. [See A69-25520 11-32]

A THEORETICAL ANALYSIS OF THE FREE VIBRATION OF

DISCRETELY STIFFENED CYLINDRICAL SHELLS WITH ARBITRARY END CONDITIONS. D. M. Egle (Oklahoma, University, Norman, Okla.) and K. E. Soder, Jr. (Atlantic Research Corp., Costa Mesa, Calif.), p. 262-274. 51 refs. [See A69-25521 11-32]

A SURVEY OF MODERN NONSENSE AS APPLIED TO MATRIX COMPUTATIONS. R. A. Rosanoff (North American Rockwell Corp., Downey, Calif.), p. 275-284. 15 refs. [See A69-25522 11-19]

INFLUENCE OF IN-PLANE EDGE SUPPORT FLEXIBILITY ON THE NONLINEAR FLUTTER OF LOADED PLATES. C. S. Ventres and E. H. Dowell (Princeton University, Princeton, N.J.), p. 285-295. 15 refs. [See A69-25523 11-32]

FLUTTER DESIGN CHARTS FOR STRESSED ISOTROPIC PANELS. C. P. Shore (NASA, Langley Research Center, Hampton, Va.), p. 296-301. 21 refs. [See A69-25524 11-32]

A METHOD FOR COMPUTING THE RESPONSE OF A GENERAL AXISYMMETRIC SHELL WITH AN ATTACHED ASYMMETRIC STRUCTURE. E. C. Steeves, B. J. Durling, and W. C. Walton, Jr. (NASA, Langley Research Center, Hampton, Va.), p. 302-328. 8 refs. [See A69-25525 11-32]

PREDICTION OF NONLINEAR TRANSIENT RESPONSE OF STRUCTURES. R. J. Melosh and D. M. Kelley (Philco-Ford Corp., Palo Alto, Calif.), p. 329-335. 14 refs. [See A69-25526 11-32]

STRESS WAVE PROPAGATION USING THE EXTENDED RITZ METHOD. E. B. Becker (Texas, University, Austin, Tex.) and R. E. Nickell (Bell Telephone Laboratories, Inc., Whippany, N.J.), p. 336-348. 17 refs. [See A69-25527 11-32]

TRANSIENT DYNAMIC RESPONSE OF LINEARLY VISCOELASTIC STRUCTURES AND CONTINUA. D. W. Malone (Purdue University, Lafayette, Ind.) and J. J. Connor (Massachusetts Institute of Technology, Cambridge, Mass.), p. 349-356. 13 refs. [See A69-25528 11-32]

TRANSFORMATION OF VARIABLES FOR REDUNDANCY OPTIMIZATION IN THE RANK FORCE METHOD. J. Robinson and G. W. Haggenmacher (Lockheed Aircraft Corp., Burbank, Calif.), p. 357-363. 6 refs. [See A69-25529 11-32]

DYNAMICS OF SPIN-STIFFENED DEPLOYABLE SPACE STRUCTURES. J. M. Hedgepeth (Astro Research Corp., Santa Barbara, Calif.), p. 364-374. 5 refs. [See A69-25530 11-32]

OBSERVATIONS ON THE MECHANISM OF THERMAL TORQUE INSTABILITY. P. F. Jordan (Martin Marietta Corp., Baltimore, Md.), p. 375-382. 5 refs. [See A69-25531 11-32]

FREQUENCIES AND MODE SHAPES OF A 100-FOOT SPACE ERECTABLE PARABOLIC ANTENNA. R. K. Gieseke (General Dynamics Corp., San Diego, Calif.), p. 383-396. 8 refs. [See A69-25532 11-32]

ON THE SPIN-STABILITY OF A FLEXIBLE BODY. J. M. Talcott (Fairchild Hiller Corp., Germantown, Md.), p. 397-404. 8 refs. [See A69-25533 11-32]

THERMALLY INDUCED VIBRATIONS OF LONG THIN-WALLED CYLINDERS OF OPEN SECTION. H. P. Frisch (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 405-420. 9 refs. [See A69-25534 11-32]

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A69-25500 * #

MINIMIZING SPACECRAFT STRUCTURE/CONTROL-SYSTEM INTERACTION.

Richard B. Noll (Kaman Corp., Kaman AviDyne, Burlington, Mass.) and Curtis H. Spenny (NASA, Electronics Research Center, Cambridge, Mass.).

IN: AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS, STRUCTURAL DYNAMICS AND AEROELASTICITY SPECIALIST CONFERENCE, NEW ORLEANS, LA., APRIL 16, 17, 1969, PROCEEDINGS. [A69-25492 11-32]

New York, American Institute of Aeronautics and Astronautics, Inc., 1969, p. 58-65. 20 refs.

Contract No. NAS 12-613.

Spacecraft structure/control-system interaction problems and their minimization are reviewed. Interaction problems are identified with three basic structural configurations. Representative spacecraft examples in each category are discussed to illustrate various methods which have been used to minimize interactions. Examples include Explorer 3, ATS, Apollo CSM/LM, ISIS 1, OSO, 1963 49B, DODGE, and Radio Astronomy Explorer. Design improvements based on flight experience are emphasized. While interaction problems of manned spacecraft have required greater-in-depth studies, in-flight difficulties are shown to be most numerous on spacecraft equipped with extendible booms. The majority of these interactions are attributed to the susceptibility of the booms to the solar environment. Interaction effects on spacecraft which are spin stabilized about the principal axis of minimum moment of inertia are included. (Author)

c31 020000 17

A69-26053 #

WORLDWIDE CLOCK SYNCHRONIZATION USING A SYNCHRONOUS SATELLITE.

Lawrence E. Gatterer, Paul W. Bottone, and Alvin H. Morgan (National Bureau of Standards, Boulder, Colo.).

(Institute of Electrical and Electronics Engineers, Conference on Precision Electromagnetic Measurements, Boulder, Colo., June 25-28, 1968.)

IEEE Transactions on Instrumentation and Measurement, vol. IM-17, Dec. 1968, p. 372-378. 12 refs.

USAF-supported research.

An experiment performed in late 1967 is reported which investigated the synchronization of widely separated clocks. One-way vhf timing signals were relayed to remote clocks from a reference clock by means of a transponder on a geostationary satellite. The problem of synchronizing clocks using one-way transmission reduces to the problem of predicting the radio propagation delay. The accuracy of predicting the delay was 10 μsec or 60 μsec depending on the method used. This technique may offer an alternative to transporting atomic standards to geodetic and spacecraft tracking stations around the world in fulfillment of their clock synchronization requirements. (Author)

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A69-26804 #

GEOSYNCHRONOUS METEOROLOGICAL SATELLITE.

V. E. Suomi and T. H. Vonder Haar (Wisconsin, University, Space Science and Engineering Center, Madison, Wis.).

(American Institute of Aeronautics and Astronautics, Annual Meeting and Technical Display, 5th, Philadelphia, Pa., Oct. 21-24, 1968, Paper 68-1094.)

Journal of Spacecraft and Rockets, vol. 6, Mar. 1969, p. 342-344.

[For abstract see issue 24, page 4585, Accession no. A68-44980]

c31 080100 23

A69-28691 #

DETERMINATION OF THE TOTAL NUMBER OF ELECTRONS IN THE IONOSPHERE FROM THE FARADAY EFFECT BY MEANS OF SIGNALS FROM THE ATS-3 SATELLITE.

D. Fel'ske and G. Bardei (Observatoriia Issledovanii Ionosfery, Kühlungsborn; Institut Solnechno-Zemnoi Fiziki, East Germany).

(Geomagnetizm i Aeronomiia, vol. 8, no. 5, 1968, p. 835-839.)

Geomagnetism and Aeronomy, vol. 8, no. 5, 1968, p. 667-670. 6 refs. Translation.

[For abstract see issue 02, page 237, Accession no. A69-11660]

c13 100500 10

A69-28935

PENETRATION OF SOLAR PROTONS TO SYNCHRONOUS ALTITUDE.

G. A. Paulikas and J. B. Blake (Aerospace Corp., Space Physics Laboratory, El Segundo, Calif.).

Journal of Geophysical Research, vol. 74, May 1, 1969, p. 2161-2168. 22 refs.

Contract No. AF 04(701)-68-C-0200.

Solar proton fluxes in two energy intervals (5 to 21 MeV and 21 to 70 MeV) were measured with detectors aboard the geostationary ATS 1 satellite during the solar proton event that began on Jan. 28, 1967. Comparison with data obtained by satellites outside the magnetosphere shows that (1) protons with energies greater than 21 Mev have essentially free access to synchronous altitude; (2) protons in the 5 to 21 MeV energy interval show a diurnal variation with the flux approaching the interplanetary flux level near local midnight. The transmission efficiency of the magnetosphere is not well organized by either the local (synchronous) magnetic field or the Kp index. (Author)

c29 110100 12

A69-31450 #
AUSTRALIAN SPACE RESEARCH ACTIVITIES FOR 1968.
COSPAR, Plenary Meeting, 12th, Prague, Czechoslovakia, May 11-24, 1969, Paper. 43 p.

Review of space research activities in Australia, which were carried out by the Department of Supply (Weapons Research Establishment), the Department of the Interior (Bureau of Meteorology), the Postmaster-General's Department, the Overseas Telecommunications Commission (Australia), and the Universities of Adelaide, Melbourne, and Tasmania. The manned space flight program in cooperation with NASA is briefly outlined. The satellite and planetary probes programs, involving results from the first Australian satellite, WRESAT, and from various tracking stations are discussed. Sounding rocket programs are considered, as well as ground-based experiments. Balloon-borne experiments involving X-ray emission from the southern sky were performed. Aspects of international cooperation are discussed. F.R.L.

c34 070600 01

A69-32106
A PROPOSED INDEX FOR MEASURING IONOSPHERIC SCINTILLATIONS.
H. E. Whitney, J. Aarons, and C. Malik (USAF, Office of Aerospace Research, Cambridge Research Laboratories, Bedford, Mass.).
(COSPAR, Plenary Meeting, 11th, Tokyo, Japan, May 9-21, 1968, Paper.)
Planetary and Space Science, vol. 17, May 1969, p. 1069-1073.
[For abstract see issue 15, page 2765, Accession no. A68-31964]

c07 000000 04

A69-32926
ON THE EXISTENCE OF SOMETIMES CONSIDERABLE TRANSPORT EFFECTS IN THE NIGHTTIME IONOSPHERE.
J. P. Schödel (Max-Planck-Institut für Aeronomie, Abteilung für Weltraumphysik, Lindau über Northeim, West Germany).
Zeitschrift für Geophysik, vol. 35, May 1969, p. 297-301.
Bundesministerium fur Wissenschaftliche Forschung Grant No. WRK-153.

Results of observations of the Faraday effect in the ionosphere by the geostationary satellite ATS-3. Faraday rotation measurements are cited as evidence of considerable nighttime electron transport. Estimates of the direction and order of magnitude of the transport are given, and examples of vertical and horizontal transport are considered. B.H.

c13 100500 30

A69-33270 * #
RESULTS FROM THE ATS-3 REFLECTOMETER EXPERIMENT.
James B. Heaney (NASA, Goddard Space Flight Center, Greenbelt, Md.).
American Institute of Aeronautics and Astronautics, Thermophysics Conference, 4th, San Francisco, Calif., June 16-18, 1969, Paper 69-644. 12 p. 21 refs.
Members, $1.00; nonmembers, $1.50.

A reflectometer experiment, capable of measuring relative specular reflectance in five wavelength bands, was placed in a synchronous orbit aboard the ATS 3 satellite. Eighteen test samples and two reference surfaces were carried on the experiment, and eight of these samples were protected from sources of environmental damage by fused silica shields. All of the test samples are highly reflecting specular materials having Al or Ag surfaces either uncoated or coated with SiO, SiO_2, Al_2O_3, or MgF_2. The results have shown a noticeable difference between shielded and unshielded samples. The loss of reflectance is generally restricted to wavelengths less than 1200 nm and is most evident in the 300 to 400 nm region. This observed decrease in reflectance has been converted to a change in solar absorptance for some samples. The change is more severe than that observed in other experiments, either flight or laboratory, from which comparable data are available. (Author)

c33 100300 02

A69-33277 #
AN ATS-E SOLAR CELL SPACE RADIATOR UTILIZING HEAT PIPES.
J. D. Hinderman, J. Madsen, and E. D. Waters (McDonnell Douglas Corp., McDonnell Douglas Astronautics Co., Donald W. Douglas Laboratories, Richland, Wash.).
American Institute of Aeronautics and Astronautics, Thermophysics Conference, 4th, San Francisco, Calif., June 16-18, 1969, Paper 69-630. 7 p.
Members, $1.00; nonmembers, $1.50.

Use of heat pipe technology for thermal equalization around the circumference of 56-in.-diam solar-cell mounting panels on a gravity gradient-stabilized synchronous earth satellite. Thermal tests were conducted to demonstrate heat pipe performance in steady-state and transient (eclipse) conditions. Actual performance of the solar panel/heat pipe substrate showed excellent correlation with predicted performance. Temperature differences between the hot and cold sides of the panels were less than 1/8 of those for panels without heat pipes. The effective solar cell temperature was reduced from 120 to 45°F, resulting in approximately a 20% increase in power output. (Author)

c33 100700 04

A69-33777
CONTRIBUTIONS TO METEOROLOGICAL SATELLITE RESEARCH [BEITRÄGE ZUR METEOROLOGISCHEN SATELLITENFORSCHUNG].
Meteorologische Abhandlungen, vol. 84, no. 4, 1968, p. I-1 to I-45. 12 refs. In German.

Summary of the progress made in satellite research, with special reference to ATS-3 with its extensive scientific program. Launched into a synchronous orbit over the South Atlantic Ocean on Nov. 5, 1967, a color picture of the earth transmitted by it on Nov. 19, 1967, is discussed from oceanographic and geomorphological viewpoints. Weather satellite ESSA 6, launched on Nov. 10, 1967, is also described. Finally, a summary is given of the space research which has occurred in the past decade in the USSR. V.P.M.

c20 080000 09

A69-35070
SPACE, TECHNOLOGY, AND SOCIETY; CANAVERAL COUNCIL OF TECHNICAL SOCIETIES, SPACE CONGRESS, 6TH, COCOA BEACH, FLA., MARCH 17-19, 1969, PROCEEDINGS. VOLUME 1.
Edited by L. E. Jones, III (Florida, University, Gainesville, Fla.).
Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1969. 466 p.
Price of two volumes, $20.

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COMPARISON OF MEASURED AND THEORETICAL VALUES OF ELECTRICAL CONDUCTIVITY IN A LOW DENSITY PLASMA. R. M. Boatman (Tennessee, University, Tullahoma, Tenn.), p. 1-13 to 1-19. 14 refs. [See A69-35072 18-25]

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SECONDARY USES OF AEROSPACE BIOMEDICAL TECHNOLOGY. T. D. Browne (Denver, University, Denver, Colo.), p. 18-1 to 18-4. 7 refs. [See A69-35104 18-34]
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A69-35101 *#
A REVIEW OF THE IMAGE DISSECTOR METEOROLOGICAL CAMERAS AND A VIEW OF THEIR FUTURE.
Edward W. Koenig (International Telephone and Telegraph Corp., Aerospace/Optical Div., Fort Wayne, Ind.) and Gilbert A. Branchflower (NASA, Goddard Space Flight Center, Greenbelt, Md.).
IN: SPACE, TECHNOLOGY, AND SOCIETY; CANAVERAL COUNCIL OF TECHNICAL SOCIETIES, SPACE CONGRESS, 6TH, COCOA BEACH, FLA., MARCH 17-19, 1969, PROCEEDINGS. VOLUME 1. [A69-35070 18-34]
Edited by L. E. Jones, III.
Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1969, p. 16-23 to 16-41.
Contracts No. NAS 5-9619; No. NAS 5-9671; No. NAS 5-11617; No. NAS 5-11618.

Description of the operation and achievements of the ATS-III IDC (Applications Technology Satellite III Image Dissector Camera) and the NIMBUS IDCS (Image Dissector Camera System). The ATC III contains an image dissector, a sun sensor for the spin rate, and the electronics required to synchronize camera timing and operation with spacecraft spin, and to retain proper phasing for earth viewing once initial phase has been commanded from the ground. The camera generates one line of video with each spacecraft rotation and is unique in that the IDC output contains all the frame and line synchronization information necessary to display the video with a minimum of special ground support equipment. The NIMBUS IDCS is an 800 TV line system with a line rate of 4 Hz and a video bandwidth of 1800 Hz. The video will be transmitted to earth in real-time AM/FM with an AM subcarrier of 2400 Hz and will be simultaneously recorded on spacecraft recorders. Camera resolution is 25% at 800 TV lines, and the output video has a highlight SNR of 38 dB (p-p/rms). Some applications of the image dissector camera are discussed, the most important being its potential use as an earth resources sensor. B.H.

c14 **080500 08**

A69-35704 *
SOLAR CELL RADIATION DAMAGE ON SYNCHRONOUS SATELLITE ATS-I.
Ramond C. Waddel (NASA, Goddard Space Flight Center, Spacecraft Technology Div., Greenbelt, Md.).
IN: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, PHOTOVOLTAIC SPECIALISTS CONFERENCE, 7TH, PASADENA, CALIF., NOVEMBER 19-21, 1968, CONFERENCE RECORD. [A69-35678 19-03]
New York, Institute of Electrical and Electronics Engineers, Inc., 1968, p. 195-205. 14 refs.

Results of a study in which various types of solar cells were monitored during 416.8 days in synchronous orbit on satellite ATS 1. Judging by the remaining percentage of initial maximum power, qualified conclusions were that (1) degradation was greater than expected; (2) optimum base resistivity was 10 ohm-cm; (3) optimum shield thickness was 6 mils; (4) sapphire and silica shields were comparable; (5) silica shields were superior to glass; (6) boron and aluminum doping were comparable; and (7) it was necessary to presume some radiation damage, some drop in illumination, and a development of series resistance to account for the results. (Author)

c03 **110500 09**

A69-36237
NTC 69; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, NATIONAL TELEMETERING CONFERENCE, WASHINGTON, D.C., APRIL 22-24, 1969, RECORD.
New York, Institute of Electrical and Electronics Engineers, Inc., 1969. 336 p.
Members, $17.50; nonmembers, $20.

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SECOND ORDER TRACKING LOOP STATISTICS AND OPTIMUM RECEIVER DESIGN. M. Y. Rhee and F. H. Hussein (Virginia Polytechnic Institute, Blacksburg, Va.), p. 321-325. 7 refs. (See A69-36286 19-07)

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A69-36254 *

A PERFORMANCE EVALUATION OF A TWO-ELEMENT LARGE APERTURE ANTENNA ARRAY.

Leonard F. Deerkoski (NASA, Goddard Space Flight Center, Greenbelt, Md.).

IN: NTC 69; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, NATIONAL TELEMETERING CONFERENCE, WASHINGTON, D.C., APRIL 22-24, 1969, RECORD. (A69-36237 19-07)

New York, Institute of Electrical and Electronics Engineers, Inc., 1969, p. 97-103. 5 refs.

Description of a two-element adaptively phased array with element gains of 18 dB assembled and evaluated at 136 MHz. The gain improvement of the system over that of a single element was measured while tracking ATS-C. The measured gain improvement fell within 0.5 dB of the theoretical maximum 90 per cent of the time, corresponding to a normalized improvement of 2.5 dB for the two-element array. The relative phase between array elements was measured while tracking Relay 2 and ESSA spacecraft, and analysis of the data from several array baselines showed the phase noise to be essentially independent for element separations greater than 400 ft. (Author)

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A69-38082 *

SIMULTANEOUS OBSERVATIONS OF 5- TO 15-SECOND PERIOD MODULATED ENERGETIC ELECTRON FLUXES AT THE SYNCHRONOUS ALTITUDE AND THE AURORAL ZONE.

G. K. Parks and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).

Journal of Geophysical Research, vol. 74, Aug. 1, 1969, p. 4003-4017. 46 refs.

NSF Grants No. GA-487; No. GA-1508; Contract No. NAS 5-9542; Grant No. NGR-24-005-008.

Two magnetospheric substorm particle events, recorded simultaneously at the 6.6 earth radii equatorial plane and the conjugate region on earth in the auroral zone, have been analyzed for fast temporal structures. The analysis indicates that the 10-sec quasi-periodic modulations observed commonly in precipitation events also exist in trapped energetic electron fluxes confined in the equatorial plane. The Fourier spectral analysis shows a significant peak at 7-8 sec periods for both the trapped and precipitated electron fluxes during the event that occurred on Apr. 21, 1967. The spectral analysis of the August 17 event shows a complicated multipeak frequency spectrum for both regions. The time development characteristics of these modulations are also studied by the dynamic spectral analysis method. The coherence analysis of the two sets of data shows that the modulation in the equatorial plane and the auroral zone were generally uncorrelated, with the exception of a 6-min duration at the beginning of the Apr. 21, 1967, event. Finally, the analysis reveals that although the modulations in precipitated fluxes attained peak-to-valley flux ratios of about 2, the modulations in the equatorial plane were only a few per cent. (Author)

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A69-38093

MEASUREMENT AND INTERPRETATION OF POWER SPECTRUMS OF IONOSPHERIC SCINTILLATION AT A SUB-AURORAL LOCATION.

Terence J. Elkins (USAF, Cambridge Research Laboratories, Bedford, Mass.) and Michael D. Papagiannis (Boston University, Dept. of Physics and Astronomy, Boston, Mass.).

Journal of Geophysical Research, vol. 74, Aug. 1, 1969, p. 4105-4115. 43 refs.

Results of an analysis of the power spectrum of ionospheric scintillation data, which is related to fluctuations in the radio refractive index in the F region. It is noted that the spectrum of geomagnetic micropulsations is in substantial agreement with the scintillation power spectrum, and a theory is developed tying the two phenomena together. A model is proposed in which horizontally ducted hydromagnetic waves produce irregularities in the F region and geomagnetic micropulsations, causing both to have the same power law spectrum. M.M.

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A69-38334
SPACE RESEARCH IX; COSPAR, PLENARY MEETING, 11TH, TOKYO, JAPAN, MAY 9-21, 1968, PROCEEDINGS.
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A69-38370 *

PRESENT STATUS OF CLOUD VELOCITY COMPUTATIONS FROM THE ATS I AND ATS III SATELLITES.

T. Fujita (Chicago, University, Dept. of Geophysical Science, Chicago, Ill.).

IN: SPACE RESEARCH IX; COSPAR, PLENARY MEETING, 11TH, TOKYO, JAPAN, MAY 9-21, 1968, PROCEEDINGS. (A69-38334 21-13)

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Latest developments in spin-scan cloud photography from the ATS geosynchronous satellite make it possible to produce images of the global disk at certain time intervals which are about 23 min for ATS 1 and 31 min for ATS 3 when the entire disk is scanned. Experiments performed with ATS 3 in April 1968 revealed that a series of one-half scans, extending from the north pole to the equator, at 14 min intervals, is capable of depicting not only the motion of neph systems at various levels but also the explosive development of severe thunderstorms over the U.S. Presented in this work are the effects of a slight movement of subsatellite longitude and latitude, apparent velocities of clouds as viewed from geosynchronous satellites, loop projection methods of cloud-velocity computation, and actual examples of computation. Included is a time-lapse motion picture of clouds in motion filmed from special half-scan picture sequences obtained in April 1968 under the project "Tornado Watch." Some severe storm-producing clouds are characterized by explosive development. They modify their environment, thus resulting in a dissipation of nearby clouds as storms grow rapidly. The most difficult problem is the estimation of cloud heights from current ATS pictures. The relationship between cloud and air motions must be studied from theoretical and analytical points of view. (Author)

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A69-38371

RELATIONSHIP BETWEEN OBSERVED WINDS AND CLOUD VELOCITIES DETERMINED FROM PICTURES OBTAINED BY THE ESSA III, ESSA V AND ATS I SATELLITES.

T. Izawa (Ministry of Transportation, Meteorological Research Institute, Tokyo, Japan) and T. Fujita (Chicago, University, Dept. of Geophysical Science, Chicago, Ill.).

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Meeting co-sponsored by the Japanese Committee on Space Research.

Edited by K. S. W. Champion, P. A. Smith, and R. L. Smith-Rose. Amsterdam, North-Holland Publishing Co., 1969, p. 571-579.

Cloud velocities were determined from ESSA 3 and ESSA 5 pictures and from ATS 1 picture sequences to study the formation of typhoon and tropical vortices in the intertropical convergence zone. Since the time interval between two consecutive satellite passes of ESSA 3 and ESSA 5 is about two hours, corresponding to five frames of the ATS picture sequence, two-hour averages of cloud velocity were computed. There is a recognizable difference both in speed and direction of motion between high and low clouds. The cloud velocities determined from the ESSA and the ATS pictures are compared with actual winds observed over the Pacific. It can be seen that velocities of high and low clouds correspond approximately to winds at about the 200 and 850 mb levels, respectively. (Author)

c20 081000 05

A69-38372

ANGULAR CHARACTERISTICS OF THE REFLECTANCE OF THE EARTH-ATMOSPHERE SYSTEM AS OBTAINED FROM A SYNCHRONOUS SATELLITE.

E. Raschke (Ruhr-Universität, Bochum, West Germany).

IN: SPACE RESEARCH IX; COSPAR, PLENARY MEETING, 11TH, TOKYO, JAPAN, MAY 9-21, 1968, PROCEEDINGS. (A69-38334 21-13)

Meeting co-sponsored by the Japanese Committee on Space Research.

Edited by K. S. W. Champion, P. A. Smith, and R. L. Smith-Rose. Amsterdam, North-Holland Publishing Co.,1969, p. 580-585. 5 refs.

The angular dependence of the reflectance of the ocean surface-cloudless atmosphere system for solar radiation between 0.45 and 0.65 microns has been studied statistically with digitized signals from the ATS 1 satellite camera system. The results show high reflectance due to specular reflection from the rough ocean surface and increasing total reflectance with decreasing elevation of the sun. (Author)

c13 080100 20

A69-39212 * #

AN ADVANCED CONTACT ION MICROTHRUSTER SYSTEM.

R. Worlock, J. J. Davis, E. James, P. Ramirez, and O. Wood (Electro-Optical Systems, Inc., Pasadena, Calif.).

(American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-552.)

Journal of Spacecraft and Rockets, vol. 6, Apr. 1969, p. 424-429. 13 refs.

Contract No. AF 33(615)-1530; No. NAS 5-10380.

(For abstract see issue 17, page 3236, Accession no. A68-33752)

c28 020900 05

A69-39754 * #

ATS-III RESISTOJET THRUSTER SYSTEM PERFORMANCE.

T. Kent Pugmire, W. S. Davis (Avco Corp., Auxiliary Propulsion Dept., Lowell, Mass.), and William Lund (NASA, Goddard Space Flight Center, Greenbelt, Md.).

(American Institute of Aeronautics and Astronautics, Propulsion Joint Specialist Conference, 4th, Cleveland, Ohio, June 10-14, 1968, Paper 68-553.)

Journal of Spacecraft and Rockets, vol. 7, July 1969, p. 790-794. 5 refs.

Contract No. NAS 5-10342.

(For abstract see issue 17, page 3236, Accession no. A68-33753)

c28 020000 14

A69-39757 #

A SIMPLIFIED APPROACH FOR CORRECTION OF PERTURBATIONS ON A STATIONARY ORBIT.

Richard E. Balsam (Mechanics Research, Inc., Los Angeles, Calif.) and Bernard M. Anzel (Hughes Aircraft Co., Satellite Systems Laboratories, El Segundo, Calif.).

(American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 2nd, San Francisco, Calif., Apr. 8-10, 1968, Paper 68-456.)

Journal of Spacecraft and Rockets, vol. 7, July 1969, p. 805-811. 7 refs.

(For abstract see issue 11, page 2109, Accession no. A68-25483)

c30 050100 02

A69-39941
NATIONAL ELECTRONIC PACKAGING AND PRODUCTION CONFERENCE, ANAHEIM, CALIF., FEBRUARY 11-13, 1969 AND PHILADELPHIA, PA., JUNE 10-12, 1969, PROCEEDINGS OF THE TECHNICAL PROGRAM.
Chicago, Industrial and Scientific Conference Management, Inc., 1969. 641 p.
$17.50.

CONTENTS:

c09 020901 01

A69-39948
PACKAGING OF HIGH VOLTAGE POWER SUPPLIES FOR ELECTRIC PROPULSION.
Alson E. Hatheway and Olin P. Wood (Electro-Optical Systems, Inc., Pasadena, Calif.).
IN: NATIONAL ELECTRONIC PACKAGING AND PRODUCTION CONFERENCE, ANAHEIM, CALIF., FEBRUARY 11-13, 1969 AND PHILADELPHIA, PA., JUNE 10-12, 1969, PROCEEDINGS OF THE TECHNICAL PROGRAM. (A69-39941 22-09)
Chicago, Industrial and Scientific Conference Management, Inc., 1969, p. 312-325. 5 refs.

Description of criteria used in designing and building the electronic subsystem for the Applications Technology Satellite ATS-D. The design effort resulted in a system of 1280 components in a 112-cu-in. envelope weighing 5.5 lb. The design also minimizes the heat that is absorbed from the ion engine at the mounting face. The only special techniques used in the design for temperature control are black velvet paint and the polished gold plate surface finishes which give wide control over the radiant heat transfer mechanism. The efforts at controlling the environment of the high voltage power supplies were successful. To date, the engine has accumulated over 3500 hours of operation in a simulated space environment, well over 2000 hours at full thrust. The system has displayed a high degree of reliability in all its operating modes. M.M.

c28 020901 01

A69-40300 *
TYPE III RADIO BURSTS IN THE OUTER CORONA.
J. K. Alexander, H. H. Malitson, and R. G. Stone (NASA, Goddard Space Flight Center, Greenbelt, Md.).
Solar Physics, vol. 8, Aug. 1969, p. 388-397. 23 refs.

Type III solar radio bursts observed from 3.0 to 0.45 MHz with the ATS 2 satellite over the period April-October 1967 have been analyzed to derive two alternative models of active region streamers in the outer solar corona. Assuming that the bursts correspond to radiation near the electron plasma frequency, "pressure equilibrium" arguments lead to streamer model one in which the streamer electron temperature derived from collision damping time falls off much more rapidly than in the "average" corona and the electron density is as much as 25 times the average coronal density at heights of 10 to 50 solar radii. In model two, the streamer electron temperature is assumed to equal the average coronal temperature, giving a density enhancement which decreases from a factor of 10 close to the sun to less than a factor of two at large distances. When the burst frequency drift is interpreted as resulting from the outward motion of a disturbance that stimulates the radio emission, model one gives a constant velocity of about 0.35c for the exciting disturbance as it moves to large distances, while with model two there is a decrease in the velocity to less than 0.2c beyond 10 solar radii. (Author)

c29 111000 06

A69-40508 *
EXPERIMENTAL VERIFICATION OF DRIFT-SHELL SPLITTING IN THE DISTORTED MAGNETOSPHERE.
K. A. Pfitzer, T. W. Lezniak, and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
Journal of Geophysical Research, vol. 74, Sept. 1, 1969, p. 4687-4693. 15 refs.
Grant No. NGL-24-005-008.

Investigation of drift-shell splitting in the nondipolar distorted magnetosphere as proposed by Roederer (1967). The theory is tested experimentally by using data from an electron spectrometer on the synchronous-orbit satellite ATS 1 and data from an electron spectrometer and ion chamber on the elliptical-orbit satellite OGO 3. The agreement between calculated and measured fluxes is satisfactory not only in predicting the proper noon-to-midnight asymmetry but also in correctly predicting the pitch-angle distribution as a function of local time. P.G.

c29 110400 21

A69-40692 *
ATS MECHANICALLY DESPUN COMMUNICATIONS SATELLITE ANTENNA.
Leonard Blaisdell. (Sylvania Electric Products, Inc., Sylvania Electronic Systems Div., Needham, Mass.), Richard Rubin (Mitre Corp., Bedford, Mass.), and Otto Mahr (Polaroid Corp., Cambridge, Mass.).
IEEE Transactions on Antennas and Propagation, vol. AP-17, July 1969, p. 415-428.
Contract No. NAS 5-9521.

Description of the antenna system on the ATS 3 spin stabilized satellite launched on Nov. 5, 1967. Using a line source feed illuminating a parabolic cylindrical reflector, a linearly polarized gain over 17 dB is achieved. The antenna is positioned by means of a vernier type stepping motor-drive system that points the antenna beam towards earth within approximately 0.7 deg in accordance with instructions received on the satellite from the ground control station. Prior to launch, the antenna system was subjected to extensive qualification testing. (Author)

c09 020000 19

A69-41127
FLIGHT SAFETY FOUNDATION, ANNUAL INTERNATIONAL AIR SAFETY SEMINAR, 21ST, ANAHEIM, CALIF., OCTOBER 8-11, 1968, TECHNICAL SUMMARY.
Arlington, Va., Flight Safety Foundation, Inc., 1968. 249 p.
$5.00.

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HOW GOES IT, p. i.

WHAT SIGNIFICANCE–STATISTICS. M. W. Eastburn (American Airlines, Inc., New York, N.Y.), p. 1-10. (See A69-41128 22-34)

RELIABILITY APPROACH TO AIRCRAFT SAFETY. I. Bazovsky (Genge Industries, Inc., Scientific and Consulting Div.), p. 10-12. (See A69-41129 22-02)

OVERALL WORLD STATISTICS. W. W. Moss (Pan American World Airways, Inc., New York, N.Y.), p. 12-28. (See A69-41130 22-34)

PLANNING FOR THE SUPERSONIC FUTURE. O. Bakke (Federal Aviation Administration, Washington, D.C.), p. 29-34. (See A69-41131 22-34)

SAFETY ELEMENTS OF ADVANCED AIRCRAFT DESIGN. T. F. Laughlin, Jr. (Lockheed Aircraft Corp., Burbank, Calif.), p. 35-43. (See A69-41132 22-02)

DESIGN FOR SAFETY–THIRD GENERATION AND AHEAD. A. G. Heimerdinger (McDonnell Douglas Corp., St. Louis, Mo.), p. 44-48. (See A69-41133 22-02)

DESIGN FOR SAFETY. D. James (British Aircraft Corp., Ltd., London, England), p. 42-57. (See A69-41134 22-02)

SAFETY ASSURANCE PROGRAM FOR THE B-747. J. N. Funk (Boeing Co., Seattle, Wash.), p. 58-72. (See A69-41135 22-02)

747 ENGINEERING PROGRAM, p. 72-78. (See A69-41136 22-34)

ADVANCED TRAINING CONCEPTS IN SIMULATION. R. E. Flexman (Illinois, University, Urbana, Ill.), p. 79-90. (See A69-41137 22-11)

HUMAN FACTORS IN FLIGHT TRAINING. A. Burrows (McDonnell Douglas Corp., Long Beach, Calif.), p. 91-97. 13 refs. (See A69-41138 22-05)

WHAT'S IMPORTANT IN SIMULATION? J. P. Reeder (NASA, Langley Research Center, Hampton, Va.), p. 98-116. 10 refs. (See A69-41139 22-11)

THE BUREAU OF AVIATION SAFETY AND THE ACCIDENT PREVENTION SYSTEM. C. O. Miller (National Transportation Safety Board, Washington, D.C.), p. 117-126. 7 refs. (See A69-41140 22-02)

THE SST ENVIRONMENT. N. A. Lieurance (ESSA, Washington, D.C.), p. 127-144. 12 refs. (See A69-41141 22-02)

SURVIVAL ASPECTS–THIRD GENERATION JETS. G. Bates (Federal Aviation Administration, Washington, D.C.), p. 145-156. (See A69-41142 22-34)

LESSONS FROM THE B-70 TO BE APPLIED TO SST SAFETY. F. Fulton (NASA, Edwards, Calif.), p. 157-169. (See A69-41143 22-02)

AIRLINE PILOTS LOOK AT THE FUTURE. C. Ruby (Air Line Pilots Association, Washington, D.C.), p. 170-187. (See A69-41144 22-34)

FLIGHT PERFORMANCE ANALYSIS. J. Nicholl (British Overseas Aircraft Corp., Hounslow, Middx., England), p. 188-190. (See A69-41145 22-02)

MEDICAL PROBLEMS FACING AIR CARRIER PILOTS TODAY AND IN THE FUTURE. E. Carter (Mayo Clinic, Rochester, Minn.), p. 191-198. (See A69-41146 22-05)

SATELLITES AND AIR SAFETY. R. Anderson, p. 199-205. (See A69-41147 22-07)

ADVANCED RECRUITING AND TRAINING METHODS. G. F. S. Hinckley (Overseas National Airways, Jamaica, N.Y.), p. 206-216. (See A69-41148 22-34)

THE COCKPIT TEAM AS PART OF THE COMPANY. R. Stone (United Air Lines, Inc., Chicago, Ill.), p. 217-222. (See A69-41149 22-34)

NEW CONCEPTS IN IN-FLIGHT MONITORING. J. Ferrarese (Federal Aviation Administration, Washington, D.C.), p. 223-228. (See A69-41150 22-05)

THE SOLUTION OF SAFETY PROBLEMS THROUGH RESEARCH AND DEVELOPMENT. R. L. Simpkins (Trans World Airlines, Inc., Kansas City, Mo.), p. 229-237. (See A69-41151 22-02)

LIST OF ATTENDEES, p. 238-240.

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A69-41147 #
SATELLITES AND AIR SAFETY.
Roy Anderson.
IN: FLIGHT SAFETY FOUNDATION, ANNUAL INTERNATIONAL AIR SAFETY SEMINAR, 21ST, ANAHEIM, CALIF.,

OCTOBER 8-11, 1968, TECHNICAL SUMMARY. (A69-41127 22-02)
Arlington, Va., Flight Safety Foundation, Inc., 1968, p. 199-205.

Discussion of a satellite system of transoceanic air traffic control for minimizing the effects of gross navigation errors that presently enforce wide separations. The system provides voice communication and position surveillance of the moderate accuracy afforded by vhf ranging. As future requirements demand higher accuracy, the same principles can be applied at L-band. Tone-code ranging is a technique that provides position surveillance with no change to a satellite designed for voice transmission between aircraft and a ground terminal, and only a modest addition to the aircraft equipment. Tone-code ranging is compatible with voice and digital communications, and can provide useful accuracy within voice bandwidth assignments. The time for interrogations is short, and the interrogations can be inserted during pauses in speech. The simple signal format permits simplex operation on a single channel. One tone is sufficient for high-range resolution, and the code serves to identify the user and resolve range ambiguity. M.M.

c07 070200 18

A69-42500

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INTERNATIONAL CONFERENCE ON COMMUNICATIONS, BOULDER, COLO., JUNE 9-11, 1969, CONFERENCE RECORD.
New York, Institute of Electrical and Electronics Engineers, Inc. (IEEE ICC Conference Publications. Volume 5), 1969. 818 p.
Members, $10.00; nonmembers, $20.

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A69-42509 *

SHORT TERM FREQUENCY STABILITY MEASUREMENTS OF THE APPLICATIONS TECHNOLOGY SATELLITE #1 MULTIPLE ACCESS COMMUNICATION SYSTEM.

G. K. Kuegler and R. Martel (Westinghouse Electric Corp., Defense and Space Center, Baltimore, Md.).

IN: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INTERNATIONAL CONFERENCE ON COMMUNICATIONS, BOULDER, COLO., JUNE 9-11, 1969, CONFERENCE RECORD. (A69-42500 23-07)

New York, Institute of Electrical and Electronics Engineers, Inc. (IEEE ICC Conference Publications. Volume 5), 1969, p. 7-29 to 7-37. 10 refs.

Contract No. NAS 5-11513.

Description of a very accurate method of determining short-term frequency stability, including test results from the ATS 1 satellite. A technique of measuring spectral purity with a 0.1-Hz resolution is also described. The data for these tests were recorded at a single ground station and then operated on by a small on-site computer. The computer is programmed to determine the frequency distribution of the instantaneous frequency received, the central tendency of the data, the amplitude spectrum of the detected signal (by a Fourier analysis) and the deviation ratio of each discrete frequency component present in the amplitude spectrum. The test results indicate that the standard deviation of the undesired frequency modulation is 5.39 plus or minus 0.32 Hz over a 500-Hz bandwidth. The amplitude spectra obtained from the Fourier analysis indicate the presence of spacecraft spin modulation, frequency distribution of the system oscillator FM noise, and the presence of power line frequency modulation. (Author)

c07 070100 12

A69-42510 *

A TDMA/PCM EXPERIMENT ON APPLICATIONS TECHNOLOGY SATELLITES.

Yukiyasu Suguri (Ministry of Posts and Telecommunications, Radio Research Laboratories, Nakaminato, Japan), Hiroyuki Doi (Nippon Telegraph and Telephone Public Corp., Electrical Communications Laboratory, Tokyo, Japan), and Eric Metzger (NASA, Goddard Space Flight Center, Greenbelt, Md.).

IN: INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INTERNATIONAL CONFERENCE ON COMMUNICATIONS, BOULDER, COLO., JUNE 9-11, 1969, CONFERENCE RECORD. (A69-42500 23-07)

New York, Institute of Electrical and Electronics Engineers, Inc. (IEEE ICC Conference Publications. Volume 5), 1969, p. 15-1 to 15-6.

Results of extensive communication tests of a Japanese-built TDMA/PCM system with the aid of Applications Technology Satellites (ATS). The system uses a low-level PN sequence for time synchronization without the knowledge of range, and the participating earth stations have control loops maintaining bit and frame coherence referred to the satellites. The design and operation of this system are described, and its specifications and characteristics are discussed. The experiments show that the system is a practical means of multiple access communications via satellites. It makes possible communications at 13 MBS 4-phase, and 27 MBS 2-phase through the ATS satellites. At these bit rates, the system capacity is 480 voice channels. V.Z.

c07 070100 13

A69-42895 * #

FORMATION AND STRUCTURE OF EQUATORIAL ANTI-CYCLONES CAUSED BY LARGE-SCALE CROSS-EQUATORIAL FLOWS DETERMINED BY ATS-I PHOTOGRAPHS.

Tetsuya T. Fujita (Chicago, University, Dept. of Geophysical Sciences, Chicago, Ill.), Kazuo Watanabe, and Tatsuo Izawa (Ministry of Transportation, Meteorological Research Institute, Tokyo, Japan).

Journal of Applied Meteorology, vol. 8, Aug. 1969, p. 649-667. 13 refs.

Research supported by the Japan Society for the Promotion of Science and NASA; ESSA Grant No. E-198-68(G); NSF Grant No. GF-255.

Determination of the fields of cloud motion over the eastern equatorial Pacific, using photographs taken by the geosynchronous ATS-1 satellite during September 1967. It is concluded that tropical nephsystems larger than a cloud cluster are accompanied by definite flowfields. These fields are mostly cyclonic and convergent, giving the impression that frictional convergence is one of the most important driving mechanisms for the formation and maintenance of cloud clusters and intertropical cloud bands. No exact relationship could be found between the cloud clusters and easterly waves. Z.W.

c20 080700 06

A69-43154 *

OBSERVATIONS OF THE REFLECTION PROPERTIES OF THE EARTH-ATMOSPHERE SYSTEM AND THE CLOUD FORMATION ABOVE THE EQUATORIAL PACIFIC FROM A SYNCHRONOUS SATELLITE (BEOBACHTUNGEN DER REFLEXIONSEIGENSCHAFTEN DES SYSTEMS ERDE-ATMOSPHÄRE UND DER BEWÖLKUNG ÜBER DEM ÄQUATORIALEN PAZIFIK VON EINEM SYNCHRONEN SATELLITEN AUS).

Ehrhard Raschke (Ruhr-Universität, Bochum, West Germany) and William R. Bandeen (NASA, Goddard Space Flight Center, Laboratory for Atmospherical and Biological Sciences, Greenbelt, Md.).

(Verband Deutscher Meteorologischer Gesellschaften, Deutsche Geophysikalische Gesellschaft, American Meteorological Society, and Royal Meteorological Society, Meteorologen-Geophysiker-Tagung, Hamburg, West Germany, Apr. 1-6, 1968.)

Annalen der Meteorologie, no. 4, 1969, p. 200-205. 13 refs. In German.

Study of the dependence of the bidirectional reflectances of the earth-atmosphere system on the zenith and the relative azimuth angle of observation and on the zenith angle of the sun. Digitized camera signals of the satellite ATS-1 were used in the investigation. Conditions were studied for cloudless and overcast atmospheres. The results, which, in part, show a strong angular dependence, are used to obtain an objective estimate of the effective cloudiness. G.R.

c20 080100 11

A69-43172 *
INTENSITY CORRELATIONS AND SUBSTORM ELECTRON DRIFT EFFECTS IN THE OUTER RADIATION BELT MEASURED WITH THE OGO 3 AND ATS 1 SATELLITES.
K.A. Pfitzer and J. R. Winckler (Minnesota, University, School of Physics and Astronomy, Minneapolis, Minn.).
Journal of Geophysical Research, vol. 74, Oct. 1, 1969, p. 5005-5018. 17 refs.
Grant No. NGL-24-005-008.
Study of the space-time distribution of the radiation in the outer radiation belt using the correlated data of two satellites, ATS 1 and OGO 3. The applicability of known models of the distorted magnetosphere during quiet conditions is tested in order to verify that under these known conditions the spectrometers could be brought into simultaneous agreement at various points on common drift shells in the very slowly changing outer zone. This comparison is extended to cases of large electron flux increases during magnetospheric substorms typified by auroral-zone bay events. Z.W.

c13 110400 22

A69-43173
PARTICLE SUBSTORMS OBSERVED AT THE GEOSTATIONARY ORBIT.
R. L. Arnoldy and K. W. Chan (New Hampshire, University, Physics Dept., Durham, N.H.).
Journal of Geophysical Research, vol. 74, Oct. 1, 1969, p. 5019-5028. 27 refs.
Contract No. AF 19(628)-68-C-0294.
Correlation study of the sudden intensity increases seen in the 50- to 150-keV and 150- to 500-keV energy channels of the ATS 1 electron spectrometer with the occurrence of magnetic substorms recorded at midnight. It is shown that electrons in the energy range from 50 to 150 keV are produced in the magnetosphere near the midnight meridian at the time of a magnetic storm. Evidence is presented showing that these new electrons are not produced at all local times but drift to their point of observation from the vicinity of the midnight meridian. Z.W.

c29 110400 23

A69-43238 * #
CESIUM CONTACT ION MICROTHRUSTER EXPERIMENT ABOARD APPLICATIONS TECHNOLOGY SATELLITE (ATS)-IV.
Robert E. Hunter, Robert O. Bartlett (NASA, Goddard Space Flight Center, Greenbelt, Md.), Robert M. Worlock, and Edmund L. James (Electro-Optical Systems, Inc., Pasadena, Calif.).
(American Institute of Aeronautics and Astronautics, Electric Propulsion Conference, 7th, Williamsburg, Va., Mar. 3-5, 1969, Paper 69-297.)
Journal of Spacecraft and Rockets, vol. 6, Sept. 1969, p. 968-970.
(For abstract see issue 09, page 1561, Accession no. A69-21218)

c28 020901 03

A69-43265 #
SOLAR PROTON RADIATION DAMAGE OF SOLAR CELLS AT SYNCHRONOUS ALTITUDES.
L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.).
Journal of Spacecraft and Rockets, vol. 6, Sept. 1969, p. 1086, 1087. 7 refs.
Discussion of solar proton radiation as a major source of damage to solar cells used in spacecraft flown at synchronous altitudes. Recent experimental measurements of low energy solar protons and alpha particles at the synchronous orbit are described, showing that the fluxes and the spectra of these particles are in general quite similar to the solar particle observations made simultaneously in interplanetary space. It is concluded that a solar cell shield of about 7-mil thickness may be considered to be sufficient for largely eliminating the damage from low intensity, low energy solar enhancements. With this thickness shield, only the protons from very high intensity, harder-spectra solar flare events will dominate the electron environment in producing radiation damage effects. O.H.

c29 110300 12

A69-43603
SOLAR FLARES AND SPACE RESEARCH; COSPAR, PLENARY MEETING, 11TH, SYMPOSIUM, TOKYO, JAPAN, MAY 9-11, 1968, PROCEEDINGS.
Symposium co-sponsored by the International Astronomical Union, the International Union of Geodesy and Geophysics, and the International Scientific Radio Union.
Edited by C. de Jager (Astronomical Institute, Utrecht, Netherlands) and Z. Švestka (Československá Akademie Věd, Astronomický Ústav, Ondřejov, Czechoslovakia).
Amsterdam, North-Holland Publishing Co., 1969. 421 p.
$20.

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PREFACE. C. de Jager (Astronomical Institute, Utrecht, Netherlands) and Z. Švestka (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. v.

INTRODUCTION–THE OPTICAL FLARE.
SOLAR FLARES–PROPERTIES AND PROBLEMS. C. de Jager (Astronomical Institute, Utrecht, Netherlands), p. 1-15. 34 refs. (See A69-43604 24-29)
THE OPTICAL FLARE. Z. Švestka (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 16-37. 31 refs. (See A69-43605 24-29)
SOLAR FLARES AND MAGNETIC FIELDS. A. B. Severnyi (Akademiia Nauk SSSR, Krymskaia Astrofizicheskaia Observatoriia, Partizanskoye, Ukrainian SSR), p. 38-60. 23 refs. (See A69-43606 24-29)
FLARE ASSOCIATED OPTICAL PHENOMENA. A. Bruzek (Fraunhofer Institut, Freiburg im Breisgau, West Germany), p. 61-77. 69 refs. (See A69-43607 24-29)

EUV, X- AND GAMMA-RAY OBSERVATION.
SOLAR EUV ENHANCEMENTS ASSOCIATED WITH FLARES. L. A. Hall and H. E. Hinteregger (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 81-86. (For abstract see issue 15, page 2842, Accession no. A68-32005)
X-RAY OBSERVATIONS OF SOLAR FLARES (Invited Review Paper). H. Friedman (U.S. Navy, Naval Research Laboratory, Washington, D.C.), p. 87-94. 14 refs. (See A69-43608 24-29)
OBSERVATIONS OF THE SOLAR FLARE SOFT X-RAY SPECTRUM AND COMPARISON WITH CENTIMETRIC RADIO BURSTS. W. M. Neupert, M. Swartz, W. A. White, and R. M. Young (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 95-101. 5 refs. (See A69-43609 24-29)
ENHANCEMENT OF THE SOLAR X-RAY SPECTRUM BELOW 25 Å DURING SOLAR FLARES. A. B. C. Walker, Jr. and H. R. Rugge (Aerospace Corp., El Segundo, Calif.), p. 102-112. (For abstract see issue 15, page 2841, Accession no. A68-31963)
THE TIME STRUCTURE OF SOLAR X-RAY BURSTS ABOVE 7.7 KEV. H. S. Hudson, L. E. Peterson, and D. A. Schwartz

(California, University, La Jolla, Calif.), p. 113-120. 10 refs. (See A69-43610 24-29)

MEASUREMENTS OF SOLAR X-RAY EMISSION FROM THE OGO-IV SPACECRAFT. R. W. Kreplin, D. M. Horan, T. A. Chubb, and H. Friedman (U.S. Navy, Naval Research Laboratory, Washington, D.C.), p. 121-130. 6 refs. (See A69-43611 24-29)

OBSERVATIONS OF SOLAR X-RAY ACTIVITY WITH A PROPORTIONAL COUNTER SPECTROMETER ON OSO-IV. J. L. Culhane, P. W. Sanford, M. L. Shaw (London, University, University College, London, England), K. A. Pounds, and D. G. Smith (Leicester, University, Leicester, England), p. 131-133.

SUDDEN INCREASE IN HIGH ENERGY GAMMA-RAY INTENSITY OBSERVED AT BALLOON ALTITUDE. I. Kondo and F. Nagase (Nagoya University, Nagoya, Japan), p. 134-143. 8 refs. (See A69-43612 24-29)

INTERPRETATION OF TIME CHARACTERISTICS OF SOLAR X-RAY BURSTS. T. Takakura (Tokyo, University, Tokyo, Japan), p. 144-150. 10 refs. (See A69-43613 24-29)

THEORY OF HARD X-RAY BURSTS. R. Snijders (Utrecht, Rijksuniversiteit, Utrecht, Netherlands), p. 151-154.

SOLAR COSMIC-RAY FLARES DEDUCED FROM THE DEVELOPING PATTERNS OF SID'S. K. Sakurai (Kyoto University, Kyoto, Japan), p. 155-162. (For abstract see issue 15, page 2842, Accession no. A68-31971)

FLARE ASSOCIATED RADIO AND PARTICLE EVENTS.

FLARE-ASSOCIATED RADIO BURSTS. T. Takakura (Tokyo, University, Tokyo, Japan), p. 165-180. 29 refs. (See A69-43614 24-29)

AN INVESTIGATION OF SOLAR X-RAY AND RADIO EMISSIONS AND THEIR RELATIONSHIP TO IONOSPHERIC PHENOMENA. A. Krüger, J. Taubenheim, and G. Entzian (Deutsche Akademie der Wissenschaften, Berlin, East Germany), p. 181-193. 6 refs. (See A69-43615 24-29)

SPECTRAL CONSIDERATIONS OF MICROWAVE SOLAR BURSTS. J. P. Castelli, J. Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.), G. A. Michael (USAF, Ent AFB, Colo.), C. Jones (Boston University, Boston, Mass.), and H. C. Ko (Ohio State University, Columbus, Ohio), p. 194-201. 13 refs. (See A69-43616 24-29)

HIGH ENERGY PARTICLE EVENTS ASSOCIATED WITH SOLAR FLARES. K. G. McCracken (Adelaide, University, Adelaide, Australia), p. 202-214. 6 refs. (See A69-43617 24-29)

POLAR CAP ABSORPTION AND GROUND LEVEL EFFECTS (Invited Review Paper). B. Hultqvist (Kungl. Vetenskapsakademien, Kiruna, Sweden), p. 215-257. 177 refs. (See A69-43618 24-29)

OBSERVATIONS OF SOLAR PROTONS ABOARD OV3-3 AND ATS-1. J. B. Blake, G. A. Paulikas, and S. C. Freden (Aerospace Corp., El Segundo, Calif.), p. 258-266. (For abstract see issue 15, page 2840, Accession no. A68-31922)

MEASUREMENT OF COSMIC RAY ANISOTROPY OF SOLAR ORIGIN BY EXPLORER 34 SATELLITE. U. R. Rao (Physical Research Laboratory, Ahmedabad, India), F. R. Allum, W. C. Bartley, R. A. R. Palmeira (Southwest Center for Advanced Studies, Dallas, Tex.), J. A. Harries, and K. G. McCracken (Adelaide, University, Adelaide, Australia), p. 267-276. 5 refs. (See A69-43619 24-29)

THE CHARGE COMPOSITION OF SOLAR COSMIC RAYS AND SOLAR ABUNDANCES. D. V. Reames and C. E. Fichtel (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 277, 278.

THE 28 JANUARY 1967 SOLAR COSMIC RAY EVENT AND RELATED COMPLICATIONS. A. J. Masley (McDonnell Douglas Corp., Santa Monica, Calif.), p. 279-283. (For abstract see issue 15, page 2840, Accession no. A68-31926)

THE 23 AND 28 MAY 1967 SOLAR COSMIC RAY EVENTS. A. D. Goedeke and A. J. Masley (McDonnell Douglas Corp., Santa Monica, Calif.), p. 284-293. (For abstract see issue 15, page 2840, Accession no. A68-31924)

SOLAR WIND DISTURBANCES ASSOCIATED WITH FLARES (Invited Review Paper). J. M. Wilcox (California, University, Berkeley, Calif.), p. 294-309. 16 refs. (See A69-43620 24-29)

POLAR CAP IONOSPHERIC RESPONSE TO SOLAR COSMIC RAY EVENTS OBSERVED BY MARINERS 2 AND 4. H. L. Stolov (New York, City University; NASA, Goddard Space Flight Center, New York, N.Y.), p. 310-318. 11 refs. (See A69-43621 24-29)

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A LARGE SCALE PATTERN IN THE SOLAR MAGNETIC FIELD. J. M. Wilcox (California, University, Berkeley, Calif.) and R. Howard (Carnegie Institution of Washington and California Institute of Technology, Pasadena, Calif.), p. 327, 328.

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THEORETICAL ASPECTS OF THE FLARE PHENOMENON (Invited Review Paper). H. U. Schmidt (Max-Planck-Institut für Physik und Astrophysik, Munich, West Germany), p. 331-345. 33 refs. (See A69-43622 24-29)

ON THE MECHANISM OF SOLAR FLARES. S. I. Syrovatskii (Akademiia Nauk SSSR, Fizicheskii Institut, Moscow, USSR), p. 346-355.

A POSSIBLE MECHANISM FOR SOLAR FLARES. H. Elliot (London, University, Imperial College of Science and Technology, London, England), p. 356-362. 10 refs. (See A69-43623 24-29)

THE NATURE OF SOLAR FLARES. D. H. Menzel (Smithsonian Institution and Harvard University, Cambridge, Mass.), p. 363-367. (For abstract see issue 15, page 2841, Accession no. A68-31927)

FAST CHANGES OF SUNSPOT EQUILIBRIUM CONDITIONS AND SOLAR FLARES. Y. D. Žugžda (Akademiia Nauk SSSR, Institut Zemnogo Magnetizma, Ionosfery i Rasprostraneniia Radiovoln, Akademgorodok, USSR), p. 368-373. 5 refs. (See A69-43624 24-29)

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ON LONG-TERM FORECASTS OF SOLAR ACTIVITY. V. Bumba and R. Howard (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 387-396. 30 refs. (See A69-43625 24-29)

ON FORECASTS OF INTERPLANETARY AND GEOPHYSICAL CONDITIONS. R. Howard and V. Bumba (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 397-404. 6 refs. (See A69-43626 24-30)

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SUMMARY OF SYMPOSIUM. E. N. Parker (Chicago, University, Chicago, Ill.), p. 412-418.

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A70-11276
SOCIETY FOR INFORMATION DISPLAY, NATIONAL SYMPOSIUM ON INFORMATION DISPLAY, 10TH, ARLINGTON, VA., MAY 27-29, 1969, TECHNICAL SESSION PROCEEDINGS.
Los Angeles, Society for Information Display (SID Quarterly Proceedings. Volume 10, No. 2); North Hollywood, Calif., Western Periodicals Co., 1969. 215 p.

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THE COMPUTER GRAPHICS TERMINAL AS A LIMITED AREA SIMULATOR. P. Horowitz (International Business Machines Corp., Gaithersburg, Md.), p. 1-11. (See A70-11277 01-11)

ANALYSIS OF RESOLUTION MEASUREMENTS OF A CATHODE RAY TUBE SPOT. J. S. Snyder (Litton Industries, Inc., San Carlos, Calif.), p. 13-26. 9 refs. (See A70-11278 01-14)

THE APPLICATION OF NUMERIC KEYBOARD CRT DISPLAYS TO WEATHER DATA ACQUISITION VIA SATELLITE FROM SHIPS AT SEA. M. Ettinger (Mark Computer Systems, Long Island, N.Y.), G. S. Doore, and D. Hobart (ESSA, Silver Spring, Md.), p. 27-36. (See A70-11279 01-08)

SURVEYING THE EARTH FROM 20,000 MILES. A. P. Colvocoresses (U.S. Geological Survey, Washington, D.C.), p. 37-49. 8 refs. (See A70-11280 01-14)

ARE DISPLAYS GOOD FOR US? J. Hatvany (Magyar Tudományos Akadémia, Budapest, Hungary), p. 57-66. 8 refs. (See A70-11281 01-34)

SAC OPERATIONAL PLANNING SYSTEM. P. D. Ulm and E. R. Niday (International Telephone and Telegraph Corp., Fort Wayne, Ind.), p. 67-86. (See A70-11282 01-08)

EDUCATIONAL APPLICATIONS OF THE SYSTEM ANALYSIS AND SYSTEM SYNTHESIS PROCESSES. A. F. Kochman (System Development Corp., Santa Monica, Calif.), p. 97-138. (See A70-11283 01-34)

APPLICATION OF MOVING-MAP DISPLAYS IN MARINE AND AIR NAVIGATION. T. K. Vickers (ITT Navigator Systems, Inc.), p. 139-151. (See A70-11284 01-21)

DISPLAYS IN AIR TRAFFIC CONTROL TERMINALS. F. S. Carr (Federal Aviation Administration, Washington, D.C.), p. 167-179. (See A70-11285 01-21)

TRENDS IN DISPLAY CONSOLE CHARACTERISTICS TO MEET GROWING DEMANDS. A. D. Hughes (Auerbach Corp., Philadelphia, Pa.), p. 183-194. (See A70-11286 01-34)

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A70-11279
THE APPLICATION OF NUMERIC KEYBOARD CRT DISPLAYS TO WEATHER DATA ACQUISITION VIA SATELLITE FROM SHIPS AT SEA.
Mel Ettinger (Mark Computer Systems, N.Y.), G. Stanley Doore, and David Hobart (ESSA, U.S. Weather Bureau, Silver Spring, Md.).
IN: SOCIETY FOR INFORMATION DISPLAY, NATIONAL SYMPOSIUM ON INFORMATION DISPLAY, 10TH, ARLINGTON, VA., MAY 27-29, 1969, TECHNICAL SESSION PROCEEDINGS. (A70-11276 01-08)
Los Angeles, Society for Information Display (SID Quarterly Proceedings. Volume 10, No. 2); North Hollywood, Calif., Western Periodicals Co., 1969, p. 27-36.

Description of the use of a keyboard CRT display for acquiring data from ships at sea utilizing the ATS-3 satellite as the transmission medium. The functional design and operation of the display together with the requirements/cost tradeoffs are emphasized. The USCGC Rockaway, which is carrying the display, is participating in the BOMEX (Barbados Oceanographic and Meteorological Experiment) Project. (Author)

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A70-11297
METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS 1 AND ATS 3.
Thomas H. Vonder Haar (Wisconsin, University, Space Science and Engineering Center, Madison, Wis.).
(American Meteorological Society, Annual Meeting, 49th, New York, N.Y., Jan. 20-23, 1969.)
Journal of Geophysical Research, vol. 74, Oct. 20, 1969, p. 5404-5412. 9 refs.

Measurements of reflected solar energy obtained from NASA's ATS satellites offer new possibilities for meteorological research. For the first time, both relative and absolute values of reflected radiance are available on a nearly continuous basis during the daytime over a large region of the earth's surface. Examples of these applications emphasize the high areal resolution and wide dynamic range of the satellite-borne cameras. (Author)

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A70-12160
A SEASONAL EFFECT IN THE MID-LATITUDE SLAB THICKNESS VARIATIONS DURING MAGNETIC DISTURBANCES.
M. Mendillo, M. D. Papagiannis (Boston University, Dept. of Physics and Astronomy, Boston, Mass.), and J. A. Klobuchar (USAF, Cambridge Research Laboratories, Bedford, Mass.).
Journal of Atmospheric and Terrestrial Physics, vol. 31, Nov. 1969, p. 1359-1364. 9 refs.

By monitoring the vhf signals from geostationary satellites, it has been possible to study the diurnal changes in total electron content during individual magnetic storms. The June 15, 1965 and the Feb. 10, 1968 storms were studied in detail for possible seasonal effects in the variations of the slab thickness during magnetic storms. On the day of the storm, the slab thickness was considerably above normal in both cases. During the second and third days after sudden commencement, however, the slab thickness was below normal for the winter storm but remained above average for the summer storm. This is probably due to changes in temperature, caused by the storm, affecting the recombination rate at different ionospheric altitudes. Possible seasonal causes of an observed midnight minimum in the slab thickness are also discussed. (Author)

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A70-12177
RESOURCES ROUNDUP; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, REGION SIX CONFERENCE, PHOENIX, ARIZ., APRIL 16-18, 1969, TECHNICAL PAPERS.
Edited by Russ Bundy (Motorola, Inc., Franklin Park, Ill.).
Phoenix, Ariz., Institute of Electrical and Electronics Engineers, Inc., 1969. 321 p.
Members, $15; nonmembers, $22.50.

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ELECTRONIC ADVANCES IN AUTOMATIC FLIGHT CONTROL. S. S. Osder (Sperry Rand Corp., Phoenix, Ariz.), p. 63-78. (See A70-12178 02-21)

A LIGHTWEIGHT UHF RANGING SYSTEM. S. H. Black (Sperry Rand Corp., Phoenix, Ariz.), p. 79-83. (See A70-12179 02-07)

OPLE DATA ANALYSIS. R. O'Bryant (Texas Instruments, Inc., Dallas, Tex.), p. 84-88. (See A70-12180 02-21)

EARTH RESOURCES DETERMINATION WITH TERRAIN IMAGING RADAR. L. C. Graham (Goodyear Aerospace Corp., Litchfield Park, Ariz.), p. 89-95. (See A70-12181 02-14)

SOME APPLICATIONS OF ANAMORPHIC HOLOGRAPHY. R. K. Peterson (Goodyear Aerospace Corp., Litchfield Park, Ariz.),

p. 96-103. (See A70-12182 02-14)

UHF CONVERSION TRANSMITTER AVAILABILITY. G. M. Cnudde and R. W. Franks (Lockheed Aircraft Corp., Sunnyvale, Calif.), p. 104-113. (See A70-12183 02-09)

ROUGHNESS DEPENDENT CIRCUMFERENTIAL WAVES. H. S. Hayre and G. Vroulis (Houston, University, Houston, Tex.), p. 162-168. 10 refs. (See A70-12184 02-23)

THE RELATIONSHIP BETWEEN RISE TIME AND SIGNAL BANDWIDTH IN DISTRIBUTED MICROWAVE NETWORKS. G. F. Ross (Sperry Rand Corp., Sudbury, Mass.), p. 169-175. 10 refs. (See A70-12185 02-07)

THE ASSOCIATIVE PROCESSOR–A NEW COMPUTER RESOURCE. J. A. Rudolph (Goodyear Aerospace Corp., Akron, Ohio), p. 179-183. (See A70-12186 02-08)

EFFECTIVENESS OF TIME-SHARING SYSTEMS IN CIRCUIT DESIGN AND ANALYSIS. H. Haskew (General Electric Co., Huntsville, Ala.), p. 184-191. (See A70-12187 02-08)

IDENTIFICATION OF BOOLEAN SYMMETRIC FUNCTIONS. E. R. Robbins and M. C. Woodfill (Arizona State University, Tempe, Ariz.), p. 192-199. 12 refs. (See A70-12188 02-19)

TIME SHARING TEST SYSTEM. W. H. Hoard (International Business Machines Corp., Research Triangle Park, N.C.), p. 200-204. (See A70-12189 02-11)

A DIGITAL SYSTEMS DESIGN LABORATORY. M. C. Woodfill (Arizona State University, Tempe, Ariz.), p. 204 A, 205-208. (See A70-12190 02-11)

THE BIOLOGICAL INERTIAL SYSTEM. R. Mayne (Arizona State University, Tempe, Ariz.), p. 209-221. 16 refs. (See A70-12191 02-05)

NOISE IN INTEGRATED OPERATIONAL AMPLIFIERS. A. J. Brodersen, E. R. Chenette, and R. C. Jaeger (Florida, University, Gainesville, Fla.), p. 224-228. 10 refs. (See A70-12192 02-07)

A SPECTRAL DENSITY APPROACH TO NOISE PERFORMANCE CALCULATIONS. J. Choma, Jr. (Pittsburgh, University, Pittsburgh, Pa.), p. 278-284. 5 refs. (See A70-12193 02-07)

STATE VARIABLE FEEDBACK AND NONLINEAR SYSTEM SYNTHESIS. J. W. Herring (Mississippi State University, State College, Miss.) and D. G. Schultz (Arizona, University, Tucson, Ariz.), p. 311-316. 13 refs. (A70-12194 02-10)

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A70-12180 *

OPLE DATA ANALYSIS.

Richard O'Bryant (Texas Instruments, Inc., Dallas, Tex.).

IN: RESOURCES ROUNDUP; INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, REGION SIX CONFERENCE, PHOENIX, ARIZ., APRIL 16-18, 1969, TECHNICAL PAPERS. (A70-12177 02-07)

Edited by Russ Bundy.

Phoenix, Ariz., Institute of Electrical and Electronics Engineers, Inc., 1969, p. 84-88.

Contract No. NAS 5-10248.

The purpose of the OPLE (Omega Position Location Equipment) experiment data analysis is to give a quantitative measure of the statistical performance of the system. The performance parameter of most interest and the one most closely examined in the analysis is the accuracy of location of remote platforms. During the experiment, several hundred million bits of data were processed. The organization of these data to enable their analysis and flow through the various steps of the analysis are described. (Author)

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A70-12564

SYMPOSIUM ON THE APPLICATION OF ATMOSPHERIC STUDIES TO SATELLITE TRANSMISSIONS, BOSTON, MASS., SEPTEMBER 3-5, 1969, SUMMARIES OF PAPERS.

Symposium sponsored by the U.S. Air Force Cambridge Research Laboratories.

Bedford, Mass., U.S. Air Force Cambridge Research Laboratories, Ionospheric Physics Laboratory, Radio Astronomy Branch, 1969. 188 p. In English and French.

CONTENTS:

MULTIPATH CHARACTERISTICS IN A SATELLITE-AIRCRAFT LINK AT 230 MHz. K. L. Jordan, Jr. (Massachusetts Institute of Technology, Lexington, Mass.), p. 11-14. (See A70-12565 02-07)

OBSERVATIONS ON VHF COMMUNICATIONS BETWEEN A SYNCHRONOUS SATELLITE RELAY AND EARTH GROUND STATIONS. S. Wishna (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 23-26. (See A70-12566 02-07)

PROPAGATION FACTORS IN RADIO-INTERFEROMETER NAVIGATION SATELLITE SYSTEMS. P. I. Klein (Communications Satellite Corp., Washington, D.C.; Pennsylvania, University, Philadelphia, Pa.), p. 27-30. 12 refs. (See A70-12567 02-07)

TOTAL ELECTRON CONTENT PREDICTIONS FOR THE SYSTEMS ENGINEER. J. A. Klobuchar (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 31-34. (See A70-12568 02-13)

CHANNEL CONSTRAINTS ON MULTIPLE ACCESS SYSTEMS. G. E. LaVean (Electronic Communications, Inc., St. Petersburg, Fla.), p. 35-38. (See A70-12569 02-07)

ATTENUATION OF THE 5-MM WAVELENGTH BAND IN A VARIABLE ATMOSPHERE. E. E. Reber, R. L. Mitchell, and C. J. Carter (Aerospace Corp., El Segundo, Calif.), p. 43-46. 9 refs. (See A70-12570 02-07)

LABORATORY STUDIES OF MICROWAVE DISPERSION CAUSED BY ATMOSPHERIC GASES. H. J. Liebe (ESSA, Boulder, Colo.), p. 47-50. 6 refs. (See A70-12571 02-07)

THE MORPHOLOGY OF F-REGION IRREGULARITY AND ITS ASSOCIATION WITH SOLAR ACTIVITY–A REVIEW. T. J. Elkins (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 62-67. 48 refs. (See A70-12572 02-13)

SCINTILLATIONS OF RADIO SIGNALS FROM A SYNCHRONOUS SATELLITE. Z. Houminer (National Committee for Space Research, Haifa, Israel), p. 74-78. 10 refs. (See A70-12573 02-07)

SECOND-ORDER FARADAY AND DOPPLER THEORY FOR CURVED EARTH-IONOSPHERE GEOMETRY. B. W. Reinisch (Lowell Technological Institute, Lowell, Mass.), p. 128-131. (See A70-12574 02-07)

CALCULATION OF THE VERTICAL DISTRIBUTION OF IONOSPHERIC ELECTRONIC DENSITY STARTING FROM A MEASUREMENT OF THE TOTAL ELECTRON CONTENT (CALCUL DE LA REPARTITION VERTICALE DE LA DENSITE ELECTRONIQUE DE L'IONOSPHERE A PARTIR DE LA MESURE DU CONTENU TOTAL D'ELECTRONS). F. Bertin and J. Papet-Lepine (Paris, Université, Paris, France), p. 163-166. (See A70-12575 02-13)

EFFECT OF GEOMAGNETIC ACTIVITY ON THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE (EFFET DE L'ACTIVITE GEOMAGNETIQUE SUR LE CONTENU TOTAL D'ELECTRONS DE L'IONOSPHERE). F. Bertin and J. Papet-Lepine (Paris, Université, Paris, France), p. 167-171. 7 refs. (See A70-12576 02-13)

A PLANNED WIDEBAND SATELLITE TRANSMISSION EXPERIMENT. E. J. Fremouw and A. A. Burns (Stanford Research Institute, Menlo Park, Calif.), p. 180-183. (See A70-12577 02-07)

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A70-12566 * #

OBSERVATIONS ON VHF COMMUNICATIONS BETWEEN A SYNCHRONOUS SATELLITE RELAY AND EARTH GROUND STATIONS.

Sheldon Wishna (NASA, Goddard Space Flight Center, Greenbelt, Md.).

IN: SYMPOSIUM ON THE APPLICATION OF ATMOSPHERIC STUDIES TO SATELLITE TRANSMISSIONS, BOSTON, MASS., SEPTEMBER 3-5, 1969, SUMMARIES OF PAPERS. (A70-12564 02-07)

Symposium sponsored by the U.S. Air Force Cambridge Research Laboratories.

Bedford, Mass., U.S. Air Force Cambridge Research Laboratories, Ionospheric Physics Laboratory, Radio Astronomy Branch, 1969, p. 23-26.

Study of the effect of solar phenomena on vhf communications between a synchronous satellite relay and earth ground stations. It was found that solar phenomena affected the quality of 135.6-MHz transmissions from the satellite. The actual sunspot number played a part only insofar as a higher number implies a more active sun, with increased chances of solar flares or radio emission. Solar radio emission, apart from that associated with specific flares, was relatively ineffective, although there is evidence that a few of these short intense bursts resulted in degraded reception at some stations. Periods of high solar-flare activity were directly reflected in increased reception problems. G.R.

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A70-12568 #

TOTAL ELECTRON CONTENT PREDICTIONS FOR THE SYSTEMS ENGINEER.

John A. Klobuchar (USAF, Cambridge Research Laboratories, Bedford, Mass.).

IN: SYMPOSIUM ON THE APPLICATION OF ATMOSPHERIC STUDIES TO SATELLITE TRANSMISSIONS, BOSTON, MASS., SEPTEMBER 3-5, 1969, SUMMARIES OF PAPERS. (A70-12564 02-07)

Symposium sponsored by the U.S. Air Force Cambridge Research Laboratories.

Bedford, Mass., U.S. Air Force Cambridge Research Laboratories, Ionospheric Physics Laboratory, Radio Astronomy Branch, 1969, p. 31-34.

Discussion of problems in predicting total electron content (TEC) values and of the magnitude of the timing and polarization errors produced by the ionosphere. The amount of polarization twist which occurs on a one-way path through the ionosphere is considered, and time delay and TEC measurements and predictions are discussed. It is shown that the best correction values for the TEC of the earth's ionosphere are obtained from real-time TEC measurements taken close to the desired path. G.R.

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A70-12594 *

PROPAGATION ERRORS IN VHF SATELLITE-TO-AIRCRAFT RANGING.

Aldo V. Da Rosa (Stanford University, Stanford Electronics Laboratories, Radioscience Laboratory, Stanford, Calif.).

IEEE Transactions on Antennas and Propagation, vol. AP-17, Sept. 1969, p. 628-634.

Contract No. NAS 5-10102.

An airplane navigation system based on vhf measurement of the range between the aircraft and a geostationary satellite is under development by NASA. An examination is made of the errors resulting from the unknown propagation characteristics of the signal through the ionosphere. These errors are found to be a function of the distance between subaircraft and subsatellite points. At short distances, unfavorable geometry causes small ranging errors to be translated into large position errors. As the distance increases, the errors become smaller, until a minimum is reached at some 5000 km. At even larger distances the errors again increase due to the greater path length of the signal in the ionosphere. Completely disregarding ionospheric effects leads to position errors of some 5 km at a 5000-km distance during the midday period near the solar cycle maximum. By using good predictions of the ionospheric electron content, it may be possible to reduce such errors to 1 km on a representative day. Since the errors are proportional to the columnar electron content, they become correspondingly smaller at night and decrease by, roughly, a factor of three during the sunspot minimum period. (Author)

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A70-13651 *

SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, ANNUAL TECHNICAL SYMPOSIUM, 13TH, WASHINGTON, D.C., AUGUST 19-23, 1968, PROCEEDINGS. VOLUME 1.

Symposium supported by the U.S. Air Force, the U.S. Army, the U.S. Navy, and NASA.

Redondo Beach, Calif., Society of Photo-Optical Instrumentation Engineers, 1969. 482 p.

Members, $20.; nonmembers, $25.

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DESIGN TECHNIQUES FOR LOW LIGHT PHOTO-OPTICAL EQUIPMENT. K. A. Hoagland (Fairchild Camera and Instrument Corp., Paramus, N.J.), p. 89-93.

A NEW STORAGE AND DISPLAY TUBE EMPLOYING SCHLIEREN OPTICS. R. J. Wohl and R. M. Ross (International Business Machines Corp., Los Gatos, Calif.), p. 95-101.

LASER RECORDING TECHNIQUES.

LASER ORIENTED SYSTEM FOR PLOTTING DIGITAL COMPUTER INFORMATION. A. Rolon and R. Hinze (Dresser Industries, Inc., Houston, Tex.), p. 103-113.

LASER RECORDING APPLICATIONS FOR INDUSTRY. D. Woywood (Radio Corporation of America, Camden, N.J.), p. 115-118.

A LASER FLYING SPOT FLAT FIELD SCANNING SYSTEM FOR READING, RECORDING AND LARGE SCREEN DISPLAY. E. Hartfield and D. Rose (Technical Operations, Inc., Mountain View, Calif.), p. 119-127.

LASER DIFFRACTION MEASUREMENT OF THE SHAPE AND DIAMETER OF DIAMOND DIES. A. J. Campillo (General Telephone and Electronics Laboratories, Inc., Bayside, N.Y.), p. 129-135.

LASER INTERFEROMETRIC OBSERVATION OF SURFACE MOTION OF ADIABATICALLY STRESSED SOLIDS. R. B. Oswald, Jr., D. R. Schallhorn, and H. A. Eisen (U.S. Army, Harry Diamond Laboratories, Washington, D.C.), p. 137-141.

EXPERIMENTAL STRESS ANALYSIS USING DOUBLY REFRACTING MATERIALS AND LASERS. G. W. Driggers, p. 143-151. 10 refs. (See A70-13657 03-32)

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APPLICATION OF HIGH SPEED PHOTOGRAPHY TO THE PHOTOELASTIC ANALYSIS OF STRUCTURAL STABILITY PROBLEMS. R. C. Tennyson (Toronto, University, Toronto, Canada), p. 177-196. 11 refs. (See A70-13659 03-32)

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FILM RECONNAISSANCE SYSTEM FOR SCIENTIFIC SPACE APPLICATIONS. R. Bashe and I. Schwartz (Fairchild Camera and Instrument Corp., Syosset, N.Y.), p. 243-249. (See A70-13664 03-14)

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A REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY. H. Ostrow and O. Weinstein (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 251-262. 7 refs. (See A70-13665 03-14)

METEOROLOGICAL INFRARED INSTRUMENTS FOR SATELLITES. I. L. Goldberg (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 263-274. 24 refs. (See A70-13666 03-14)

DATA HANDLING SYSTEM–APPLICATIONS OF SATELLITE DERIVED METEOROLOGICAL DATA. C. A. Spohn (ESSA, Suitland, Md.), p. 275-278. (See A70-13667 03-08)

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AIRCRAFT MULTISPECTRAL SCANNERS. D. R. Nance and J. D. Lewis (Texas Instruments, Inc., Dallas, Tex.), p. 293-299. (See A70-13670 03-14)

MULTISPECTRAL SCANNERS FOR SPACECRAFT. W. J. Baldwin, J. J. Schlickman, R. A. Weagant, and W. L. Wolfe (Honeywell, Inc., Lexington, Mass.), p. 301-309. 5 refs. (See A70-13671 03-14)

POTENTIAL EARTH RESOURCES APPLICATIONS OF THE APOLLO 6 (502 MISSION) PHOTOGRAPHY. J. L. Kaltenbach (NASA, Manned Spacecraft Center, Houston, Tex.), p. 311-323. (See A70-13672 03-13)

LASER APPLICATIONS.

METEOROLOGICAL APPLICATIONS OF LIDAR. W. E. Evans and R. T. H. Collis (Stanford Research Institute, Menlo Park, Calif.), p. 325-336. 25 refs. (See A70-13673 03-07)

LASERS FOR SATELLITE RANGING AND PHOTOGRAPHY. R. L. Iliff (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 337-340. 9 refs. (See A70-13674 03-07)

OPTICAL COMMUNICATIONS EXPERIMENTS AT 6328 Å AND 10.6μ. R. F. Lucy (Sylvania Electric Products, Inc., Waltham, Mass.), p. 341-350. 7 refs. (See A70-13675 03-07)

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HEART VOLUME BY COMPUTER AIDED ANALYSIS OF PHOTOGRAPHIC IMAGES–A PROGRESS REPORT. A. H. Gott, F. H. Voss (Aerospace Corp., El Segundo, Calif.), A. F. Bowyer (Loma Linda University, Loma Linda, Calif.), and B. L. Lendrum (Illinois, University, Urbana, Ill.), p. 375-386. 5 refs. (See A70-13678 03-05)

COMPUTER GRAPHICS SIMULATION OF THE HUMAN HEART. A. F. Bowyer, V. J. Johns, Jr. (Loma Linda University, Loma Linda, Calif.), A. H. Gott (Aerospace Corp., San Bernardino, Calif.), and B. Kubert (Illinois, University, Urbana, Ill.), p. 387-392.

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EFFECTS OF CERTAIN APPROXIMATIONS IN IMAGE QUALITY EVALUATION FROM EDGE TRACES. H. B. Hammill and T. M. Holladay (Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.), p. 411-418.

LASER HAZARDS.

BIOLOGICAL EFFECTS OF LASER RADIATION. M. N. Stein (U.S. Armed Forces Institute of Pathology, Washington, D.C.; Eye Research Foundation, Bethesda, Md.), p. 419, 420. (See A70-13679 03-05)

A SHORT ANNOTATED BIBLIOGRAPHY ON LASER EYE PROTECTION. C. H. Swope (American Optical Corp., Framingham, Mass.), p. 421-425. 17 refs. (See A70-13680 03-05)

LASER HAZARDS CONTROL IN THE LABORATORY AND IN THE FIELD. D. H. Sliney (U.S. Army, Environmental Hygiene Agency, Edgewood Arsenal, Md.), p. 427-430. 9 refs. (See A70-13681 03-05)

AUTOMOBILE SAFETY RESEARCH.

PHOTO-OPTICAL INSTRUMENTATION OF AUTOMOBILE COLLISIONS–AN AID TO INJURY REDUCTION RESEARCH. D. Severy, D. Blaisdell, and B. McGuire (California, University, Los Angeles, Calif.), p. 431-447.

SEEING IN THE SEA. C. N. DeMund (General Dynamics Corp., San Diego, Calif.), p. 449-454.

SUMMARY OF THE MODULATION TRANSFER FUNCTION MEETING. R. R. Shannon and R. J. Wollensak, p. 455-468.

FIBER OPTICS SEMINAR. R. L. Stow (Columbia Broadcasting System, Inc., Stamford, Conn.), p. 469, 470.

c14 080000 12

A70-13665 *

A REVIEW OF A DECADE OF SPACE CAMERA SYSTEMS DEVELOPMENT FOR METEOROLOGY.

Harvey Ostrow and Oscar Weinstein (NASA, Goddard Space Flight Center, Greenbelt, Md.).

IN: SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS, ANNUAL TECHNICAL SYMPOSIUM, 13TH, WASHINGTON, D.C., AUGUST 19-23, 1968, PROCEEDINGS. VOLUME 1. (A70-13651 03-14)

Symposium supported by the U.S. Air Force, the U.S. Army, the U.S. Navy, and NASA.

Redondo Beach, Calif., Society of Photo-Optical Instrumentation Engineers, 1969, p. 251-262. 7 refs.

Brief description of some of the specific meteorological TV cameras that have been developed over the past ten years. The reasons that prompted sensor selection are discussed, and the camera characteristics are tabulated. A camera system planned for flight on a future synchronous altitude earth-oriented satellite, and using an image dissector which provides very high resolution, wide dynamic range, improved photocathode stability, and relatively wide spectral response, is briefly described. Some comprehensive articles written about the various types of image sensors employed in TV satellite applications are listed in a bibliography. M.M.

c14 080000 13

A70-13976

DRIFT MIRROR INSTABILITY IN THE MAGNETOSPHERE–PARTICLE AND FIELD OSCILLATIONS AND ELECTRON HEATING.

L. J. Lanzerotti, A. Hasegawa, and C. G. Maclennan (Bell Telephone Laboratories, Inc., Murray Hill, N.J.).

Journal of Geophysical Research, vol. 74, Nov. 1, 1969, p. 5565-5578. 24 refs.

Reanalysis of the published L = 5 equatorial magnetosphere particle and field data from the Apr. 18, 1965 geomagnetic storm in the context of the drift mirror instability theory developed by Hasegawa. These data, together with previously unpublished electron pitch angle data, are shown to satisfy the requirements and consequences of the instability. Additional particle data observed during a 1967 substorm by an experiment on satellite ATS 1 are also presented to show that the observation of the April 18 instability was not an isolated occurrence in the magnetosphere. The data also contain evidence for electron heating during the time of the instability. F.R.L.

c29 110300 14

A70-13991 *

TRAVELING IONOSPHERIC DISTURBANCES ORIGINATING IN THE AURORAL OVAL DURING POLAR SUBSTORMS.

M. J. Davis and A. V. da Rosa (Stanford University, Radioscience Laboratory, Stanford, Calif.).

Journal of Geophysical Research, vol. 74, Nov. 1, 1969, p. 5721-5735. 23 refs.

Contract No. NAS 5-10102.

A study of large-scale traveling ionospheric disturbances has been carried out by investigating the signatures they leave in columnar electron content records. Columnar content was obtained at a number of widely spaced stations by measuring the Faraday rotation angle of a signal from a geostationary satellite. The results of observations from February 1967 to November 1968 are presented. A simple model relating variations in electron concentration produced by the passage of atmospheric gravity waves to changes in columnar content is developed. Using this model, the observed fluctuations in columnar content are shown to be consistent with the effects expected to be produced by neutral atmospheric waves. Virtually all fluctuations studied occurred during magnetically disturbed periods with a tendency for more frequent occurrence near the middle of magnetic storms. A good correlation between the relative amplitudes of the disturbances, defined as the rms amplitude of the perturbations in electron content divided by the unperturbed content, and Kp is shown to exist. The disturbances exhibit a diurnal variation in speed and direction of travel. The speed variation is not completely explained. It is suggested that the disturbances originate in the auroral oval during polar substorms. (Author)

c13 100502 04

A70-16152 #

ON ANOMALOUS DARK PATCHES IN SATELLITE-VIEWED SUNGLINT AREAS.

E. Paul McClain and Alan E. Strong (ESSA, National Environmental Satellite Center, Environmental Sciences Group, Hillcrest Heights, Md.).

Monthly Weather Review, vol. 97, Dec. 1969, p. 875-884. 12 refs.

Irregularities in sea-surface sunglint patterns have been frequently noticed in photographs from earth-orbiting satellites. High-resolution color photographs from low-altitude manned spacecraft missions have shown small-scale detail in many of the sunglint pictures. At the much higher altitude of the Applications Technology Satellites (ATS), the reflection pattern of the sun is spread over such a large area that varying sea-surface conditions can be inferred in many areas within a single sunglint region. Of particular interest are patches or swaths of ocean surface that appear dark within the brighter sunglint region. Short-period time sequences of photographs from ATS III exhibit reversals in brightness when the horizontal specular point moves into the area of the anomalous dark feature. Modeling statistics of sea-surface slope for increasing near-surface wind velocities show (1) a rapid drop in maximum sunglint radiance and (2) an increase in the area covered by the total glint pattern. It is shown, by combining calm surface conditions with higher background sea states, that sunglint patterns can be obtained which are very similar to those observed from satellites. Consequently, anomalous dark swath observations from ESSA satellites can be used to infer sea-state variations. The streaklike anomalies in many cases correspond to calm waters beneath high-pressure ridges or, when paralleling coastlines, the seaward limit of local sea-breeze circulations. (Author)

c13 080900 15

A70-17220 #

CIRCULATION IN THE TROPICS AS REVEALED BY SATELLITE DATA.

Vincent J. Oliver and Ralph K. Anderson (ESSA, National Environmental Satellite Center, Suitland, Md.).

American Meteorological Society, Bulletin, vol. 50, Sept. 1969, p. 702-707. 16 refs.

Brief description of some of the more important contributions by weather satellites to our understanding of circulation in the tropics. The data and techniques which made the findings possible are summarized. It is noted that satellite pictures have greatly increased our qualitative understanding of circulation in the tropics. Thus far, the data reveal only those parts of the circulation that produce cloud formations, the rest must be inferred. They give us insight into energy exchange processes between the polar latitude and the tropics, as well as between the Northern and Southern Hemispheres. They reveal, through different cloud types and their distribution, the form of interaction taking place between the atmosphere and the boundary surface. They show the convective cloud clusters and tropical storms where significant energy conversion is taking place. M.M.

c20 080900 14

A70-18409

PCM TIME DIVISION SATELLITE MULTIPLE ACCESS COMMUNICATION SYSTEM (SMAX).

Masami Takada and Hiroyuki Doi (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan).

Electrical Communication Laboratory, Review, vol. 17, Aug. 1969, p. 725-746. 19 refs.

Time division multiple access communication is free of intermodulation effects and PCM is unvulnerable to interference. The PCM-TDMA system is usually considered to contain some invalid time slot in each TDMA carrier burst and required satellite orbit information. This report presents a new PCM-TDMA system which provides increased time slot utility and requires no knowledge of range between earth station and satellite. The features of the system are (1) carrier burst acquisition at PCM subframe on the satellite is established with a low-level PN sequence and (2) clock and frame coherency among subframes are maintained by control of participating earth stations. Demand assigned voice channel control system is realized by the variable destination multiple access technique. The system employs (1) individual control of each earth station and (2) multiconnected common signaling circuit. (Author)

c07 070400 05

A70-18410

ACQUISITION IN TDMA SATELLITE COMMUNICATION SYSTEM (SMAX).

Yukio Inoue (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan).

Electrical Communication Laboratory, Review, vol. 17, Aug. 1969, p. 747-756.

In time-division multiple-access satellite communication, it is necessary for each station to be provided with an acquisition which inserts a time-divided information into an assigned time slot. The present paper treats of design and experimental results regarding the acquisition system of a newly developed satellite multiple access transmission (SMAX) communication system. The acquisition system features use of a low-level method employing a PN code which is repeated with the same period as the PCM frame, and the acquisition is carried out automatically. In addition, experiments with a satellite have proven that faultless operation can be obtained, and the acquisition system can be applied to a practical use with a satisfactory result. (Author)

c07 070400 06

A70-18411

CLOCK SYNCHRONIZATION IN TDMA SATELLITE COMMUNICATION SYSTEM (SMAX).

Shoji Kondo (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan).

Electrical Communication Laboratory, Review, vol. 17, Aug. 1969, p. 757-766. 13 refs.

Design and test results are presented of a clock synchronizing system for a PCM-TDMA system in which clock timing is perfectly synchronized. The synchronizing system is composed of three subloops; an electronic automatic phase control loop, a mechanical automatic phase control loop and a mechanical automatic frequency control loop. In spite of difficulties due to a long time delay in the control loop, the system was successfully designed and performed properly. (Author)

c07 070400 07

A70-18412

CHANNEL CONTROL AND SIGNALING IN SATELLITE COMMUNICATION SYSTEM–SMAX.

Minoru Kutami, Masaru Ono, Hiromasa Ikeda, and Shiro Sugimura (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan).

Electrical Communication Laboratory, Review, vol. 17, Aug. 1969, p. 767-778.

Description of a multiple-access channel control system operating in a variable-destination multiple-access mode for use in a PCM-TDMA satellite communication system. Certain design considerations are presented, a brief outline of the equipment and its performance is given, and the characteristics of the signaling channels are cited. The results of some experiments on a satellite to measure the characteristics of the data channels and to evaluate the error control function in the multiple-access control system are summarized. A.B.K.

c07 070400 09

A70-18567

THUNDERSTORMS AND THUNDERSTORM PHENOMENA; AMERICAN METEOROLOGICAL SOCIETY, CONFERENCE ON SEVERE LOCAL STORMS, 6TH, CHICAGO, ILL., APRIL 8-10, 1969, PREPRINTS.

Boston, American Meteorological Society, 1969. 382 p.
Members, $10.00; nonmembers, $15.

CONTENTS:

c20 080700 06

A70-18578 #

STRUCTURE OF A DISTURBANCE IN THE EQUATORIAL PACIFIC OCEAN, INCLUDING THE ROLE OF ORGANIZED CONVECTIVE DOWNDRAFTS IN ITS RAPID DECAY.

Edward J. Zipser (National Center for Atmospheric Research, Boulder, Colo.).

IN: THUNDERSTORMS AND THUNDERSTORM PHENOMENA; AMERICAN METEOROLOGICAL SOCIETY, CONFERENCE ON SEVERE LOCAL STORMS, 6TH, CHICAGO, ILL., APRIL 8-10, 1969, PREPRINTS. (A70-18567 06-20)

Boston, American Meteorological Society, 1969, p. 105-113. 5 refs.

The Line Islands Experiment, conducted on and near Palmyra, Fanning, and Christmas Islands during February-April 1967, produced extensive data in disturbances of the equatorial trough zone. One disturbance which passed through the heart of the data network is analyzed in detail. This disturbance intensified rapidly just east of Fanning Island during the night of March 31-April 1, but satellite observations show that it dissipated rapidly during the daylight hours of April 1. Data from serial rawinsonde releases on the islands, combined with research aircraft data, are presented which demonstrate that unsaturated downdrafts are produced, first on the convective scale and the mesoscale, finally becoming organized over the entire 600 km extent of the system. In order to produce the observed downdrafts, it is shown that the three-dimensional circulation pattern within regions of intense convection is closely analogous to the pattern in typical mid-latitude squall lines. (Author)

c20 080700 07

A70-18583 * #
METEOROLOGICAL SATELLITE STUDY ON THE DEVELOPMENT OF TORNADO-PRODUCING THUNDERSTORMS.
K. Ninomiya (Chicago, University, Chicago, Ill.).
IN: THUNDERSTORMS AND THUNDERSTORM PHENOMENA; AMERICAN METEOROLOGICAL SOCIETY, CONFERENCE ON SEVERE LOCAL STORMS, 6TH, CHICAGO, ILL., APRIL 8-10, 1969, PREPRINTS. (A70-18567 06-20)
Boston, American Meteorological Society, 1969, p. 202-207. 9 refs. ESSA Grants No. E-22-45-68(G); No. E-198-68(G); Grant No. NGR-14-001-008.

A mesoscale dynamic and synoptic study of the tornado-producing thunderstorms on Apr. 23, 1968 is made by using conventional surface and upper-air data combined with ATS-III data. A series of mesoscale disturbances with a period of 2-3 hours and 60-90 kt phase speed seems to be related to the convective activity. The characteristic magnitude of convergence of the disturbance is of the order 0.0001 per sec. Strong outflow was observed in the higher troposphere over the storm area. The outflow was associated with the swelling of the isobaric surface due to the convective warming in the mid-troposphere. The vertical exchange of momentum due to the severe convection is also discussed. (Author)

c20 081100 04

A70-19196
DATA UTILIZATION FROM METEOROLOGICAL SATELLITES.
Clifford A. Spohn (ESSA, National Environmental Satellite Center, Suitland, Md.).
New York Academy of Sciences, Transactions, Series 2, vol. 31, Dec. 1969, p. 1103-1105.

Discussion of the uses being made of the data provided by the operational environmental satellite system after the first three years of operation. The data are presented to the analyst in two forms: analog-produced single pictures and computer-produced digital mosaics. At the Center a number of analyses are produced. Some are from each orbital coverage as received; others are at set daily times to provide information on a standard schedule for the use of the National Meteorological Center. The first is the locating of actual or incipient tropical storms. A second major program is the analysis of synoptic weather patterns. G.R.

c20 080900 16

A70-21378 **Effects of sudden commencements on solar protons at the synchronous orbit.** G. A. Paulikas and J. B. Blake (Aerospace Corp., El Segundo, Calif.). *Journal of Geophysical Research,* vol. 75, Feb. 1, 1970, p. 734-742. 21 refs. Contract No. AF 04(701)-68-C-0200.

Observation of increases in solar proton flux coincident with sudden commencements by detectors aboard the geostationary ATS-1 satellite during 1967 and 1968. The flux increases are of short duration (less than 30 min) and are of magnetospheric origin. Decay of the proton flux after the sudden commencement enhancement is consistent with pitch angle scattering by hydromagnetic waves. (Author)

c29 110100 13

A70-21779 **Signal characteristics of a very-high-frequency satellite-to-aircraft communications link.** Gerald T. Bergemann and Howard L. Kucera (Collins Radio Co., Cedar Rapids, Iowa). *IEEE Transactions on Communication Technology,* vol. COM-17, Dec. 1969, p. 677-685.

The results of a series of very-high-frequency (VHF) aeronautical communications tests conducted with NASA Applications Technology satellites are summarized. The tests were undertaken to collect data which could be compared to the results obtained from a previously derived analytical model. Specifically, the objective of the program was the measurement of the received signal strength and fading characteristics, as received on board a typical commercial jet aircraft to determine the effectiveness of communication and to establish parameters which can be useful to the communication system designer. A discussion of the analytical model, including the antenna characteristics, is followed by a brief description of the test program. The results and conclusions included consideration of the signal amplitude behavior, signal-to-noise ratio, antenna pattern effects, multipath, and system gain and noise. Probability distributions of signal fading and examples of unusual signal reception are included. The probability distributions provide a guide to system designers in establishing communications reliability for specific systems. It was concluded from the tests that the received signal level exceeded the voice intelligibility threshold more than 98 per cent of the time using the test system. (Author)

c07 070204 04

A70-22193 **Applications of Omega Position Location Experiment to mass transportation.** Francis J. Enge (Hazeltine Corp., Little Neck, N.Y.). *(Institute of Navigation, Annual Meeting, 25th, New York, N.Y., June 24-26, 1969.) Navigation,* vol. 16, Winter 1969-1970, p. 407-418.

Discussion of the applications of the Omega Position Location Experiment including a synchronous satellite (ATS-3) as a high attitude radio relay to merchant shipping, air traffic control, and moving vehicle location and communications. The experiment has demonstrated that a relatively low power VHF system can relay up-converted VLF OMEGA signals without significant phase distortion, thereby enabling a synchronous satellite to collect this data from a very wide area of the earth's surface, and relay it to a ground terminal. Position accuracy is presently within 1-2 miles at day and 2-4 miles at night. This system appears to be suitably applicable to command and control of slow, medium and high speed vehicles, enabling an independent position location input for surveillance in real-time. O.H.

c21 080400 05

A70-22227 **The weather satellite program.** Glenn E. Matthews. *SMPTE, Journal,* vol. 79, Feb. 1970, p. 95-104. 26 refs.

Review of the operation of the four principal U.S. weather satellite systems in use by the end of 1969. Satellite configurations and onboard equipment are described for the TIROS, Nimbus, ESSA, and ATS systems. Typical photographs from each system are reproduced to show the types of cloud records which are made available. The results of predictions based on satellite observations are examined in terms of benefits offered in diverse disciplines. T.M.

c31 080900 18

A70-22894 # **Earth resources data processing as viewed from an environmental satellite data processing experience base.** C. L. Bristor (ESSA, National Environmental Satellite Center, Suitland, Md.). *American Institute of Aeronautics and Astronautics, Earth Resources Observations and Information Systems Meeting, Annapolis, Md., Mar. 2-4, 1970, Paper 70-284.* 10 p. 7 refs. Members, $1.00; nonmembers, $1.50.

Parallelisms are drawn between the projected information extraction efforts using imaging sensors on earth resources satellites and the similar efforts currently in progress with environmental satellite imaging sensors. Global mapping of digitized vidicon imagery from the TIROS Operational Satellite (TOS) system over the past several years and an extended experimental mapping operation using spin scan imagery from Applications Technology Satellites (ATS) has provided the experience base. Display inadequacies are discussed for the case of manual information extraction with input data from large dynamic range imaging scanners. In-flight vidicon response variations are presented, and the need for response normalization and close signal monitoring is stressed. The photogrammetric experiences with vidicons and scanners—the problems in X,Y raster normalization and satellite attitude determination—are related to the earth resources mission with particular reference to multi-channel coincidence requirements for 'signature' extraction. (Author)

c13 080900 20

A70-24326 **International Telecommunications Satellite Consortium and Institution of Electrical Engineers, International Conference on Digital Satellite Communication, London, England, November 25-27, 1969, Proceedings.** London, Institution of Electrical Engineers, 1969. 565 p. In English and French.

Record message networks employing satellites and small earth terminals. S. H. Hanell (Communications Satellite Corp., Washington, D.C.), p. 1-14. (See A70-24327 10-07)

Optimum interoperation of FDMA, TDMA and terrestrial systems in the interregional telecommunication network. H. Haeberle and E. Herter (Standard Elektrik Lorenz AG, Stuttgart, West Germany), p. 15-25. (See A70-24328 10-07)

A small station satellite system using delta modulation. D. R. C. Snowden (Australian Post Office Research Laboratories, Melbourne, Australia), p. 26-38. (See A70-24329 10-07)

New PCM-TDMA satellite communication system and variable destination channel control technique. M. Takada, S. Nakamura, S. Kondo, Y. Inoue, M. Ono, and H. Ikeda (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan), p. 39-50. (See A70-24330 10-07)

SPADE—A PCM FDMA demand assignment system for satellite communications. A. M. Werth (Communications Satellite Corp., Washington, D.C.), p. 51-68.

Processing of bursts in a TDMA system. W. G. Maillet (Communications Satellite Corp., Washington, D.C.), p. 69-82. (See A70-24331 10-07)

TTT system—50 MBPS PCM-TDMA system with time-preassignment and TASI features. K. Nosaka (Kokusai Denshin Denwa Co., Ltd., Tokyo, Japan), p. 83-94. 7 refs. (See A70-24332 10-07)

Theoretical and experimental considerations of the carrier and the bit timing recovery in the burst mode operation. S. Yokoyama and T. Noguchi (Nippon Electric Co., Ltd., Tokyo, Japan), p. 95-105. (See A70-24333 10-07)

The optimum system design for digital satellite communications using multi-phase modulation. S. Yokoyama and M. Tachibana (Nippon Electric Co., Ltd., Tokyo, Japan), p. 106-115. (See A70-24334 10-07)

Considerations on the clock synchronization loop including delay time. M. Tachibana (Nippon Electric Co., Ltd., Tokyo, Japan), p. 116-126. (See A70-24335 10-07)

PSK modems for satellite communications. C. J. Wolejsza, Jr., A. M. Walker, and A. M. Werth (Communications Satellite Corp., Washington, D.C.), p. 127-143. 8 refs. (See A70-24336 10-07)

High speed PCM Codec for satellite communication. Y. Ōhashi, M. Kishigami, S. Shigaki, S. Tanaka, and T. Okada (Nippon Electric Co., Ltd., Tokyo, Japan), p. 144-153. 8 refs. (See A70-24337 10-07)

Carrier synchronization techniques of PSK-modem for TDMA systems. K. Nozaka, T. Muratani (Kokusai Denshin Denwa Co., Ltd., Tokyo, Japan), M. Ogi, and T. Shoji (Fujitsu, Ltd., Kawasaki, Japan), p. 154-165. (See A70-24338 10-07)

Burst synchronization in TDMA system. H. Sasaki, T. Maruyama (Kokusai Denshin Denwa Co., Ltd., Tokyo, Japan), M. Hashimoto, H. Kanzaki, and Y. Sakamoto (Fujitsu, Ltd., Kawasaki, Japan), p. 166-176. 5 refs. (See A70-24339 10-07)

A comparison of independent burst and burst coherent TDMA techniques. L. C. Palmer and S. A. Rhodes (Communications and Systems, Inc., Falls Church, Va.), p. 177-188. 5 refs. (See A70-24340 10-07)

SNR and error rate calculations for coherent non-linear satellite channels. J. M. Aein (Institute for Defense Analyses, Arlington, Va.), p. 189-201. 17 refs. (See A70-24341 10-07)

Degraded error probability for multi-phase digital signalling with linear distortion and Gaussian noise. M. Y. Weidner (TRW Systems Group, Redondo Beach, Calif.), p. 202-212. 7 refs. (See A70-24342 10-07)

A comparative study of the utilization of the geo-stationary orbit. J. C. Fuenzalida (Communications Satellite Corp., Washington, D.C.), p. 213-225. 10 refs. (See A70-24343 10-07)

Some comparisons of the traffic-carrying capacity of communication-satellites using digital techniques with the capacity of satellites using frequency modulation. D. I. Dalgleish and A. G. Reed (General Post Office, London, England), p. 226-240. 5 refs. (See A70-24344 10-07)

A survey of interference problems associated with the use of digital satellite communications. A. K. Jefferis (General Post Office, London, England), p. 241-252. (See A70-24345 10-07)

Efficient PCM satellite communication with minimum interference to terrestrial radio links. W. Debrunner and W. Nu (PTT Research Laboratories, Berne, Switzerland), p. 253-261. (See A70-24346 10-07)

Signalling system for demand assignment. D. L. Thomas and W. B. Deller (Plessey BTR, Ltd.), p. 262-271. (See A70-24347 10-07)

Some considerations in the design and operation of a demand assignment signalling and switching sub-system (DASSS). J. F. Boag, p. 272-283. 6 refs. (See A70-24348 10-07)

Incorporating PCM satellite circuits in the International Telephone network—Some transmission performance aspects. S. Munday (General Post Office, London, England), p. 284-296. (See A70-24349 10-07)

Signaling and switching for demand assigned satellite communications. G. D. Dill and N. Shimasaki (Communications Satellite Corp., Washington, D.C.), p. 297-308. (See A70-24350 10-07)

The telecommunication satellite as an integrated time division transmission-switching system. A. de Flammineis and A. Loffreda (Centro Studi e Laboratori Telecomunicazioni, Turin, Italy), p. 309-318. 6 refs. (See A70-24351 10-07)

Operation modes and applicability of PCM-TDMA satellite communication system. T. Ohta (Kokusai Denshin Denwa Co., Ltd., Tokyo, Japan), p. 319-330. 10 refs. (See A70-24352 10-07)

A TDMA system proposed for the experimental German-French communication satellite 'Symphonie.' G. Eckhardt (Telefunken AG, Berlin, West Germany), B. Reidel (Siemens AG, Munich, West Germany), and H. Rupp (Standard Elektrik Lorenz AG, Stuttgart, West Germany), p. 331-342. 5 refs. (See A70-24353 10-07)

TDMA and switching. H. Häberle, E. Herter, and G. Schmidt (Standard Elektrik Lorenz AG, Stuttgart, West Germany), p. 343-354. (See A70-24354 10-07)

A comparison of two digital systems for demand assignment of satellite circuits. R. F. Purton (Plessey BTR, Ltd.), p. 355-364. (See A70-24355 10-07)

Traffic simulation in a telephone network via satellite with preassigned and demand assigned circuits. F. Manucci and A. Tonietti (Centro Studi e Laboratori Telecomunicazioni, Turin, Italy), p. 365-374. 5 refs. (See A70-24356 10-07)

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An adaptive multiple access satellite communication system at millimeter wavelengths. S. Nishida, J. Murakami, S. Asakawa, and N. Goto (Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan), p. 387-398. (See A70-24358 10-07)

An on-board switched multiple-access system for multimeter-wave satellites. W. G. Schmidt (Communications Satellite Corp., Clarksburg, Md.), p. 399-407. (See A70-24359 10-07)

Economic aspects of a satellite telecommunication system with pre-assigned and demand assigned circuits. E. Husu and F. Motolese (Società Italiana Telecomunicazioni Siemens S. p. A., Milan, Italy), p. 408-417. (See A70-24360 10-07)

Economic aspects of data transmission by satellite. D. C. Pope (General Post Office, London, England), p. 418-427. (See A70-24361 10-07)

MAT-1: INTELSAT's experimental 700-channel TDMA/DA system. W. G. Schmidt, O. G. Gabbard, E. R. Cacciamani, W. G. Maillet, and W. W. Wu (Communications Satellite Corp., Washington, D.C.), p. 428-440. 15 refs. (See A70-24362 10-07)

Possibilities of increasing the efficiency of TDMA systems. M. Hanni (Siemens AG, Munich, West Germany), B. Ostermann (Telefunken AG, Berlin, West Germany), and H. Rupp (Standard Elektrik Lorenz AG, Stuttgart, West Germany), p. 441-452. (See A70-24363 10-07)

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Influence of modulation techniques on the utilization efficiency of assigned frequency bands in digital transmissions (Influence des procédés de modulation sur l'efficacité d'utilisation des bandes de fréquences allouées dans le cas de transmissions digitales). M. R. Liger (Société Anonyme des Télécommunications, Paris, France), p. 472-481. (See A70-24365 10-07)

TDMA system control. B. Reidel (Siemens AG, Zentral-Laboratorium für Nachrichtentechnik, Munich, West Germany), p. 482-493. (See A70-24366 10-07)

Traffic problems in a telephone network via satellite with preassigned and demand assigned circuits. I. Cappetti (Centro Studi e Laboratori Telecomunicazioni, Turin, Italy), p. 494-504. (See A70-24367 10-07)

Possible solutions for a synchronous system. W. Bitzer (Telefunken AG, Backnang, West Germany), p. 505-517. (See A70-24368 10-07)

Future satellite-relayed digital multiple access systems. S. G. Lutz (Hughes Research Laboratories, Malibu, Calif.), p. 518-531. 13 refs. (See A70-24369 10-07)

Use of ATIC system to TDMA via satellite. G. M. Costa, E. Lyghounis, and I. Poretti (Società Italiana Telecomunicazioni Siemens S.p.A., Milan, Italy), p. 532-542. (See A70-24370 10-07)

Collection and relay of earth resources data. S. D. Dorfman (Hughes Aircraft Co., El Segundo, Calif.), p. 543-558. 5 refs. (See A70-24371 10-07)

c07 070400 09

A70-24330 **New PCM-TDMA satellite communication system and variable destination channel control technique.** M. Takada, S. Nakamura, S. Kondo, Y. Inoue, M. Ono, and H. Ikeda (Nippon Telegraph and Telephone Public Corp., Tokyo, Japan). In: International Telecommunications Satellite Consortium and Institution of Electrical Engineers, International Conference on Digital Satellite Communication, London, England, November 25-27, 1969, Proceedings. (A70-24326 10-07) London, Institution of Electrical Engineers, 1969, p. 39-50.

Description of a PCM-TDMA (PCM-time division multiple access) system which provides maximum time slot utility, a PCM subframe acquisition technique which requires no satellite orbit information, and a variable destination multiple access system by the distributed channel control system with a common signaling channel for each station. Principal features of the system are the elimination of a guard time slot between carrier bursts and carrier and clock signal recovery time by use of differentially coherent detection-synchronized clock timing among subframes. Although guard time slots can be eliminated, one invalid bit remains which is devoted to overlapping of carrier bursts. An automatic subframe acquisition system using a low-level carrier modulated by pseudo random noise code sequence is used, hence it is not necessary to have computerized data on the satellite orbit. The acquisition system coordinates well with the synchronized clock timing system. This TDMA system provides considerable simplification. F.R.L.

c07 070400 10

A70-24430 * **Determination of the columnar electron content and the layer shape factor of the plasmasphere up to the plasmapause.** O. G. Almeida, A. V. Da Rosa (Stanford University, Stanford, Calif.), and O. K. Garriott (Stanford University, Stanford, Calif.; NASA, Manned Spacecraft Center, Houston, Tex.). *Planetary and Space Science,* vol. 18, Feb. 1970, p. 159-170. 15 refs. Contract No. NAS 5-10102.

Measurements of the total columnar electron content of the plasmasphere up to the plasmapause have been made using the beacon transmitters aboard the geostationary satellite ATS-III. The technique employed is a combination of the differential Doppler frequency and the Faraday rotation angle methods. Such a combination permits the determination of the integration constant necessary to convert differential Doppler data into information about the absolute value of the columnar content. A 'layer shape factor' defined as the ratio between the Faraday rotation angle and the columnar content is also determined. The diurnal behavior of this factor can yield information on the exchange of ionization between the ionosphere and the protonosphere. This paper describes the analysis used to obtain both the absolute value of content and the shape factor. (Author)

c13 100509 04

A70-24810 **Dispersive motions of ionospheric irregularities.** Micheal D. Papagiannis (Boston University, Boston, Mass.) and Terence J. Elkins (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Journal of Atmospheric and Terrestrial Physics,* vol. 32, Mar. 1970, p. 383-395. 13 refs. Contract No. AF 19(628)-68-C-0097.

Cross correlation functions for satellite scintillations at spaced receivers, show a systematic skewness, indicative of dispersive motions of ionospheric irregularities. Other features of the correlation functions, such as secondary pumps frequently present at large time lags and a very obvious change in the shape of the curve over a long baseline are also suggestive of dispersive ionospheric wave motions. The fact that the skewness is found to be greater for a low elevation satellite than for one at higher elevation, suggests that these motions might contain a frequency dependent vertical component. The effects of a vertical velocity component upon the conventional horizontal spaced receiver measurements are carefully analyzed. Useful information, relating to velocity dispersion, was also obtained at a single location, by investigating the correlation between multifrequency scintillation records of a radio star. Because of previous suggestions that apparent skewness of spaced receiver correlation functions was due merely to statistical sampling errors, the stationarity of the scintillation data is examined in considerable detail. (Author)

c13 100500 58

A70-25433 # **Experimental evaluation of VHF for position fixing by satellite.** Roy E. Anderson (GE Research and Development Center, Schenectady, N.Y.). *American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 3rd, Los Angeles, Calif., Apr. 6-8, 1970, Paper 70-489.* 22 p. 6 refs. Members, $1.00; nonmembers, $1.50.

The VHF transponders of the ATS-1 and ATS-3 geostationary satellites were used in ranging and position fixing experiments. An interrogation signal was transmitted from a ground terminal to ATS-3, which relayed it to the vehicle transponders. The vehicle that was addressed repeated the signal and its response was relayed back through both satellites to the ground terminal, where propagation times were measured; lines-of-position and fixes were computed. The 0.43 second 'tone-code' ranging signal contained a single audio tone frequency. Ambiguity was resolved and user craft identified by a simple digital code. Five vehicles were used in the test: two aircraft, a ship, an oceanographic buoy, and a truck. Ionospheric and multipath effects were studied. It is concluded that a VHF system could have an accuracy of plus or minus 1 nautical mile for ships and aircraft if calibration transponders are used to monitor the ionosphere. (Author)

c07 070211 08

A70-25460 # **Frequency stability characteristics and stabilization techniques in an SSB-FDMA/PhM multiple access system.** S. J. Andrzejewski (Westinghouse Defense and Space Center, Baltimore, Md.). *American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 3rd, Los Angeles, Calif., Apr. 6-8, 1970, Paper 70-411.* 13 p. Members, $1.00; nonmembers, $1.50.

Investigation of the frequency stability characteristics and stabilization techniques in an SSB-FDMA/PhM multiple access system. Utilizing a Fourier analysis technique, it was determined that the short term frequency instability of a received test tone was mainly caused by incidental modulation components, S/C spin modulation components, and the quadrature component of the normally distributed thermal noise. The mathematics for the reference carrier method (regarded as the most promising technique for reducing frequency instability) are developed to determine the condition for complete cancellation. It is shown that the resultant perturbations will vary sinusoidally with an argument that is a function of time and the modulation frequency of the incidental modulation. M.V.E.

c07 070100 16

A70-25464 * # **An efficiency evaluation of the ATS-3 hydrazine orbit control system.** Robert H. Greene, Martin S. Ross, and Ann H. West (IBM Corp., Federal Systems Div., Gaithersburg, Md.). *American Institute of Aeronautics and Astronautics, Communications Satellite Systems Conference, 3rd, Los Angeles, Calif., Apr. 6-8, 1970, Paper 70-460.* 10 p. 7 refs. Members, $1.00; nonmembers, $1.50. Contract No. NAS 5-10022.

This paper describes a general statistical method for efficiency evaluation of the onboard, pulsed-jet orbit control system of spin-stabilized spacecraft ATS-3. A sample of 15 actual ATS-3 stationkeeping maneuvers employing pulses ranging in number from 89 to 3,336 was used. Although this sample is small, the one sigma spread in data is shown to correspond to theoretically calculated uncertainties. The total RMS error due to propulsion system uncertainties and the impulsive thrust assumption is observed to be about 10% of the velocity increment imparted. Accuracy of the orbit determination data employed in the analysis was found to be 150 meters in semimajor axis using 24 hours of tracking data at one-half hour intervals. It is shown that, using an orbit predicted over a 1-week period, the uncertainty in maneuver efficiency calculation ranges from 8 to 30% depending on maneuver size. (Author)

c31 021102 01

A70-25636 * # **Color enhancement of Nimbus high resolution infrared radiometer data.** E. R. Kreins (USAF, Environmental Technical Applications Center, Washington, D.C.) and L. J. Allison (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Applied Optics,* vol. 9, Mar. 1970, p. 681-686. 9 refs.

Two examples of Nimbus high resolution infrared radiometer (HRIR) data processed by a color display enhancement system demonstrate possible meteorological, oceanographic, and geomorphological applications of this technique for geophysical research. A commonly used means of displaying radiation temperatures mapped by the HRIR has been a black and white photofacsimile film strip. However, the human eye can distinguish many more colors than shades of gray, and this characteristic permits an analyst to evaluate quantitatively radiation values mapped in color more readily than in black and white. (Author)

c14 080100 39

A70-26929 **International Symposium on Remote Sensing of Environment, 6th, Ann Arbor, Mich., October 13-16, 1969, Proceedings. Volume 1.** Symposium sponsored by the University of Michigan, the U.S. Geological Survey, the U.S. Department of Agriculture, the Environmental Science Services Administration, and the U.S. Coast Guard. Ann Arbor, Mich., Michigan, University, 1969. 663 p. Price of two volumes, $15.

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A spectral discrimination technique for agricultural applications. D. L. Earing (Michigan, University, Ann Arbor, Mich.) and I. W. Ginsberg (Sensors, Inc., Ann Arbor, Mich.), p. 21-32. 6 refs. (See A70-26931 12-13)

Multispectral imagery and automatic classification of spectral response for detailed engineering soils mapping. M. G. Tanguay (Ecole Polytechnique, Montreal, Canada), R. M. Hoffer, and R. D. Miles (Purdue University, Lafayette, Ind.), p. 33-63. 10 refs. (See A70-26932 12-13)

Application of computer processed multispectral data to the discrimination of land collapse (sinkhole) prone areas in Florida. A. E. Coker (U.S. Geological Survey, Tampa, Fla.), R. Marshall, and N. S. Thomson (Michigan, University, Ann Arbor, Mich.), p. 65-75, 77. 9 refs. (See A70-26933 12-13)

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The inventory of earth resources on enhanced multiband space photography. R. N. Colwell and J. D. Lent (California, University, Berkeley, Calif.), p. 133-143. 8 refs. (See A70-26936 12-13)

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Capability of airborne laser profilometer to measure terrain roughness. L. E. Link (U.S. Army, Waterways Experiment Station, Vicksburg, Miss.), p. 189-196. (See A70-26938 12-16)

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Some results of inflight testing an infrared sensor as a clear air turbulence detector. II. R. Jimenez (Pan American World Airways, Inc., Jamaica, N.Y.), p. 308-326. 8 refs. (See A70-26947 12-14)

Remote probing of wind and turbulence through cross-correlation of passive signals. F. R. Krause (NASA, Marshall Space Flight Center, Huntsville, Ala.), V. E. Derr, N. L. Abshire, and R. G. Strauch (ESSA, Boulder, Colo.), p. 327-359. 8 refs. (See A70-26948 12-14)

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Geological applications of remote sensing.

Geological comparison of spacecraft and aircraft photographs of the Potrillo Mountains, New Mexico, and Franklin Mountains, Texas. D. L. Amsbury (NASA, Manned Spacecraft Center, Houston, Tex.), p. 493-515. 25 refs. (See A70-26956 12-13)

Aerial infrared surveys and borehole temperature measurements of coal mine fires in Pennsylvania. G. W. Greene (U.S. Geological Survey, Denver, Colo.), R. M. Moxham (U.S. Geological Survey, Washington, D.C.), and A. H. Harvey (U.S. Bureau of Mines, Washington, D.C.), p. 517-525.

Airborne geological mapping using infrared emission spectra. I. R. J. P. Lyon (Stanford University, Stanford, Calif.) and J. Patterson (E.R.A., Inc., Houston, Tex.), p. 527-552. 7 refs. (See A70-26957 12-14)

Comparison of airborne spectral gamma radiation data with field verification measurements. A. E. Purvis and F. J. Buckmeier (Texas Instruments, Inc., Dallas, Tex.), p. 553-564.

Remote sensing of luminescent materials. W. R. Hemphill, G. E. Stoertz (U.S. Geological Survey, Washington, D.C.), and D. A. Markle (Perkin-Elmer Corp., Norwalk, Conn.), p. 565-585. 30 refs. (See A70-26958 12-13)

An experimental evaluation of the basic assumptions used in the analysis of microwave radiometric ground truth data. R. J. Hruby, B. Ragent (NASA, Ames Research Center, Moffett Field, Calif.), and A. T. Edgerton (Aerojet-General Corp., El Monte, Calif.), p. 587-602. 5 refs. (See A70-26959 12-14)

Pseudo-radar topographic shadowing for detection of subcontinental sized fracture systems. D. U. Wise (Massachusetts, University, Amherst, Mass.; Franklin and Marshall College, Lancaster, Pa.), p. 603-615. 6 refs. (See A70-26960 12-13)

Recent developments in remote sensing for geophysical applications. A. R. Barringer and J. D. McNeill (Barringer Research, Ltd., Rexdale, Ontario, Canada), p. 617-636. (See A70-26961 12-13)

The influence of radar look-direction on the detection of selected geological features. H. C. MacDonald, J. N. Kirk, L. F. Dellwig, and A. J. Lewis (Kansas, University, Lawrence, Kan.), p. 637-650. 15 refs. (See A70-26962 12-13)

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A70-26939 * # Hydrologic communications experiment on the Applications Technology Satellite (ATS-1). Allen F. Flanders, Francis V. Kohl, and Thomas W. Davis (ESSA, U.S. Weather Bureau, Silver Spring, Md.). In: International Symposium on Remote Sensing of Environment, 6th, Ann Arbor, Mich., October 13-16, 1969, Proceedings. Volume 1. (A70-26929 12-13) Symposium sponsored by the University of Michigan, the U.S. Geological Survey, the U.S. Department of Agriculture, the Environmental Science Services Administration, and the U.S. Coast Guard. Ann Arbor, Mich., Michigan, University, 1969, p. 197-204. NASA-supported research.

In a combined ESSA/NASA experiment, hydrologic data relay and equipment configuration testing was conducted via the VHF transponder on board the geostationary NASA Applications and Technology Satellite (ATS-1). Digital river and rainfall data were transmitted from hydrologic platforms in Arkansas, California, and Oregon upon satellite relayed interrogation by the NASA Command and Data Acquisition (CDA) station at Mojave, California. The data messages, relayed through the satellite, were recorded at Mojave, and transmitted to the Weather Bureau's Office of Hydrology in Silver Spring, Md., for teleprinter readout. (Author)

c11 070209 02

A70-27192 * Storm-related wave phenomena observed at the synchronous, equatorial orbit. Joseph N. Barfield and Paul J. Coleman, Jr. (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 75, Apr. 1, 1970, p. 1943-1946. 9 refs. Grant No. NGR-05-007-004.

Discussion of quasi-sinusoidal fluctuations of relatively large amplitudes recorded in the magnetic field at ATS 1 during several geomagnetic storms. It is pointed out that during four of the six geomagnetic storms studied quasi-sinusoidal oscillations have been detected after the main-phase minimum. During two events in which the H component of the field was unusually weak and the intensity of solar-flare protons was unusually strong at ATS 1, the higher-frequency fluctuations occurred simultaneously. G.R.

c13 110800 40

A70-27739 * Electron content obtained from Faraday rotation and phase path length variations. Owen K. Garriott (NASA, Manned Spacecraft Center, Houston, Tex.), Aldo V. da Rosa (Stanford University, Stanford, Calif.), and William J. Ross (Pennsylvania State University, University Park, Pa.). *Journal of Atmospheric and Terrestrial Physics,* vol. 32, Apr. 1970, p. 705-727. 46 refs.

A critical study is made of electron content calculations made by measurements of polarization rotation and phase path length changes. The accuracies of the principal methods are examined for satellites in 'low', eccentric and geostationary orbits. Observed variation with local time, latitude, season, solar cycle and in ionospheric storms are summarized. Finally the relevance of these measurements to existing ionospheric problems is discussed. (Author)

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A70-28270 # Global photography of the earth (Global'noe fotografirovanie zemli). B. V. Vinogradov. *Zemlia i Vselennaia,* Jan.-Feb. 1970, p. 31-38. In Russian.

Survey of the current capabilities of satellites for large-scale photography of the entire globe. The difficulties associated with mosaic patterns of the entire earth surface are outlined, and the advantages offered by complete photographs from large distances are explained. Examples of photographs obtained from ATS and Molniia satellites are given, and the interpretation of evident features is demonstrated. T.M.

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A70-30058 Particles and fields in the magnetosphere; Summer Advanced Study Institute, Symposium, University of California, Santa Barbara, Calif., August 4-15, 1969, Proceedings. Symposium supported by the U.S. Army, the Defense Atomic Support Agency, the Lockheed Aircraft Corp., the U.S. Navy, and the University of California. Edited by B. M. McCormac (Lockheed Research Laboratories, Palo Alto, Calif.). Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 17), 1970. 452 p. $23.80.

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Entry of solar cosmic rays into the earth's magnetosphere. K. A. Anderson (California, University, Berkeley, Calif.), p. 3-17. 20 refs. (See A70-30059 13-29)

Formation and geometry of geomagnetic tail. A. J. Dessler (Rice University, Houston, Tex.), p. 18-23. 31 refs. (See A70-30060 13-13)

Magnetotail plasma and magnetospheric substorms. E. W. Hones, Jr. (California, University, Los Alamos, N. Mex.), p. 24-33. 7 refs. (See A70-30061 13-29)

A model current system for the magnetospheric substorm. S.-I. Akasofu (Alaska, University, College, Alaska), p. 34-45. 17 refs. (See A70-30062 13-29)

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Anisotropic distributions of energetic electrons in the earth's magnetotail and magnetosheath. S. Singer and S. J. Bame (California, University, Los Alamos, N. Mex.), p. 122-131. 21 refs. (See A70-30071 13-29)

Trapped and polar particles during the June 9, 1968 magnetic storm. P. L. Rothwell, V. H. Webb, and L. Katz (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 132-140. 10 refs. (See A70-30072 13-29)

Solar particle observations over the polar caps. G. A. Paulikas, J. B. Blake, and A. L. Vampola (Aerospace Corp., El Segundo, Calif.), p. 141-147. 9 refs. (See A70-30073 13-29)

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Magnetic field observations in high beta regions of the magnetosphere. M. Sugiura, T. L. Skillman, B. G. Ledley, and J. P. Heppner (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 165-170. 13 refs. (See A70-30076 13-13)

Fluctuations in the distant geomagnetic field during substorms - ATS 1. P. J. Coleman, Jr. and R. L. McPherron (California, University, Los Angeles, Calif.), p. 171-194. 15 refs. (See A70-30077 13-29)

Ac magnetic fields. C. T. Russell and R. E. Holzer (California, University, Los Angeles, Calif.), p. 195-212. 35 refs. (See A70-30078 13-13)

Electric fields in the ionosphere and magnetosphere. G. Haerendel and R. Lüst (Max-Planck-Institut für Physik und Astrophysik, Garching, West Germany), p. 213-228. 21 refs. (See A70-30079 13-13)

Auroral and polar cap electric fields from barium releases. E. M. Wescott, J. D. Stolarik, and J. P. Heppner (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 229-238. (See A70-30080 13-13)

Satellite measurements of dc electric fields in the ionosphere. D. A. Gurnett (Iowa, University, Iowa City, Iowa), p. 239-246. 23 refs. (See A70-30081 13-13)

Variations in electric fields from polar orbiting satellites. N. C. Maynard and J. P. Heppner (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 247-253. 12 refs. (See A70-30082 13-13)

Wave-particle interactions.

High frequency electrostatic waves in the magnetosphere. C. F. Kennel (California, University, Los Angeles, Calif.), R. W. Fredricks, and F. L. Scarf (TRW Systems Group, Redondo Beach, Calif.), p. 257-265. 10 refs. (See A70-30083 13-29)

Mutually interacting instabilities in the magnetosphere. J. M. Cornwall, p. 266-274. 13 refs. (See A70-30084 13-29)

Ac fields and wave particle interactions. F. L. Scarf, R. W. Fredricks, I. M. Green, and G. M. Crook (TRW Systems Group, Redondo Beach, Calif.), and C. F. Kennel (TRW Systems Group, Redondo Beach; California, University, Los Angeles, Calif.), p. 275-283. 12 refs. (See A70-30085 13-29)

Hydromagnetic waves and instabilities in the magnetosphere. A. Hasegawa (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), p. 284-291. 17 refs. (See A70-30086 13-29)

Intensity of discrete vlf emissions. R. A. Helliwell (Stanford University, Stanford, Calif.), p. 292-301. 5 refs. (See A70-30087 13-29)

Radiation belt observations.

Summary of particle populations in the magnetosphere. J. I. Vette (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 305-318. 44 refs. (See A70-30088 13-29)

Further comments concerning low energy charged particle distributions within the earth's magnetosphere and its environs. L. A. Frank (Iowa, University, Iowa City, Iowa), p. 319-331. 32 refs. (See A70-30089 13-29)

The origin and distribution of energetic electrons in the Van Allen radiation belts. J. R. Winckler (Minnesota, University, Minneapolis, Minn.), p. 332-352. 22 refs. (See A70-30090 13-29)

Recent measurements of inner belt protons. H. Elliot and R. J. Hynds (Imperial College of Science and Technology, London, England), p. 353-363. 10 refs. (See A70-30091 13-29)

Alpha particles trapped in the earth's magnetic field. S. M. Krimigis (Johns Hopkins University, Silver Spring, Md.), p. 364-379. 19 refs. (See A70-30092 13-29)

Measurements of trapped alpha-particles - L2 to L4.5. J. B. Blake and G. A. Paulikas (Aerospace Corp., Los Angeles, Calif.), p. 380-384. 6 refs. (See A70-30093 13-29)

Acceleration and motion of particles.

Introductory survey of radiation belt diffusion. C.-G. Fälthammar (Kungl Tekniska Högskolan, Stockholm, Sweden), p. 387-395. 52 refs. (See A70-30094 13-29)

Trapped protons greater than 100 keV and possible sources. D. J. Williams (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 396-409. 33 refs. (See A70-30095 13-29)

Radial diffusion of trapped particles. M. Walt (Lockheed Research Laboratories, Palo Alto, Calif.), p. 410-415. 8 refs. (See A70-30096 13-29)

On the balance between radial and pitch angle diffusion. G. Haerendel (Max-Planck-Institut für Physik und Astrophysik, Garching, West Germany), p. 416-428. 14 refs. (See A70-30097 13-29)

Summary.

Panel report. M. Walt (Lockheed Research Laboratories, Palo Alto, Calif.), p. 431-441. (See A70-30098 13-29)

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A70-30077 * Fluctuations in the distant geomagnetic field during substorms - ATS 1. Paul J. Coleman, Jr. and Robert L. McPherron (California, University, Los Angeles, Calif.). In: Particles and fields in the magnetosphere; Summer Advanced Study Institute, Symposium, University of California, Santa Barbara, Calif., August 4-15, 1969, Proceedings. (A70-30058 13-29) Symposium supported by the U.S. Army, the Defense Atomic Support Agency, the Lockheed Aircraft Corp., the U.S. Navy, and the University of California. Edited by B. M. McCormac. Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 17), 1970, p. 171-194. 15 refs. Grant No. NGR-05-007-004.

Analysis of magnetometer data from the ATS 1 spacecraft in order to characterize the substorm-type variations of the geomagnetic field at a geocentric distance of 6.6 earth radii. Relatively abrupt recoveries of the H component (from less than the quiet day average toward the quiet day average) were often recorded when the spacecraft was in the night sector. Each such recovery was accompanied by a negative bay at local midnight. However, the inverse is not true - i.e., negative bays occurred near local midnight without an accompanying recovery in H. T.M.

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A70-30090 * **The origin and distribution of energetic electrons in the Van Allen radiation belts.** J. R. Winckler (Minnesota, University, Minneapolis, Minn.). In: Particles and fields in the magnetosphere; Summer Advanced Study Institute, Symposium, University of California, Santa Barbara, Calif., August 4-15, 1969, Proceedings. (A70-30058 13-29) Symposium supported by the U.S. Army, the Defense Atomic Support Agency, the Lockheed Aircraft Corp., the U.S. Navy, and the University of California. Edited by B. M. McCormac. Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 17), 1970, p. 332-352. 22 refs. Grant No. NGL-24-005-008.

Discussion of some new results on the injection and distribution of the energetic electron component in the Van Allen radiation belts as a result of magnetic storms. The results described were obtained from magnetic deflection electron spectrometers carried in the OGO 1 and OGO 3 satellites in elliptical orbits penetrating both the inner and outer zone regions and in the ATS 1 geostationary orbit satellite in the outer zone. Correlations with ground based magnetic and auroral measurements, as well as with observations from high-altitude balloons have contributed to the interpretation of the results described. Special attention is given to long-term variations of the inner zone and inner zone injection characteristics, as well as to substorm correlated electron increases in the outer radiation belt and acceleration of electrons near midnight. M.V.E.

c29 110400 19

A70-31138 **Global weather prediction: The coming revolution.** Edited by Bruce Lusignan and John Kiely (Stanford University, Stanford, Calif.). New York, Holt, Rinehart and Winston, Inc., 1970. 316 p. $15.

Contents:

Preface. B. Lusignan and J. Kiely (Stanford University, Stanford, Calif.), p. v, vi.

Introduction, p. 3-6.

Goals.

An overview. T. Malone (Travelers Insurance Co., Hartford, Conn.), p. 8-17. (See A70-31139 14-34)

The world weather program. R. Hallgren (ESSA, Office of World Weather Systems), p. 18-34. (See A70-31140 14-34)

The analog and weather-type methods of weather forecasting. R. Elliott (North American Weather Consultants, Santa Barbara, Calif.), p. 36-44. (See A70-31141 14-20)

Benefits.

Costs and benefits of weather prediction. J. C. Thompson (San Jose State College, San Jose, Calif.), p. 46-54. (See A70-31142 14-34)

Benefit analysis of a global weather prediction network, p. 56-64. (See A70-31143 14-20)

Components of the satellite system.

Communication satellites. H. Rosen (Hughes Aircraft Co., Los Angeles, Calif.), p. 66-81. (See A70-31144 14-31)

Gravity-gradient satellites of the ATS program. E. Marriott (Hughes Aircraft Co., Communication Satellite Systems Laboratory), p. 82-99. (See A70-31145 14-31)

Solar-cell power supplies for weather-balloon and satellite systems. K. Winsor (Electro-Optical Systems, Inc., Pasadena, Calif.), p. 100-118. (See A70-31146 14-03)

Nuclear power supplies. W. Homeyer (General Dynamics Corp., San Diego, Calif.), p. 120-130. (See A70-31147 14-22)

Operative weather satellite systems.

The TIROS weather satellites. A. Schnapf (RCA, Princeton, N.J.), p. 132-166. (See A70-31148 14-31)

The Nimbus satellite system. S. Weiland (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 168-185. (See A70-31149 14-31)

The spin cloud camera. V. Suomi (Wisconsin, University, Madison, Wis.), p. 186-201. (See A70-31150 14-14)

The atmospheric models.

A six-level model of the atmosphere. C. Leith (National Center for Atmospheric Research, Boulder, Colo.), p. 204-219. (See A70-31151 14-13)

The four basic requirements for numerical weather prediction. Y. Mintz (California, University, Los Angeles, Calif.; Tel Aviv University, Tel Aviv, Israel), p. 220-231. (See A70-31152 14-20)

The second stream.

The GHOST free-floating balloon system. S. Ruttenberg (National Center for Atmospheric Research, Boulder, Colo.), p. 234-252. (See A70-31153 14-20)

The EOLE experiment. P. Morel (Paris, Université, Paris, France), p. 254-263. (See A70-31154 14-20)

The use of lidar for weather observation. M. Ligda, p. 264-283. (See A70-31155 14-20)

Remote sensors. J. O'Brien, p. 284-301. (See A70-31156 14-20)

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A70-31145 **Gravity-gradient satellites of the ATS program.** Edwin Marriott (Hughes Aircraft Co., Communication Satellite Systems Laboratory). In: Global weather prediction: The coming revolution. (A70-31138 14-20) Edited by Bruce Lusignan and John Kiely. New York, Holt, Rinehart and Winston, Inc., 1970, p. 82-99.

The ATS program grew out of the earlier SYNCOM satellites discussed above by Rosen, and as its name implies, serves as an orbiting platform for a variety of experiments, among which is the spin-scan cloud camera described in Part 5 by Suomi. Marriott begins with a general discussion of the ATS program and then concentrates on the gradient-stabilized vehicles and the problems associated with this particular form of stabilization. (Author)

c31 090000 60

A70-31146 **Solar-cell power supplies for weather-balloon and satellite systems.** Keith Winsor (Electro-Optical Systems, Inc., Pasadena, Calif.). In: Global weather prediction: The coming revolution. (A70-31138 14-20) Edited by Bruce Lusignan and John Kiely. New York, Holt, Rinehart and Winston, Inc., 1970, p. 100-118.

Having discussed generally the SYNCOM, Early Bird, and the Applications Technology Satellite Systems in the two previous articles, we now turn to a more detailed investigation of power supplies for the satellite and balloon systems. (Author)

c04 020200 04

A70-31150 **The spin cloud camera.** Verner Suomi (Wisconsin, University, Madison, Wis.). In: Global weather prediction: The coming revolution. (A70-31138 14-20) Edited by Bruce Lusignan and John Kiely. New York, Holt, Rinehart and Winston, Inc., 1970, p. 186-201.

In December 1966, the spin-scan camera designed by Suomi and Parent was put into a synchronous orbit over the Pacific. The camera takes cloud-cover pictures every 20 min of a large portion of the earth. From these stationary snapshots Suomi has made motion pictures which show the changes in the cloud patterns and the development of storm systems. Such a visual record is very useful in working toward and understanding of the global circulation patterns. Suomi ends Part 5 with a discussion of the spin scan cloud camera which is being flown on the ATS (Applications Technology Spacecraft) series of satellites. (Author)

c14 080100 35

A70-31680 # **Air density at heights near 180 km in 1968 and 1969.** D. G. King-Hele and Doreen M. C. Walker (Royal Aircraft Establishment, Farnborough, Hants., England). *COSPAR, Plenary Meeting, 13th, Leningrad, USSR, May 20-29, 1970, Paper.* 11 p. 10 refs.

The satellite 1967-31A (ATS 2), launched in April 1967, was unusual in having a low perigee (180 km initially), a near-constant cross-sectional area, and a lifetime of more than two years. We have analyzed its orbit to obtain 212 values of air density, mainly at heights between 160 and 190 km, during 14 months of high solar activity between July 4, 1968 and September 2, 1969 (when the satellite decayed). In general, the air density exhibits only a weak dependence on solar activity, but the link between density and geomagnetic disturbances is obvious throughout: the two strongest geomagnetic storms, on November 1, 1968 and May 15, 1969, are accompanied by increases in density of 30 and 70% respectively. When such short-term variations are ignored, the underlying trend is a semiannual variation in density, with maxima in October-November 1968 and March 1969, and minima in July 1968, January 1969, and July-August 1969. The July minima are deeper than the January minimum, and the average density at the maxima exceeds that at the minima by a factor of 1.32. (Author)

c13 080000 23

A70-32543 # **Spatial scale of geomagnetic phenomena on January 13 and 14, 1967 (O skali przestrzennej zjawisk geomagnetycznych w dniach 13-14 Stycznia 1967 roku).** Mieczysław Kozłowski (Warszawa, Uniwersytet, Warsaw, Poland) and Waldemar Kraiński (Polska Akademia Nauk, Zakład Geofizyki, Warsaw, Poland). *Acta Geophysica Polonica,* vol. 18, no. 1, 1970, p. 65-71. In Polish.

Investigation of the temporal behavior of geomagnetic disturbances on January 13 and 14, 1967 from the viewpoint of classifying them as DCF, DR, or DP types with the associated spatial scales. The initial phase is shown to have a component which does not exhibit DCF features. The main phase at mid-latitudes contains features similar to bay disturbances which coincide with increased particle flux intensities recorded by the ATS 1 satellite. The latitudinal distribution of the phenomena does not permit their designation as polar disturbances (DP). T.M.

c13 100500 56

A70-33701 **Technology today and tomorrow; Canaveral Council of Technical Societies, Space Congress, 7th, Cocoa Beach, Fla., April 22-24, 1970, Proceedings. Volume 1.** Edited by T. H. Hanrahan (Aerospace Corp., El Segundo, Calif.). Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1970. 621 p. Price of two volumes, $20.

Contents:

Future mechanical space vehicle systems.

Space shuttle aerodynamic development studies. J. E. Butsko (General Dynamics Corp., San Diego, Calif.), p. 1-1 to 1-14. (See A70-33702 16-31)

Design, fabrication and test of a boron wing structure. A. August, A. London, and W. Ludwig (Grumman Aerospace Corp., Bethpage, N.Y.), p. 1-15 to 1-27. (See A70-33703 16-32)

Separation dynamics of multibody clusters of hinged and/or linked lifting-entry vehicles. M. J. Hurley, Jr. and M. J. Lanfranco (General Dynamics Corp., San Diego, Calif.), p. 1-29 to 1-52. 8 refs. (See A70-33704 16-31)

Cobalt-base alloys in aerospace. F. R. Morral (Battelle Memorial Institute, Columbus, Ohio), p. 1-53 to 1-63. 24 refs. (See A70-33705 16-17)

Space shuttle booster configuration features. R. A. Lynch (General Dynamics Corp., San Diego, Calif.), p. 1-65 to 1-79. (See A70-33706 16-31)

Astronaut maneuvering research vehicle. J. R. Tewell (Martin Marietta Corp., Denver, Colo.), p. 1-81 to 1-88. (See A70-33707 16-05)

Earth resources satellites application.

Practical applications of sequential pattern recognition techniques. R. Newman and B. Reisine (Purdue University, Lafayette, Ind.), p. 2-1 to 2-9.

Some shifting relationships between the user community and the Earth Resources Program. A. H. Muir (Earth Satellite Corp., Washington, D.C.), p. 2-11 to 2-14. 6 refs. (See A70-33708 16-34)

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Automated systems for information retrieval in education. W. K. Cumming (Brevard Junior College, Cocoa, Fla.), p. 3-1 to 3-4.

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A large scale computer-based educational system for the seventies. D. L. Bitzer and D. Skaperdas (Illinois, University, Urbana, Ill.), p. 3-15 to 3-26.

Sensitivity techniques in learning. M. I. Veiner (Florida State University, Patrick AFB, Fla.), p. 3-27 to 3-34.

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Simulation of health manpower requirements. F. D. Kennedy (Research Triangle Institute, Research Triangle Park, N.C.), p. 4-1 to 4-10.

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Off-duty concepts for long duration space missions. E. W. Karnes, L. A. Loudis, J. D. Thomas (Martin Marietta Corp., Denver, Colo.), and T. Spiritoso (Temple University, Philadelphia, Pa.), p. 4-15 to 4-27. (See A70-33709 16-05)

The interaction of life sciences and engineering technologies in man/system integration. W. W. Murphy, J. R. Swink (General Electric Co., Daytona Beach, Fla.), and E. J. McLaughlin (NASA, Office of Manned Space Flight, Washington, D.C.), p. 4-29 to 4-32.

Future electronic/electrical space vehicle systems.

Optical communications using gallium arsenide injection lasers. J. A. Boyd and R. H. Nelson (Radiation, Inc., Melbourne, Fla.), p. 5-1 to 5-10. 6 refs. (See A70-33710 16-07)

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Selection and preliminary design of light-weight, low-cost X-band aircraft antennas for defense satellite communications. K. G. Schroeder (TRW Systems Group, Redondo Beach, Calif.), p. 5-23 to 5-29. (See A70-33712 16-07)

Oceanographic projects.

Forecast of world ocean objectives. L. V. Stover (Oceans General, Inc., Miami, Fla.), p. 6-1 to 6-4.

The use of satellite cloud photography to infer oceanographic phenomena. J. R. Greaves and C. J. Bowley (Allied Research Associates, Inc., Concord, Mass.), p. 6-5 to 6-15. 16 refs. (See A70-33713 16-13)

Astronaut restraints for the aquanaut. G. W. O'Neil, Jr. (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.), p. 6-17 to 6-26.

Fluidic technology and some recent applications to space and oceanography. M. Rountree and W. J. Westerman, Jr. (McDonnell Douglas Astronautics Co., Titusville, Fla.), p. 6-27 to 6-47. 33 refs. (See A70-33714 16-03)

Trade off analysis of pulse compression for a satellite radar altimeter. C. J. Mundo (Raytheon Co., Wayland, Mass.), p. 6-49 to 6-64. 7 refs. (See A70-33715 16-14)

Impact of aerospace technology on future ocean systems. D. P. Germeraad (Lockheed Missiles and Space Co., Sunnyvale, Calif.), p. 6-65 to 6-81.

Manufacturing processes in space.

Unique manufacturing processes in space environment. H. F. Wuenscher (NASA, Marshall Space Flight Center, Huntsville, Ala.), p. 7-1 to 7-10. 8 refs. (See A70-33716 16-11)

Techniques and examples for zero-g melting and solidification processes. R. T. Frost (General Electric Co., Valley Forge, Pa.), p. 7-11 to 7-21. 35 refs. (See A70-33717 16-15)

Selected examples for space manufacturing processes, facilities, and experiments. W. H. Steurer (General Dynamics Corp., San Diego, Calif.), p. 7-23 to 7-53. 9 refs. (See A70-33718 16-15)

Chemical and biochemical space manufacturing. C. L. Kober (Martin Marietta Corp., Denver, Colo.), p. 7-55 to 7-64. 9 refs. (See A70-33719 16-15)

Positioning and handling in weightless environment. L. H. Berge (NASA, Marshall Space Flight Center, Huntsville, Ala.), p. 7-65 to 7-72. 13 refs. (See A70-33720 16-15)

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X-ray and gamma-ray astronomy at the turning point. L. E. Peterson (California, University, La Jolla, Calif.), p. 8-1 to 8-26. 40 refs. (See A70-33721 16-30)

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Viewpoints on systems engineering.

Application of turn-key construction to industrialized urban housing in Missouri. K. P. Buchert, W. W. Milner (Missouri, University, Columbia, Mo.), and H. Rubey, p. 9-1 to 9-3.

A total-system view of environmental management. W. L. Dowdy, G. E. Clark, and R. G. Crum (North American Rockwell Corp., Downey, Calif.), p. 9-5 to 9-22.

Systems engineering management: Whose system Whose management. R. G. Relyea (Better Management Associates, Inc., Satellite Beach, Fla.), p. 9-23 to 9-27.

An application of new systems and technology to flight management avionics. A. A. Paris (RCA, Moorestown, N.J.), p. 9-29 to 9-49. (See A70-33724 16-09)

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New frontiers in surface transportation. J. M. Beggs (U.S. Department of Transportation, Washington, D.C.), p. 10-1 to 10-4.

The automobile's role in the future. J. L. Hult (RAND Corp., Santa Monica, Calif.), p. 10-5 to 10-9.

Florida transportation - Where to from here. J. Hunter (U.S. Department of Transportation, Tallahassee, Fla.), p. 10-11 to 10-14.

Tubeflight - A review. W. B. Brower, Jr. (Rensselaer Polytechnic Institute, Troy, N.Y.), p. 10-15 to 10-45.

Communication and surveillance for ground transportation. D. E. Magnus, M. Abele, and H. Medecki (General Applied Science Laboratories, Inc., Westbury, N.Y.), p. 10-47 to 10-66.

Meteorological projects.

A satellite analysis of twin tropical cyclones in the western Pacific. J. L. Cox and G. Jager (U.S. Weather Bureau, Washington, D.C.), p. 11-1 to 11-18.

The hurricane modification project - Past results and future prospects. R. C. Gentry (ESSA, Miami, Fla.), p. 11-19 to 11-28.

Satellite-observed sunglint patterns - Unusual dark patches. C. J. Bowley (Allied Research Associates, Inc., Concord, Mass.), p. 11-29 to 11-39. 11 refs. (See A70-33725 16-13)

Future applications of electronics.

Interactive computer graphics - An advanced computer technology. G. V. J. Yuscavage (Boeing Co., Huntsville, Ala.), p. 12-1 to 12-7. (See A70-33726 16-08)

Interactive computer graphics applied to continuous systems simulation. B. J. Schroer (Boeing Co., Huntsville, Ala.), p. 12-9 to 12-17. 13 refs. (See A70-33727 16-08)

Image enhancement techniques. D. B. Gennery (RCA, Patrick AFB, Fla.), p. 12-19 to 12-36.

Case study in digital simulation. B. L. Capehart (Florida, University, Orlando, Fla.) and R. M. Strong (Martin Marietta Corp., Orlando, Fla.), p. 12-37 to 12-45. 9 refs. (See A70-33728 16-08)

A new multiple access technique for use with satellite networks. E. Thomas (Page Communications Engineers, Inc., Washington, D.C.), p. 12-47 to 12-51. (See A70-33729 16-07)

Broadcast opportunities with satellites and CATV, and their control in the public interest. J. L. Hult (RAND Corp., Santa Monica, Calif.), p. 12-53 to 12-60.

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A70-33721 * X-ray and gamma-ray astronomy at the turning point. Laurence E. Peterson (California, University, La Jolla, Calif.). In: Technology today and tomorrow; Canaveral Council of Technical Societies, Space Congress, 7th, Cocoa Beach, Fla., April 22-24, 1970, Proceedings. Volume 1. (A70-33701 16-30) Edited by T. H. Hanrahan. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1970, p. 8-1 to 8-26. 40 refs. Grant No. NGR-05-005-003; Contract No. NAS 5-3177.

Since 1962, approximately 40 point X-ray sources have been isolated, only about six of which have been identified with known radio or optical objects or have been studied over the 1-300 keV energy range. Data on the X-ray fluxes, positions, sizes and spectra of these sources have provided new information of considerable astrophysical significance and indicate that the exploratory stage of X-ray astronomy is now over. At higher energies, confirmation of a diffuse flux to 6 MeV and the successful detection of 100 MeV gamma-rays from the galaxy indicate the necessity of further exploratory experiments. Satellite borne instruments on a larger scale than previously implemented will be needed to take advantage of the unique opportunity now available for advancing high-energy astrophysics. (Author)

A70-33725 **Satellite-observed sunglint patterns - Unusual dark patches.** Clinton J. Bowley (Allied Research Associates, Inc., Concord, Mass.). In: Technology today and tomorrow; Canaveral Council of Technical Societies, Space Congress, 7th, Cocoa Beach, Fla., April 22-24, 1970, Proceedings. Volume 1. (A70-33701 16-30) Edited by T. H. Hanrahan. Cape Canaveral, Fla., Canaveral Council of Technical Societies, 1970, p. 11-29 to 11-39. 11 refs.

Anomalous dark areas in sunglint patterns are frequently observed in the Applications Technology Satellite (ATS) photography. These dark areas appear to be caused by relatively calm surface conditions against a background of higher sea states. Evidence of cold water temperatures suggests the presence of upwelling. These sightings may thus be of importance to the fishing industry. (Author)

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A70-33830 **Comparison of changes in total electron content along three paths.** J. A. Klobuchar and C. Malik (USAF, Ionospheric Physics Laboratory, Bedford, Mass.). *Nature*, vol. 226, June 20, 1970, p. 1113, 1114.

Measurement of the total electron content of the ionosphere during the Mar. 7, 1970, solar eclipse along paths toward three geostationary satellites from a ground station. The total electron content was determined by monitoring the amount of twist of the polarization of linear, attitude-stable, vhf radio waves transmitted from the geostationary satellites Early Bird, ATS-3, and ATS-5. The three total electron content curves for the eclipse day are nearly identical, with the exception that the recovery along the Early Bird path was not as great as along the other two paths. The path from the Early Bird satellite was furthest east, or latest in local time, and could be expected to recover least of the three paths because of the lower solar elevation angles along this path. A.B.K.

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A70-33831 **Observations of ionospheric electron content during the March 7, 1970 solar eclipse.** O. G. Almeida and A. V. da Rosa (Stanford University, Stanford, Calif.). *Nature*, vol. 226, June 20, 1970, p. 1115, 1116.

Results of Faraday rotation measurements of the vhf transmissions from the geostationary satellites ATS-1 and ATS-3 carried out at various observatories in the United States during the Mar. 7, 1970, eclipse. A bite-out in electron content of about 30% is observed for stations where the bulk of the ionosphere was totally eclipsed (Eastville, Va., and two others), while the bite-out at stations away from the path of totality was not detectable. From the measurements of electron content at Eastville both the columnar electron content and its time derivative were calculated. As expected, near the end of totality the rate of change in the columnar content reached its largest negative value. A.B.K.

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A70-33835 **Response of the F-region ionosphere to a solar eclipse.** B. J. Flaherty, H. R. Cho, and K. C. Yeh (Illinois, University, Urbana, Ill.). *Nature*, vol. 226, June 20, 1970, p. 1121-1123. 8 refs. USAF-supported research.

Discussion of preliminary results of a determination of the integrated electron density in the ionosphere from measurements of the Faraday rotation of linearly polarized signals from the geostationary satellite ATS 3 at 137 MHz during the March 7, 1970 solar eclipse. The analysis is limited to data obtained at Norfolk, Virginia. Graphs showing the eclipse day and control day variations in the electron content, and the computed variations in the critical frequency of the F2 layer on an eclipse day are presented and discussed. V.P.

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A70-33836 **Possible detection of atmospheric gravity waves generated by the solar eclipse.** M. J. Davis and A. V. da Rosa (Stanford University, Stanford, Calif.). *Nature*, vol. 226, June 20, 1970, p. 1123.

Experimental verification of a suggestion made by Chimonas and Hines (1970) that the cool shadow of the moon, moving at supersonic speed across the atmosphere of the earth during a solar eclipse, should generate gravity waves which would build up into a bow wave. Confirmation of this suggestion was obtained by studying the columnar electron content of the ionosphere by measuring the Faraday rotation angle of the vhf transmissions from the geostationary satellites ATS 1 and ATS 3. A graph showing the fluctuations (corresponding to the gravity waves due to the eclipse) in electron content along the Stanford to ATS 1 and Stanford to ATS 3 paths on Mar. 7, 1950 is presented. V.P.

c13 100500 66

A70-33926 * # **Exhaust plume convective heat transfer measurements from a space firing of the ATS rocket motor.** R. W. Fehr and R. J. Wensley (Hughes Aircraft Co., El Segundo, Calif.). *American Institute of Aeronautics and Astronautics, Thermophysics Conference, 5th, Los Angeles, Calif., June 29-July 1, 1970, Paper 70-843.* 8 p. 10 refs. Members, $1.00; nonmembers, $1.50. Contract No. NAS 5-3823.

Data gathered during the in-flight firing of the ATS-C (Advanced Technology Satellite) apogee rocket motor to verify the exhaust plume heating analysis of the ATS VHF whip antennas are presented. From the temperature data obtained from two cylindrical calorimeters, convective heating rates are derived for comparison with analytical predictions. This comparison shows the measured data to be 40 to 50 percent less than the heating rates predicted with the analytical models used in the antenna analysis. A brief discussion of the nozzle flow analysis, the method of characteristics solution of the plume expansion, and the heating rate calculations are given, including the limiting assumptions made in each. An improved correlation between test and prediction is shown when a correction for exhaust product chemical composition is made to the heating rate analysis. Although anomolous behavior of one calorimeter prevented the positive measurement of plume radiation, a tentative conclusion is made that plume radiation was less than that predicted for a uniform radiosity. (Author)

c33 030303 01

A70-34101 **Aerospace mechanisms. Part A - General Applications.** Edited by G. G. Herzl (Lockheed Missiles and Space Co., Sunnyvale, Calif.). San Francisco, J. W. Stacey, Inc. (Aerospace Mechanisms Series. Volume 1), 1970. 455 p. $27.50.

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c31 020000 25

A70-34115 # **Despinning the ATS satellite.** J. P. Dallas (Hughes Aircraft Co., Los Angeles, Calif.). In: Aerospace mechanisms. Part A - General applications. (A70-34101 16-31) Edited by G. G. Herzl. San Francisco, J. W. Stacey, Inc. (Aerospace Mechanisms Series. Volume 1), 1970, p. 139-145.

Description of the design and performance of a two-stage yo-yo despin system operated with a nutation damper to provide adequate despin accuracy for an ATS gravity-gradient stabilized synchronous satellite. The dimensional elements of this despin system are shown to be noncritical when compared with other systems, such as a single-stage yo-yo, and all-gas-jet despin system, a free-wheeling single-stage yo-yo, and combinations of single-stage yo-yo with inertia-wheel system or gas-jet system. This property of this ATS despin mechanism is expected to influence favorably reliability and cost, because 'the margin of predicted performance over required limits can be made comfortably large. The critical thermal problems and the high-vacuum bearing problems associated with such designs are solved with large margins of safety by using this two-stage yo-yo despin mechanism. V.Z.

c31 020800 06

A70-34132 # **A flow-control valve without moving parts.** W. L. Owens, Jr. (Lockheed Missiles and Space Co., Sunnyvale, Calif.). In: Aerospace mechanisms. Part A - General applications. (A70-34101 16-31) Edited by G. G. Herzl. San Francisco, J. W. Stacey, Inc. (Aerospace Mechanisms Series. Volume 1), 1970, p. 291-296.

The design and operation of a 'valveless' flow-control device that has been flown on Application Technology Satellites A and D are described. A considerable increase in reliability over a mechanical valve is possible in applications where response times on the order of minutes are acceptable at thrust levels below .01 lbf. Theoretical performance curves for flow termination time and mass loss rate are presented for several candidate subliming materials. Good agreement between calculated and experimental values of flow termination time and mass loss rates is demonstrated. (Author)

c03 020000 26

A70-34145 * # **Unique mechanism features of ATS stabilization boom packages.** R. A. Lohnes, D. N. Matteo (GE Valley Forge Space Technology Center, King of Prussia, Pa.), and E. R. Grimshaw (Spar Aerospace Products, Ltd., Toronto, Canada). In: Aerospace mechanisms. Part A - General applications. (A70-34101 16-31) Edited by G. G. Herzl. San Francisco, J. W. Stacey, Inc. (Aerospace Mechanisms Series. Volume 1), 1970, p. 399-407. Contract No. NAS 5-9042.

Description of the unique mechanism of the motorized primary boom packages and the damper-borne self-erecting secondary boom package utilized on the Applications Technology Satellite (ATS) gravity-gradient experiment. Although ATS-2 attained a highly elliptical orbit, instead of the planned, medium-altitude circular orbit, all the primary and secondary booms uncaged and extended to full width on command. Subsequent scissor operations of the primary booms to both extreme limits were accomplished successfully, one four months after launch, the other six months after launch. F.R.L.

c03 090000 61

A70-34149 # **Mechanical design of the spin-scan cloud camera.** D. T. Upton (Santa Barbara Research Center, Goleta, Calif.). In: Aerospace mechanisms. Part A - General applications. (A70-34101 16-31) Edited by G. G. Herzl. San Francisco, J. W. Stacey, Inc. (Aerospace Mechanisms Series. Volume 1), 1970, p. 435-441.

The development and design of two spin-scan cloud cameras, successfully operating at a 23,000-statute-mile synchronous altitude, are described. The first, a single-color camera (black and white pictures), was launched from Cape Kennedy on Dec. 6, 1966. This camera is still in daily use and has provided many thousands of high-resolution pictures. The second, a multicolor camera, was launched on Nov. 6, 1967. Use of the satellite spin, combined with a precision step mechanism to obtain pictures of the earth's cloud cover, is described in detail. (Author)

c14 080100 36

A70-35930 * # **A study of cloud distributions using reflected radiance measurements from the ATS satellites.** Alfred J. Stamm and Thomas H. Vonder Haar (Wisconsin, University, Madison, Wis.). *Journal of Applied Meteorology,* vol. 9, June 1970, p. 498-507. 8 refs. Contract No. NAS 5-11542.

Reflected radiance measurements from the multicolor spin-scan cloud camera on Applications Technology Satellite III are used to determine the percentages of selected areas of the earth that are cloud-free. The areas chosen are meteorologically active and represent common cloud patterns. Use of several data unit sizes shows how the observed percent clear area decreases with decreasing spatial resolution of a simulated sensor. Methods of determining a cloud-no cloud threshold are discussed. The change of cloud cover over a period of a few hours is examined. It is found that clouds smaller than the instantaneous field of view are often not recognized as clouds and therefore tend to affect the interpretation of spacecraft camera measurements. The results of this investigation are used to suggest the optimum spatial resolution for radiometrically sounding the atmosphere from a geosynchronous satellite using an instrument described in the report. (Author)

c20 080100 46

A70-36004 **Penetration of solar protons into the magnetosphere and magnetotail.** L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), M. D. Montgomery, and S. Singer (California, University, Los Alamos, N. Mex.). *Journal of Geophysical Research,* vol. 75, July 1, 1970, p. 3729-3734. 25 refs. ARPA-AEC-supported research.

Three sets of satellite measurements are used to compare solar proton fluxes in the magnetotail, in the outer magnetosphere, at synchronous altitude, and in interplanetary space. Comparisons of the interplanetary and magnetosphere proton fluxes show that outer magnetosphere disturbances play a strong role in the initial access of near-90 deg pitch angle protons to synchronous altitude. One comparison of the magnetotail and synchronous altitude fluxes suggests that the synchronous altitude fluxes may not always result from a scattering of the protons in from the tail. The interplanetary magnetotail proton comparisons further confirm the results of Montgomery and Singer (1969), who found that delays in the proton access to the magnetotail were always present. (Author)

c29 110300 30

A70-36010 * **The acceleration and precipitation of Van Allen outer zone energetic electrons.** George K. Parks (Minnesota, University, Minneapolis, Minn.). *Journal of Geophysical Research,* vol. 75, July 1, 1970, p. 3802-3816. 31 refs. NSF Grant No. GA-487; Contract No. NAS 5-9542.

Discussion of the experimental results of a particle correlation experiment conducted between the magnetosphere and the auroral zone taking into consideration also a theoretical interpretation of the experimental results. It is found that the precipitation time profiles and increases of outer zone energetic electron fluxes are extremely well correlated. The enhancement of electron fluxes observed at synchronous altitudes is predominantly in the 50- to 150-keV energies. The variations observed in higher energy electron fluxes are generally correlated with variations in the local magnetic field and hence can be accounted for by adiabatic theories. Energy spectrums of the equatorial and auroral zone electrons are similar, with typical e folding energies of about 20 keV for both regions. G.R.

c29 110400 29

A70-36025 * **Magnetic fluctuations during magnetospheric substorms. I.** Robert L. McPherron and Paul J. Coleman, Jr. (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 75, July 1, 1970, p. 3927-3931. 5 refs. Grant No. NGR-05-007-004.

Description of ATS-1 observations of large-amplitude irregular fluctuations in the magnetic field at 6.6 R sub E during the expansion phase of magnetospheric substorms. The fluctuations are very irregular, with no apparent period, and are most predominant in the H component (parallel to the earth's rotation axis). The association of the fluctuations with the recovery in the H component suggests that this is a turbulent process in which compressional waves play an important role. F.R.L.

c30 110800 49

A70-37471 **Intercorrelated satellite observations related to solar events; European Space Research Organization, Annual ESLAB/ESRIN, Symposium, 3rd, Noordwijk, Netherlands, September 16-19, 1969, Proceedings.** Edited by V. Manno and D. E. Page (ESRO, European Space Research and Technology Centre, Noordwijk, Netherlands). Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 19), 1970. 638 p. $38.20.

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Foreword. D. E. Page and V. Manno (ESRO, Noordwijk, Netherlands), p. V.

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Solar particles and electromagnetic radiation.

High energy flare radiation. C. De Jager (Astronomical Institute, Utrecht, Netherlands), p. 25-33. 16 refs. (See A70-37473 19-29)

Satellite observations of solar cosmic rays. F. B. McDonald (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 34-52. 20 refs. (See A70-37474 19-29)

Propagation of solar and galactic cosmic rays of low energies in interplanetary medium. S. N. Vernov, A. E. Chudakov, P. V. Vakulov, E. V. Gorchakov, N. N. Kontor, Iu. I. Logachev, G. P. Liubimov, N. V. Pereslegina, and G. A. Timofeev (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR), p. 53-89. 28 refs. (See A70-37475 19-29)

Particle event forecasting. Z. Švestka (Československá Akademie Věd, Ondřejov, Czechoslovakia), p. 90-101. 48 refs. (See A70-37476 19-29)

Proposed solar proton event classification system. D. F. Smart and M. A. Shea (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 102-107. 6 refs. (See A70-37477 19-29)

Solar wind variations during and after solar events.

Solar wind disturbances associated with solar activity. A. J. Hundhausen (California, University, Los Alamos, N. Mex.), p. 111-129. 27 refs. (See A70-37478 19-29)

Variations of solar wind fluxes observed on board Venera-5 and Venera-6 from January 21 to March 21 1969 and pulsations of the earth's electromagnetic field caused by these variations. K. I. Gringauz, V. A. Troitskaia, E. K. Solomatina, and R. V. Shchepetnov (Akademiia Nauk SSSR, Radiotekhnicheskii Institut and Institut Fiziki Zemli, Moscow, USSR), p. 130-139. 12 refs. (See A70-37479 19-29)

Magnetic field variations in interplanetary space. J. M. Wilcox (California, University, Berkeley, Calif.), p. 140-151. 23 refs. (See A70-37480 19-29)

Bow shock variations following solar events.

Plasma measurements across the bow shock and in the magnetosheath. A. J. Hundhausen (California, University, Los Alamos, N. Mex.), p. 155-169. 29 refs. (See A70-37481 19-29)

Interaction of solar energetic particles with the earth's bow shock and magnetopause. S. Singer (California, University, Los Alamos, N. Mex.), p. 170-180. 13 refs. (See A70-37482 19-29)

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Magnetic and electric field changes across the shock and in the magnetosheath. F. L. Scarf, R. W. Fredricks (TRW Systems Group, Redondo Beach, Calif.), P. J. Coleman, C. F. Kennel, and C. T. Russell (California, University, Los Angeles, Calif.), p. 181-189. 10 refs. (See A70-37483 19-29)

The magnetosphere during and after solar events.

Solar particle observations over the polar caps. G. A. Paulikas, J. B. Blake, and A. L. Vampola (Aerospace Corp., El Segundo, Calif.), p. 193-204. 15 refs. (See A70-37484 19-29)

Access of solar particles to synchronous altitude. L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), p. 205-228. 29 refs. (See A70-37485 19-29)

Entry of low energy solar protons into the magnetosphere. C. O. Bostrom (Johns Hopkins University, Silver Spring, Md.), p. 229-238. 28 refs. (See A70-37486 19-29)

Trapped particle population changes associated with solar events. J. G. Roederer (Denver, University, Denver, Colo.), p. 239-250. 14 refs. (See A70-37487 19-29)

Geomagnetic storms at ATS 1. P. J. Coleman, Jr. (California, University, Los Angeles, Calif.), p. 251-279. 21 refs. (See A70-37488 19-13)

Magnetospheric electric fields. H. Völk and G. Haerendel (Max-Planck-Institut für Physik und Astrophysik, Garching, West Germany), p. 280-296. 45 refs. (See A70-37489 19-13)

The magnetotail.

Experimental observations in the magnetotail during an interplanetary disturbance. E. W. Hones, Jr. (California, University, Los Alamos, N. Mex.), p. 299-308. 22 refs. (See A70-37490 19-13)

Tearing instabilities in the magnetosphere. K. Schindler (ESRO, Frascati, Italy), p. 309-315. 10 refs. (See A70-37491 19-13)

Some ionospheric effects following solar events.

Current problems in polar-cap absorption. G. C. Reid (Colorado, University; ESSA, Boulder, Colo.), p. 319-334. 35 refs. (See A70-37492 19-13)

Interdisciplinary investigations of the auroral phenomena. I. A. Zhulin (Akademiia Nauk SSSR, Institut Zemnogo Magnetizm, Krasnaya Pakhra, USSR), p. 335-340. 6 refs. (See A70-37493 19-13)

Aspects of auroral morphology. T. N. Davis (Alaska, University, College, Alaska), p. 341-350. 32 refs. (See A70-37494 19-13)

Acceleration and precipitation of Van Allen electrons during magnetospheric substorms. G. K. Parks (Toulouse, Université, Toulouse, France), p. 351-363. 35 refs. (See A70-37495 19-13)

Satellite and rocket results for the February 25, 1969 event.

Introduction to the ESRO spacecraft ESRO-II/Iris, ESRO-I/Aurorae and HEOS-I. D. E. Page (ESRO, Noordwijk, Netherlands), p. 367-381. (See A70-37496 19-31)

Ground observations of the solar event of February 25, 1969. K. G. Lenhart (ESOC, Darmstadt, West Germany), p. 382-404. (See A70-37497 19-30)

Substorm influences on vhf continuous wave auroral backscatter. P. Czechowsky and G. Lange-Hesse (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany), p. 405-412. 12 refs. (See A70-37498 19-07)

X-ray observations between 1 and 55 A of the February 25th flare. A. C. Brinkman, W. De Graaff (Utrecht, Rijksuniversiteit, Utrecht, Netherlands), and M. L. Shaw (ESRO, Noordwijk, Netherlands), p. 413-418. (See A70-37499 19-29)

The solar particle event of February 25, 1969. P. C. Hedgecock (Imperial College of Science and Technology, London, England), p. 419-426. 6 refs. (See A70-37500 19-29)

Interplanetary magnetic field measured by Pioneer 8 during the 25 February 1969 event. F. Mariani (Roma, Università, Rome, Italy), B. Bavassano (CNR, Rome, Italy), and N. F. Ness (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 427-435. 8 refs. (See A70-37501 19-30)

Observation of solar wind discontinuities from February 24 to February 28, 1969. A. Bonetti (CNR, Florence, Italy), G. Moreno (Firenze, Università, Florence, Italy), M. Candidi, A. Egidi, V. Formisano, and G. Pizzella (CNR; Roma, Università, Rome, Italy), p. 436-447. 7 refs. (See A70-37502 19-29)

Observations of the spectra and time history of protons in interplanetary space, February 25-28, 1969. E. Barouch (CNRS, Paris; Commissariat à l'Energie Atomique, Gif-sur-Yvette, Essonne, France), J. Engelmann, M. Gros, L. Koch (Commissariat à l'Energie Atomique, Gif-sur-Yvette, Essonne, France), and P. Masse (Institut National d'Astronomie et de Gèophysique; Commissariat à l'Energie Atomique, Gif-sur-Yvette, Essonne, France), p. 448-459. 11 refs. (See A70-37503 19-29)

Solar cosmic ray increase on 25 February-5 March, 1969 according to measurements from Venus-5 and Venus-6 space probes. S. N. Vernov, N. N. Kontor, G. P. Liubimov, N. V. Pereslegina, and E. A. Chuchkov (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR), p. 460-470. 16 refs. (See A70-37504 19-29)

Low energy proton measurements in interplanetary space on board the HEOS-1 satellite. A. Balogh and R. J. Hynds (Imperial College of Science and Technology, London, England), p. 471-477. 6 refs. (See A70-37505 19-29)

The solar particle event of 25 February, 1969. A. R. Engel (Imperial College of Science and Technology, London, England), p. 478-485. 9 refs. (See A70-37506 19-29)

Observations recorded by the Leeds University cosmic ray detector on board the ESRO II spacecraft during the solar flare of February 25th, 1969. R. Jakeways, P. L. Marsden, and I. R. Calder (Leeds University, Leeds, England), p. 486-491. (See A70-37507 19-29)

ESRO 1 satellite observations of 1-30 MeV protons during the 25th February 1969 solar event. G. R. Thomas, R. Dalziel, and W. Donaldson (Science Research Council, Slough, Bucks., England), p. 492-498. 11 refs. (See A70-37508 19-29)

Rocket measurements of protons and alpha-particles during the February 25, 1969 solar event. G. Wibberenz and M. Witte (Kiel, Neue Universität, Kiel, West Germany), p. 499-507. 25 refs. (See A70-37509 19-29)

Rocket observations of protons and alpha-particles at Andøya after the solar flares of 24th-25th February 1969. H. F. Van Beek and G. A. Stevens (Utrecht, Rijksuuniversiteit, Utrecht, Netherlands), p. 508-514. (See A70-37510 19-29)

Electron density observations during the PCA event of 25 February 1969. M. Jespersen (Danish Space Research Institute, Lyngby, Denmark), J. Trøim, and B. Landmark (Forsvarets Forskningsinstitutt, Kjeller, Norway), p. 515-519. 6 refs. (See A70-37511 19-29)

Rocket-borne D-region probe measurements. J. Murdin and T. S. Bowling (University College, Dorking, Surrey, England), p. 520-523. 5 refs. (See A70-37512 19-13)

Electron density measurements in the thermal plasma of the magnetosphere using a Langmuir probe. R. Freeman, K. Norman, and A. P. Willmore (University College, London, England), p. 524-534. 5 refs. (See A70-37513 19-13)

Ionospheric measurements by the ESRO-I satellite during the February 25th 1969 solar proton event. W. J. Raitt (University College, Dorking, Surrey, England), p. 535-548. (See A70-37514 19-13)

ESRO I satellite observations of 45-450 keV electrons during the period 24th February-3rd March 1969. G. R. Thomas, P. A. Smith, and R. Dalziel (Science Research Council, Slough, Bucks., England), p. 549-556. 9 refs. (See A70-37515 19-29)

ESRO I measurements of low-energy auroral particles from February 23 to March 2, 1969. W. Riedler (Kiruna Geofysiska Observatorium, Kiruna, Sweden), p. 557-566. (See A70-37516 19-13)

An observation of the February 26, 1969 interplanetary shock wave. A. J. Hundhausen, S. J. Bame, and M. D. Montgomery (California, University, Los Alamos, N. Mex.), p. 567-570. (See A70-37517 19-30)

The association of energetic storm particles with interplanetary shock waves. S. Singer (California, University, Los Alamos, N. Mex.), p. 571-582. 20 refs. (See A70-37518 19-29)

GM observations of auroral particles and ground observations during the February 25th solar event. P. Stauning (Denmark, Technical University, Lyngby, Denmark), G. Skovli (Forsvarets Forskningsinstitutt, Kjeller, Norway), and A. Bahnsen (Danish Space Research Institute, Lyngby, Denmark), p. 583-591. 8 refs. (See A70-37519 19-13)

Observation of low-energy solar protons during the February 25, 1969 event. F. Søraas, K. Aarsnes, and H. R. Lindalen (Bergen, Universitet, Bergen, Norway), p. 592-598. (See A70-37520 19-29)

High energy solar electrons. C. J. Bland, G. D. Antoni, C. Dilworth, D. Maccagni, E. G. Tanzi (Milano, Università; CNR, Milan, Italy), Y. Keochlin, A. Raviart, and L. Treguer (Conseil Européen pour la Recherche Nucléaire, Gif-sur-Yvette, Essonne, France), p. 599-609. 7 refs. (See A70-37521 19-29)

OGO-5 measurements of electrons above 500 MeV. B. N. Swanenburg (Leiden, Rijksuniversiteit, Leiden, Netherlands), p. 610-613. (See A70-37522 19-29)

Lecture in conclusion.

Suggestions for future observations. W. I. Axford (California, University, La Jolla, Calif.), p. 617-619. (See A70-37523 19-30)

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A70-37485 **Access of solar particles to synchronous altitude.** L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). In: Intercorrelated satellite observations related to solar events; European Space Research Organization, Annual ESLAB/ESRIN, Symposium, 3rd, Noordwijk, Netherlands, September 16-19, 1969, Proceedings. (A70-37471 19-29) Edited by V. Manno and D. E. Page. Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 19), 1970, p. 205-228. 29 refs.

When a source of solar-originated particles is present in interplanetary space, comparable fluxes of these particles with similar spectral characteristics are usually observed inside the magnetosphere at synchronous altitudes. The temporal and spectral changes in the access of these solar protons and alpha particles to synchronous altitude are discussed and reviewed. Possible consequences of the presence of substantial fluxes of low energy solar protons deep inside the magnetosphere are also discussed. (Author)

c29 110300 13

A70-37488 * **Geomagnetic storms at ATS 1.** Paul J. Coleman, Jr. (California, University, Los Angeles, Calif.). In: Intercorrelated satellite observations related to solar events; European Space Research Organization, Annual ESLAB/ESRIN, Symposium, 3rd, Noordwijk, Netherlands, September 16-19, 1969, Proceedings. (A70-37471 19-29) Edited by V. Manno and D. E. Page. Dordrecht, D. Reidel Publishing Co. (Astrophysics and Space Science Library. Volume 19), 1970, p. 251-279. 21 refs. Grant No. NGR-05-007-004.

Results of studies of 18 geomagnetic storms observed at ATS 1 during the first six months of 1967. The storm-time disturbance field, storm phases, and storm-associated pulsations are discussed. The occurrence of several different storm-time pulsation phenomena at the synchronous equatorial orbit is noted. The nature of these phenomena is analyzed. V.Z.

c13 110800 35

A70-38866 * # **Optimum launch trajectories for the ATS-E mission.** Omer F. Spurlock and Fred Teren (NASA, Lewis Research Center, Cleveland, Ohio). *American Astronautical Society and American Institute of Aeronautics and Astronautics, Astrodynamics Conference, Santa Barbara, Calif., Aug. 19-21, 1970, AIAA Paper 70-1051.* 12 p. 9 refs. Members, $1.25; nonmembers, $2.00.

Optimum trajectories for the Applications Technology Satellite (ATS)-E mission are obtained. Analysis, procedure, and results are presented. The trajectories are numerically integrated from launch to insertion into the final orbit. As a result of a much smaller than optimum apogee motor, these trajectories, unlike conventional synchronous orbit trajectories, require noncircular parking orbits and large amounts of inclination reduction before the solid motor burn at apogee. Constraints on parking orbit perigee radius and duration are included. Figures are presented describing the results. (Author)

c30 050500 01

A70-40311 * **Millimeter wave propagation measurements from the Applications Technology Satellite (ATS-V).** Louis J. Ippolito (NASA, Goddard Space Flight Center, Greenbelt, Md.). *IEEE Transactions on Antennas and Propagation,* vol. AP-18, July 1970, p. 535-552. 16 refs.

Description of a millimeter wave propagation experiment conducted by means of the ATS-5 satellite launched in August 1969. It provided the first information on the propagation characteristics of the earth's atmosphere for earth-space links in the 12.5 to 18 GHz and 26.5 to 40 GHz frequency bands. Seven participating stations commenced data acquisition operations early in October 1969. Amplitude and phase measurements on two independent test links at 15.3 GHz (downlink) and 31.65 GHz (uplink) are providing propagation characteristics during defined weather conditions. These measurements are to provide the systems designer with a data base to support performance predictions for projected millimeter wave links and will aid in determining the utility of these frequency bands for communications and data-link applications. The satellite did not achieve the 3-axis earth-oriented stabilization condition that was originally planned and is presently spinning at 76 r/min at 105 deg west longitude, in geosynchronous orbit. Modifications have been made to the existing data analysis program which permit the conduct of meaningful propagation measurements, even with spin modulated data. Spacecraft and ground hardware are described, including modifications required by the satellite spin. Preliminary measurements acquired during the early months of satellite operation are presented, including comparisons of attenuation with rainfall rate, sky temperature, and weather classification observations. M.V.E.

c07 070300 15

A70-40476 **U.S. Air Force, Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Boston, Mass., September 3-5, 1969, Proceedings.** *Radio Science,* vol. 5, June 1970. 131 p.

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Total electron content studies in equatorial regions. A. N. Hunter (Lancaster, University, Lancaster, England), p. 869-880. 69 refs. (See A70-40477 20-13)

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Influence of solar activity on the total electron content of the ionosphere over Tortosa. E. Galdón and Luis F. Alberca (Observatorio del Ebro, Tortosa, Spain), p. 913-915. 13 refs. (See A70-40482 20-13)

A proposed wide-band satellite transmission experiment. E. J. Fremouw and A. A. Burns (Stanford Research Institute, Menlo Park, Calif.), p. 917-924. 14 refs. (See A70-40483 20-07)

Proposal for a new style beacon experiment to determine integral Nds for the ionosphere and magnetosphere. W. Dieminger, G. K. Hartmann, and G. Schmidt (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany), p. 925-929. 6 refs. (See A70-40484 20-07)

Scintillation.

The equatorial F-layer irregularity extent as observed from Huancayo, Peru. P. Bandyopadhyay (Perú, Instituto Geofisico, Huancayo, Peru) and J. Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 931-938. 9 refs. (See A70-40485 20-13)

Studies on F-region irregularities at low latitude from scintillations of satellite signals. J. N. Bhar, A. D. Gupta, and S. Basu (Calcutta, University, Calcutta, India), p. 939-942. 7 refs. (See A70-40486 20-13)

A note on correlation distance of vhf fading from irregularities in the equatorial ionosphere. T. S. Golden (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 943-947. 5 refs. (See A70-40487 20-07)

Scintillation studies of a synchronous satellite's radio signals at a low-latitude station. Z. Houminer (Radio Observatory, Haifa, Israel), p. 949-951. 10 refs. (See A70-40488 20-07)

40-MHz ionospheric scintillation and the sporadic-E layer. M. Anastassiadis, G. Moraitis (Athens, University, Athens, Greece), and D. Matsoukas (National Observatory, Athens, Greece), p. 953-957. 8 refs. (See A70-40489 20-13)

The high-latitude F-region irregularity structure during the October 30-November 4, 1968, magnetic storm. J. Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 959-966. 6 refs. (See A70-40490 20-13)

Measurement of irregularity heights by the spaced receiver technique. L. M. Paul, K. C. Yeh, and B. J. Flaherty (Illinois, University, Urbana, Ill.), p. 967-973. 23 refs. (See A70-40491 20-07)

Heights of ionospheric irregularities at a sub-auroral latitude. W. C. Kidd (USAF, Cambridge Research Laboratories, Bedford, Mass.), p. 975-978. 7 refs. (See A70-40492 20-13)

Solar microwave scintillation. V. L. Badillo (Manila Observatory, Manila, Philippines), p. 979-982. (See A70-40493 20-07)

High-frequency propagation.

Results of the OV4-1 dual satellite experiment on guided ionospheric propagation. J. I. Barker (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio), p. 983-996. 24 refs. (See A70-40494 20-07)

Ionospheric ducting of radio signals in the ORBIS CAL experiment. J. P. Mullen (USAF, Cambridge Research Laboratories, Bedford, Mass.) and L. H. Zuckerman (USAF, Geopole Observatory, Thule, Greenland), p. 997-1005. 33 refs. (See A70-40495 20-07)

c07 100500 42

A70-40479 **Ionospheric storms at midlatitudes.** M. Mendillo, M. D. Papagiannis (Boston University, Boston, Mass.), and J. A. Klobuchar (USAF, Cambridge Research Laboratories, Bedford, Mass.). *(U.S. Air Force, Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Boston, Mass., Sept. 3-5, 1969.) Radio Science,* vol. 5, June 1970, p. 895-898. 8 refs.

The total electron content of the ionosphere often responds in a dramatic way to increases in geomagnetic activity. By monitoring the VHF signals from the geostationary satellite ATS 3, it has been possible to study in detail the very pronounced increases in total content often found during the afternoon hours on the day of the commencement of a magnetic storm. Comparisons with magnetic field data show that the enhancements in electron content coincide with increases in the total magnetic field. This simultaneity suggests that, when the magnetosphere is compressed during the initial phase of a storm, the ionization stored in the magnetic tubes of force may be dumped into the topside of the F region. Such a depletion of the protonosphere is in agreement with whistler measurements, which indicate that a contraction of the plasmasphere occurs during periods of increased magnetic activity. (Author)

c13 100500 43

A70-40485 **The equatorial F-layer irregularity extent as observed from Huancayo, Peru.** P. Bandyopadhyay (Perú, Instituto Geofisico, Huancayo, Peru) and Jules Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.). *(U.S. Air Force, Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Boston, Mass., Sept. 3-5, 1969.) Radio Science,* vol. 5, June 1970, p. 931-938. 9 refs.

Discussion of characteristics of the equatorial irregularity structure which were revealed by simultaneous observations of propagation paths to two synchronous satellites transmitting at 137 MHz. Data were taken between July 1967 and February 1969. The abrupt onset of scintillations on a particular path within minutes led to the concept that a sharp boundary of about 10 km exists between quiet nonscintillating regions and regions of irregularities. (Author)

c13 100500 44

A70-40490 **The high-latitude F-region irregularity structure during the October 30-November 4, 1968, magnetic storm.** Jules Aarons (USAF, Cambridge Research Laboratories, Bedford, Mass.). *(U.S. Air Force, Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Boston, Mass., Sept. 3-5, 1969.) Radio Science,* vol. 5, June 1970, p. 959-966. 6 refs.

Study of multistation scintillation observations of the 137-MHz transmissions from the synchronous satellite ATS-3 during the magnetic storm of October 30 to November 4, 1968. The investigation was undertaken in order to separate the diurnal pattern of high-latitude irregularities from storm-time effects. The night maximum was maintained during magnetic storms, but the pattern was modulated by storm-time effects. Daytime scintillation indices were increased at specific times during the magnetic storm; a universal time correlation was observed for stations in Europe and in North America. Peak scintillation activity shifted from before midnight (under quiet magnetic conditions) to the 0130 to 0430 time period. G.R.

c13 100500 70

A70-41049 * Compatibility evaluation of an ammonia-aluminum-stainless steel heat pipe. E. D. Waters and P. P. King (Donald W. Douglas Laboratories, Richland, Wash.). In: Space systems and thermal technology for the 70's; American Society of Mechanical Engineers, Space Technology and Heat Transfer Conference, Los Angeles, Calif., June 21-24, 1970, Proceedings. Part 2. (A70-41014 21-33) New York, American Society of Mechanical Engineers, 1970. 10 p. Research sponsored by the Hughes Aircraft Co., the McDonnell Douglas Astronautics Independent Research and Development Program, and NASA.

Tests were conducted to confirm the ability of an ammonia-aluminum-stainless steel heat pipe to operate for extended periods without failure either by fluid loss or by degradation of the energy transport mechanisms. Test conditions were chosen to accelerate the postulated failure mechanisms. The heat pipes were operated to simulate particular spacecraft lifetimes of 7 to 10 years. Post-test thermal performance was compared with pre-test performance and the heat pipes were sectioned for metallographic examination. Results of the performance tests and photomicrographs of the metallurgical specimens are presented. (Author)

c33 021000 01

A70-41326 Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 1. Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970. 763 p. Price of two volumes, members, $15; nonmembers, $20.

Contents:

Foreword. W. E. Noller. 1 p.

Image coding by coding contours. L. C. Wilkins and P. A. Wintz (Purdue University, Lafayette, Ind.), p. 2-22 to 2-23. (See A70-41327 21-07)

Analysis of intermodulation distortion in an FDMA satellite communications system with a bandwidth constraint. R. B. McClure (COMSAT Laboratories, Clarksburg, Md.), p. 8-29 to 8-36. (See A70-41328 21-07)

Analysis of satellite communications in a multipath environment. J. J. Uhran, Jr. and J. L. Massey (Notre Dame, University, Notre Dame, Ind.), p. 10-20 to 10-24. (See A70-41329 21-07)

An approach to impulse noise due to adjacent channel interference. K. H. Greene (COMSAT Laboratories, Clarksburg, Md.), p. 10-29 to 10-34. (See A70-41330 21-07)

Optical communications system design and evaluation. J. H. Ward (ITT, San Fernando, Calif.), p. 14-3 to 14-10. (See A70-41331 21-07)

Statistical detection with pattern recognition and threshold learning. E. A. Graham (ONERA, Paris, France), p. 18-18 to 18-21. 12 refs. (See A70-41332 21-08)

Threshold determination in sequential detection with fixed error rates. N. E. Nahi and R. M. Gagliardi (Southern California, University, Los Angeles, Calif.), p. 18-26 to 18-27. (See A70-41333 21-07)

A comparative analysis of frequency modulation threshold extension techniques. G. D. Arndt and F. J. Loch (NASA, Manned Spacecraft Center, Houston, Tex.), p. 21-20 to 21-26. (See A70-41334 21-07)

Some system considerations for millimeter wave space communications. G. J. Bonelle (TRW Systems Group, Redondo Beach, Calif.), p. 22-1 to 22-13. 34 refs. (See A70-41335 21-07)

Avalanche diode oscillators - Proven solid-state microwave sources. D. L. Scharfetter (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), p. 22-14 to 22-18. 17 refs. (See A70-41336 21-09)

Millimeter wave communications experiments for satellite applications. J. W. Dees, G. P. Kefalas, and J. C. Wiltse (Martin Marietta Corp., Orlando, Fla.), p. 22-20 to 22-26. 11 refs. (See A70-41337 21-07)

Carbon dioxide laser systems for space communications. J. H. McElroy (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 22-27 to 22-37. 48 refs. (See A70-41338 21-07)

Optical modulation at gigahertz rates. G. White (Bell Telephone Laboratories, Inc., Holmdel, N.J.), p. 22-38 to 22-45. 20 refs. (See A70-41339 21-07)

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A70-41337 Millimeter wave communications experiments for satellite applications. Julian W. Dees, George P. Kefalas, and James C. Wiltse (Martin Marietta Corp., Orlando, Fla.). In: Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 1. (A70-41326 21-07) Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970, p. 22-20 to 22-26. 11 refs.

Wide-band millimeter wave communications experiments are described for use in satellites. The description covers equipment currently in orbit (ATS-5) and experiments already planned or suggested for the future. The frequency range of interest lies between 15 and 60 GHz at the present time. In addition to communications links, radiometric experiments and an experiment utilizing the moon as a base are discussed. (Author)

c07 070300 14

A70-41340 Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 2. Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970. 763 p. Price of two volumes, members, $15.; nonmembers, $20.

Contents:

A comprehensive amplitude probability distribution for atmospheric radio noise. L. B. Browne and Lynnwood L. Lay (Westinghouse Electric Corp., Leesburg, Va.), p. 29-8 to 29-14. 5 refs. (See A70-41341 21-07)

Limitations of fence and pit shielding for satellite earth stations. E. R. Nagelberg (Bell Telephone Laboratories, Inc., Whippany, N.J.), p. 30-1 to 30-7. 8 refs. (See A70-41342 21-07)

Analysis of adjacent channel interference in a multicarrier FM communications system. M. Wachs (COMSAT Laboratories, Clarksburg, Md.), p. 30-8 to 30-16. 5 refs. (See A70-41343 21-07)

Design study of a transportable earth station for satellite communications systems. K. C. O'Brien and H. J. Scagnelli (Bell Telephone Laboratories, Inc., Whippany, N.J.), p. 30-17 to 30-23. (See A70-41344 21-09)

A computer-controlled frequency-shift radiometer for satellite power monitoring.. E. E. Steinbrecher and L. F. Gray (COMSAT Laboratories, Clarksburg, Md.), p. 30-24 to 30-30. 10 refs. (See A70-41345 21-14)

Earth station transitions within the INTELSAT system. J. B. Potts and H. Prescott (Communications Satellite Corp., Washington, D.C.), p. 30-34 to 30-41. (See A70-41346 21-07)

Airline communications requirements for the seventies. B. F. McLeod (Pan American World Airways, Inc., Miami, Fla.), p. 33-2 to 33-6. (See A70-41347 21-07)

Data Link communications for the seventies. L. C. Keene (ITT, New York, N.Y.), p. 33-10 to 33-12. (See A70-41348 21-07)

Airframe requirements for future communications. R. Dunn (Boeing Co., Renton, Wash.), p. 33-13 to 33-19. (See A70-41349 21-02)

Time to cycle slip in first and second order phase lock loops. L. Schuchman (Bellcomm, Inc., Washington, D.C.), p. 34-1 to 34-9. 5 refs. (See A70-41350 21-10)

c07 070700 05

A70-41347 **Airline communications requirements for the seventies.** B. F. McLeod (Pan American World Airways, Inc., Miami, Fla.). In: Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 2. (A70-41340 21-07) Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970, p. 33-2 to 33-6.

Discussion of the features required for a new and largely automated airline communications system which is to be planned for the near future. The development and application of a system improving the present operating efficiency, free of many present restraints, and cooperating with many other systems to form a Flight Information System is considered. Several examples of communications services provided by this system are presented. They include collecting, analyzing, storing, transmitting, receiving, and presenting information required by air traffic control and advisory services, the flight crews, and company ground offices. It is shown that the technology required by such a system already exists; modest portions of the system are already installed in the B-747 and newer aircraft. However, development of a detailed specification and production of associated hardware will still require a large effort. O.H.

c07 070200 26

A70-41362 **The relationship of high latitude scintillations to VHF synchronous satellite communications.** Jules Aarons and John P. Mullen (USAF, Cambridge Research Laboratories, Bedford, Mass.). In: Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 2. (A70-41340 21-07) Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970, p. 40-30 to 40-39. 11 refs.

Discussion of high latitude observations of VHF signals from synchronous satellites, which have shown fading characteristics of great interest to communication and navigation systems designers. Utilizing 136 MHz transmissions from ATS-3, and 254 MHz signals from LES-6, fading is shown to have a diurnal pattern with deepest fades occurring at night and during magnetic storms. Observations were made predominantly from Thule and Narssarssuaq, Greenland, and from Sagamore Hill, Mass. The diurnal pattern of the irregularity structure at high latitudes shows a lower latitude boundary of 57 deg invariant latitude around midnight, and an 80 deg boundary around noon. The latitudinal variations of the scintillation boundary are correlated with movements of the trough (the ionospheric region linked to open field lines in the magnetosphere). F.R.L.

c07 100500 69

A70-41363 * **L-band performance characteristics of the ATS-5 spacecraft.** F. J. Kissel (Westinghouse Electric Corp., Baltimore, Md.). In: Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 2. (A70-41340 21-07) Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970, p. 40-40 to 40-49. Contract No. NAS 5-21019.

Results of uplink and downlink propagation measurements made at L-band frequencies (1650 and 1550 MHz, respectively) using the ATS 5 spacecraft and the NASA STADAN station near Mojave, California. The spacecraft was in synchronous equatorial orbit. Diurnal variations due to ionospheric effects were negligible (less than 0.3 dB) based on four 24-hr test sequences. Short-term fading and scintillation effects were less than 0.3 dB on both uplink and downlink over a typical four minute test period (about 360 samples).

Measurements of short-term fading were made using a sample technique which allowed synchronization of the sample interval (approximately 15 msec) with the spacecraft spin rate (approximately 76.2 rpm). A method was devised to adjust system timing so that the sample interval occurred during maximum illumination of the earth station by the spacecraft antenna. T.M.

c07 070700 06

A70-41366 **Multiple channel vhf satellite test results on ATS-1 and ATS-3.** L. K. Harman and R. L. Baldridge (Westinghouse Electric Corp., Baltimore, Md.). In: Institute of Electrical and Electronics Engineers, International Conference on Communications, San Francisco, Calif., June 8-10, 1970, Proceedings. Volume 2. (A70-41340 21-07) Edited by Donald Green. New York, Institute of Electrical and Electronics Engineers, Inc. (Conference Record. Volume 6), 1970, p. 46-12 to 46-21. 8 refs.

Results of multiple-access vhf testing performed on two synchronous orbit satellites, ATS-1 and ATS-3. The ATS-1 transponder, which operates in saturation, was found to have a high level of odd-order intermodulation products, many of which, with equal spacing, would cause serious distortion in all channels. Third-order intermodulation products were measured at 9 dB below the equal power accessing carriers. Compression in ATS-1 was found to further decrease the overall carrier-to-noise ratio of lower-power accessing signals. ATS-3 alleviated both the intermodulation and compression problems by means of a linear transponder. In-orbit test results have demonstrated a marked improvement in performance. Compression appears to be nonexistent, and the intermodulation products were measured at 11 dB below those measured on ATS-1. In addition, ATS-3 has approximately 1 dB improvement in carrier-to-noise ratio, due to its better performance characteristics. A.B.K.

c07 070213 03

A70-42653 # **Results of position experiments using distance measurements of satellite ATS-3.** K. W. Schrick and W. Goebel. *European Navigation Institutes, Quadripartite Meeting, Rome, Italy, May 11-14, 1970, Paper.* 10 p.

Description of the position experiment in a determination of system parameters for a navigation satellite system, using the U.S. satellite ATS-3. It appears from the experiment that the use of orbital elements cannot be recommended either for experimental investigations or for a working system. On the contrary, the true position must be given at short intervals of maximum one hour. M.M.

c20 070212 07

A70-43512 # **Progress and goals for aeronautical applications of space technology.** D. J. Fink (General Electric Co., Space Div., Philadelphia, Pa.) and Roy E. Anderson. *EUROSPACE, U.S.-European Conference, 4th, Venice, Italy, Sept. 22-25, 1970, Paper.* 14 p.

Discussion of the application of satellite technology to aeronautics taking into consideration the technology available today and the techniques and equipment that can be designed through analytical studies and preliminary tests that are now in progress. It is pointed out that the decade of the 1970s will undoubtedly see the first operational use of synchronous satellites for communication and radio determination for improved transoceanic traffic control. In the late 1970s or the early 1980s satellites may be used for air traffic control over land areas. The use of VHF for immediate needs and the further development of the technology required for the operational use of L-band are discussed. A survey of past, current, and projected experimental work is given. G.R.

c31 070211 12

A70-43816 **Penetration of solar particles to ionospheric heights at low latitudes.** L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.) and T. E. Graedel (Bell Telephone Laboratories, Inc., Whippany, N.J.). *Nature,* vol. 228, Oct. 3, 1970, p. 45. 10 refs.

Discussion of the evidence presented by Ganguly and Rao (1970) for the possibility of the penetration of high-energy solar particles to ionospheric heights at the equator. The optical flare data and the solar proton data from ATS-1 and Explorer 34, collected during three periods of anomalous absorption, are examined. It is concluded that there is little basis for the contention that solar particles can penetrate directly to low altitudes and thus influence ionospheric absorption at the equator. Z.W.

c29 110300 31

A70-43850 * **Evidence for the large-scale azimuthal drift of electron precipitation during magnetospheric substorms.** L. H. Rosen and J. R. Winckler (Minnesota, University, Minneapolis, Minn.). *Journal of Geophysical Research,* vol. 75, Oct. 1, 1970, p. 5576-5581. 9 refs. NSF Grant No. GA-1508; Grant No. NGL-24-005-008.

Investigation of the latitude extent of the precipitation of incident electrons during magnetic substorms by analyzing data taken by the Alaska chain of riometers operated by ESSA. More than 100 substorm absorption events occurring during March and April 1967 are examined, and typical events are charted and analyzed. In particular, the apparent north-south progression of precipitation onset is discussed in detail. O.H.

c13 110400 31

A70-43853 * **Growth phase of magnetospheric substorms.** Robert L. McPherron (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 75, Oct. 1, 1970, p. 5592-5599. 21 refs. NSF Grant No. GA-1315; Contract No. NAS 5-9098.

Discussion of a modified model of magnetospheric substorms. In contrast to previous models which have consisted of two main phases - i.e., an explosive expansion phase and a more gradual recovery phase - evidence is presented that indicates that polar magnetospheric substorms have a significant growth phase prior to the expansion phase. An expansion of the concept of a magnetospheric substorm is therefore suggested to include such a growth phase. O.H.

c13 110800 50

A70-44227 **Present problems of position finding and navigation in the space, in the air and at sea; Proceedings of the International Congress, Hamburg, West Germany, October 28-30, 1969. Volume 2.** Congress supported by the Ministerium für Bildung und Wissenschaft. Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1970. 272 p. $7.50.

Contents:

Preface. 1 p.

Long waves (10 to 20 kHz).

Introduction User problems. H. C. Freiesleben (Standard Elektrik Lorenz AG, Stuttgart, West Germany), p. 1.1-1.8.

Apparent changes of phase and group velocities in the low frequency transmission field. E. Proverbio and F. Chlistovsky (Brera Observatory, Milan, Italy), p. 2.1-2.15. 5 refs. (See A70-44228 23-07)

Synchronization of local time base with hour signals in the determination of geographic positions. F. Chlistovsky and E. Proverbio (Brera Observatory, Milan, Italy), p. 3.1-3.17.

Basic questions of the propagation of vlf waves. H. Volland (Bonn, Universität, Bonn, West Germany), p. 4.1-4.14. (For abstract see issue 03, page 449, Accession no. A70-13616)

Vlf radio wave propagation and its influence in position finding. B. Burgess (Royal Aircraft Establishment, Farnborough, Hants., England), p. 5.1-5.14. (For abstract see issue 03, page 523, Accession no. A70-13614)

Frequencies 100 to 300 kHz as well as 1 to 2 MHz.

User problems. G. Zickwolff, p. 6.1-6.11.

Airborne observations of LORAN C performance. W. Blanchard (Decca Navigation Co., Ltd., New Malden, Surrey, England), p. 7.1-7.10. (For abstract see issue 03, page 523, Accession no. A70-13615)

Geometry and ionosphere effects upon wave propagation in the range from 0.2 to 2 MHz. W. Elling (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany), p. 8.1-8.14. 10 refs. (See A70-44229 23-07)

Frequencies above 10 MHz.

User problems - Frequencies above 10 MHz. J. Filz (Deutsche Lufthansa AG, Hamburg, West Germany), p. 9.1-9.10. (See A70-44230 23-07)

Influence of the troposphere on low incident satellite signals in the range of wavelength 15 to 2 m. G. Hartmann (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany), p. 10.1-10-13. 5 refs. (See A70-44231 23-07)

Position fixing by distance measuring to geostationary satellites. K.-W. Schrick (Deutsches Hydrographisches Institut, Hamburg, West Germany), p. 11.1-11.14. (See A70-44232 23-21)

Frequencies above 1 GHz.

Effect of wave propagation upon radio location. E. Vocke (Marineortungsschule, Bremerhaven, West Germany), p. 12.1-12.7. (For abstract see issue 03, page 449, Accession no. A70-13607)

Geodetical distance measuring with microwave equipment. W. Höpcke (Hannover, Universität, Hanover, West Germany), p. 13.1-13.9.

Some results of geodetical electronic distance measurements in the North Sea wet duct. R. Spellauge (Hannover, Universität, Hanover, West Germany), p. 14.1-14.26.

Structure of the troposphere and its influence upon wave propagation. G. Fengler, p. 15.1-15.19. (For abstract see issue 03, page 449, Accession no. A70-13612)

Radar superrefraction and subrefraction. H. Jeske (Hamburg, Universität, Hamburg, West Germany), p. 16.1-16.23. 13 refs. (See A70-44233 23-07)

Contribution to the discussion on 'Frequencies above 1 Gigahertz.' E. Vocke (Marineortungsschule, Bremerhaven, West Germany), p. 17.1-17.12.

c07 070212 05

A70-44232 **Position fixing by distance measuring to geostationary satellites.** K.-W. Schrick (Deutsches Hydrographisches Institut, Hamburg, West Germany). In: Present problems of position finding and navigation in the space, in the air and at sea; Proceedings of the International Congress, Hamburg, West Germany, October 28-30, 1969. Volume 2. (A70-44227 23-07) Congress supported by the Ministerium für Bildung und Wissenschaft. Düsseldorf, Deutsche Gesellschaft für Ortung und Navigation, 1970, p. 11.1-11.14. Translation.

Discussion of experiments in which the distance to the ATS-3 satellite was measured aboard the research ship Meteor in an attempt to determine the position of the ship during its voyages in 1968 to the West African Coast and the Iceland Faroe Step. Equipment developed by the German Aerospace Research and Test Installation at Oberpfaffenhofen (DFVLR) and a phase-difference measuring technique were used in the 149.22 and 135.6 MHz experiments. The factors interfering with the measurements and the accuracy of this position-fixing method are discussed. Considerations for enhancing the accuracy of this method are given. V.Z.

c21 070212 06

A70-44453 **Survival and Flight Equipment Association, Annual Symposium, 8th, Las Vegas, Nev., September 28-October 1, 1970, Proceedings. Volume 1.** Van Nuys, Calif., Survival and Flight Equipment Association, 1970. 343 p. $10.00.

Contents:

Preface. R. H. Shannon, p. III.

Foreword, p. IV.

The USAF School of Aerospace Medicine's approach to training the medical investigator of aircraft accidents. H. F. Mulligan (USAF, School of Aerospace Medicine, Brooks AFB, Tex.), p. 1-6. (See A70-44454 23-05)

SAR - Satellite Alarm Rescue. W. R. Crawford (U.S. Naval Air Test Center, Patuxent River, Md.), p. 7-25. (See A70-44455 23-03)

Evaluation of the lap belt and pre-inflated air bag during impact with human sled subjects. C. D. Gragg, C. D. Bendixen, T. D. Clarke, H. S. Klopfenstein, and J. F. Sprouffske (USAF, Aeromedical Research Laboratory, Holloman AFB, N. Mex.), p. 27-43. 9 refs. (See A70-44456 23-02)

Environmental control in deep submergence vehicles. S. K. Rush (U.S. Navy, Submarine Development Group, San Diego, Calif.), p. 45-57.

NASA safety related research. H. K. Strass (NASA, Office of Advanced Research and Technology, Washington, D.C.), p. 59-87. (See A70-44457 23-34)

Manned testing in the simulated space environment. A. C. Bond (NASA, Manned Spacecraft Center, Houston, Tex.), p. 89-141. 9 refs. (See A70-44458 23-05)

An optimal hierarchy of colors for markers and signals. R. L. Hilgendorf (USAF, Aerospace Medical Research Laboratory, Wright-Patterson AFB, Ohio), p. 143-155. 6 refs. (See A70-44459 23-04)

Reliability of in-flight escape systems and survival equipments in U.S. Navy ejections - Successful and unsuccessful. E. V. Rice (U.S. Naval Safety Center, Norfolk, Va.) and F. H. Austin, Jr. (U.S. Navy, Washington, D.C.), p. 157-162. (See A70-44460 23-03)

Recommendations for accident survival. I. Peterson (United Air Lines, Inc., New York, N.Y.), p. 163-170.

Development of nonmetallic materials for space applications. R. E. Smylie and E. L. Hays (NASA, Manned Spacecraft Center, Houston, Tex.), p. 171-197. (See A70-44461 23-05)

Nonmetallic-material selection criteria, test requirements, test techniques and data, and configuration control as applied to manned spacecraft. W. M. Bland, Jr. (NASA, Manned Spacecraft Center, Houston, Tex.), p. 199-245. (See A70-44462 23-05)

Highlights of the survival training program for physicians in the Aerospace Medicine Primary Course at the USAF School of Aerospace Medicine. E. F. Hames (USAF, School of Aerospace Medicine, Brooks AFB, Tex.), p. 247-250. (See A70-44463 23-05)

A statewide civilian helicopter ambulance system Results of the first year of operation in Arizona. J. L. Schamadan (Samaritan Health Service, Phoenix, Ariz.), p. 251-254.

Helicopter automatic approach and hover coupler systems. L. Cotton and R. Mills (United Aircraft Corp., Stratford, Conn.), p. 255-278. (See A70-44464 23-02)

Survival in foam. O. S. Willey, Jr. (Gulf and Western Industrial Product Co., Swarthmore, Pa.), p. 279-287. (See A70-44465 23-02)

Industry's role in the safe exploration of the deep ocean environment. H. J. Smith, Jr. (Lockheed Missiles and Space Co., Sunnyvale, Calif.), p. 289-293.

Commercial and military aircraft emergency egress systems. J. D. Caldara and F. B. Pollard (Aircraft and Missile Consultants, Manhattan Beach, Calif.), p. 295-333. 14 refs. (See A70-44466 23-02)

Training simulation to improve go/no go ejection decisions. W.

F. Cunningham, E. V. Rice, F. A. Radcliffe, and H. W. Purefoy (U.S. Naval Safety Center, Norfolk, Va.), p. 335-339. 5 refs. (See A70-44467 23-11)

c05 070200 28

A70-44455 **SAR - Satellite Alarm Rescue.** W. R. Crawford (U.S. Naval Air Test Center, Patuxent River, Md.). In: Survival and Flight Equipment Association, Annual Symposium, 8th, Las Vegas, Nev., September 28-October 1, 1970, Proceedings. Volume 1. (A70-44453 23-05) Van Nuys, Calif., Survival and Flight Equipment Association, 1970, p. 7-25.

Discussion of the potential for a Global Rescue Alarm Net (GRAN) which makes use of satellites for relaying distress signals from personnel in trouble anywhere in the world. It is pointed out that present search and rescue communication techniques have insufficient range capability because of line-of-sight restrictions. These restrictions can be eliminated by the use of satellites. Investigations involving the use of the satellites Nimbus, LES-3 and ATS-3 prove the feasibility of GRAN. G.R.

c03 070200 29

A70-45017 **International Astronautical Federation, Congress, 19th, New York, N.Y., October 13-19, 1968, Proceedings. Volume 3 - Propulsion re-entry physics.** Edited by Michał Łunc. Oxford, Pergamon Press, Ltd.; Warsaw, Państwowe Wydawnictwo Naukowe, 1970. 582 p. In English, Russian, and French. Price of four volumes, $108.

Contents:

Fundamental aspects.

Quasi-steady sphericosymmetric monopropellant decomposition in inert and reactive environments. F. E. Fendell (TRW Systems Group, Redondo Beach, Calif.), p. 3-27. (For abstract see issue 23, page 4450, Accession no. A68-44235)

On some new aspects concerning inductive magnetoplasmadynamic (MPD) propulsion systems. W. Peschka and R. Holzschuh (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Stuttgart, West Germany), p. 29-41. (For abstract see issue 23, page 4452, Accession no. A68-44274)

Investigation of liquid propellants in high pressure and high temperature gaseous environments. T. P. Torda and R. L. Matlosz (Illinois Institute of Technology, Chicago, Ill.), p. 43-58. (For abstract see issue 23, page 4450, Accession no. A68-44273)

Application of the Galerkin method in the solution of combustion-instability problems. B. T. Zinn (Georgia Institute of Technology, Atlanta, Ga.) and E. A. Powell, p. 59-73. (For abstract see issue 23, page 4497, Accession no. A68-44272)

Theoretical and experimental investigations on inductive plasma accelerators with electromagnetic standing waves. R. Köhne, A. Meert, and H. G. Wichmann (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Stuttgart, West Germany), p. 75-99. (For abstract see issue 23, page 4452, Accession no. A68-44276)

Launch systems.

An apparent adaptive notch filter for thrust vector control. Z. Thompson (NASA, Marshall Space Flight Center, Huntsville, Ala.) and J. C. Hung (Tennessee, University, Knoxville, Tenn.), p. 101-107. (For abstract see issue 23, page 4452, Accession no. A68-44278)

An advanced launch system using 156-in. solid rocket motors. R. P. Dawson and J. F. Meyers (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.), p, 109-130. (For abstract see issue 23, page 4484, Accession no. A68-44271)

Dynamic behavior of liquid propellant in the tanks of the third stage of the European ELDO-A-rocket. K. Schiffner (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Mülheim, West Germany), p. 131-151. (For abstract see issue 23, page 4387, Accession no. A68-44270)

The morphological continuum in solid-propellant grain design. J. S. Billheimer (Aerojet General Corp., Sacramento, Calif.) and F. R. Wagner (Utah, University, Salt Lake City, Utah), p. 153-187. (For abstract see issue 23, page 4450, Accession no. A68-44269)

Perfecting the Valois engine equipping the first stage of the Diamant B booster (Mise au point du moteur Valois équipant le premier étage du lanceur Diamant B. H. Bortzmeyer (Centre National d'Etudes Spatiales, Brétigny-sur-Orge, Essonne, France) and F. Bachelot (Délégation Ministérielle pour l'Armement, Vernon, Eure, France), p. 189-196. (For abstract see issue 23, page 4452, Accession no. A68-44267)

Orbiting maneuvering systems.

Spherical rocket motors for space and upper stage propulsion. W. G. Andrews, D. R. Reed, and L. S. Dougherty (Thiokol Chemical Corp., Elkton, Md.), p. 197-215. (For abstract see issue 23, page 4451, Accession no. A68-44236)

Position and orientation propulsion systems for unmanned vehicles. A. Burstein and H. DiCristina (Hughes Aircraft Co., Culver City, Calif.), p. 217-225. (For abstract see issue 23, page 4452, Accession no. A68-44437)

A subliming solid reaction control system. J. D. Shepard (Lockheed Missiles and Space Co., Sunnyvale, Calif.) and R. P. Routt (Lockheed California Co., Burbank, Calif.), p. 227-239. (For abstract see issue 23, page 4451, Accession no. A68-44237)

Pulsed plasma satellite control systems. D. L. Lockwood (Cornell Aeronautical Laboratory, Inc., Buffalo, N.Y.), p. 241-253. (For abstract see issue 23, page 4484, Accession no. A68-44268)

Conception and development of an apogee motor in the European context (Conception et développement d'un moteur d'apogée dans le contexte Européen). E. Renzulli and H. Eychenne (Société Européenne d'Etude et d'Intégration de Systèmes Spatiaux, Courbevoie, Hauts-de-Seine, France), p. 255-263. (See A70-45018 23-28)

Electric propulsion for orbit transfer. R. C. Godwin and T. Rees (Hawker Siddeley Dynamics, Ltd., Stevenage, Herts., England), p. 265-279. (For abstract see issue 23, page 4452, Accession no. A68-44266)

New problems of re-entry aerodynamics.

Radiating flows during entry into planetary atmospheres. R. Goulard, R. E. Boughner, R. K. Burns, and H. F. Nelson (Purdue University, Lafayette, Ind.), p. 283-323. (For abstract see issue 23, page 4341, Accession no. A68-44259)

Aerodynamic heating of lifting bodies (Aerodinamicheskoe nagrevanie nesushchikh tel). G. I. Maikapar (Akademiia Nauk SSSR, Moscow, USSR), p. 325-335. 9 refs. (See A70-45019 23-01)

Drag and stability of various Mars entry configurations. M. V. Krumins (U.S. Navy, Naval Ordnance Laboratory, Silver Spring, Md.), p. 337-360. (For abstract see issue 23, page 4482, Accession no. A68-44225)

Experimental study of the near wake of bodies of revolution in supersonic flows (Etude expérimentale du proche sillage de corps de révolution en écoulement supersonique). M. Sirieix, J. Delery, and B. Monnerie (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France), p. 361-384. (For abstract see issue 23, page 4510, Accession no. A68-45116)

The calculation of base flow and near wake properties by the method of integral relations. M. Holt and J. C. S. Meng (California, University, Berkeley, Calif.), p. 385-397. (For abstract see issue 23, page 4342, Accession no. A68-44262)

Supersonic flow past blunt bodies with large surface injection. T. D. Taylor and B. S. Masson (Northrop Corp., Hawthorne, Calif.), p. 399-411. (For abstract see issue 23, page 4342, Accession no. A68-44264)

Interaction problems in hypersonic fluid dynamics.

Blunt bodies in hypersonic gas flows with allowance for radiation transfer (Obtekanie zatuplennykh tel giperzvukovym potokom gaza s uchetom perenosa izlucheniia). O. M. Belotserkovskii, L. M. Biberman, S. Ia. Bronin, A. N. Lagar'kov, and V. N. Fomin (Akademiia Nauk SSSR, Moscow, USSR), p. 413-439. 20 refs. (See A70-45020 23-01)

Bodies of revolution with a minimum head drag coefficient and low heat transfer at high supersonic flight speeds (Tela vrashcheniia s minimal'nym koeffitsientom lobovogo soprotivleniia i maloi teploperedachei pri bol'shikh sverkhzvukovykh skorostiakh poleta). G. L. Grodzovskii (Akademiia Nauk SSSR, Moscow, USSR), p. 441-454. 32 refs. (See A70-45021 23-01)

Axisymmetric viscous interaction with small velocity slip and transverse curvature-effects of Prandtl number and radio of specific heats. D. F. Rogers (U.S. Naval Academy, Annapolis, Md.), p. 455-486. (For abstract see issue 23, page 4341, Accession no. A68-44261)

Hypersonic laminar boundary around slender bodies. R. V. S. Yalamanchili (U.S. Army, Missile Command, Redstone Arsenal, Ala.) and D. R. Jeng (Toledo, University, Toledo, Ohio), p. 487-520. (For abstract see issue 23, page 4341, Accession no. A68-44258)

Kinetic theory of the sharp leading edge problem. II Hypersonic flow. A. B. Huang and P. F. Hwang (Georgia Institute of Technology, Atlanta, Ga.), p. 521-545. (For abstract see issue 23, page 4342, Accession no. A68-44263)

Alpha-effects are negligible in hypersonic unsteady aerodynamics - Fact or fiction. L. E. Ericsson (Lockheed Missiles and Space Co., Sunnyvale, Calif.), p. 547-561. (For abstract see issue 23, page 4341, Accession no. A68-44260)

Effects of an entry probe gas envelope on experiments concerning planetary atmospheres. N. R. Mukherjee and H. G. Gross (Douglas Aircraft Co., Santa Monica, Calif.), p. 563-584. (For abstract see issue 23, page 4341, Accession no. A68-44257)

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A70-46048 # **Electronic system for utilization of satellite cloud pictures.** Sidney M. Serebreny, Eldon J. Wiegman, Rex G. Hadfield, and William E. Evans (Stanford Research Institute, Menlo Park, Calif.). *(Symposium on Tropical Meteorology, Honolulu, Hawaii, June 2-11, 1970.) American Meteorological Society, Bulletin,* vol. 51, Sept. 1970, p. 848-855. 6 refs.

An electronic system to study ATS photographs is described. Cloud pictures are scanned by a TV camera which inputs cloud data onto memory disks from which the data can be recalled and displayed on a cathode-ray tube. Display options include time-lapse, variable magnification and frame-to-frame differencing. Electronic cursors permit digital readout of displacements of identifiable cloud elements. Data handling techniques and the computer-data process for this system are described. (Author)

c20 080100 45

A70-46201 # **Position experiments using distance measurements of satellite ATS-3.** W. Goebel and K. W. Schrick. *Institute of Navigation, Journal,* vol. 23, Oct. 1970, p. 476-484.

Discussion of the position experiment conducted as a part of a program for determining the system parameters for a navigation satellite system undertaken by the Federal Republic of Germany. The U.S. satellite ATS-3 was used in the experiments. The basic principles involved in the tests are considered. Measured and computed distances are compared and the accuracy of the obtained data is discussed. G.R.

c21 070212 08

A71-10551 **American Meteorological Society, Radar Meteorology Conference, 14th, Tucson, Ariz., November 17-20, 1970, Proceedings.** Boston, American Meteorological Society, 1970. 459 p. Members, $15.; nonmembers, $20.

Contents:

Storm reflectivity models. F. J. Altman (Computer Sciences Corp., Falls Church, Va.), p. 291-295. (See A71-10585 01-20)

Motion of radar echoes within a cloud envelope. R. W. Shaw (McGill University, Montreal, Canada), p. 297-300. 8 refs. (See A71-10586 01-20)

Development of procedures for vectoring aircraft around thunderstorms. W. Lewis (FAA, Atlantic City, N.J.), p. 301-304. 7 refs. (See A71-10587 01-20)

Mesoscale analysis.

Formation and emergence of an anticyclonic eddy within a severe thunderstorm as revealed by radar and surface data. L. R. Lemon (U.S. Weather Bureau, Norman, Okla.), p. 323-328. 15 refs. (See A71-10588 01-20)

Hurricanes and cyclones.

In- and outflow field of hurricane Debbie as revealed by echo and cloud velocities from airborne radar into ATS-III pictures. T. T. Fujita (Chicago, University, Chicago, Ill.), and P. G. Black (U.S. Weather Bureau, Miami, Fla.), p. 353-358. 11 refs. (See A71-10589 01-20)

Data processing. I - Digital data.

Processing and analysis techniques used with the NSSL weather radar system. K. E. Wilk and K. C. Gray (U.S. Weather Bureau, Norman, Okla.), p. 369-374. 6 refs. (See A71-10590 01-20)

Computations and experiments relevant to digital processing of weather radar echoes. P. M. Austin and M. R. Schaffner (MIT, Cambridge, Mass.), p. 375-380. 6 refs. (See A71-10591 01-08)

A digital integrator for precipitation echoes. M. J. Mitchell, W. G. Myers, P. L. Smith, Jr. (South Dakota School of Mines and Technology, Rapid City, S. Dak.), G. O. Langer, G. H. Saum, and G. R. Gray (National Center for Atmospheric Research, Boulder, Colo.), p. 383-386. (See A71-10592 01-08)

A solid state digital integrator for weather radar signals. G. A. Works and H. L. Groginsky (Raytheon Advanced Development Laboratory, Wayland, Mass.), p. 387-390. (See A71-10593 01-08)

An experiment in digitizing weather radar data from a four station network. S. G. Bigler, R. G. McGrew, and M. St. Clair (U.S. Weather Bureau, Silver Spring, Md.), p. 395-398. (See A71-10594 01-08)

Computer-controlled processing of radar precipitation signals and lightning data. G. W. Neal, J. H. Tracey, and N. E. Levine (Missouri, University, Rolla, Mo.), p. 399-402. 5 refs. (See A71-10595 01-08)

Computer analysis of radar weather echo data. D. W. Staggs and C. G. Lonnquist (Illinois State Water Survey, Urbana, Ill.), p. 403-405. 8 refs. (See A71-10596 01-08)

Data processing. II.

Radar weather performance enhanced by pulse compression. R. W. Fetter (McGill University, Montreal, Canada), p. 413-418. 6 refs. (See A71-10597 01-07)

Decorrelation time of weather radar signals. J. D. Reid (McGill University, Montreal; Department of Mines and Technical Surveys, Ottawa, Canada), p. 419, 420. (See A71-10598 01-07)

Autocorrelation of weather patterns by an incoherent optical method. I. I. Zawadzki (McGill University, Montreal, Canada), p. 421-424. (See A71-10599 01-07)

Spectrum analysis of radar sea return. G. F. Andrews (Miami, University, Miami, Fla.), p. 449-451. 10 refs. (See A71-10600 01-07)

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A71-10579 # **Simultaneous measurement of attenuation, emission, and backscatter by precipitation along a satellite to earth path.** John I. Strickland (Department of Communications, Communications Research Centre, Ottawa, Canada). In: American Meteorological Society, Radar Meteorology Conference, 14th, Tucson, Ariz., November 17-20, 1970, Proceedings. (A71-10551 01-20) Boston, American Meteorological Society, 1970, p. 215-219. 5 refs.

Calculations of path attenuations at 15.3 GHz for slant paths of 30 deg elevation from simultaneous measurements of sky temperature at 15.3 GHz and radar backscatter measurements at 2.86 GHz. These predicted attenuations have been compared with path attenuations measured directly using the ATS-5 satellite beacons at 15.3 GHz. Generally good agreement between measured and predicted attenuations has been found. M.M.

c07 070300 28

A71-10589 * # **In- and outflow field of hurricane Debbie as revealed by echo and cloud velocities from airborne radar into ATS-III pictures.** T. T. Fujita (Chicago, University, Chicago, Ill.) and P. G. Black (U.S. Weather Bureau, National Hurricane Research Laboratory, Miami, Fla.). In: American Meteorological Society, Radar Meteorology Conference, 14th, Tucson, Ariz., November 17-20, 1970, Proceedings. (A71-10551 01-20) Boston, American Meteorological Society, 1970, p. 353-358. 11 refs. ESSA Grant No. E 22-69-70(G); Grant No. NGR-14-001-008.

Complete analysis of the inflow and outflow fields in Hurricane Debbie on Aug. 20, 1969, using airborne radar and ATS-III satellite pictures together with aircraft and synoptic wind data. Radar echo velocities have been computed using Fujita's time-lapse film-loop technique and radial profiles constructed for four quadrants of the storm. Their spatial distribution has been plotted and used as an indication of the low level flow field within 150 n mi of the storm center. M.M.

c20 081200 09

A71-10851 # **An objective method for estimating wind-speed fields from wind-direction fields.** R. L. Mancuso (Stanford Research Institute, Menlo Park, Calif.). *Royal Meteorological Society, Quarterly Journal*, vol. 96, Oct. 1970, p. 601-609. 13 refs. Grant No. DA-AB-07-68-C-0192.

An objective method is described for obtaining an estimate of the wind-speed values within the interior of a region when only the streamline field for the region and the wind-speed values along the boundary are given. The method has been developed and tested for possible use in data-scarce areas where conventional wind analyses cannot be made, but where wind-direction fields might be derived with reasonable accuracy and detail from satellite cloud photographs. The basic approach consists of computing the wind speeds within the interior of the region by stepping downwind along the streamlines from the known wind-speed values at the inflow boundary. Divergence is assumed to be constant along each streamline and is determined in a manner such that successive computational cycles minimize the differences between the computed and known wind speeds at the outflow boundary. The testing was conducted using known wind-velocity fields over the U.S. and also ATS-3 cloud-motion data over the Caribbean. The computed wind-speed fields were found to be in reasonably good agreement with the actual wind-speed fields. (Author)

c20 080900 26

A71-10976 **NTC 70; Institute of Electrical and Electronics Engineers, National Telemetering Conference, Los Angeles, Calif., April 27-30, 1970, Proceedings.** New York, Institute of Electrical and Electronics Engineers, Inc., 1970. 211 p. Members, $20.; nonmembers, $25.

Contents:

Temperature telemetry for determining the pyrogenic effects of drugs. K. L. Fox, A. A. Beisang, J. E. Carter, and R. C. Lillehei (Minnesota, University, Minneapolis, Minn.), p. 11-13. (See A71-10977 01-05)

Marine traffic control by satellite telemetry. R. G. Bland, I. L. Jacobson, and F. D. MacKenzie (NASA, Electronics Research Center, Cambridge, Mass.), p. 23-30. 6 refs. (See A71-10978 01-21)

Modeling an air traffic control environment. E. J. Dalabakis and T. R. Holmes (Electronic Communications, Inc., St. Petersburg, Fla.), p. 31-36. (See A71-10979 01-21)

Flight implementation and results of a frequency diversity S-band telemetry system. D. S. Podietz (General Electric Co., Philadelphia, Pa.), p. 51-57. (See A71-10980 01-31)

A physiological data telemetry link. E. A. Elpel and W. H. Foy (Stanford Research Institute, Menlo Park, Calif.), p. 85-90. 6 refs. (See A71-10981 01-05)

Implantable biotelemetry systems. T. B. Fryer (NASA, Ames Research Center, Moffett Field, Calif.), p. 91-96. 5 refs. (See A71-10982 01-05)

An associative data acquisition system. M. D. Johnson and D. C. Gunderson (Honeywell, Inc., St. Paul, Minn.), p. 109-115. 16 refs. (See A71-10983 01-08)

Output format coding for data compressors. W. M. Rathbone (Lockheed Electronics Co., Houston, Tex.), p. 117-121. (See A71-10984 01-07)

Dual swept radiometer for the ATS-5 satellite. M. Chomet, R. Watterson (Sanders Associates, Inc., Plainview, N.Y.), and R. G. Stone (NASA, Washington, D.C.), p. 125-131. (See A71-10985 01-14)

Telemetry system for spherical ICBM reentry vehicles. R. M. Lum and J. N. Hines (Bell Telephone Laboratories, Inc., Whippany, N.J.), p. 133-137. (See A71-10986 01-07)

The small astronomy satellite telemetry system. M. R. Peterson (Johns Hopkins University, Baltimore, Md.), p. 139-145. 5 refs. (See A71-10987 01-07)

Remote Modules - An approach to decentralized telemetry systems. J. R. Silverman and M. S. Maxwell (NASA, Goddard Space Flight Center, Greenbelt, Md.), p. 147-152. (See A71-10988 01-07)

A linguistic approach to telemetry decommutation. J. H. Kulick (Pennsylvania, University, Philadelphia, Pa.), p. 193-196. (See A71-10989 01-07)

Pioneer project 1965-1970. R. R. Nunamaker, L. W. Dickerson, and C. F. Hall (NASA, Ames Research Center, Moffett Field, Calif.), p. 205-213. 11 refs. (See A71-10990 01-30)

An experiment with VHF satellite and HF-SSB communications for data collection from ocean data stations (buoys). D. K. Hall (General Dynamics Corp., San Diego, Calif.) and J. W. Coste (U.S. Coast Guard, Governors Island, N.Y.), p. 217-235. (See A71-10991 01-07)

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A71-10985 * **Dual swept radiometer for the ATS-5 satellite.** M. Chomet, R. Watterson (Sanders Associates, Inc., Plainview, N.Y.), and R. G. Stone (NASA, Washington, D.C.). In: NTC 70; Institute of Electrical and Electronics Engineers, National Telemetering Conference, Los Angeles, Calif., April 27-30, 1970, Proceedings. (A71-10976 01-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 125-131.

Description of the features, operation and specifications of the Dual Swept Radiometer System for the ATS-5 satellite. The main section of the system consists of two swept radiometers, each independently programmable with an internal noise source for calibration purposes. During normal operation, radiometer 1 is stepped through its frequency range in synchronization with the telemetry data readout, while radiometer 2 will be operated in a number of modes as determined by command signals. Both radiometers are capable of operating over the frequency band of 50 kHz to nominally 4 MHz. The system uses high impedance preamplifiers whose gain vs frequency characteristics complement the cosmic noise distribution and the antenna characteristics. In order to maintain control of potential spurious inputs, the preamplifiers have a rolloff at 5 MHz which, coupled with a low-pass filter in the radiometer, prevents inputs outside the scanned bands. M.M.

c14 111000 11

A71-10991 **An experiment with VHF satellite and HF-SSB communications for data collection from ocean data stations (buoys).** Donald K. Hall (General Dynamics Corp., Convair Div., San Diego, Calif.) and James W. Coste (U.S. Coast Guard, Governors Island, N.Y.). In: NTC 70; Institute of Electrical and Electronics Engineers, National Telemetering Conference, Los Angeles, Calif., April 27-30, 1970, Proceedings. (A71-10976 01-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 217-235.

Experimental investigation of the relative merits of satellite and hf digital data communications for collecting data from large networks of ocean data stations (ODS). The experiment demonstrated the feasibility of two-way vhf telemetry communications via ATS-1 from an ocean data station moored in the North Pacific to the ATS ground station at Mojave, Calif. The feasibility of using the vhf link and associated equipment was successfully demonstrated on 51 occasions during September-December 1961. This experimental system permitted definition of some of the problem areas at the ATS-1 frequencies. The experiment was highly successful, although the transmission reliability has been less than the value desirable for an operational system. M.M.

c07 070206 05

A71-11351 **The global circulation of the atmosphere; Royal Meteorological Society and American Meteorological Society, Joint Conference, London, England, August 25-29, 1969, Proceedings.** Edited by G. A. Corby (Meteorological Office, Bracknell, Berks., England). London, Royal Meteorological Society, 1970. 275 p. $15.

Contents:

Foreword. G. A. Corby (Meteorological Office, Bracknell, Berks., England), p. 1.

The nature of the global circulation of the atmosphere - A present view. E. N. Lorenz (MIT, Cambridge, Mass.), p. 3-23. 30 refs. (See A71-11352 01-20)

Numerical simulation of the global atmosphere. J. Smagorinsky (ESSA, Geophysical Fluid Dynamics Laboratory; Princeton University, Princeton, N.J.), p. 24-41. 24 refs. (See A71-11353 01-20)

The energy balance of the global atmosphere. R. E. Newell, D. G. Vincent, T. G. Dopplick, D. Ferruzza (MIT, Cambridge, Mass.), and J. W. Kidson (New Zealand Meteorological Service, Wellington, New Zealand), p. 42-90. 141 refs. (See A71-11354 01-20)

The atmospheric boundary layer in relation to large-scale dynamics. P. A. Sheppard (Imperial College of Science and Technology, London, England), p. 91-112. 29 refs. (See A71-11355 01-20)

The role of the tropics in the global circulation. D. H. Johnson (Meteorological Office, Bracknell, Berks., England), p. 113-136. 46 refs. (See A71-11356 01-20)

The role of extratropical disturbances in the global atmosphere. C. W. Newton (National Center for Atmospheric Research, Boulder, Colo.), p. 137-158. 55 refs. (See A71-11357 01-20)

The structure and dynamics of the stratosphere. R. J. Murgatroyd (Meteorological Office, Bracknell, Berks., England), p. 159-195. 140 refs. (See A71-11358 01-20)

Some laboratory experiments on free thermal convection in a rotating fluid subject to a horizontal temperature gradient and their relation to the theory of the global atmospheric circulation. R. Hide (Meteorological Office, Bracknell, Berks., England), p. 196-221. 71 refs. (See A71-11359 01-20)

Recent developments in satellite techniques for observing and sensing the atmosphere. V. E. Suomi (Wisconsin, University, Madison, Wis.), p. 222-234. 21 refs. (See A71-11360 01-31)

Progress on the planning and implementation of the Global Atmospheric Research Programme. B. R. Bolin (Stockholm, Universitet, Stockholm, Sweden), p. 235-255. 16 refs. (See A71-11361 01-20)

Titles and authors of other papers presented at the conference, p. 256.

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A71-11360 # **Recent developments in satellite techniques for observing and sensing the atmosphere.** V. E. Suomi (Wisconsin, University, Madison, Wis.). In: The global circulation of the atmosphere; Royal Meteorological Society and American Meteorological Society, Joint Conference, London, England, August 25-29, 1969, Proceedings. (A71-11351 01-20) Edited by G. A. Corby. London, Royal Meteorological Society, 1970, p. 222-234. 21 refs.

Survey of recent developments in instruments and techniques for observing atmospheric parameters from satellites. Satellite temperature soundings obtained with the aid of upwelling IR methods are evaluated, and a balloon radio altimeter is described which provides reference-level data over regions with inadequate observation networks. Wind determination from cloud motion data is explained, and IR imaging and sounding systems are outlined in terms of interpretation procedures and principal errors. Examples of data obtained include temperature and pressure profiles, computer-derived wind patterns, and cloud images. T.M.

c31 080100 27

A71-11497 * **Preliminary results of a low-energy particle survey at synchronous altitude.** R. D. Sharp, E. G. Shelley, R. G. Johnson (Lockheed Research Laboratories, Palo Alto, Calif.), and G. Paschmann (Max-Planck-Institut für Physik und Astrophysik, Garching, West Germany). *Journal of Geophysical Research*, vol. 75, Nov. 1, 1970, p. 6092-6101. 35 refs. Contract No. NAS 5-10392.

Preliminary analysis of the data from the first few weeks of operation of the auroral particles experiment on the ATS 5 satellite. These data reveal some interesting characteristics of the low-energy particle environment at synchronous altitude during magnetically quiet times. The most prominent feature of the data is the occurrence of enhanced electron fluxes during local night in association with magnetic bay activity as observed on ground magnetograms. A tentative description of some of the 'signatures' of these magnetospheric substorm events is presented, based on the limited body of data that has so far been analyzed. M.V.E.

c29 111300 08

A71-13174 **Synoptic preview of ionospheric data taken at Fort Monmouth, New Jersey, during the eclipse.** P. R. Arendt, F. Gorman, Jr., and H. Soicher (U.S. Army, Institute for Exploratory Research, Fort Monmouth, N.J.). *Nature*, vol. 226, June 20, 1970, p. 1114.

Description of ionospheric observations made at Fort Monmouth during the solar eclipse of Mar. 7, 1970. A preliminary preview of how data from the ATS-3 satellite observations are related to the vertical ionogram data obtained at Wallops Island is presented. The data are consistent insofar as the comparison of F-region data with total electron content data is concerned. M.M.

c13 100500 67

A71-14204 * # **Convective transport of mass and energy in severe storms over the United States - An estimate from a geostationary altitude.** D. N. Sikdar, V. E. Suomi, and C. E. Anderson (Wisconsin, University, Madison, Wis.). *Tellus*, vol. 22, no. 5, 1970, p. 521-532. 11 refs. NASA-supported research; ESSA Grant No. WBG-27.

Some important characteristics of intense convection associated with tornado vortices are described in a case study based on photographs of the United States on April 19 and 23, 1968, that were transmitted from NASA's geosynchronous satellite, ATS-3. The growth rates of a number of convection complexes as estimated from the satellite cloud photographs are studied. Based on a three-layer convection model, the upward fluxes of mass and energy in these severe storms are computed. The computed fluxes seem to be higher by at least one order of magnitude than in a moderate thunderstorm (Brown, 1967). It is suggested that the pronounced growth rate of a convection complex as estimated on the ATS-3 satellite photographs should be an indication of the presence of severe storm cells below the cirrus canopy. (Author)

c20 080100 24

A71-14245 # **Benefits gained from space research (Korzyści z badań kosmicznych).** Maria Mielczarska. *Technika Lotnicza i Astronautyczna*, vol. 25, Sept. 1970, p. 2-5. In Polish.

Survey of practical benefits gained both directly from applications technology satellites and indirectly from industrial utilization of materials and techniques developed in the space effort. The Intelsat and Orbita satellite communications networks are reviewed, and a brief outline is given of satellite programs concerning meteorology, geodesy, navigation, geology, and agriculture. Attention is given to recent developments in fiberglass reinforced materials, electronic equipment, management techniques, and medical science. T.M.

c34 000000 06

A71-14519 * **Experimental study of magnetospheric motions and the acceleration of energetic electrons during substorms.** T. W. Lezniak and J. R. Winckler (Minnesota, University, Minneapolis, Minn.). *Journal of Geophysical Research*, vol. 75, Dec. 1, 1970, p. 7075-7098. 33 refs. Grants No. NGL-25-005-008; No. NGL-24-005-008.

Statistical study of 500- to 1000-keV electrons at synchronous orbit, leading to the conclusion that near local midnight there exists a 'fault line' west of which substorms are accompanied by geomagnetic inflation, and east of which they are accompanied by collapse. By use of measured magnetic data, it is shown that the collapse is an inward convective surge of field lines with an average convective velocity estimated at 0.5 earth rad/min. Magnetotail plasma particles of initial energies up to 10 to 20 keV are convected inward and energized tenfold; protons drift longitudinally westward (producing the observed evening inflation, and perhaps establishing a partial ring current), and electrons drift eastward. A model is described which exhibits the asymmetric inflation and collapse behavior about the fault line. F.R.L.

c13 110400 30

A71-14522 **Comparison of the predicted and observed magnetic field at ATS 1.** W. P. Olson (McDonnell Douglas Astronautics Co., Huntington Beach, Calif.) and W. D. Cummings (Grambling College, Grambling, La.). *Journal of Geophysical Research,* vol. 75, Dec. 1, 1970, p. 7117-7121. 13 refs. Research supported by the McDonnell Douglas Astronautics Co.

The principal features of the quiet-day magnetic field variations at the position of the geosynchronous satellite ATS 1 are compared with the fields predicted by several magnetospheric models. To properly predict the ATS 1 field, the magnetopause model must include 'tilt' effects (caused by the changing orientation of the earth's dipole axis with respect to the solar wind direction), and the model of the tail field must allow the neutral sheet currents to return on the magnetopause. Olson's models of the magnetopause and tail fields, which incorporate these features, are used to predict the daily and seasonal field variations at other geosynchronous longitudes. The fields predicted by these models account for most of the observed ATS 1 variations. (Author)

c13 110800 55

A71-14537 * **Sudden impulses in the magnetosphere observed at synchronous orbit.** V. L. Patel (California, University, Los Angeles, Calif.; Denver, University, Denver, Colo.) and P. J. Coleman, Jr. (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 75, Dec. 1, 1970, p. 7255-7260. 11 refs. NSF Grant No. GA-10999; Grant No. NGR-05-007-004.

ATS 1 data on the magnetic field in the equatorial plane at a geocentric distance of 6.6 earth radii have been used to study sudden impulses (si). Fifteen si events that produced effects at ATS 1 were examined. Records on the surface field at high and low latitudes were compared with the ATS 1 record for each event. (Author)

c13 110800 56

A71-14896 * **Degradation of thermal control coatings by vacuum ultraviolet irradiation.** M. J. Donohoe and F. N. Paczkowski (NASA, Goddard Space Flight Center, Thermophysics Branch, Greenbelt, Md.). *(American Society for Testing and Materials, Symposium on Coatings in Space, Cincinnati, Ohio, Dec. 11, 12, 1969.) Journal of Materials,* vol. 5, Dec. 1970, p. 950-956. 8 refs.

A laboratory study, initiated at the Goddard Space Flight Center to determine the effects of ultraviolet irradiation on several thermal coatings used in space environments, is compared with similar experiments performed on board the Applications Technology Satellite ATS-1 launched in 1966. The coatings on the satellite suffered unexpected degradation, which did not correlate well with findings in the original laboratory simulation. Vacuum UV exposure was possibly the missing environmental constituent. Although long wavelength UV makes up 90 percent of the solar UV radiation, most damage results from irradiation below 250 nm. Consequently, a program was undertaken to check the omission and to provide a simple method for degrading thermal control coatings using vacuum UV radiation. The 1236-A krypton line was used because of the instability of lithium fluoride optics to Lyman alpha (1216 A) radiation. (Author)

c13 021001 01

A71-15009 **ATS-5 millimeter wave propagation experiment.** Cletus M. Vammen and F. Leon McCormick (Martin Marietta Corp., Communications and Electronics Div., Orlando, Fla.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-6, Nov. 1970, p. 825-831. 6 refs.

This paper describes the design of the millimeter wave experiment aboard the ATS 5 satellite. This equipment is the first millimeter wave communications equipment in space. The function of the equipment is to provide earth-space propagation data at Ku- and Ka-band frequencies. The designs of the phase locked Ka-band receiver, the Ku-band transmitter, the antennas, and the telemetry and processing equipment are described. Mechanical and environmental problems are also discussed. (Author)

c07 070300 26

A71-15587 * # **Absolute efficiency measurements for channel electron multipliers utilizing a unique electron source.** G. Paschmann (Max-Planck-Institut für Physik und Astrophysik, Garching, West Germany), E. G. Shelley, C. R. Chappell, R. D. Sharp, and L. F. Smith (Lockheed Research Laboratories, Palo Alto, Calif.). *Review of Scientific Instruments,* vol. 41, Dec. 1970, p. 1706-1711. 13 refs. Research supported by the Lockheed Independent Research Program and DASA; Contracts No. NAS 5-10392; No. Nonr-3398(00).

Description of a unique low-energy (0 to 50 keV) electron accelerator which provides a broad, parallel, low-intensity electron beam with excellent long-term stability. The beam intensity is approximately 1,000,000 electrons/sq cm/sec and the long-term stability is better than 2%/day. A prototype of this accelerator is described, and the results of its application to instrument calibration and channel electron multiplier (CEM) efficiency measurements are presented. The absolute electron detection efficiency for CEMs was found to vary from approximately 90% at 1 keV to 73% at 14 keV with a probable error of plus or minus 10%. The large disagreement among the various published measurements of CEM detection efficiency is discussed. (Author)

c14 111302 11

A71-16662 # **Aircraft, spacecraft, satellite and radar observations of Hurricane Gladys, 1968.** R. Cecil Gentry, Robert C. Sheets (U.S. Weather Bureau, National Hurricane Research Laboratory, Coral Gables, Fla.), and Tetsuya T. Fujita (Chicago, University, Chicago, Ill.). *Journal of Applied Meteorology,* vol. 9, Dec. 1970, p. 837-850. 16 refs. ESSA Grant No. NSSL-E-22-41-69.

Hurricane Gladys, Oct. 17, 1968, is studied with data collected by Apollo 7 manned spacecraft, ESSA's especially instrumented aircraft, weather search radar, the ATS-III and ESSA 7 satellites, and conventional weather networks. This is the first time data from all of these observing tools have been used to study the structure and dynamics of a hurricane. Techniques used in computing and integrating the various types of data are described and illustrated. A dominant feature of this immature hurricane was a large cloud which provided a major link between the low- and high-level circulations of the storm. Evidence is presented to suggest this type of cloud and its attendant circulation are features representative of tropical cyclones passing from the tropical storm to the hurricane stage. (Author)

c20 081200 10

A71-17258 * **Magnetopause crossing of the geostationary satellite ATS 5 at 6.6 RE.** T. L. Skillman and M. Sugiura (NASA, Goddard Space Flight Center, Laboratory for Space Physics, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 76, Jan. 1, 1971, p. 44-50. 10 refs.

Discussion of the unusually large magnetic field decrease preceded by an impulsive increase of about 100 gammas observed by the geostationary satellite ATS 5 during the moderate magnetic storm of September 29-30, 1969. The field remained low for about 1 min and returned to the preevent level as abruptly as it decreased. From the ATS 1 and ATS 5 observations and magnetograms from ground observatories, it has been inferred that the magnetosphere was greatly compressed before the event; the magnetopause distance was probably near 7 earth radii at the subsolar point. By comparing the changes observed by ATS 5 with the field measured by ATS 1, which was 3 hours behind ATS 5 in local time, the event is interpreted as a magnetopause crossing of ATS 5 caused by a localized rapid inward motion of the magnetopause and its subsequent recession, temporarily creating an indentation on the magnetopause surface and briefly exposing ATS 5 to the magnetosheath field. M.V.E.

c13 100600 04

A71-17259 * **Stormtime disturbance fields at ATS 1.** Paul J. Coleman, Jr. (California, University, Los Angeles, Calif.) and W. D. Cummings (Grambling College, Grambling, La.). *Journal of Geophysical Research,* vol. 76, Jan. 1, 1971, p. 51-62. 8 refs. Grant No. NGR-05-007-004.

Comparison of the magnetic field measurements made at the synchronous equatorial satellite ATS 1 during nine geomagnetic storms with simultaneous field measurements made at low-latitude observatories. The nine storms occurred during the first 6 months of 1967. The results indicate that the sudden-commencement (sc) compression of the cavity persists through the initial phase and well into the main phase decrease, perhaps until the time of the main phase minimum. The sc is often accompanied by an increase in the tail current, which then also persists through the initial phase. The tail current increases further during the main phase decrease. However, both the compression and particularly the tail current are sometimes intermittently variable during this part of the storm. There is some evidence that the neutral-sheet current in the tail and the ring current are contiguous while the ring current is developing. As the tail current decreases, the ring current and neutral-sheet current apparently separate. M.V.E.

c13 110800 57

A71-17269 **Scintillation boundary during quiet and disturbed magnetic conditions.** Jules Aarons and Richard S. Allen (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Journal of Geophysical Research,* vol. 76, Jan. 1, 1971, p. 170-177. 15 refs.

Study of the variations in the equatorward boundary of the irregularity structure as shown by ionospheric scintillation taken from a large series of observations of satellite beacons and radio star emissions. It is found that during quiet days the boundary dips to its lowest latitude before midnight local time and reaches its highest latitude from 0630 to 1030 LT. With increasing magnetic index, the latitude of the boundary moves lower at all hours, but the change is a function of local time. M.V.E.

c13 100500 98

A71-17283 **Proton drift echoes in the magnetosphere.** L. J. Lanzerotti, C. G. Maclennan, and M. F. Robbins (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). *Journal of Geophysical Research,* vol. 76, Jan. 1, 1971, p. 259-263. 14 refs.

Discussion of the first observational evidence of drift periodic echoes in the energetic proton fluxes in the magnetosphere. The data were obtained at synchronous altitude. The data conclusively confirm previous conjectures that these solar particles are apparently trapped for 'several' drift periods. The results considered imply that at least some of the rather energetic solar protons can be transported, via sc- and si-produced third invariant-violating radial diffusion, across L shells and deep into the magnetosphere. G.R.

c30 110300 38

A71-18801 **EASCON '70; Institute of Electrical and Electronics Engineers, Electronics and Aerospace Systems Convention, Washington, D.C., October 26-28, 1970, Record.** New York, Institute of Electrical and Electronics Engineers, Inc., 1970. 351 p. Members, $12.50; nonmembers, $14.

The central theme of benefit to mankind is maintained throughout the varying session categories. These include the effects of technology on government, optical systems for today's society, air traffic control, application of technology to urban problems, application satellite systems, impact of computers on society, electrography, effects of advances in data communications, new applications of radar, and developments in transportation systems. The problem of including science and technology in the formulation of a national policy is examined extensively, and user requirements are formulated for earth resource satellites. New laser and electrooptical systems are described, together with selected new electronic devices and techniques. Socioeconomic aspects of computers, sensing techniques, distribution networks, and system planning procedures are examined.

Individual items are abstracted in this issue. T.M.

c07 070700 07

A71-18816 * **Navigation and communication experiment at L-band on board S. S. Manhattan using ATS-5 satellite.** Orest J. Hanas (Applied Information Industries, Moorestown, N.J.) and Richard M. Waetjen (U.S. Department of Transportation Systems Center, Cambridge, Mass.). In: EASCON '70; Institute of Electrical and Electronics Engineers, Electronics and Aerospace Systems Convention, Washington, D.C., October 26-28, 1970, Record. (A71-18801 07-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1970, p. 132-135. Contract No. NAS 12-2260.

An experiment is described in which for the first time L-band signals relayed by the synchronous ATS-5 satellite were successfully used for navigation and data communications. Two receiving stations were used, one stationary in Moorestown, N.J., and the other marine mobile on the icebraking tanker S. S. Manhattan, which traveled from Newport News, Va. to the vicinity of Thule, Greenland. The system used employed bi-phase PSK modulation of three tones for ranging, with superimposed data information. The receiver is a modulation-lock-loop type which does not require carrier lock. Results are described in terms of carrier-to-noise ratios, system precision, accuracy, multipath effects, and the quality of data transmission. G.R.

c07 070704 05

A71-19001 **Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings.** Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany). Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970. 306 p.

Among the topics considered are the use of satellite transmissions for ionospheric research, the determination of total electron content from Doppler shift measurements, tropospheric effects on radio wave propagation, problems of air navigation, observational opportunities afforded by the ATS-F geostationary satellite, problems in evaluating Faraday measurements, a new West German ground station for satellite acquisition, observations of the Early Bird satellite, phase-path calculations for transionospheric propagation, atmospheric effects on the accuracy of a satellite tracking system, the use of satellite beacon data for solar corona Faraday rotation measurements, the use of the U.S. Navy Navigation Satellite System for determining ionospheric electron content, observations of ATS-3 radio signals, and the special features of small-frequency fluctuations of satellite radio signals.

Individual items are abstracted in this issue. A.B.K.

c13 100500 71

A71-19006 * # **Columnar electron content up to the plasmasphere.** O. G. Almeida and A. V. da Rosa (Stanford University, Stanford, Calif.). In: Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings. (A71-19001 07-13) Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann. Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970, p. 6-1 to 6-4. Contract No. NAS 5-10102.

Determination of the total columnar electron content of the plasmasphere up to the plasmapause by combining phase path difference with the Faraday rotation technique and radar n-profiles covering the altitude range from 100 to about 1000 km. The combined technique is described and the results are analyzed. O.H.

c13 100500 72

A71-19007 # **Significance of columnar electron content measurements.** A. V. da Rosa (Stanford University, Stanford, Calif.). In: Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings. (A71-19001 07-13) Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann. Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970, p. 7-1 to 7-7. 14 refs.

Discussion of some aspects of the problem of columnar electron content measurements by means of geostationary satellites. The electron content studies conducted so far are briefly reviewed. Some engineering applications of the electron content measurements are discussed. The significance of an extension of the ionospheric research to developing countries where, in particular, the cost of data reduction can be much lower, is also considered. O.H.

c13 100500 73

A71-19008 # **Columnar electron content analysis programs.** A. V. da Rosa (Stanford University, Stanford, Calif.). In: Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings. (A71-19001 07-13) Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann. Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970, p. 8-1 to 8-20.

Description of various programs for processing of basic data - i.e., the Faraday rotation angle vs time tabulations contained in the Faraday Data Tapes, in the analysis of the columnar electron content. Different processing and analysis programs, as well as special plot and tabulation programs, are considered. O.H.

c13 100500 74

A71-19029 * # **The ionospheric electron content as determined from Faraday rotation measurements of an earth satellite and deep space probe.** B. D. L. Mulhall and C. T. Stelzried (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings. (A71-19001 07-13) Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann. Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970, p. 30-1 to 30-10.

Ionospheric electron content determinations from Faraday rotation measurements made at NASA Deep Space Network, Goldstone, Calif., tracking station and at Stanford University are compared. The NASA measurements were made by a polarimeter monitoring the Pioneer VII Deep Space Probe, transmitting at 2.3 GHz. Measurements at Stanford were made while observing the ATS-1 geostationary satellite beacon at 137 MHz during the fall of 1968. The reasons for lack of agreement of the data on certain days are discussed taking into consideration errors in modeling and different conditions in the ionosphere at widely separated locations. G.R.

c13 100500 75

A71-19034 # **Some results of ATS-measurements.** J. P. Schödel, G. Schmidt, and G. K. Hartmann (Max-Planck-Institut für Aeronomie, Lindau über Northeim, West Germany). In: Max-Planck-Institut für Aeronomie, Symposium on the Future Application of Satellite Beacon Experiments, Lindau über Northeim, West Germany, June 2-4, 1970, Proceedings. (A71-19001 07-13) Symposium co-sponsored by the Deutsche Gesellschaft für Ortung und Navigation. Edited by W. Dieminger and G. K. Hartmann. Lindau über Northeim, West Germany, Max-Planck-Institut für Aeronomie, 1970, p. 35-1 to 35-12. 6 refs. Bundesministerium für Bildung und Wissenschaft Grants No. WRK 125; No. WRK 153.

Observations of variations in the electron content of the ionosphere, based on ATS-3 radio signals, are shown to indicate the influence of gravity waves on the distribution of electrons within the upper atmosphere. Other observed wave-like variations, representing large-scale movements of electrons or traveling ionospheric disturbances, are also reviewed. M.V.E.

c13 100500 76

C-3

A71-19660 * **Magnetopause electric field inferred from energetic particle measurements on ATS 5.** F. H. Bogott and F. S. Mozer (California, University, Berkeley, Calif.). *Journal of Geophysical Research,* vol. 76, Feb. 1, 1971, p. 892-899. 21 refs. Contract No. NAS 5-10362.

Energetic (greater than 30 keV) proton and electron flux measurements were made at 6.6 earth radii on ATS 5 during magnetopause crossings on Sept. 29, 1969, and Mar. 8, 1970. In each event, an order of magnitude decrease in the electron flux was observed more than 200 electron gyroradii before the boundary was reached, while the proton flux remained unchanged until after the boundary crossing. To explain these data, an outward-directed electric field is assumed to have existed in a region 800 to 1000 km wide on the earthward side of the magnetopause, excluding electrons but not protons from this region. The required electric field is about 65 mV/meter, producing a potential of about 50 kV across the boundary layer. These data are consistent with models of a closed magnetosphere and are inconsistent with a completely open magnetosphere, but they apply only during periods of extreme magnetic activity. (Author)

c29 111200 09

A71-19664 * **Quiet day magnetic field at ATS 1.** W. D. Cummings (Grambling College, Grambling, La.), P. J. Coleman, Jr., and G. L. Siscoe (California, University, Los Angeles, Calif.). *Journal of Geophysical Research,* vol. 76, Feb. 1, 1971, p. 926-932. 11 refs. Grant No. NGR-05-007-004.

A study of the quiet day magnetic field at ATS 1 for the interval of January through June 1967 is presented. For each of 28 quiet days the H component (perpendicular to the equatorial plane) is Fourier-decomposed to yield approximate values for the gradient in the field of the external currents evaluated at the earth. These starting with the half-radius of the sphere and finishing with the upper mantle. The facility can reproduce analytical dipole models of the geomagnetic field with an accuracy improved (as compared to dipole models) by introduction of new field sources. Fields can be approximated by current systems not only of the radial-dipole type but of any configuration and orientation. V.P.

c13 110800 58

A71-21216 * **Plasma sheet convection velocities inferred from electron flux measurements at synchronous altitude.** E. G. Shelley, R. G. Johnson, and R. D. Sharp (Lockheed Research Laboratories, Palo Alto, Calif.). *(National Center for Atmospheric Research and ESSA Research Laboratories, Symposium on Upper Atmospheric Research, Boulder, Colo., Aug. 17-21, 1970.) Radio Science,* vol. 6, Feb. 1971, p. 305-313. 25 refs. Contract No. NAS 5-10392.

Large increases in the low energy electron fluxes (0.5 to 50 kev) are observed to occur at synchronous altitude on most nights in the local evening or midnight sectors. These increases are usually found to be associated with magnetic substorms. The time of increase in the fluxes is found to be energy dependent, with the lower energy electrons nearly always being observed first for the evening and midnight events. If one interprets these flux increases as resulting from an inward convection of the plasma sheet in connection with a substorm, one can estimate the convection velocity at synchronous altitude from the measured energy dependent time of flux increase and earlier measurements (Vasyliunas, 1968; Shield and Frank, 1970; Frank, 1970) of the energy dependent radial structure of the inner edge of the plasma sheet. The median velocity estimated from 38 cases by this technique is approximately 3 km/sec. This implies a westward electric field of approximately 0.36 mv/m, a value consistent with other measurements of this field. (Author)

c25 111302 10

A71-21454 # **An automated technique for obtaining cloud motion from geosynchronous satellite data using cross correlation.** John A. Leese, Charles S. Novak (National Oceanic and Atmospheric Administration, National Environmental Satellite Center, Suitland, Md.), and Bruce B. Clark (IBM Corp., Federal Systems Div., Gaithersburg, Md.). *Journal of Applied Meteorology,* vol. 10, Feb. 1971, p. 118-132. 17 refs.

Development of an automatic procedure for determining cloud motion from geosynchronous satellite pictures based on the use of cross correlation. The speed required for use in a real-time operational system is attained by application of the fast Fourier transform as a computational algorithm in determining the cross-correlation coefficients. A sample of 300 vectors determined from low-level clouds was compared with those obtained by manual methods in a nonoperational environment. Speeds agreed within 10 knots in 82% of the cases, and directions within 30 deg in 72% of the sample. It appears that a combination of the manual and automated techniques provides the best operational solution. F.R.L.

c20 080900 28

A71-23070 **Meteorology for the supersonic transport (Meteorologie für den Überschall-Luftverkehr).** Heinz Panzram. *Naturwissenschaftliche Rundschau,* vol. 24, Mar. 1971, p. 113-115. In German.

It is pointed out that the operation of supersonic transport poses new meteorological problems because of the high altitude and the high flight velocities involved. Meteorological conditions for the subsonic flight phase at lower altitudes in connection with takeoff and landing operations are the same as for other aircraft. However, for the second flight phase during the transition from subsonic to supersonic velocities at altitudes between 9 and 16 km conditions are already dissimilar to those encountered by present airliners. The aid of Applications Technology Satellites and other satellites in providing better and more accurate information about thunderstorms which may occur even in the lower stratosphere is discussed. Problems regarding predictions concerning clear-air turbulence, wind, and temperature are examined. Other subjects considered are cosmic radiation, ozone, and supersonic boom. G.R.

c20 080000 32

A71-23522 **Dependency of scintillation fading of oppositely polarized VHF signals.** H. E. Whitney and W. F. Ring (USAF, Ionospheric Physics Laboratory, Bedford, Mass.). *IEEE Transactions on Antennas and Propagation,* vol. AP-19, Jan. 1971, p. 151; Author's Reply, K. Takahashi (National Space Development Agency, Tokyo, Japan), p. 152.

Under the effects of ionospheric scintillations, the fading of RH and LH circularly polarized 136 MHz signals is observed to be perfectly correlated. Polarization diversity reception will not improve the reliability of vhf space communications through the turbulent ionosphere. (Author)

c07 100500 96

A71-23553 * # **Time variation of tropical energetics as viewed from a geostationary altitude.** D. N. Sikdar and V. E. Suomi (Wisconsin, University, Madison, Wis.). *Journal of the Atmospheric Sciences,* vol. 28, Mar. 1971, p. 170-180. 20 refs. Contract No. NAS 5-11542.

Use of time-lapse ATS-I satellite cloud photographs as a data source for the evaluation of the convective transport of latent heat from the lower troposphere to the tropical upper troposphere. The analysis reveals that the meso- to subsynoptic-scale convection systems over the tropical mid-Pacific are well organized on a time scale of a few days and are controlled by the large-scale motion field. The time variation of this heat transport, in the sector 120 to 180 W, 15 N to 15 S, indicates an approximate periodicity of five days. Furthermore, this pulsating feature seems to be tied to a wave-like disturbance field of wavelength nearly 75 deg of longitude and moving westward with an approximate speed of 15 deg of longitude per day. (Author)

c20 080100 74

A71-24315 **Scintillation effects on satellite signals observed through the polar ionosphere.** Jules Aarons, John P. Mullen, and Lawrence H. Zuckerman (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Franklin Institute, Journal,* vol. 290, Sept. 1970, p. 315-323. 11 refs.

Description of experiments on the scintillation caused by the diffraction of the transmitted signal by the ionospheric irregularity structure at high latitudes. The experiments were conducted in Thule, Greenland, from October 1968 to May 1969. In particular, the depth of fading signals of synchronous satellites during a very quiet period magnetically was contrasted with that of a disturbed period. Some earlier observations of satellite beacon fluctuations are reviewed. M.M.

c07 100500 80

A71-24790 * **Low-latitude DS component of geomagnetic storm field.** K. Kawasaki and S.-I. Akasofu (Alaska, University, College, Alaska). *Journal of Geophysical Research,* vol. 76, Apr. 1, 1971, p. 2396-2405. 18 refs. NSF Grants No. GA-17663; No. GA-1703; Grant No. NGR-02-001-001.

Relationships between the low-latitude DS component and the intensity of auroral electrojet are examined for several intense geomagnetic storms. It is shown that the magnitude of the DS component fluctuates considerably during the course of a storm and that magnetospheric substorms are responsible for the fluctuations. In particular, during the main phase many substorms are associated with a temporary decrease of DS during its early phase and with a subsequent increase during a later phase. Therefore there temporarily occurs a strong anticorrelation between DS and the electrojet intensity. The origin of the DS component is discussed in the light of recent particle observations by the synchronous satellite ATS 5. (Author)

c13 100500 104

A71-25381 * # **Dynamical analysis of outflow from tornado-producing thunderstorms as revealed by ATS III pictures.** K. Ninomiya. *Journal of Applied Meteorology,* vol. 10, Apr. 1971, p. 275-294. 23 refs. ESSA Grants No. E 22-41-69(G); No. E 198-68(G); Grant No. NGR-14-001-008.

Detailed synoptic and dynamic analyses of outflow from tornado-producing thunderstorms of Apr. 23, 1968, were made by using conventional rawinsonde data combined with ATS III pictures. It was found that the pre-existing flow at the cirrus level over storm areas changed dramatically into outflow as the storms developed. When the storms reached their mature stage, the horizontal dimensions of the outflow increased to about 500 km. Detailed analyses of rawinsonde data inside the outflow area revealed the existence of a midtropospheric warm core accompanied by a significant field of convergence below the 700-mb surface. Quantitative analysis of the thermodynamical and dynamical aspects of the outflow field showed that the outflow was induced and maintained by convective warming. (Author)

c20 081100 02

A71-26608 # **Measurement of sky noise temperature at the frequencies of 16 GHz and 35 GHz.** Yuichi Otsu. *Radio Research Laboratories, Review,* vol. 16, July 1970, p. 379-394. 12 refs. In Japanese, with abstract in English.

An experiment on the 16 and 35 GHz radiometers for use in the ATS-5 Millimeter Wave Experiment was carried out during June and July, 1969, to estimate the antenna and feeder loss which caused an apparent increase in antenna temperature, and to measure the sky noise temperature under various atmospheric conditions. The average apparent increases in temperature due to the antennas and their feeder losses were 35 K for the 16 GHz radiometer and 24 K for the 35 GHz radiometer. Calculations of changes in the sky noise temperature under various weather conditions were made using the standard atmospheric models. On clear days, the sky noise temperature changes, in accordance with Shulkin's (1951) equations, from 3 to 9 K at 15 GHz and from 13 to 27 K at 35 GHz when the ground humidity and temperature change from 20 to 100% and from 288 to 308 K, respectively. M.M.

c07 070300 16

A71-27912 * **Magnetospheric substorm of August 25-26, 1967.** E. W. Hones, Jr., Sidney Singer (California, University, Los Alamos, N. Mex.), L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), J. D. Pierson (NASA, Manned Spacecraft Center, Houston, Tex.), and T. J. Rosenberg (Maryland, University, College Park, Md.). *Journal of Geophysical Research,* vol. 76, May 1, 1971, p. 2977-3009. 52 refs. USAF-AEC-ARPA-supported research; Grant No. NsG-673.

The temporal history of the magnetospheric substorm that began late on Aug. 25, 1967 is examined comprehensively. Features of the substorm that readily identified the occurrence of breakup were preceded for more than 1 hr by causally related magnetosphere-wide phenomena. This period, which is termed the development phase of the substorm, was characterized by a reduction of the thickness of the magnetotail plasma sheets, the buildup of a partial ring current, and the gradual development of magnetic bays and cosmic noise absorption at some auroral zone stations. The observed rate of thinning of the plasma sheet is evidence for a dawn-to-dusk electric field of approximately 1 kv/R sub E (earth radii) imposed across the magnetosphere during the period of approximately 2 hr when the interplanetary magnetic field in the vicinity of the earth was for the most part normal to the ecliptic and pointing southward. Following breakup, increases in the flux of energetic trapped electrons were detected near local noon. M.M.

c30 110300 38

A71-29666 **Simultaneous storm-time increases of the ionospheric total electron content and the geomagnetic field in the dusk sector.** M. D. Papagiannis, M. Mendillo (Boston University, Boston, Mass.), and J. A. Klobuchar (USAF, Cambridge Research Laboratories, Bedford, Mass.). *Planetary and Space Science,* vol. 19, May 1971, p. 503-511. 18 refs. Contract No. AF 19(628)-68-C-0097.

Using the Faraday rotation technique with the ATS-3 satellite, it has been possible to monitor changes in the total electron content (N sub T) of the mid-latitude ionosphere during the first day of 20 geomagnetic storms. Our analysis has shown that during the positive phase (delta N sub T is greater than 0) of ionospheric storms the absolute magnitude of the increase in N sub T exhibits a very pronounced maximum near sunset. The mean value of delta N sub T at 17:00 LT is more than five times the average delta N sub T value at local noon. This effect is basically independent of the storm commencement time and is usually associated with substantial local enhancements of the total geomagnetic field. The N sub T enhancements are discussed in terms of a contraction and draining of the plasmasphere. A model is presented in which the dawn-dusk electric field responsible for the magnetospheric convection slows down the corotational motion of the plasmaspheric ionization in the dusk sector. This braking action causes a 'pile up' of the plasma and the magnetic field along the entire dusk sector. (Author)

c13 100500 107

A71-30898 * **Results of an experiment to locate and read data from unmanned transponders using satellites.** Roy E. Anderson (General Electric Co., Schenectady, N.Y.). In: NTC '71; Institute of Electrical and Electronics Engineers, National Telemetering Conference, Washington, D.C., April 12-15, 1971, Record. (A71-30896 14-07) New York, Institute of Electrical and Electronics Engineers, Inc., 1971, p. 15-28. Contract No. NAS 5-11634.

The vhf transponders of NASA's ATS-1 and ATS-3 satellites have been used to locate and communicate with ships and aircraft and to locate and read sensor data from a buoy moored at sea. The remote platforms have included a buoy moored in deep water near Bermuda, Coast Guard cutters in the Gulf of Mexico and Pacific Ocean, aircraft in flight over the continental United States and the North Atlantic, and a network of ground-based transponders at Ireland, Greenland, Iceland, Newfoundland, the state of Washington, and Argentina. Position fix accuracies were approximately 1 n mi, 1 sigma, using ordinary vhf band mobile communications equipment with simple, inexpensive tone-code responders connected between the receivers and transmitters. Much better accuracy would be obtained using wider bandwidth at higher radio frequencies. The tests confirmed that a network of remote, unmanned platforms can be interrogated at any time, in any sequence with the location of each platform and its sensor data immediately available at the ground station. (Author)

c07 070211 15

A71-31755 * **Plasma clouds in the magnetosphere.** S. E. DeForest and C. E. McIlwain (California, University, La Jolla, Calif.). *Journal of Geophysical Research,* vol. 76, June 1, 1971, p. 3587-3611. 21 refs. Contract No. NAS 5-10364; Grant No. NGL-05-005-007.

Equatorial observations by the geostationary satellite ATS 5 of the charged particles on auroral lines of force reveal the frequent injection of plasma into this region of the magnetosphere. These intrusions of hot plasma are found to have a one-to-one correspondence with magnetospheric substorms. An injection is assumed to correspond to an inward flow from the plasma sheet in the magnetotail. This flow seems to subside gradually so that injection eventually ceases. The net result is the insertion of a relatively discrete set of particles, i.e., a 'plasma cloud,' on lines of force that are not normally involved in the flow of the plasma sheet particles. The clouds of freshly injected plasma are dispersed by the earth's magnetic and electric fields such that complicated energy structure is generated. (Author)

c13 111400 07

A71-33393 **Total electron content during the great magnetic storm of March 8, 1970.** P. R. Arendt (U.S. Army, Institute for Exploratory Research, Fort Monmouth, N.J.). *Nature Physical Science,* vol. 231, June 28, 1971, p. 197, 198. 5 refs.

Evaluation of total electron content data obtained from polarization measurements of the ATS-3 satellite beacon at 137.35 MHz and from simultaneous bottomside vertical sounding. The total electron content showed much higher than average values. The true height variations of the plasma frequencies indicate a bottomside electron density depletion while total content was still increasing, and a topside depletion while the total content was decreasing fast during bottomside expansion and enhancement. A mechanism which qualitatively explains the trend and sequence of the heavy motion of the bottomside plasma during the initial storm phase is suggested. A.B.K.

c13 100500 112

A71-33588 **Satellites for education.** P. A. Rubin (Hughes Aircraft Co., El Segundo, Calif.). In: Organizing space activities for world needs; International Academy of Astronautics, International Astronautical Congress, 19th, New York, N.Y., October 13-19, 1968, Proceedings. (A71-33580 16-34) Edited by E. A. Steinhoff. Oxford, Pergamon Press, Ltd., 1971, p. 273-291. 7 refs.

Satellite systems for distributing educational television programs generally fall into three classes. Distribution satellites can relay the TV signals to typically a 30-foot terminal. From here the signal can be rebroadcast by conventional stations to home TV receivers. Limited broadcast satellites provide for transmission from the satellites to less expensive receivers with antennas approximately 10 ft in diameter. The direct broadcast satellite transmits directly from the satellite to a home receiver. Questions of orbit utilization and ground stations are discussed together with NASA's Applications Technology Satellite program. G.R.

c31 010000 42

A71-33783 * # **A study of dynamics of traveling ionospheric disturbances.** K. C. Yeh (Illinois, University, Urbana, Ill.). *COSPAR, Plenary Meeting, 14th, Seattle, Wash., June 18-July 2, 1971, Paper.* 9 p. 9 refs. Grant No. NGR-14-005-002.

Description of certain experimentally observed properties of traveling ionospheric distrubances (TIDs) and certain deductions on the dynamic parameters of the acoustic-gravity wave by use of a fairly crude theory. The experiment involves continuous monitoring, at one or three stations, of wave polarization of radio signals transmitted by the geostationary satellite ATS-3. TIDs occur as quasi-sinusoidal oscillations in the polarimeter output. In general, the oscillations are observed to be in the frequency range 0.01 to 0.1 cpm. Experimental results show that these oscillations in February and August tend to be more sharply peaked than those of May and possibly also November. By triangulation the three-station data are capable of yielding information on the horizontal wave vector and hence the horizontal phase velocity. F.R.L.

c13 100500 109

A71-33845 * # **VLBI observations of radio emissions from geostationary satellites.** R. D. Michelini and M. D. Grossi (Smithsonian Astrophysical Observatory, Cambridge, Mass.). *COSPAR, Plenary Meeting, 14th, Seattle, Wash., June 18-July 2, 1971, Paper.* 20 p. Contract No. NSR-09-015-079.

From very long-baseline interferometry (VLBI) observations of geostationary satellites, the orbital elements of a satellite and its inertial position can be determined. A constellation of satellites fixed in this way can serve as a coordinate frame in the measurement of polar motion and continental drift. By addition of other measurements, such as laser or radio ranging, the satellite can also be used as a radio source for measurements of an absolute position on the earth's surface. In 1970, VLBI observations of L-band emissions of the ATS-5 satellite were conducted over a transcontinental baseline. Although the data were not sufficient to demonstrate fully the capability of the method, analysis of the ATS observations shows the presence of interference fringes related to the modulation waveform emitted by the satellite and to the various motions of the satellite. The measured VLBI time delays are in agreement with the geometry of the observations and with the instrumental delay, both determined independently. O.H.

c07 070103 02

A71-33955 * **On polar substorms as the source of large-scale traveling ionospheric disturbances.** M. J. Davis (Stanford University, Stanford, Calif.). *Journal of Geophysical Research,* vol. 76, July 1, 1971, p. 4525-4533. 17 refs. Contract No. NAS 5-10102; Grant No. NGR-05-020-001.

The present study shows that it is possible to relate the occurrence of large-scale traveling ionospheric disturbances (TID's) observed at midlatitudes with polar substorms on a statistical basis. In addition under favorable conditions (relatively low geomagnetic activity) it is possible to show a connection between the occurrence of the TID's and substorms on a one-to-one basis. Columnar electron content measurements were used to detect the TID's and magnetograms from several high-latitude geomagnetic observatories were used to study the substorms. The results strongly support the theory that large-scale TID's originate during polar substorms. It was also possible to determine the location of the source of a number of individual TID's. These locations lie primarily in the evening sector of the auroral oval. (Author)

c13 100500 108

A71-33975 **Ionosphere-gravity wave interactions during the March 7, 1970, solar eclipse.** P. R. Arendt (U.S. Army, Institute for Exploratory Research, Fort Monmouth, N.J.). *Journal of Geophysical Research,* vol. 76, July 1, 1971, p. 4695-4697. 5 refs.

The measurements considered are based on beacon polarization data from ATS 3 received on 137.35 MHz. On the basis of the investigation it is concluded that eclipse effects, not magnetic storm effects, produced the electron content variations measured during the initial phase of the eclipse. Thus far the prediction of Chimonas and Hines (1970) regarding the generation of observable traveling ionospheric disturbance effects by a thermospheric bow wave during a solar eclipse is confirmed, but it is by no means evident that the perturbations reported are indeed a part of the bow wave spectrum they discussed. G.R.

c13 100500 111

A71-34244 * # **Meteorological satellites.** John M. Denoyer (NASA, Office of Space Science and Applications, Washington, D.C.). *ITU Telecommunication Journal,* vol. 38, May 1971, p. 366-368.

Characteristics and capabilities of meteorological satellites launched since 1960 are reviewed. The review includes the Tiros, Itos, Nimbus, and ATS programs and vehicles. Features of future meteorological satellite projects - i.e., the Synchronous Meteorological Satellite (SMS) program, and the international Global Atmospheric Research Program (GARP) - are also discussed. O.H.

c31 080000 33

A71-35215 * # **Determination of the sea surface slope distribution and wind velocity using sun glitter viewed from a synchronous satellite.** Nadav Levanon (Tel Aviv University, Tel Aviv, Israel). *Journal of Physical Oceanography,* vol. 1, July 1971, p. 214-220. 5 refs. Contract No. NASw-65.

This work demonstrates the feasibility of determining the east-west component of the sea surface slope distribution from a synchronous satellite, through quantitative analysis of the sun glitter. The Cox-Munk sun glitter technique, utilizing a single photograph of the whole-sun glitter pattern, taken from an aircraft altitude, is adapted to a much higher altitude. This is done by making a sequence of light intensity measurements, reflected from a single point on the ocean, as this fixed point scans the westward moving sun glitter pattern. Wind velocity is calculated from the slope variance, using the Cox-Munk empirical relation. Calculated wind velocities for three locations in the Pacific, on two separate days, are compared to direct wind measurements taken at these locations during the Line Islands Experiment. The agreement is within plus or minus 1 m/sec. (Author)

c13 081000 20

A71-37359 **Equatorial and precipitating solar protons in the magnetosphere. I - Low-energy diurnal variations.** L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). *Journal of Geophysical Research,* vol. 76, Aug. 1, 1971, p. 5235-5243. 28 refs.

Use of recent experimental determinations of the total proton gamma-ray production cross sections, together with equatorial proton fluxes measured on ATS 1, to calculate the predicted diurnal variations in the precipitating low-energy solar proton-produced gamma rays. Reasonable agreement is obtained in the relative diurnal variations for observations separated two hours in local time and on approximately the same L shell. However, the predicted gamma-ray fluxes, using the equatorial data, are approximately ten times less than those actually measured. (Author)

c29 110300 33

A71-37360 **Equatorial and precipitating solar protons in the magnetosphere. II - Riometer observations.** T. A. Potemra (Johns Hopkins University, Silver Spring, Md.) and L. J. Lanzerotti (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). *Journal of Geophysical Research,* vol. 76, Aug. 1, 1971, p. 5244-5251. 29 refs. Contract No. N 00017-62-C-0604.

Use of the equatorial solar protons measured on ATS 1 during the Jan. 28, 1967, solar event, together with the ionosphere model of Potemra et al. (1969), to calculate the expected daytime 30-MHz riometer absorption. The computed absorption values compare favorably with the riometer observations at Byrd, Antarctica, located on approximately the same L shell (L = 7) as ATS 1 (L = 6.4). The latitude profiles measured by the polar-orbiting satellite 1963-38C show that during the decay of the event Byrd was within a latitude region where fewer protons precipitated in comparison to higher latitudes. The absorption measured at Byrd during this period was systematically lower than the absorption measured at either South Pole (L = 13) or McMurdo (L = 32), stations well within the polar cap. Absorption values computed from the 1963-38C proton fluxes at the latitude of Byrd compare favorably with the observed absorption at this station. Empirical linear relationships between the square root of the 360 deg omnidirectional ATS 1 proton fluxes greater than some E sub min and the daytime 30-MHz riometer absorptions are also studied, with an excellent correlation found for E sub min over a wide energy range. (Author)

c29 110300 34

A71-37361 * Quiettime observation of a coherent compressional Pc-4 micropulsation at synchronous altitude. J. N. Barfield (California, University, Los Angeles, Calif.), L. J. Lanzerotti, C. G. Maclenann (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), G. A. Paulikas, and Michael Schulz (Aerospace Corp., El Segundo, Calif.). *Journal of Geophysical Research*, vol. 76, Aug. 1, 1971, p. 5252-5258. 20 refs. Grant No. NGR-05-007-004; Contracts No. N 00014-69-A-0200-4016; No. AF 04(701)-70-C-0059.

Observation that during a magnetically quiet interval (1740 to 1850 UT), on Feb. 14, 1967, the magnetic-field intensity and energetic electron fluxes (E equal to about 0.3 to 2.0 MeV) at ATS 1 exhibited coherent modulations having a frequency of 33.8 cph (period equal to about 106.5 sec) and a duration of approximately 40 oscillations. The electron fluxes and the magnetic field oscillated in phase. The field perturbation reached 8 gamma (peak to peak) in the direction of the unperturbed geomagnetic field. The transverse component of the field perturbation was practically zero. The characteristics of the observed oscillations appear to be compatible with those of a compressional (magnetosonic) excitation of the outer magnetosphere. The substantially radial normal mode is perhaps driven by a bounce-resonant interaction with the 15-keV protons that populate the quiet-time ring current. (Author)

c07 110300 35

STAR ABSTRACTS (N-)

N66-19654*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABILIZATION SYSTEM Sixth Quarterly Progress Report, 1 Oct.-31 Dec. 1965
20 Jan. 1966 192 p *Its* Doc.-66SD4201
(Contract NAS5-9042)
(NASA-CR-71188) CFSTI: HC $5.00/MF $1.25 CSCL 22C
Progress is reported in the design and development of gravity gradient stabilization systems for the Applications Technology satellites. Detailed discussions are given in the following areas: systems analysis and integration, boom subsystem, combination passive damper, attitude sensor system, ground testing, quality control, materials and processes, manufacturing, and reliability. Various photographs, charts, graphs, tables, and schematics are included. C.T.C.

c03 090000 21

N66-23507*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Seventh Monthly Progress Report, 1-31 Jan. 1965
10 Feb. 1965 35 p *Its* DOC.-65504217)
(Contract NAS5-9042)
(NASA-CR-74450) CFSTI: HC $2.00/MF $0.50 CSCL 22B
Investigations and progress in the systems analysis and integration, and boom, damper, and other subsystems are reported for the gravity gradient stabilization system. Equations for the solar aspect sensor/antenna polarization measurement system were derived. Emphasis is placed on the completion of the sensor system error analysis. A dynamic envelope drawing for the secondary boom was prepared. The damping coefficient was measured for the eddy current disks using copper, high purity aluminum, and raw stock aluminum. An analytical expression for the solar energy distribution at the bottom of the detector reticles was derived. Changes in solar aspect sensor component specifications are mentioned. The power control unit, near completion, is discussed. The overall bandwidth of the TV camera subsystem was estimated, and the corresponding values of obtainable horizontal and vertical readout accuracy were calculated. N.E.N.

c31 090000 09

N66-23508*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Fifth Monthly Progress Report, 1-30 Nov. 1964
10 Dec. 1964 45 p ref *Its* Doc.-64SD4390
(Contract NAS5-9042)
(NASA-CR-74451) CFSTI: HC $2.00/MF $0.50 CSCL 22B
Progress was directed toward further implementation of the stabilization system and vehicle attitude sensing system. A new damper clutch was developed that eliminates the complexity of the former system without sacrificing the requirements placed on the damper. Testing continued with the objective of evaluating the properties of the eddy current damper. A magnetic mockup was constructed of the damper which will be used for magnetic dipole evaluation. Decisions were made concerning a number of pending design items in the primary boom system. One of the important items was finalization of the lubricant for the boom mechanism. Evaluation and testing were carried on for the electronic packages that comprise the attitude sensing system. Author

c31 090000 07

N66-23509*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Eighth Monthly Progress Report, 1-28 Feb. 1965
10 Mar. 1965 44 p *Its* DOC.-65SD4243
(Contract NAS5-9042)
(NASA-CR-74452) CFSTI: HC $2.00/MF $0.50 CSCL 22B
Systems analysis, integration and design were continued on the stabilizing boom and dampers and on the attitude sensors for the gravity gradient stabilization systems. Emphasis continued to be placed on the sensor system error analysis. Preliminary conclusions indicate that for attitude determination, the rf sensor/antenna polarization measurement system is the first choice with the earth sensor/antenna polarization measurement scheme a close second. The primary boom deployment investigations are reported. The method of caging the damper boom and eddy current damper was reviewed. Tests on the hysteresis damping present in the magnetic torsioned restraint element of the eddy-current damper showed the hysteresis loss was about 10% of the specified goal. The attitude sensor subsystem is discussed, including the solar aspect sensor design and video bandwidth studies. N.E.N.

c31 090000 10

N66-24497*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Third Quarterly Progress Report, 1 Jan.-31 Mar. 1965
20 Apr. 1965 393 p *Its* Doc.-65SD4266
(Contract NAS5-9042)
(NASA-CR-74571) CFSTI: HC $7.00/MF $2.00 CSCL 22B
A preliminary flow diagram is presented for the computer program of the Applications Technology Satellite (ATS) mathematical model, and a preliminary orbit test plan is included for the ATS-A flight. In support of the combination passive damper concept, test results are detailed for an evaluation of the diaphragm clutch, measurement of the eddy current damping coefficients, torsional restraint, and diamagnetic repulsion force measurements. Theory and operation of the boom angle detector, which has a digital output and simplified circuitry, are discussed. The electrical configuration and interface for the attitude sensor, as well as a method for simulating the Earth as seen from the TV camera, are included. The effect of orbit parameter uncertainties on the determination of spacecraft attitude is reported, and a TV attitude sensory error analysis is included. Other reports deal with: (1) ATS-A capture studies; (2) response to internal disturbance torques; (3) effects of primary rod extension rate on structural integrity; and (4) analysis of solar aspect sensor electrical, mechanical, and optical errors. M.W.R.

c31 090000 11

N66-24502*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE

ADVANCED TECHNOLOGICAL SATELLITE First Quarterly Report, 29 Jun.-30 Sep. 1964
16 Oct. 1964 217 p refs *Its* Doc.-64SD4361
(Contract NAS5-9042)
(NASA-CR-74573) CFSTI: HC $6.00/MF $1.25 CSCL 22B

Systems development and analysis, a preliminary definition of the orbit test plan, and details of the orbit test simulation exercise are presented for the gravity gradient stabilization system for the advanced Applications Technology Satellite (ATS). Coordinate frames required to derive the mathematical model are presented. Factors which influence the design concept selection of the boom subsystem are included, and test activities on the boom subsystem are detailed. Progress is reported for the three critical interface areas: spacecraft, power, and sensors. Various concepts for use in the design of the combination passive damper were considered, with attention given to establishing compatibility between an eddy current damper and a hysteresis damper. An attitude sensor subsystem has been selected which meets the requirement for monitoring vehicle attitude. Reliability and control activity are considered; and an appendix deals with determination of gravity gradient stabilization for ATS pitch, roll, and yaw angles from solar aspect information. M.W.R.

c31 090000 05

N66-24503*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Fifth Quarterly Progress Report, 1 Jul.-30 Sep. 1965
20 Oct. 1965 189 p *Its* Doc.-65SD4464
(Contract NAS5-9042)
(NASA-CR-74572) CFSTI: HC $5.00/MF $1.25 CSCL 22B

Systems evaluation and integration efforts are reported for the Applications Technology Satellite (ATS), and attention is given to various parts of the flight evaluation plan. Results are presented for analytical studies dealing with (1) vehicle attitude errors due to vehicle magnetic dipole and (2) TM-2 system response to pulsing thrustor. Boom thermal bending analysis and orbital excitations are considered. Progress is reported for the combination passive damper and the attitude sensor subsystem. Various engineering evaluation, qualification, and flight acceptance tests are discussed. Quality control and inspection procedures are considered; along with reliability, parts and standards, materials and processes, and manufacturing. Appendices deal with (1) cable cutting malfunction analysis, (2) vibration test plan for combination passive damper dynamic model, and (3) limit switch configuration analysis. M.W.R.

c31 090000 20

N66-24505*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Fourth Quarterly Progress Report, 1 Apr.-30 Jun. 1965
20 Jul. 1965 80 p *Its* Doc.-65SD4381
(Contract NAS5-9042)
(NASA-CR-74536) CFSTI: HC $3.00/MF $0.75 CSCL 22B

The Applications Technology Satellite (ATS) data processing system design and the flight evaluation plan are documented; and reports are presented on capture analysis for the ATS-A vehicle, thrustor and flywheel inversion, and hysteresis damping. Analytical and design efforts have been discontinued on the variable torque hysteresis damping concept. The O-ring seal used in the boom drive assembly is evaluated, and results of lubrication tests are reported. Photographs illustrate the developmental models of the transmission assembly, TV tip targets, and test fixtures. An analysis is presented of the solar aspect sensor detector-electronics interface, and reliability analyses are reported for the sensor and the passive hysteresis damper. An analytical description is given for a diamagnetic shaft support for use in orbiting satellites, the mathematical model developed for this support is applied to a complex shaft loading condition, and computer solutions are presented. M.W.R.

c31 090000 19

N66-26264*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Second Quarterly Progress Report, 1 Oct.-31 Dec. 1964
10 Jan. 1965 517 p refs
(Contract NAS5-9042)
(NASA-CR-75009; Doc.-65SD4201) CFSTI: HC $8.16/MF $2.50 CSCL 22B

The capability of the proposed gravity gradient system mathematical model is compared with the current GAPS III Program. Computer runs show the effect on performance of various disturbances. Studies made include computer runs comparing the performance of eddy current damping with hysteresis damping, isolated effect of boom thermal bending, capture studies, and attitude error sensing analysis. Items investigated in the primary boom subsystem include lubricant selection, relative rod length and the advantage of shunt wound motors for scissoring and boom extension. Electrical isolation of the booms from their supporting structure was investigated; and functions have been assigned for the microswitches used throughout the boom subsystems. Laboratory tests were conducted on diamagnetic torsional restraint, eddy current and hysteresis damping, and torsion wire suspension. A report on the rf attitude sensor is included. Author

c31 090000 08

N66-35656*# National Aeronautics and Space Administration, Washington, D. C.
COMMUNICATIONS SATELLITES
Washington, GPO [1966] 22 p
(EP-40) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Historical background, purpose, and problems and their solutions are briefly presented. The function of active and passive satellites is outlined, and characteristics are given of Echo and II, Telstar, Relay, and Project Syncom. The role of satellites in television transmission and in commercial application is discussed. Technical questions are considered, and future technical developments in general, and the ATS Project in specific, are covered. K.W.

c31 010000 20

N66-35944*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SYNCHRONOUS OPERATIONAL METEOROLOGICAL SATELLITE FEASIBILITY STUDY

Jun. 1966 118 p refs

(NASA-TM-X-55555; X-731-66-271) CFSTI: HC $3.00/MF $1.00 CSCL 22B

A spin scan camera for daytime observation of cloud cover to be flown and the first launch of the Applications Technology Satellite is described. Means of exploiting this new technique on a quick reaction basis by use of existing synchronous satellite technology are suggested. The method chosen leans heavily on the use of HS-303A (Intelsat II) with redundant spin scan cameras added. Objectives of the synchronous operational meteorological feasibility study are related; and constraints in planning the systems, cost, and schedule are briefly discussed. Various tradeoffs are mentioned and evaluated and a feasible system definition is reached. Subsystems such as the meteorological equipment, transponder, telemetry, and power supply are mentioned. Ground stations for servicing the spacecraft and relaying data and/or obtaining data are discussed. The thrust augmented improved Delta vehicle and the apogee motor used in the overall vehicle are examined. S.P.

c20 080100 01

N66-36326*# National Aeronautics and Space Administration, Washington, D. C.

SYMPOSIUM ON PASSIVE GRAVITY-GRADIENT STABILIZATION

1966 291 p refs Symp. held at Ames Res. Center, Moffett Field, Calif., 10-11 May 1965

(NASA-SP-107) GPO: HC $1.75; CFSTI: MF $0.75

CONTENTS:

c31 090000 13

N66-36329*# National Aeronautics and Space Administration, Washington, D. C.

STABILIZATION REQUIREMENTS FOR COMMUNICATION AND NAVIGATION SATELLITES

A. M. Greg Andrus *In its* Symp. on Passive Gravity-Gradient Stabilization 1966 p 19-32 (See N66-36326 21-31) GPO: HC $1.75; CFSTI: MF $1.75

The need for communications satellites developed as a result of increasing world requirements for long-distance real-time communications. The paper summarizes the evolution of long-distance communications, including submarine cables, Moon-bounce techniques, and Courier, Score, Echo I and II, Relay, Telstar, and Syncom satellites, and discusses, in particular, the gravity-gradient efforts that the NASA Communication and Navigation Programs Division is pursuing as part of the Applications Technology Satellite (ATS) flight project. Some applications of active and passive stabilization systems to future mission possibilities, such as direct voice and television broadcast, navigation traffic control, and orbiting relay satellites for deep-space communications and navigation, are discussed. Author

c31 090000 14

N66-36333*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STUDY OF GRAVITY-GRADIENT EXPERIMENT OF APPLICATIONS TECHNOLOGY SATELLITE

Benjamin G. Zimmerman *In* NASA. Washington Symp. on Passive Gravity-Gradient Stabilization 1966 p 105-114 refs (See N66-36326 21-31) GPO: HC $1.75; CFSTI: MF $1.75

The gravity-gradient experiment associated with the Applications Technology Satellite (ATS) program uses inertial coupling to permit the damping of all satellite librations by a single auxiliary body having a single degree of freedom with respect to the primary body. A linearized analysis demonstrated that this technique gives good small-angle performance, and preliminary values of system parameters were selected on the basis of this study. This paper reviews studies made with a large-angle mathematical model of the ATS gravity-gradient configuration. The mathematical model permits the choice of linear or hysteresis damping and includes the effects of noncoincidence of the satellite center of pressure and center of the gravity-gradient booms. The in-flight experiments simulated include modification of system moments of inertia by changing the angle between the gravity-gradient booms and introduction of a controlled sinusoidal disturbance torque by a momentum wheel. Author

c31 090000 15

N66-36337*# General Electric Co., Philadelphia, Pa.

PASSIVE DAMPER BEARING AND GRAVITY-GRADIENT ROD DEVELOPMENT

E. M. Mazur, D. N. Matteo, and R. S. Oxenreider *In* NASA. Washington Symp. on Passive Gravity-Gradient Stabilization 1966 p 157-183 refs (See N66-36326 21-31) GPO: HC $1.75; CFSTI: MF $1.75

The paper discusses the design and development work in the field of passive dampers for gravity-gradient stabilization systems. In addition, the basic materials research and testing programs aimed at producing improved gravity-gradient rods are covered. The discussion on dampers covers the effort expended in the design of the eddy-current damper with the frictionless diamagnetic suspension and the associated low-order force test fixtures and facilities which were required to ground-test the component. The unique magnetic torsional restraint required for gravity-anchored passive systems is also described. The culmination of this work is an eddy-current damper which will be flight-tested along with a magnetic hysteresis damper on the Applications Technology Satellite in 1966. The magnetically anchored viscous-fluid damper flight-tested successfully on a satellite in January 1964 is also described. The refinements made to this damper over the past year result in suspension and weight improvements and have been flight-tested on additional satellites during the past few months. A spherical magnetically anchored eddy-current damper is also discussed. In the field of gravity-gradient rods, early test work is described including the first testing of long rods in a thermal vacuum chamber to demonstrate the effectiveness of silverplating the rods to reduce thermal bending. Author

c31 090000 16

N66-37117*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE Eighth Quarterly Progress Report, 1 Apr.-30 Jun. 1966

20 Jul. 1966 97 p *Its* Doc.-66SD4388

(Contract NAS5-9042)

(NASA-CR-78017) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Applications Technology Satellite inversions by means of rod retraction/or extension were completed and the effects of scissor angle on the performance were determined. A pyrotechnically actuated primary boom release system was implemented to provide positive caging during launch and uncaging by means of squibs. Boom element cracking was eliminated successfully by implementing the retrofits, and tests on the combination passive damper were completed. Acceptance tests of the system prototype units were also completed and component qualification tests were started. A summary of these test data is included. G.G.

c31 090000 22

N67-11348*# National Aeronautics and Space Administration, Washington, D. C.
FIRST ATS LAUNCH SET, DECEMBER 6
2 Dec. 1966 36 p
(NASA News Release-65-57) Available from the Scientific and Technical Information Division CSCL 22B

A narative account is presented on the Applications Technology Satellite (ATS) program and on the satellite ATS-B scheduled for launching December 6, 1966. The communications, technology, and scientific experiments are discussed, and details on the orbit and launching are given. The power, control, and command and telemetry subsystems are described, and the ground stations and tracking activities are covered. N.E.N.

c31 010000 18

N67-12119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS TECHNOLOGY SATELLITE (ATS) MOTOR DEVELOPMENT
R. G. Anderson and R. A. Grippi *In its* Space Programs Sum. No. 37-40, Vol. IV 31 Aug. 1966 p 73-75 refs (See N67-12101 02-34) CFSTI: HC$3.75/MF$1.25

Results of storage and static firing are reported for the solid propellant apogee motor developed for the Applications Technology Satellite (ATS). After six months of storage, no detrimental effects were observed on the ATS storage units. Static firing is reported for the first combination apogee motor-spacecraft test; and temperature data from the externally mounted thermocouples and other data indicate that the apogee unit functioned nominally in all respects. Another static test shows that the mechanical portion of the safe and arm device can withstand the pressures of temperatures of a full duration apogee motor firing. M.W.R.

c31 030004 01

N67-15719*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATIONS TECHNOLOGY SATELLITE MOTOR DEVELOPMENT
D. R. Frank and R. G. Anderson *In its* Space Programs Sum. No. 37-41, Vol. IV 31 Oct. 1966 p 91-96 refs (See N67-15701 06-11) CFSTI: HC$3.00/MF$0.65

Qualification tests were conducted on eight ATS apogee motors to establish a performance-temperature history for flight input information, and to demonstrate the acceptability of the motor hardware for flight use. During each test the motor was spun at 100 rpm. The first four motors were fired following a complete motor temperature conditioning at 100°F; the remaining four were temperature conditioned at 40°F before ignition. All motor component S/Ns used in the program are listed. Such important performance parameters as test conditions, and weight, time, pressure, and thrust data are tabulated. M.G.J.

c28 030004 02

N67-16926*# General Electric Co., Philadelphia, Pa. Spacecraft Dept.
DEVELOPMENT OF A PASSIVE DAMPER FOR A GRAVITY-GRADIENT STABILIZED SPACECRAFT
E. J. Buerger *In* Santa Clara Univ. Aerospace Mech. 20 May 1966 p 297-309 (See N67-16901 07-30) CFSTI: HC $3.00/MF $0.65

The configuration of a component that combines two forms of magnetic, passive damping is described: an eddy-current damper, and a hysteresis damper. These dampers are so constructed that either one may be engaged, and the other disengaged, upon command. These dampers and the auxiliary components for switching, a unique angle indicator, and a caging device (used during the launch environment) are housed within a single envelope designated as the combination passive damper. Author

c32 090000 24

N67-18982*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABILIZATION SYSTEM Quarterly Progress Report, 1 Jul.-30 Oct. 1966
15 Nov. 1966 93 p
(Contract NAS5-9042)
(NASA-CR-82465; Doc.-66SD4505; QPR-9) CFSTI: HC $3.00/MF$0.65 CSCL 22B

Technical progress toward the design and development of gravity gradient stabilization systems for the Applications Technology Satellites (ATS) is reported. The ATS math model computer program was checked out, and computations were obtained for vehicle altitude dynamics. It was found that the major contributor to boom deflection in orbit is the thermal bending component, and empirical and analytical approaches for determining the magnitude of rod bending are described. The computer processing system to be used for evaluation of the ATS-A and determination of attitude is specified, and final performance estimates for the ATS-A and ATS-D are presented. Other areas covered include qualification testing of mounting brackets, details of the solar aspect sensor system, and system compatibility testing. C.T.C.

c31 090000 35

N67-19866* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X/Y ANGLE AND POLARIZATION ANGLE TRACKING OF THE ATS-B SPACECRAFT USING THE ROSMAN 85-FOOT ANTENNA NO. 2 AND MOJAVE 40-FOOT ANTENNA
Thomas Keating Feb. 1967 85 p
(NASA-TM-X-55716; X-513-67-95) CFSTI: $3.00 CSCL 17I

The 85-foot-diameter and 40-foot-diameter Cassegrain parabolic antennas located at Rosman, North Carolina and Mojave (Goldstone Dry Lake), California are used to track the ATS-B spacecraft. These antennas are required to automatically track the position of the spacecraft and the plane of the linearly polarized r-f wave radiated by the spacecraft antennas. The report describes the design features of the equipment and the performance of the tracking systems in support of the ATS-B launch operations. Author

c07 050000 01

N67-20281*# National Aeronautics and Space Administration, Washington, D. C.
PROJECT ATS-A
31 Mar. 1967 41 p
(NASA News Release-67-71) Available from the Scientific and Technical Information Division CSCL 22B

Discussed is the second Applications Technology Satellite to be launched after April 4, 1967, by an Atlas-Agena vehicle into a 6,900-mile orbit. The primary mission objective of this space vehicle is to test and evaluate a passive gravity gradient control system which uses the force of gravity to keep the spacecraft stabilized on three axes and pointed toward the Earth. In addition to the gravity gradient experiment, ATS-A will carry communications, meteorological, and several scientific experiments to measure the orbital environment of the satellite. ATS-A will carry two standard television cameras as a part of the gravity experiment that will provide measurements of the bending effects due to solar heating and radiative cooling on the booms extending out from the satellite. The amount of boom bending will be compared with later synchronous flights. Other tests slated for ATS-A include a microwave communications experiment, two meteorological cameras, an environmental measurements experiment and a Department of Defense albedo experiment. Author

c31 021300 01

N67-21021*# National Aeronautics and Space Administration, Washington, D. C.
REPORT TO THE SPACE SCIENCE BOARD ON THE SPACE SCIENCE AND APPLICATIONS PROGRAMS
Nov. 1966 189 p refs
(NASA-TM-X-59454) CFSTI: HC$3.00/MF$0.65 CSCL 22A

The major satellite and space probe firings since 1958, carried out in connection with the Office of Space Science Applications, are briefly detailed and plans for forthcoming missions are described for lunar, planetary, and biological satellites. Space applications are outlined for communications, earth resources, geodesy, meteorology, sounding rockets, and navigational purposes. The Apollo Project manned space flight future missions are highlighted. A list is presented of the university programs conducted in coorperation with NASA, and summary costs of launched spacecraft are indicated. R.Ll.

c30 010000 16

N67-23641*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY 37-43, VOLUME IV FOR THE PERIOD DECEMBER 1, 1966 TO JANUARY 31, 1967. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
28 Feb. 1967 418 p refs
(Contract NAS7-100)
(NASA-CR-83604) CFSTI: HC$3.00/MF$0.65 CSCL 22A

Space programs supporting research and advanced development are reviewed for the areas of systems analysis, spacecraft guidance and control, materials testing, propulsion systems, instrumentation, theoretical physics, and communications and telemetry. For individual titles see N67-23642–N67-23664.

c11 000000 02

N67-23653*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Supporting Res. and Advanced Develop. 28 Feb. 1967 p 163–176 refs (See N67-23641 12-11)

Propellant binders terminated by acid chloride groups are investigated, as are the simplified interior ballistics of propellant actuated devices and motor development for the Application Technology Satellite (ATS). Exposure of dimer acid chloride to the atmosphere is graphed, and tables summarize data on dimer acid chloride curing with both epoxides and azridines. An analysis is presented for a piston with simply defined motion, and the surface burning of single perforate propellants is shown to be very nearly constant. Storage units and testing of an omnidirectional antenna are considered for the ATS. Data from the four high speed cameras confirmed visual data that the antenna released and maintained a flight path along the motor centerline axis at least until it was past the region of the spacecraft VHF antennas. M.W.R.

c27 030004 05

N67-24601*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
AN ADVANCED STUDY OF AN APPLICATION TECHNOLOGY SATELLITE (ATS-4) MISSION, VOLUME I, BOOK 1 Final Study Report, May–Nov. 1966
9 Nov. 1966 384 p
(Contract NASw-1410)
(NASA-CR-81604; DOC.-66SD4529, Vol. I, Bk. 1) CFSTI: HC $3.00 CSCL 22B

The general mission of the Applications Technology Satellite (ATS-4) is discussed, and a comprehensive summary is given of the design of the baseline spacecraft. The project objectives and their feasibility are considered, and the experiments to be conducted are described. The program objectives were stated to include establishing the feasibility of developing a large aperture, deploying satellite antenna and the precision spacecraft stabilization techniques required for accurate orientation of a parabolic antenna, a phased array, and an interferometer. A feasible spacecraft configuration is defined and an analysis of the performance capabilities is presented. A preliminary program plan for spacecraft development including identification of and approaches to the solution of engineering development problems and an estimate of the program schedule and development costs is included. L.E.W.

c31 010000 12

N67-24602*# General Electric Co., Philadelphia, Pa. Missile and Systems Div.
AN ADVANCED STUDY OF AN APPLICATION TECHNOLOGY SATELLITE (ATS-4) MISSION, VOLUME I, BOOK 2 Final Study Report, May–Nov. 1966
9 Nov. 1966 536 p refs
(Contract NASw-1410)
(NASA-CR-81767; DOC.-66SD4529, Vol. I Bk. 2) CFSTI: HC $3.00 CSCL 22B

A discussion is presented of the system and subsystem tradeoff considerations which led to the selection of the preferred spacecraft approach for the Applications Technology Satellite (ATS-4). The analysis also identified an alternate approach that offers slightly better rf performance at the expense of deployment complexity. Details are given on the configuration selection; paraboloid antenna; guidance and control; tracking, telemetry, and command; power; spacecraft design; and apogee motor selection. L.E.W.

c31 010000 13

N67-24603*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
AN ADVANCED STUDY OF AN APPLICATION TECHNOLOGY SATELLITE (ATS-4) MISSION, VOLUME I, BOOK 3 Final Study Report, May–Nov. 1966
9 Nov. 1966 468 p refs
(Contract NASw-1410)
(NASA-CR-81766; DOC.-66SD4529, Vol. I Bk. 3) CFSTI: HC $3.00 CSCL 22B

The launch phase sequence, experiment selection and operational sequence, ground equipment and ground station considerations, and technical appendices are presented for the

Applications Technology Satellite (ATS-4). The flight dynamics concerned with placing the ATS-4 into an earth synchronous equatorial orbit are discussed. Each of the major operational events from launch vehicle liftoff to stabilization in the synchronous orbit are discussed with the rationale for the selected launch trajectory. The experiments and measurements program is described, including the derivation of measurement requirements from mission objectives, formulation of measurements procedures, integration of the procedures into the overall program, and the derivation of experiment equipment requirements. In the area of support operations, consideration is given to equipment requirements, mechanical support equipment electrical support equipment, test facilities, launch facilities, orbital support, and software. L.E.W.

c31 010000 14

N67-24604*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 1 Final Report
Dec. 1966 70 p
(Contract NASw-1411)
(NASA-CR-81616; SSD-102.3, Vol. 1) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Experiments conducted in the two year mission in equatorial synchronous orbit are analyzed, and the subsystem summaries are presented. The four principal experiments are identified as: (1) deployment, pointing, and utilization of a large parabolic antenna for simultaneous multifrequency communications; (2) active spacecraft stabilization with possible augmentation by passive means; (3) deployment, pointing, and utilization of a high gain, multibeam, electronically steered array; and (4) demonstration of a precision radio interferometer as a sensor for spacecraft attitude and/or antenna pointing reference. The parabolic antenna, stabilization and control system, phased array, and interferometer are briefly described. N.E.N.

c31 010000 21

N67-24605*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 2 Final Report
Dec. 1966 141 p
(Contract NASw-1411)
(NASA-CR-81615; SSD-102.3, Vol. 2) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Details are presented on the systems analysis for the Applications Technology Satellite-4. and operations plan are outlined. The evaluation test is given for the parabolic antenna, phased array, interferometer, and attitude control experiments. The power supply and power loads for the various experiments are described, and weight factors are summarized. Antenna accuracy and efficiency, and the failure modes for the systems and operations are discussed. N.E.N.

c31 010000 22

N67-24606*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 3 Final Report
Dec. 1966 290 p
(Contract NASw-1411)
(NASA-CR-81603; SSD-102.3, Vol. 3) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The engineering considerations for the ATS-4 development are discussed. Details are presented on the concept evolution and evaluation. The design and fabrication of the deployable trussed frame petal antenna reflector are described. The structural, dynamic, and thermal analyses of the satellite and its components are emphasized. Literature pertaining to the effects of residual, thermal, and mechanical loading stresses on the dimensional stability of metal structures in space is included. The techniques for determining in-orbit antenna surface accuracy are reviewed. Expandable truss antennas, inflatable antennas, rigid panel antennas, and petal axis of rotation determination are also discussed. N.E.N.

c31 010000 23

N67-24607*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 4 Final Report
Dec. 1966 139 p
(Contract NASw-1411)
(NASA-CR-81599; SSD-102.3, Vol. 4) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The power subsystem and the orbital analysis are presented for the ATS-4. A study of the power output vs time characteristics over the orbital period resulted in the choice of a cruciform design with two double-faced panels. The solar cell radiation degradation was computed, and the battery characteristics were determined. The results of studies relating to trajectory and orbital analyses are given, including launch vehicles, apogee injection stages, ascent trajectories and injection stations, orbit payloads, orbit injection errors, orbit perturbation, orbit guidance, and auxiliary propulsion systems. N.E.N.

c31 010000 24

N67-24608*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 5 Final Report
Dec. 1966 248 p
(Contract NASw-1411)
(NASA-CR-81562; SSD-102.3, Vol. 5) CFSTI: $3.00 CSCL 22B

Consideration is given to the attitude stabilization and control system (SCS) of the Applications Technology Satellite (ATS-4). Details are given on stability and control requirements, attitude reference subsystem, disturbance torque model, torquer subsystem, computation and data handling, system operational description, system performance, and system physical description. The requirements imposed on the SCS are stated to be establishment of a desired vehicle orientation, control of the command offset pointing direction of the spacecraft antenna, execution of commanded tracking maneuvers, monitoring of system performance, and performance of certain control system experiments. Numerous control modes are discussed, including ascent and orbit injection, initial rate arrest, acquisition, offset pointing, and satellite tracking. L.E.W.

c31 010000 25

N67-24609*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 6 Final Report
Dec. 1966 236 p
(Contract NASw-1411)
(NASA-CR-81769; SSD-102.3, Vol. 6) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Described and analyzed are the parabolic antenna feed, the phased array, and the communications equipment of the Application Technology Satellite experiment. A square array of four paraboloids fed in an off-set arrangement are studied as an alternate to prime focus and Cassegrain configurations; it appears as if tolerance requirements of the four-dish configuration are less stringent. G.G.

c31 010000 26

N67-24610*# Fairchild Hiller Corp., Germantown, Md. Space Systems Div.
ATS-4 STUDY PROGRAM, VOLUME 7 Final Report
Dec. 1966 383 p
(Contract NASw-1411)
(NASA-CR-81769; SSD-102.3, Vol. 7) CFSTI: HC $3.00 CSCL 22B

The direct phase reading X-band radio interferometer as the ATS-4 attitude sensor is discussed. Studies indicated that separate antenna systems for the interferometer and the phased array are preferred. The general circuit, mechanical and thermal design, and physical characteristics are discussed, and an error analysis is presented. Other concepts are also described. N.E.N.

c31 010000 27

N67-24611*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ADVANCE STUDY OF AN APPLICATIONS TECHNOLOGY SATELLITE (ATS-4) MISSION Final Report
30 Nov. 1966 525 p refs
(Contract NASw-1412)
(NASA-CR-81765; LMSC-A847537) CFSTI: HC $3.00 CSCL 22B

Details are given on the mission of the Applications Technology Satellite (ATS-4) whose primary purpose it is to demonstrate the employment of large-aperture antennas in conjunction with precision spacecraft stabilization techniques. Information is given on experiment description, spacecraft description, ascent performance and stationkeeping, ground system definition, development approach, and schedules and cost. A number of alternatives were studied in the areas of launch vehicles, spacecraft configurations, subsystems, and experiments. The study concluded that the spacecraft and the experiments are feasible, that meaningful experiments can be conducted with a spacecraft placed in synchronous orbit by existing launch vehicles, and that the spacecraft development will advance the state of the art without requiring major inventions. L.E.W.

c31 010000 15

N67-26338*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABILIZATION SYSTEM Quarterly Progress Report, 1 Nov. 1966–31 Jan. 1967
20 Feb. 1967 47 p refs
(Contract NAS5-9042)
(NASA-CR-84029; DOC.-67SD4241; QPR-10) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Emphasis was directed toward implementing the handling of flight data in preparation for the launch of ATS-A. These efforts included the establishment of data formats and procedures for the quick-look system wherein on-line attitude computations will be done on the GE desk side computer from near real-time data. It is reported that the first flight unit primary boom systems were acceptance tested, thereby completing the gravity gradient stabilization system. Deployment malfunctions occurred during a series of engineering tests that involved a prototype damper boom, and conclusions reached as a result of the evaluations included a revised rewind procedure. Other testing results are reported for a flight unit TV camera and a flight unit solar aspect sensor. C.T.C.

c31 090000 36

N67-26568*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARLY RESULTS FROM THE SOLAR CELL RADIATION DAMAGE EXPERIMENT ON ATS-1
Ramond C. Waddel Apr. 1967 40 p
(NASA-TM-X-55772; X-711-67-176) CFSTI: HC $3.00/MF $0.65 CSCL 10A

The experiment involved the exposure and observation of 30 one by two centimeter solar cells of various types and covered by various kinds of shields as they suffered radiation damage after liftoff. Results so far show that some cells were damaged during launch, presumably from electrons and protons in the Van Allen belts. The results were obtained through two sets of observations recorded during the first 3.28 days after liftoff during which the spacecraft made three near equatorial passages through the radiation belts. Solar cells with 1 mil covers deteriorated slightly while cells with thicker shields were apparently undamaged. A comparison of results from 1 ohm cm p-on-n and n-on-p cells with 10 ohm cm n-on-p cells confirms the improvements made in the radiation resistance of solar cells. R.N.A.

c03 110500 01

N67-28765*# International Business Machines Corp., Gaithersburg, Md. Scientific Satellite Systems Dept.
SPACE SYSTEMS ANALYSIS AND COMPUTER PROGRAMMING SERVICES Quarterly Progress Report, 1 Jan.–31 Mar. 1967
31 Mar. 1967 195 p refs
(Contract NAS5-10022)
(NASA-CR-84797; QPR-3) CFSTI: HC $3.00/MF $0.65 CSCL 09B

Details are presented on the ground support systems in the areas of satellite attitude determination and steering, orbit determination, maneuver command, telemetry data processing and reduction, operations support, and business management controls. Special mention is made of the support given to the launch and subsequent mission of TIROS Operations Satellite-B, Orbiting Solar Observatory-C, and Applications Technology Satellite-A. In-orbit support of other than routine nature is described for Atmospheric Explorer-B and Applications Technology Satellite-B. Definitive orbit work was performed on the ATS-B, GEOS, and POGO satellites. Detailed recommendations and conclusions are included. N.E.N.

c08 040000 03

N67-29141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY 37–44, VOL. IV FOR THE PERIOD FEBRUARY 1, 1967 TO MARCH 31, 1967. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
30 Apr. 1967 370 p refs
(Contract NAS7-100)
(NASA-CR-84965; JPL-SPS-37-44, Vol. IV) CSCL 22B

Articles summarizing research and development in systems analysis, guidance and control, engineering mechanics, propulsion, space sciences, and telecommunications are presented. For individual titles see N67-29142–N67-29164.

c34 030004 07

N67-29151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37–44, Vol. IV 30 Apr. 1967 p 87–103 refs (See N67-29141 16-34)

Density distribution and pressure gradient analyses are discussed for propellant gases in a ballistic system of burning propellants. It is concluded that the energy required to accelerate the gases may be considered second order at low velocities and assumes primacy at higher velocities. Weight and measurement data and static test data are presented for Applications Technology Satellite apogee motors stored for approximately 16 months. A second ATS omnidirectional antenna test is also reported, and results indicate that the igniter impulse was sufficient to separate the antenna-dome from the motor and that the antenna was released and maintained a free flight path satisfactorily. An investigation to determine weight increase of rocket motors with thrust control provided showed that the increases would be 19.03 lb for the Syncom and 28.69 for the ATS motors. N.E.N.

c27 030004 06

N67-31355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-4 GSFC CONCEPT DESIGN STUDY
Harry L. Gerwin, comp. Jan. 1967 326 p refs
(NASA-TM-X-55833; X-730-67-10) CSCL 22B

The Applications Technology Satellite (ATS-4) program is found to meet the criteria set by NASA; and it is considered practical to design it for use with the Saturn launch vehicle (SLV-3C) Atlas–Centaur with the TE-364 apogee motor that can inject 1797 lb into orbit. A 30-foot diameter deployable antenna, fine pointing (0.1 degree) and slewing (17.5 degrees in 30 minutes), and oriented platform at synchronous altitude are found to be feasible and practical. The oriented platform can be used for experiments in attitude determinations, attitude control, and communications. Details are presented for the ATS-4 nominal ascent and injection sequence, payload tradeoffs and spinning body studies, and various orbit analyses; as well as for propulsion, command and telemetry, and ground support systems. Other aspects investigated include the spacecraft structure, the transponders and communications system, the controls system, and thermal analysis of the ATS-4. M.W.R.

c31 020000 03

N67-31562*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF SECOND NASA MICROELECTRONICS SYMPOSIUM
Jun. 1967 557 p refs Symp. held at Greenbelt, Md., 19–22 Sep. 1966
(NASA-TM-X-55834; X-722-67-252) CFSTI: HC $3.00/MF $0.65 CSCL 09A

Symposium papers on the application of microelectronics to NASA Space Program. For individual titles see N67-31563–N67-31605.

c09 110000 04

N67-31605*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROELECTRONICS ON ATS
R. L. Van Allen *In its* Proc. of 2d NASA Microelectron. Symp. Jun. 1967 p 519–528 refs (See N67-31562 18-09)

Described are reliability aspects, methods of handling, packaging, and general comments concerning the use of microelectronics in the Environmental Measurements Experiment (EME) encoder. The EME is the scientific experimental package scheduled to fly on each of the three major variations of the Applications Technology Satellite. Four complete encoders have been fabricated for EME of which three have been given qualification or acceptance tests. The total microelectronic device time totals more than 1,800,000 flat pack hours. Three of the systems were fabricated using flat packs with aluminum-gold interconnections. Most of the fourth system and spares were fabricated with devices having golg-gold bonds. In each encoder there are approximately three flat packs used for each transistor; however, in the entire EME package (including the power supply and command interface) transistors are used in nearly the same ratio as flat packs. There have been no transistor failures in any tests on the complete encoders; however, three flat packs have failed after submodules were assembled into a complete system. These three failures occurred during the encoder preacceptance tests. No failures have occurred during spacecraft qualification or acceptance testing. S.C.W.

c09 110000 05

N67-31688# Naval Research Lab., Washington, D. C. Shock and Vibration Information Center.
THE SHOCK AND VIBRATION BULLETIN 36, PART 7
Feb. 1967 173 p refs Presented at the 36th Symp. on Shock and Vibration, Los Angeles, 18–20 Oct. 1966; Sponsored by AF
(AD-651404) CFSTI: HC $3.00/MF $0.65

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9. THE "VACUUM SPRING" K. D. Robertson (Army Material Res. Agency) p 103–111 ref (See N67-31697 18-32)
10. SELF-ADAPTIVE VIBRATION BALANCING DEVICE FOR HELICOPTERS H. E. Hooper (Boeing Co.) p 113–127 refs (See N67-31698 18-32)
11. SHOCK RESPONSE OF ELECTRONIC EQUIPMENT CABINETS BY NORMAL MODE METHOD T. K. Hasselman and C. M. Hwang (TRW Sys.) p 129–134 refs (See N67-31699 18-32)
12. DAMPED VIBRATIONS OF ELASTICALLY SUPPORTED RIGID BODY WITH COUPLING BETWEEN TRANSLATION AND ROTATION F. H. Collopy (ITEK Corp.) p 135–144 refs (See N67-31700 18-32)
13. MISSILE HANDLING ANALYSIS C. R. Brown and A. J. Avis (Westinghouse Elec. Corp.) p 145–151 refs (See N67-31701 18-32)

c32 020000 04

N67-31692# Hughes Aircraft Co., El Segundo, Calif.
DYNAMIC ANALYSIS OF ATS-B SPACECRAFT
Saul M. Kaplan and Victor Terkun *In* NRL, Washington Shock and Vibration Bull. 36, Pt. 7 Feb. 1967 p 41–62 refs (See N67-31688 18-32)

The analytical model and the digital computer techniques used in evaluating the dynamic characteristics and loads of the ATS-B Applications Technology Satellite are briefly described. A vibration test was performed on a structural test model of the ATS-B spacecraft. Comparisons of the test data with analytically predicted accelerations at various locations on the spacecraft structure and components are presented and show excellent agreement. Author

c31 020000 05

N67-32037*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR POWER SYSTEMS FOR SATELLITES IN NEAR-EARTH ORBITS
C. M. Mac Kenzie Mar. 1967 30 p refs Presented at the IEEE 6th Photovoltaic Specialists Conf., Cocoa Beach, Fla., 28–30 Mar. 1967 Submitted for publication
(NASA-TM-X-55826; X-716-67-77) CFSTI: HC $3.00/MF $0.65 CSCL 10B

Solar conversion and energy storage power systems of the Explorer XXXIII, Nimbus I, and Applications Technology Satellite (ATS-I) are described. Although the basic concepts of all three systems are identical, implementation of these concepts varies with parameters such as attitude, stabilization, and mission. Each system is, therefore, discussed with respect to mission objectives, solar array, battery, power control and distribution, and performance. Attention is given to undervoltage and load switching, the prime converter, and telemetry sensors for the Explorer power system; and battery-discharge control, current sensors, solar array voltage limiter units, and bus paralleling relay for the ATS-1. M.W.R.

c03 020201 03

N67-33025* California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
A MAGNETOMETER EXPERIMENT FOR THE APPLICATIONS TECHNOLOGY SATELLITE Final Technical Report, 5 Feb. 1965–6 Dec. 1966
R. C. Snare 6 Dec. 1966 15 p
(Contract NAS5-9570)
(NASA-CR-86992) CSCL 22B

The experiment, consisting of two individual fluxgate magnetometers, offset field generators and spin demodulation circuits, measures the magnetic field environment of the Applications Technology Satellite (ATS) and resolves the field into two orthogonal components, one parallel and the one normal to the spacecraft spin axis. The purpose of the experiment is to provide data for the study of the structure and variations of the earth's magnetic field and to provide magnetic field data for correlation with energetic particle and plasma experiments also on the ATS spacecraft. Author

c14 110802 01

N67-34761*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37–45, VOLUME IV FOR THE PERIOD APRIL 1, 1967 TO MAY 31, 1967. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
30 Jun. 1967 363 p refs
(Contract NAS7-100)
(NASA-CR-87450; JPL-SPS-37-45, Vol. IV) CFSTI: HC $3.00/MF $0.65 CSCL 22A

Articles on JPL space exploration programs and related supporting research and advanced development projects are presented. For individual titles, see N67-34761 through N67-34781.

c30 000000 02

N67-34768*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37–45, Vol. IV 30 Jun. 1967 p 71–91 refs (See N67-34761 20-30)

The Applications Technology Satellite (ATS) motor development is discussed in terms of weight and measurement data on the ATS apogee motor storage units; the design and release mechanism evaluation of an omnidirectional antenna; and the flight motor storage and surveillance program. Experiments were conducted on acid anhydride–epoxide and acid anhydride–aziridine reactions in efforts to define curing reactions and a model system for use in determining prepolymer functionality. Results indicate that while these reactions could conceivably be used for binder curing, the problems associated with these systems make them less practical than existing curing reactions. Side-force numerical integrations over the nozzle and pintle surface are reported for the pintle nozzle thrust vector control system. To assess the importance of the pressure oscillation rate of depressurization on low pressure combustion extinction, data on low frequency instability and extinguishment data for five propellants were reduced. Figures depict the pressure oscillation frequency versus mean chamber pressure for each. M.G.J.

c28 030004 08

N67-35934* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-I SOLAR CELL RADIATION DAMAGE EXPERIMENT, FIRST 120 DAYS
Raymond C. Waddel Aug. 1967 39 p
(NASA-TM-X-55908; X-710-67-412) CFSTI: HC $3.00/MF $0.65 CSCL 10A

The voltage–current characteristics of 30 silicon solar cells having different base resistivities, dopants, shield materials, shield thicknesses and filters were monitored in orbit. The launch procedure, which involved one and one-half ellipses of perigee 100 nautical miles and apogee 19,300 nautical miles, caused severe damage to all unshielded cells; other cells bearing shields from 1 mil to 60 mils in thickness suffered no such damage. After attaining synchronous orbit at 19,300 nautical miles all cells suffered degradation. In 120 days all shielded cells dropped in maximum power from 4.5 to 11 percent. Tentative conclusions include: a base resistivity of 10 ohm-cm is optimum, a shield thickness of 6 mils of silica is optimum, conventional cells are superior to graded base (drift-field) cells, type 7940 silica shields are superior to type 0211 glass shields, a damage mechanism (possibly shield darkening) other than particle damage to the cell was present which led to an optimum shield thickness other than maximum. Author

c03 110500 08

N67-36032*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABLIZATION SYSTEM Quarterly Progress Report, 1 Feb.–30 Apr. 1967
20 May 1967 139 p
(Contract NAS5-9042)
(NASA-CR-88130; Doc.-67SD4292; QPR-11) CFSTI: HC $3.00/MF $0.65 CSCL 22B

During this period, the ATS-A was launched but due to an improper Agena D second burn, the spacecraft remained in a highly eccentric transfer orbit. The gravity gradient boom system was successfully deployed and all other gravity gradient stabilization system components performed nominally. A system flight performance analysis is presented along with a detailed performance analysis of each of the gravity gradient system components. The satellite's highly eccentric orbit produced noticeable flexible boom motions. An investigation of these boom dynamics is included. Also described are activities that were performed in connection with the development, testing, quality control, and manufacture of components of the gravity gradient stabilization system. R.N.A.

c31 090000 39

N67-36203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SECOND AEROSPACE MECHANISMS SYMPOSIUM
George G. Herzl, ed. 15 Aug. 1967 197 p refs Proc. held Aerospace Mech. Symp., Santa Clara, Calif., 4–5 May 1967
(Contract NAS7-100)
(NASA-CR-87990; JPL-TM-33-355) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The problems encountered in designing mechanisms and mechanical components for aerospace applications and space environment performance are discussed. For individual titles, see N67-36204 through N67-36225.

c31 020800 03

N67-36222*# Hughes Aircraft Co., Los Angeles, Calif.
DESPINNING THE ATS SATELLITE
J. P. Dallas *In* JPL 2d Aerospace Mech. Symp. 15 Aug. 1967 p 147–154 refs (See N67-36203 21-31)

The ATS synchronous gravity-stabilized spacecraft is designed to be despun by a two-stage yo-yo in combination with a nutation damper. The unique advantage of the ATS despin mechanism arises from the use of a two-stage yo-yo system in which the off-axis rate errors of the first stage, starting from 100 rpm, are damped out by a nutation damper prior to releasing the second-stage yo-yo, starting from 10 rpm. Author

c32 020800 04

N67-36634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPLE EXPERIMENT
Charles Laughlin, Gay Hilton, and Richard Lavigne Jun. 1967 61 p refs
(NASA-TM-X-55885; X-733-67-266) CFSTI: HC $3.00/MF $0.65 CSCL 17G

The Omega position location equipment (OPLE) concept is explained, and details are given on an experiment designed to demonstrate the feasibility of using the Omega navigational system in conjunction with synchronous satellites to establish a global location and data collection system. The operational system would consist of an OPLE control center (OCC), a synchronous satellite, and the OPLE platform electronic packages (PEP) working jointly with the Omega network. The Omega system, the satellite transponder, and the OCC and PEP equipments are described in detail, and the operation of the system transmission links and timing sequence is discussed. Platform deployment and systems test plans are outlined. M.G.J.

c21 080400 01

N67-38002*# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
SATELLITE NAVIGATION STUDIES Quarterly Progress Report, 1 Apr.–30 Jun. 1967
Y. Morita, F. Zwas, and D. Colling Aug. 1967 14 p
(Contract NASr-54(10))
(NASA-CR-88871; QPR-6) CFSTI: HC $3.00/MF $0.65 CSCL 17G

Efforts centered on determining aircraft positional fixes using the VHF channels on the currently operational satellite ATS-1 and the soon-to-be launched satellite ATS-C. The digital computer model is being modified to include VHF propagation effects, and the model will be used to predict expected aircraft position fixes. In addition, equipment characteristics for use aboard aircraft are being delineated. Author

c21 070200 12

N67-40331*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY LAUNCH VEHICLE FLIGHT EVALUATION REPORT NASA APPLICATIONS TECHNOLOGICAL SATELLITE (ATS) PROGRAM FLIGHT NO. 1, NASA ATLAS-AGENA NO. 19 (LAUNCHED DECEMBER 6, 1966)

Washington, NASA, 1967 85 p refs

(NASA-TM-X-52348) CFSTI: HC$3.00 CSCL 22B

The NASA Applications Technological Satellite—1 (ATS-1) Atlas/Agena Vehicle, carrying 1550 lb of separable payload, was successfully launched. The vehicle flight consisted of an Atlas boost, an Agena first burn, an intervening Agena-spacecraft coast, and an Agena second burn. All aerospace ground equipment operated satisfactorily during countdown and launch, except that the 2-inch motion switch malfunctioned at lift-off. All Atlas systems performed satisfactorily. All Agena systems performed satisfactorily with the exception of a momentary drop in engine chamber pressure during second burn. This momentary drop had no adverse effect on the flight results. The ATS-1 flight was the first to use as a spacecraft aerodynamic shroud the Standard Agena Clamshell shroud. The shroud performed successfully during the flight. The ATA-1 launch vehicle flight performance, each major Atlas and Agena vehicle borne system, the ground radio guidance system, and the spacecraft shroud system are described. The performance of each system is evaluated, and significant data are presented.

Author

c31 030100 04

N68-10248* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MANNED SPACE FLIGHT NETWORK RADAR ANALYSIS REPORT
Apr. 1967 26 p
(NASA-TM-X-63008; X-552-67-192; Rept.-2) CSCL 17I

The analysis of the radars and associated equipment used for recording the high-speed magnetic tape data is presented. The following spacecraft and their launching dates during the winter of 1966–1967 are covered: lunar orbiter, February 5; GTA-12, November 11; Titan 3-C, January 18; Scanner L3-2843, December 10; Applications Tech Sat-B, December 7; Intelsat II (F-1), October 26; Intelsat II (-2), January 11; and Echo II tracked February 11. The pass by pass and the network analyses are outlined, and the data are tabulated. N.E.N.

c07 030100 02

N68-10647* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE APPLICATIONS TECHNOLOGY SATELLITE IMAGE DISSECTOR CAMERA EXPERIMENT
G. A. Branchflower, R. H. Foote, and D. Figgins Washington NASA Nov. 1967 15 p
(NASA-TN-D-4186) CFSTI: $3.00 CSCL 14E

The image dissector camera experiment, which is scheduled to fly aboard the Applications Technology Satellite-C, is described. Camera system parameters are presented and a description of system operation, including the clock synchronizer and timing and control logic, is given. Ground support equipment is also discussed. Author

c14 080500 05

N68-11802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STUDIES OF REFLECTION CHARACTERISTICS OF THE PLANET EARTH FROM A SYNCHRONOUS SATELLITE—PRELIMINARY RESULTS
Ehrhard Raschke and William R. Bandeen Nov. 1967 16 p refs
(NASA-TM-X-63045; X-622-67-572) CFSTI: HC $3.00/MF $0.65 CSCL 03B

Digitized data of nine ATS-1 photographs taken on 21 and 22 April 1967 were used to study statistically the dependence of reflection properties of the earth-atmosphere system on the zenith and azimuthal angles of measurement and on the zenith angle of incident solar radiation. Four states of the sky were defined for this study: complete overcast, cloudy-overcast, cloudless atmosphere, and minimal reflection. The limited quantity of data analyzed so far provides sufficiently accurate results only for small solar zenith angles ($0.0° \leq \zeta \leq 25.8°$). A remarkably high reflection was found in all conditions in a small angular range around the specular point of the sun on the earth's surface. The horizon appeared to be brighter than other areas for cloudless atmosphere conditions only. A maximum of reflected solar radiation due to direct backscattering was not found in these preliminary results. Author

c30 080100 08

N68-11831* Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
VHF REPEATER EXPERIMENT Final Report
1 Feb. 1967 194 p refs
(Contract NAS5-9593)
(NASA-CR-90507; SSD-70041R) CFSTI: $3.00 CSCL 22B

Details are presented on the design, circuitry, and testing, and operating characteristics for the VHF repeater experiment carried on the Applications Technology Satellite launched 6 December 1966. The objectives of the experiment are to provide continuous voice communications link between a ground control station and aircraft and to operate a meteorological network using data from small unmanned stations. The initial designs and changes in configurations are discussed, and the most difficult problem is identified as the antenna design. The third harmonic and VHF waveform generators, and the antenna deployment mechanism are described and diagrammed. The prelaunch and in-orbit testing are covered. Analyses of the antenna and its components are included. N.E.N.

c31 070200 04

N68-12306*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-47, VOLUME 3 FOR THE PERIOD AUGUST 1, 1967 TO SEPTEMBER 30, 1967. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
31 Oct. 1967 304 p refs
(Contract NAS7-100)
(NASA-CR-91047; JPL-SPS-37-47, V. 3) CSCL 22

An overview is presented on the research projects being conducted in the areas of systems analysis, project engineering, guidance and control, applied mechanics, environmental simulation, propulsion, space sciences, and telecommunications. For individual titles, see N68-12307 through N68-12328.

c30 030004 12

N68-12315*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Space Programs Sum. No. 37-47, Vol. 3 31 Oct. 1967 p 69–84 refs (See N68-12306 03-30)

Engineering research studies in the following areas are reported: solid propulsion binder investigations; propellant binders terminated by acid chloride groups; Application Technology Satellite motor development; and oxidizer particle size effects in dual oxidizer high slope solid propellant formulations. Included are investigations of polyesters of dimer acid, partial hydrogenation of unsaturated hydroxy-terminated telagens, infrared studies of saturethane curing, preparation of trifunctional alcohol, and the development of a model curing system. C.T.C.

c27 030004 11

N68-12817 Wisconsin Univ., Madison. Meteorology Dept.
STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS Annual Report, 1966
Mar. 1967 135 p refs
(Grant CWB-WBG-27)

CONTENTS:

c13 080100 03

N68-12818 Wisconsin Univ., Madison. Santa Barbara Research Center, Goleta, Calif.
ATS SPIN-SCAN CLOUD CAMERA AND PRELAUNCH CALIBRATION PROCEDURE
In its Studies in Atmospheric Energetics based on Aerospace Probings Mar. 1967 p 1–40 Prepared jointly with Santa Barbara Res. Center (See N68-12817 04-13)

Design details and specifications are presented on the spin-scan cloud camera, which consists of a high resolution telescope and a photomultiplier light detector coupled with a precision latitude step mechanism. This mechanism combined with the spinning motion of the synchronous Applications Technology Satellite (ATS) provides complete coverage of the earth from 52.5° north latitude to 52.5° south latitude and from the west limb to the east limb. Ground commands and telemetry outputs associated with the camera are also described. To provide the required test features, a special calibration instrument was constructed to check camera performance. Primary purposes of the calibration were to establish the relationship between the energy intercepted by the camera as it views a suitable target illuminated by sunlight and the camera output signal, and to set the level of the camera signal so typical targets on the earth will generate voltages which fall within the design range of the satellite telemetry system. The difficulties encountered in the procedure are discussed, and the measurement data obtained are assessed. M.G.J.

c14 080100 04

N68-12860*# ITT Industrial Labs., Fort Wayne, Ind.
IMAGE DISSECTOR CAMERA SUBSYSTEM, ASSOCIATED GROUND SUPPORT EQUIPMENT, AND INTEGRATION SUPPORT FOR APPLICATIONS TECHNOLOGY SATELLITE Quarterly Report, Nov. 17, 1966–Feb. 17, 1967
7 Sep. 1967 10 p
(Contract NAS5-10200)
(NASA-CR-91350; ITTIL-67-1045; QR-3) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Fabrication of flight model circuit boards and other subassemblies is reported, along with the completion of printed circuit assemblies for the flight camera and the initiation of module testing. Fabrication and construction work on the ground support unit was also completed, and additional design and development effort was directed toward the nutation correction technique and its circuitry. The sample and hold circuit for this correction circuit was refined, and its configuration is depicted. M.G.J.

c11 080500 02

N68-12990* Allied Research Associates, Inc., Boston, Mass.
NASA/ESSA WEFAX EXPERIMENT EVALUATION REPORT (ATS-1)
1967 42 p
(Contract NAS5-10204)
(NASA-CR-91360) CFSTI: $3.00 CSCL 17B

Weather facsimile transmissions are evaluated to determine the feasibility of disseminating meteorological data and satellite cloud camera pictures for a central weather station source to widely scattered remote weather stations or receiving units. From the ground station, the charts and pictures are transmitted to the ATS-1 for relay via the VHF transponder in the spacecraft to all participating automatic picture transmission (APT) stations. Based on over 11,800 weather chart receptions, it was concluded that weather charts can be transmitted to widely scattered receiving stations with acquisition angles even as low as 3°. An evaluation of over 10,700 satellite picture receptions, showed that satellite cloud cover pictures can be retransmitted from a central source through an earth synchronous satellite to the weather stations. To obtain quality reception, the pictures should be transmitted from digital data. Nearly 70% of both receptions were classified as good or excellent by all stations. M.G.J.

c07 080204 01

N68-15175# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
ATS-1 OMNIDIRECTIONAL SPECTROMETER Quarterly Report, 15 May–15 Aug. 1967
G. A. Paulikas, J. B. Blake, S. C. Freden, and S. S. Imamoto
Oct. 1967 31 p refs
(Contract F04695-67-C-0158)
(TR-0158(3260-20)-4; SAMSO-TR-67-100; AD-663234)

Continuing analysis of electron data from the ATS-1 omnidirectional spectrometer shows (a) an electron flux vs time structure that exhibits periodicity probably associated with the interplanetary field sector structure, and (b) that magnetometer data fail to organize electron flux data; i.e., the electron flux variations are governed by temporal effects. Proton fluxes, some associated with flares, have been detected a surprisingly large fraction of the time. Further details of the proton events in January and February 1967 are presented. Author (TAB)

c29 See N68-27213

N68-16083# Hughes Aircraft Co., Culver City, Calif. Power Systems Dept.
HUGHES-DEVELOPED SOURCE ELECTRICAL POWER SYSTEMS. SURVEYOR. SYNCOM. INTELSAT 1 (HS303 EARLY BIRD). INTELSAT 2 (HS303A LANI BIRD). APPLICATION TECHNOLOGY SATELLITES
M. Swerdling Feb. 1967 141 p refs
(SSD-70049R)

Detailed descriptions are given of the electrical power subsystems employed on the following satellites: Surveyor, Syncom, Intelsat I (HS303 Early Bird), Intelsat II (HS303A Lani Bird), and Applications Technology Satellites. Emphasis is placed on system operation and predicted and actual flight performance, including radiation and environmental effects. Discussed are such areas as the solar panels, main batteries, auxiliary battery and auxiliary battery controls, regulators, weight analyses, and performance. C.T.C.

c31 020200 01

N68-16263*# ITT Industrial Labs., Fort Wayne, Ind.
CONTINUOUS SCANNING METEOROLOGICAL CAMERA SYSTEM FOR ATS Final Report, 22 Sep. 1965–10 Sep. 1967
10 Nov. 1967 16 p
(Contract NAS5-9671)
(NASA-CR-92709; ITTIL-67-1054) CFSTI: HC $3.00/MF $0.65 CSCL 14E

This report presents a chronological review of activities in the development of the image dissector camera system for the Applications Technology Satellite. Areas of performance are traced from initial design studies through qualification testing of the prototype camera. Author

c14 080500 04

N68-16805# Bohan (Walter A.) Co., Park Ridge, Ill.
CHARACTERISTICS OF CLOUD COVER PATTERNS OVER THE UNITED STATES
Walter A. Bohan Apr. 1967 47 p
(Contract CWB-11096)
(PB-176102)

The purpose of the selected case study series reports is to provide examples of meteorological satellite cloud photography and related synoptic weather data in a case history format. Primary emphasis is placed on cloud pattern recognition and interpretation, as an aid to operational synoptic weather analysis and forecasting. A brief test describing the meteorological implications is usually included with each case presented. In this series, however, circumstances do not permit the addition of text on meteorological interpretations. Author

c20 080000 02

N68-17061# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS Annual Report, 1966
Verner E. Suomi Mar. 1967 134 p refs Prepared in cooperation with Santa Barbara Res. Center
(Grant CWB-WBG-27)
(PB-175997) CFSTI: HC$3.00/MF$0.65

Contents: ATS spin-scan cloud camera and prelaunch calibration procedure; the reflection of sunlight to space and the absorption by the earth and atmosphere over the United States during Spring, 1962; the albedo of a striated plane parallel turbid medium; the theoretical basis for low-resolution radiometer measurements from a satellite; the 'chirp' digital radiosonde; the prototype data logging system for the ESSA III flate-plate radiometers; the prototype flat plate radiometers for the ESSA III satellite. Author

c13 080100 03

N68-17213*# General Electric Co., Philadelphia, Pa. Spacecraft Dept.
APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABILIZATION SYSTEM Quarterly Progress Report, 1 May–31 Jul. 1967
20 Aug. 1967 39 p refs
(Contract NAS5-9042)
(NASA-CR-92713; Doc.-67SD4348; QPR-12) CFSTI: HC $3.00/MF$0.65 CSCL 22B

An analysis of the current technical state of the systems is presented. The tumbling of the ATS-2 has continued because of the eccentric orbit, and predictions are that it will continue for an indefinite time. Rates were observed from 4°/min. to as high as 51°/min. The tumbling rate precluded meaningful attempts to obtain 3-axis attitude determination; however, generation of sun vector coordinates continued because of the omnidirectional characteristics of the gravity gradient system sun sensors. The ATS-2 primary booms were scissored. The Combination Passive Damper was clutched from the eddy current to the magnetic hysteresis mode. Telemetry data verified that two boom systems were successfully scissored. A profile of the scissoring and excursions of the damper boom angle in the vicinity of the clutching operation are shown. Investigation of ATS-2 boom dynamics phenomena was concluded with the finding that the observed high frequency components of boom and center body motions are explainable in terms of orbit eccentricity alone and would not have occurred if the spacecraft had been put into a circular orbit. Components of the system aboard the ATS-2 are discussed, and primary boom motions are analyzed based on latest TV data. K.W.

c31 090000 42

N68-17924*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MILLIMETER WAVE PROPAGATION EXPERIMENT FROM THE ATS-E SPACECRAFT
J. W. Dees, J. L. King, and J. C. Wiltse [1967] 10 p Presented at IEEE, Group on Microwave Theory and Tech., New York, 18–21 Mar. 1968
(NASA-TM-X-60763) CFSTI: HC$3.00/MF$0.65 CSCL 17B

Instrumentation is described for a millimeter wave propagation experiment to be performed with the Applications Technology Satellite-E. Wideband signals near 15.3 and 31.65 GHz will be transmitted between the spacecraft and several ground stations, and attenuation and phase distortion effects caused by the atmosphere and meteorological phenomena will be measured. The objective is to obtain propagation data at varied ground locations for a variety of weather conditions, including seasonal variations. Details of both the ground station and spacecraft millimeter wave equipment are described. Author

c07 070300 01

N68-19111*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.,
ATLAS/AGENA-25 APPLICATIONS TECHNOLOGY SATELLITE C OPERATIONS SUMMARY
26 Oct. 1967 33 p
(NASA-TM-X-60905; TR-588) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The Applications Technology Satellite-3 mission objectives are discussed, the Atlas/Agena launch vehicle and the satellite are described, and the mission plan and post-inject operations are outlined. The launch operation plane includes descriptions of the ground facilities, data acquisition equipment, and meteorological services. Also described are the communications facilities to be used for prelaunch and early postlaunch operations. The Atlas/Agena and spacecraft operations to be performed during the launch countdown are listed. R.N.A.

c31 030000 01

N68-19166# National Center for Atmospheric Research, Boulder, Colo.
A CATALOGUE OF METEOROLOGICAL DATA OBTAINED DURING THE LINE ISLANDS EXPERIMENT, FEBRUARY–APRIL 1967
Edward J. Zipser and Ronald C. Taylor (Hawaii Inst. of Geophys.) Jan. 1968 365 p refs Line Isls. Expt. Rept.-1
(NCAR-TN-35; HIG-67-19)

Data collected during the Line Islands experiment is catalogued to provide a comprehensive picture of the oceanic part of the equatorial trough zone, to evaluate cloud photography from the ATS-1 synchronous satellite, and to serve as a pilot program for future experiments in tropical meteorology. Kinds of data collected, dates and frequencies of observations, dates and times of satellite pictures, and obvious limitations of the data are included. Hourly tabulations of most of the surface data parameters, taken between February and April 1967, include wind directions and speeds, moisture parameters, and rainfall data. Summaries of upper air soundings are presented, as are details of various flights, lists of satellite pictures, and a meteorological data guide for the Line Islands. M.W.R.

c20 080700 03

N68-19789*# Sylvania Electric Products, Inc., Waltham, Mass. Electronic Systems Eastern Div.
ADVANCED TECHNOLOGICAL SATELLITE ELECTRO-MECHANICAL DESPUN ANTENNA Final Report
L. Blaisdell 19 Oct. 1967 151 p refs
(Contract NAS5-9521)
(NASA-CR-93732; F181-1) CFSTI: HC $3.00/MF $0.65 CSCL 09F

Following the development of two breadboard models and a prototype, two flight models of a microwave frequency electromechanical despun antenna system were designed to operate in space for a one-year minimum with a five-year design goal. The antenna system, consisting of a mechanical drive assembly and four separate control electronic packages, is mechanically and electrically compatible with a cylindrical spin-stabilized spacecraft for satellite communications with earth stations. Overall performance of the antenna system is reported and specifications and requirements are defined for the radio frequency, control electronics, and environmental and mechanical areas. Thermal interface between the mechanically despun antenna and the spacecraft was analyzed, and the antenna system met all design specifications and performance requirements. A motor drive, bearing, and lubrication system performed successfully for 7800 hours in a vacuum of 10^{-7} Torr. Temperature was found to be the most sensitive environment of the control electronics system, and the flight systems were successfully tested to temperature limits equal to the qualification test limits. M.W.R.

c07 020000 07

N68-19934*# Sylvania Electric Products, Inc., Waltham, Mass. Electronic Systems Eastern Div.
ADVANCED TECHNOLOGICAL SATELLITE ELECTRO-MECHANICAL DESPUN ANTENNA. APPENDICES Final Report
L. Blaisdell 19 Oct. 1967 278 p
(Contract NAS5-9521)
(NASA-CR-93735; F181-1, App.) CFSTI: HC $3.00/MF $0.65 CSCL 09F

Results obtained during the development of an electromechanical despun antenna for advanced technological satellites are presented. Graphs and tables detail the radio frequency pattern and impedance test data results, vibration test reports, and control electronics data and system power drain. Procedures and results are given for flight model number one of the despun antenna for radiated interference in the 15kHz to 1 GHz range and for power line interference from 150 kHz to 25 MHz. Thermal energy exchange was determined between the mechanically despun antenna and the satellite for three synchronous orbits; a 58-zone mathematical model was used to describe the thermal behavior of the antenna and the equations were solved by computer. M.W.R.

c07 020000 08

N68-20992*# National Aeronautics and Space Administration, Washington, D. C.
GODDARD SPACE FLIGHT CENTER, GREENBELT, MARYLAND
[1967] 4 p
(NASA Facts-0-5/10-67) CSCL 22D

Search for new knowledge and overall philosophy of the Goddard Space Flight Center is mentioned in a NASA fact sheet that discusses research related to scientific satellites, applications satellites, and tracking and communications. Responsibility of Goddard is for the development of unmanned orbiting satellites in the interest of basic and applied science, sounding rocket experiments, and the NASA worldwide network of tracking stations serving both manned and unmanned scientific space missions. M.W.R.

c11 000000 03

N68-21751# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
BOUNDARY OF ENERGETIC ELECTRONS DURING THE JANUARY 13–14, 1967 MAGNETIC STORM
George A. Paulikas, J. Bernard Blake, Stanley C. Freden, and Sam S. Imamoto Jan. 1968 26 p refs
(Contract F04695-67-C-0158)
(TR-0158(3260-20)-5; SAMSO-TR-68-56; AD-665422)

Measurements of energetic electron fluxes were made aboard the synchronous satellite ATS-1 (1966-110A) during the magnetic storm of January 13-14, 1967. Between 0007 and about 0105

UT (approximately 1400-1500 local time) on January 14, the electron fluxes dropped to background levels in a manner which when associated with the onboard magnetometer data suggests that the boundary of the magnetosphere was compressed to less than 6.6 Re on the day side of the magnetosphere. Author (TAB)

c29 110100 02

N68-23889*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
ATS POWER SUBSYSTEM RADIATION EFFECTS STUDY, PHASE 1 Final Report
W. D. Brown Feb. 1968 127 p refs
(Contract NAS5-3823)
(NASA-CR-94612; SSD-80089R) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Available flight data for six synchronous satellites and for the special ATS solar cell experiment were analyzed in an effort to identify the damage mechanism that resulted in the anomalous degradation of the solar cell arrays. Since all degradations exhibited a logarithmic time dependence, it was assumed that radiation effects were the basic cause. A laboratory irradiation test program with proton energies and fluences comparable to those expected in a synchronous orbit established low energy proton damage as the primary damage mechanism responsible for performance degradation. Cross correlation of the various data identified the degradation source as transmission loss in the coverslide assemblies and it was concluded that the aft panel and the solar cell experiment mounted on the aft panel, were contaminated with some substance that darkened with time under ultraviolet (UV) and/or low energy proton exposure. G.G.

c31 100700 01

N68-24000*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IGNITION SYSTEM FOR THE ATS ROCKET MOTOR
Thomas P. Lee 1 Feb. 1967 43 p refs
(Contract NAS7-100)
(NASA-CR-94620; JPL-TM-33-317) CFSTI: HC $3.00/MF $0.65 CSCL 21B

This report documents the design, development, testing, and qualification of an igniter system for the solid-propellant Applications Technology Satellite (ATS) apogee rocket motor. The rocket motor contains 760 lb of propellant with about 898 sq in. of initial burning surface to be ignited. The L* at ignition is 140. The development phase started with a scale-up of the Syncom I igniter and rapidly progressed to an internally insulated aluminum basket with twelve gas ports and a pyrotechnic charge of 19 ALCLO pellets and two solid-grain ALCLO main grain charges. The igniter interfaces to either a development closure for data acquisition or to a safe-and-arm (S&A) device for flight and qualification testing. Ignition of the pyrotechnic charge is initiated either by a single dual-bridgewire squib for development testing, or two PC-37 squibs when used with the S&A device. The igniter, less closure or S&A, weighs 1 lb. Author

c28 030004 04

N68-24001*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
QUALIFICATION PHASE FOR THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE ROCKET MOTOR Technical Memorandum, Jul.–Aug. 1966
D. R. Frank and R. G. Anderson 15 Sep. 1967 40 p refs
(Contract NAS7-100)
(NASA-CR-94621; JPL-TM-33-339) CFSTI: HC $3.00/MF $0.65 CSCL 21H

The preparation, testing, and evaluation of the qualification phase for the Applications Technology Satellite apogee rocket motor are documented. A total of eight apogee motor assemblies were tested under simulated altitude conditions at the Arnold Engineering Development Center, Tullahoma, Tennessee, during July and August 1966. All units were tested while spinning at 100 rev/min. Four units were tested at each test temperature of 40 and 100°F. On December 7, 1966, the first flight firing of the apogee unit placed the ATS-B satellite into a near-synchronous, equatorial orbit. Author

c28 030004 10

N68-24008*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN, FABRICATION, AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR NOZZLE
Richard A. Grippi, Jr. 15 Jul. 1967 75 p
(Contract NAS7-100)
(NASA-CR-94619; JPL-TM-33-333) CFSTI: $3.00 CSCL 21H

This report documents the design, fabrication, and testing of the Applications Technology Satellite apogee motor nozzle. On firing, the apogee motor provides the necessary velocity increment, at the apogee of the elliptical transfer orbit, to place the satellite in a synchronous orbit. The nozzle construction consists of: (1) high-density, graphite throat insert, (2) tape-wrapped, carbon-cloth, phenolic-resin throat section, (3) tape-wrapped, silica-cloth, phenolic-resin exit cone, (4) aluminum attachment ring, and (5) an aluminum throat closure diaphragm. A length limitation was imposed on the propulsion system; therefore, the nozzle was submerged into the motor chamber to accommodate the 35:1 expansion ratio of the contoured nozzle. Verification of the nozzle design was accomplished through static motor firings and environmental tests, which included temperature cycle, booster acceleration, booster vibration, and space temperature vacuum exposure. On December 7, 1966, the first flight firing of the apogee unit placed the ATS-B satellite into a near-synchronous, equatorial orbit. Author

c28 030004 09

N68-24974*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN, FABRICATION, AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR CHAMBER
V. F. Lardenoit, B. K. Wada, and D. P. Kohorst 1 Nov. 1966 84 p
(Contract NAS7-100)
(NASA-CR-94668; JPL-TM-33-309) CFSTI: HC $3.00/MF $0.65 CSCL 21H

On firing, the apogee motor provides the necessary impulse to place the satellite in near synchronous orbit. The choice for the chamber material was Ti–6Al–4V alloy. An optimum design was achieved by a team effort among materials, structures fabrication, propulsion, and design personnel. Certain tradeoffs that were required are discussed in detail. The chamber consists of two half shells and a mounting ring. Fabrication was accomplished by forging to shape, machining to the desired thickness, and welding of the components. Verification of chamber design was determined from hydroburst test, vibration tests, and acceleration tests. Author

c28 030004 03

N68-25736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION DAMAGE SHIELDING OF SOLAR CELLS ON A SYNCHRONOUS SPACECRAFT
Ramond C. Waddel May 1968 16 p refs
(NASA-TM-X-63232; X-710-68-195) CFSTI: HC $3.00/MF $0.65 CSCL 10A

The ATS-I synchronous spacecraft (altitude 22,240 miles, launched Dec. 6, 1966) carried a group of conventional n-on-p, 10 ohm-cm, silicon, boron-doped solar cells with various radiation shields. The shields were, mostly, of Corning type 7940 artificial fused silica, of thicknesses from zero to 60 thousandths of an inch. The solar cell damage observed, as deduced from voltage-current curves, was larger than expected. The maximum power from cells bearing shields of 0, 1, 6, 15, 30, and 60 thousandths of an inch in thickness fell, during 416.8 days in orbit, to 11.4, 84.9, 92.5, 88.7, 86.9, and 83.5 percent of initial values, respectively. The short-circuit currents fell to 41.4, 90.1, 91.7, 92.7, 92.6, and 93.9 percent, respectively. The open-circuit voltages fell to 55.0, 97.2, 98.9, 98.7, and 98.3 percent, respectively. Author

c03 110500 02

N68-25934*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS TECHNOLOGY SATELLITE, VOLUMES 1 THROUGH 6 Technical Data Report
6 Jun. 1968 4159 p Revised Supersedes NASA-TM-X-60437; See N67-86371
(NASA-TM-X-61130; NASA-TM-X-60437) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Design, development, fabrication, prelaunch test, and flight performance data are presented on the Applications Technology Satellite program, which was undertaken to collect and confirm data for various technologies having wide applications in space and space flight. Among the major experiments are those concerned with the stabilization of satellites by gravity gradient techniques. The multiple-mission design concept allows for numerous different space and earth studies, plux experimentation with advanced satellite communication technologies. Systems analyses are presented on the spacecraft and launch vehicles; operations and orbit parameters are defined for the five ATS flights; and ground station equipment and support are described. Details are given on the designs for the communications, meteorological, gravity gradient and environmental measurements experiments, and on other technological experiments pertaining to the nutation sensor, the self-contained navigation system, and albedo and ionospheric studies. Performance data for each are analyzed. M.G.J.

031 000000 05

N68-27213# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE ATS-1 OMNIDIRECTIONAL SPECTROMETER Final Report, Sep. 1967–Jan. 1968
Mar. 1968 118 p refs
(Contract F04695-67-C-0158)
(TR-0158(3260-20)-7; SAMSO-TR-68-173; AD-669066)

The omnidirectional spectrometer on ATS-1 measures energetic electrons above four integral thresholds (>300 keV, >450 keV, >1.05 MeV, and >1.9 MeV) and energetic protons in two differential channels (5 to 21 MeV and 21 to 70 MeV) by means of solid-state detectors. Analysis of about nine months of electron data shows that during magnetically quiet or moderately disturbed times a diurnal variation in the electron fluxes exists, with the noon-to-midnight ratio being larger for the more energetic electron groups and also, on the average, being larger for magnetically disturbed days. Magnetic storms produce a great deal of fine structure in the electron fluxes, with changes occurring on the time scale of minutes. The effect of such storms is to disrupt the diurnal variation and to depress the electron fluxes. Recovery to pre-storm levels is an energy-dependent process proceeding more sharply for more energetic electrons. Recovery is not smooth, but proceeds in a stepwise fashion. Modulation of electron fluxes is seen on a six-to-eight-day scale; preliminary data show that these modulations are associated with the sector structure of the interplanetary field. Protons were detected associated with impulsive solar proton events of 28 January 1967, 14 February 1967, and 23 May 1967. Author (TAB)

c14 110100 03

N68-27385*# Rice Univ., Houston, Tex. Dept. of Space Science.
ON THE VARIETY OF PARTICLE PHENOMENA DISCERNIBLE AT THE GEOSTATIONARY ORBIT VIA THE ATS-1 SATELLITE
J. W. Freeman, Jr. and J. J. Maguire [1967] 27 p refs
Presented at the Birkeland Symp. on Aurora and Magnetic Storms, Sandefjord, Norway, Sep. 1967 Submitted for publication
(Contract NAS5-9561)
(NASA-CR-95215) CFSTI: HC$3.00/MF$0.65 CSCL 03B

The three most salient phenomena that have been observed with the Rice University ion detector aboard the ATS-1 synchronous orbit satellite were studied. These phenomena are, a gross pre-post/midnight asymmetry in the enhanced energetic charged particle fluxes observed on the night side of the earth, a magnetopause penetration to 6.5 R_E with the subsequent detection of discrete clouds of energetic particles executing repeated longitudinal drift about the earth, and bursts of very low energy, $E < 50$ eV, highly directional positive ions tentatively associated with hydromagnetic transients. Each of these phenomena are described in sufficient detail to illustrate the prominent facts. Author

c29 110700 04

N68-27386*# Rice Univ., Houston, Tex. Dept. of Space Science.
ANOMALOUS PARTICLE FLUXES AT THE SYNCHRONOUS ORBIT, 13–14 JANUARY 1967
J. W. Freeman, Jr. and J. J. Maguire Aug. 1967 21 p refs
(Contract NAS5-9561)
(NASA-CR-95216) CFSTI: HC$3.00/MF$0.65 CSCL 03B

On January 13 and 14, 1967 an intense magnetic storm occurred. Within three hours after the beginning of the main phase, a positive impulse was seen at low latitude stations. Coincident with this impulse anomalously high anisotropic particle fluxes were observed by the low energy ion detector aboard the synchronous satellite ATS-1. These particles are consistent with the interpretation that the magnetopause was pushed inward beyond 6.5 earth radii during this event. Subsequent to this anisotropic flux observed in the magnetosheath, there occurred three separate isotropic particle bursts in the pre-midnight hemisphere, separated in time by about two and one-half hours. High time resolution of the first two bursts gives evidence of a remarkable coherence, indicating that the detector may have observed a nearly monoenergetic cloud of plasma drifting essentially intact around the earth for at least two orbits. Author

c29 110700 03

N68-27542*# Raytheon Co., Norwood, Mass. Equipment Div.
ATS SSB AFC CARRIER OFFSET STUDY Final Report, 13 Apr.–27 Jul. 1966
Jul. 1966 31 p
(Contract NAS5-10176)
(NASA-CR-95101) CFSTI: HC$3.00/MF$0.65 CSCL 09F

A plan for increasing the range of the ATS SSB AFC was studied so that in addition to tracking a satellite with a Doppler shift of ±35 kc, the system is capable of acquiring and tracking a spacecraft with a carrier offset as high as ±180 kc. An initial design study is reported and alternative solutions advanced. A recommended solution employing a wide range, low noise VCO is proposed along with results of a feasibility test on a VCO. The physical implementation within the ATS-SSB Transmitter is described, and a field change procedure is recommended. Author

c07 070100 05

N68-28000*# Boeing Co., Huntsville, Ala.
ACOUSTICAL QUALIFICATION OF S-1C FIN STRUCTURES
Clark J. Beck, Jr. and David R. Kennedy (Brown Eng. Co.) *In* NRL The Shock and Vibration Bull., No. 37, Pt. 5 Jan. 1968 p 167–173 ref (See N68-27989 16-32)

During the launch phase of flight, a spacecraft is subjected to a variety of loads. To establish confidence that a spacecraft will survive the launch environment, practice was to subject a spacecraft and/or components to single environment tests in series, for which specifications included conservatisms in an attempt to cover the unknowns arising from the combination of these single tests. However, a more realistic test philosophy which permits real-time simulation of the combined launch environments has recently been implemented at Goddard Space Flight Center using the launch phase simulator (LPS) test facility. The LPS can reproduce the combined launch environments of vacuum, acoustics, acceleration, and vibration on large spacecraft structures, all in real time. The first combined environmental flight program test performed on the LPS facility is described. This test was the real-time combined acoustic-pressure profile test of the Application Technology Satellite (ATS-A) prototype spacecraft performed on March 16, 1967. The characteristics of the LPS acoustic and vacuum systems, pretest preparation, test philosophy and procedures, and results of the test program are discussed. Also included are a cursory treatment of contamination control of the facility and a brief discussion of other combined environmental tests of this type performed on the LPS. Author

c32 021300 02

N68-28845# National Environmental Satellite Center, Washington, D. C.
PROCESSING AND DISPLAY EXPERIMENTS USING DIGITIZED ATS-1 SPIN SCAN CAMERA DATA
M. B. Whitney, R. C. Doolittle, and B. Goddard Apr. 1968 63 p refs
(NESC-44)

Several experiments with digitally processed ATS1 Spin Scan Cloud Camera data are described. Digital pictures are presented with their analog equivalents. Some work on earth location of pictorial data and satellite attitude determination are presented. Suggestions are made for possible improvements in hardware and processing techniques. Author

c14 080900 04

N68-28816*# Electro-Optical Systems, Inc., Pasadena, Calif.
CONTACT ION ENGINE SYSTEM FOR ATS SATELLITES D AND E Annual Progress Report, 22 Mar. 1967–22 Mar. 1968
R. M. Worlock 24 May 1968 63 p
(Contract NAS5-10380)
(NASA-CR-95623; EOS-7202-A-1) CFSTI: HC $3.00/MF $0.65 CSCL 21C

This report covers the first twelve months effort on a program to fabricate and test ion microthruster systems for Applications Technology Satellites D and E, provide appropriate ground support equipment, and provide technical support of spacecraft integration and launch. During the reporting period, March 22, 1967 to March 22, 1968, the majority of the effort required in support of ATS-D was completed. The microthruster system design was finalized and a qualification model system was built and subjected to a qualification test program. Necessary test equipment was designed and fabricated. Two flight model ion microthruster systems were fabricated, flight acceptance tested and delivered to the spacecraft contractor. As a result of spacecraft integration tests, microthruster system modifications were made to ensure compatibility with spacecraft equipment. The most important modification consisted of the addition of an external filter box which provided transient filtering on all telemetry, power and command lines. Author

c28 020900 03

N68-29080*# National Aeronautics and Space Administration, Washington, D. C.
ATS-D LAUNCH SCHEDULED
16 Jul. 1968 8 p
(NASA News Release-68-127) CFSTI: HC $3.00/MF $0.65 CSCL 22B

Prelaunch data and mission objectives are presented on the ATS-D which is scheduled for launch by an Atlas Centaur rocket. To be called the ATS-4 when in orbit, the satellite will have a gravity gradient stabilization system as its prime experiment. An assessment will be made of the performance of this passive control system which uses the earth's gravity as an anchor for stabilizing the spacecraft in orbit, and which is expected to be a long-life, economical technique. Another first is an onboard meteorological image orthicon television camera (a day–night sensor) specifically designed for a synchronous equatorial, gravity gradient stabilized spacecraft. A microwave communications experiment has been designed for transmission of voice, television (color, and black and white), and telegraph and digital data to several ground stations. Tests of an ion engine will be conducted to determine how well a small ion engine with a variable-controlled thrust of only 5 to 20 micropounds, keeps the ATS precisely on station at 107°W longitude. M.G.J.

c31 010000 39

N68-29903*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.

FABRICATION OF THERMAL COATED EXTENDABLE BOOM Final Report

20 Mar. 1968 42 p refs

(Contract NAS5-10130)

(NASA-CR-95805; Rept.-7826A) CFSTI: HC $3.00/MF $0.65 CSCL 11F

A process for coating booms to be thermally stable was developed for use in the Application Technology Satellite. An α ratio of about 6:1 between internal and external absorptivities, and minimization of total heat were required. The coatings used are vacuum-deposited aluminum for the outside surface and black copper oxide on the inside surface of a beryllium copper alloy strip. Details are given on the problem areas encountered and techniques developed for the initial cleaning of the raw beryllium copper strip, application of a masking lacquer, development of the black copper oxide on the strip, removal of masking lacquer, photo masking and etching, metallizing the strip with aluminum, and boom forming. Solar absorptance and reflectance of the coated strip are measured in order to evaluate space stability of the boom. Also, evidence is presented to show the desired property of low evaporative loss of copper oxide in a space vacuum environment. D.H.B.

c15 090000 47

N68-31978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE DYNAMIC CHARACTERISTICS OF SATELLITES HAVING LONG ELASTIC MEMBERS

Harold P. Frisch Washington Aug. 1968 42 p refs

(NASA-TN-D-4576) CFSTI: HC$3.00/MF$0.65 CSCL 22B

Many satellites, such as ATS-A, ATS-D, DODGE, RAE, etc., have clamped to the surface of their central body long elastic members which when set into vibratory motion can significantly influence the motion of the central body. If such a satellite is reasonably symmetrical, we can predict its dynamic characteristics by modeling the entire satellite as a symmetric double-beam system; that is, by a rigid symmetric central body having clamped to its surface two long, diametrically opposed uniform elastic beams with tip weights possessing identical physical and geometrical properties. In this paper, dimensionless equations which define the natural modes and frequencies of such a satellite system are derived and solved. The solutions are outlined in graphical form and then used to solve the equations that describe the elastic response of the satellite to an arbitrary periodic forcing function. The results in both graphical and analytical form make it possible to predict with slide-rule accuracy the natural frequencies of any satellite that can be modeled as a symmetric double-beam system. Author

c31 020000 13

N68-33032# Chicago Univ., Ill.

A STUDY OF MESOSCALE CLOUD MOTIONS COMPUTED FROM ATS-1 AND TERRESTRIAL PHOTOGRAPHS

Tetsuya Fujita, Dorothy L. Bradbury, Clifford Murino, and Louis Hull Mar. 1968 30 p refs

(Grants CwB-WBG-34; NSF GA-864)

(SMRP-RP-71; PB-178403) CFSTI: HC$3.00/MF$0.65

A local area near Hawaii was selected for computation because a stereo-camera network was operated on top of Haleakala on Maui. Independent computation of cloud velocities from terrestrial photogrammetry revealed that the velocities of middle clouds computed from both ATS-I and terrestrial photographs are very close to each other. These cloud velocities were found to represent approximately the wind velocities at the cloud levels. An attempt was made to improve local upper-air analyses by adding the cloud velocities on corresponding upper-air charts even though the heights of the clouds were not known accurately. Also computed were the divergence and vorticity of the cloud velocities determined from ATS-I pictures. Despite the fact that it is uncertain that a group of clouds which moves with similar velocities is located at unique height; the computed fields are found to be quite meaningful. Author (USGRDR)

c20 081000 02

N68-33169*# National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE ELECTRONIC SYSTEMS TECHNOLOGY

1967 319 p refs Briefing for Ind. Held at MIT, 3–4 May 1967 Sponsored by the Electron. Ind. Assoc.

(NASA-SP-154) GPO: HC$1.25; CFSTI: MF$0.65 CSCL 22A

Conference papers are presented on NASA planning and requirements for electronic systems technology, with particular reference to mission goals; earth orbital, lunar, and planetary technologies; and avionics. For individual titles see N68-33169 through N68-33189.

c30 070200 06

N68-33173*# National Aeronautics and Space Administration, Washington, D. C.

SPACEPOWER ADVANCED TECHNOLOGY PLANNING

William H. Woodward *In its* Aerospace Electron. Systems Technol. 1967 p 75–86 (See N68-33169 20-30)

Survey data are presented on the space power requirements for future unmanned science probe and orbiter missions, unmanned Application technology satellite S mission, and manned missions. Possible thermal energy source and photon energy source space power systems and components are depicted, and energy sources and conversion systems are listed. Eight systems of principal interest are discussed and their power range estimated. These include thermoelectric and Brayton isotope systems for low power ranges (below 10 kw); the thermoelectric, Rankine, and thermionic reactors for ranges above 10 kw; and batteries or fuel cells required for energy storage with all these systems, or as a short duration space power system. Technology ready dates are predicted. Large array technology is mentioned, and it is stated that a lightweight, solar, electric propulsion system weighing 35 kilograms per kilowatt, including the solar cell array, the thrusters, and the power conditioning, could be attained by about 1969–1970. M.G.J.

c30 020200 02

N68-33188*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
COMMUNICATIONS AND NAVIGATION SATELLITES AS AERONAUTICAL AIDS
L. C. Van Atta *In its* Aerospace Electron. Systems Technol. 1967 p 273 281 (See N68-33169 20-30)

Two ways in which synchronous satellites could provide better position information for air traffic control (ATC) are cited: (1) Aircraft-derived position information can be communicated to the ground ATC facility via the satellite, using either voice or digital communications. (2) Aircraft positions can be determined independently by a satellite-based surveillance system and communicated to the ATC facility. As an indication of the studies devoted to systems concepts, some methods of navigation or position determination are described briefly. These include distance-measurement navigation, range-angle-angle navigation, crossed fan-beam navigation satellite using two beams at right angles, and determination of position from the Doppler shift as used in the Transit project navigational satellite system. The objectives and accomplishments of the Ad Hoc Joint Navigation Satellite Committee are reviewed. Summary data are presented on the results obtained from the ATS-1/aircraft voice communications experiment. Also reported is a proposed system study on the conceptual feasibility of an L-band satellite-aided communications system for the SST. M.G.J.

c21 070200 07

N68-33538# Hughes Aircraft Co., El Segundo, Calif. Systems Analysis Section.
DESIGN CONSIDERATIONS FOR SPIN AXIS CONTROL OF DUAL-SPIN SPACECRAFT
R. J. Mc Elvain and W. W. Porter *In* Aerospace Corp. Proc. of the Symp. on Attitude Stabilization and Control of Dual-Spin Spacecraft Nov. 1967 p 145–158 refs (See N68-33527 20-31)

The spin axis and velocity control system design considerations for dual-spin spacecraft are described. These design considerations are natural extensions of the technology developed at Hughes Aircraft Company for spin-stabilized vehicles such as Syncom, Intelsat II, and the Applications Technology Satellites. In most cases, the spin axis and velocity control system can employ many of the same hardware elements as for pure spinners to achieve the performance requirements. A typical example is treated in which the design considerations for a hypothetical synchronous altitude satellite mission are discussed. The example emphasizes those aspects peculiar to the dual-spin configuration. The primary differences which affect the north-south spin-axis orientation accuracy are the alignment and runout of the bearing assembly which connects the spinning and despun sections, and the large solar torque effects on the spacecraft. These and other considerations are treated in some detail via the example spacecraft and mission, and serve to illustrate the application of these techniques for spin axis and velocity control. Author

c31 020800 05

N68-33593*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF METEOROLOGICAL SATELLITES IN THE UNITED STATES
William Nordberg Aug. 1968 19 p refs
(NASA-TM-X-63313; X-620-68-311) CFSTI: HC $3.00/MF $0.65 CSCL 22B

The basic concept of meteorological satellites is discussed in terms of the Tiros series, and the progressive technological advancements which resulted in the launch of Essa to initiate the series of Tiros operational satellites (TOS). The role of the Applications Technology satellites in making cloud cover observations is also discussed. Details are given on the Nimbus series of global meteorological observations. The systems design is based on a spacecraft capable of delivering on the order of 200 watts of electrical power to the experiments; a mechanical structure which can accommodate a maximum number of experimental instruments and which can be pointed at the earth at all times with an accuracy of about 1°; a stable and moderate thermal environment; and a data system which can acquire and store on the order of 10^9 to 10^{12} bits per orbit and transmit these data to the ground over Alaska, and which can transmit continuously a lesser amount of data. By placing the spacecraft into a sun synchronous orbit at a height of about 1100 km, the Nimbus can observe practically all points on the globe at least twice during every 24-hour period. Experimental results are assessed, and plans for the second generation of satellites are proposed. M.G.J.

c31 080000 11

N68-33635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE PUMP REQUIREMENTS FOR FIELD OPERATIONAL BROADBAND RUTILE TRAVELING-WAVE MASERS
L. E. Rouzer Washington Sep. 1968 12 p refs
(NASA-TN-D-4764) CFSTI: HC $3.00/MF $0.65 CSCL 20E

This paper discusses microwave pump sources available for use in a field operational, rutile, broadband, traveling wave maser for the Applications Technology Satellite (ATS) program. Included is a brief resume of the current solid state microwave pump sources, klystrons, and the Hughes and OKI backward wave oscillators. The spin Hamiltonian for iron-doped rutile is given; its solution yields a pump frequency of 54.7 GHz and pump bandwidth of 500 MHz for a 4.065- to 4.195-GHz signal frequency. The suitability of the OKI backward wave oscillator for the application here considered has been determined; it is simple and comparatively inexpensive to operate in the field. The solid state modulator circuit capable of sweeping the OKI backward wave oscillator over 500 MHz is described; and the pump package, which maintains the tube temperature at 130°F (well within the operating range required by the tube) is discussed. Author

c16 060000 10

N68-33988# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 70, NO. 5: WEATHER SATELLITE OBSERVATIONS AND THEIR VALUE TO THE EUROPEAN WEATHER PICTURE, 1966. PART 5: NOVEMBER–DECEMBER 1966 [METEOROLOGISCHE ABHANDLUNGEN. BAND 70, HEFT 5: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG DAS EUROPAEISCHE WETTERBILD 1966. TEIL 5: NOVEMBER–DEZEMBER 1966]
Ingrid Haupt et al 1967 196 p refs In GERMAN; ENGLISH summary CFSTI: HC $3.00/MF $0.65

The ATS-1 (Application Technology Satellite) is described, including its technical and meteorological programs, orbital characteristics, and its special system of camera equipment, the Spin Scan Cloud Cover Camera, which photographs always the same area of the earth from a synchronous, stationary orbit of about 36,000 km. The daily European weather situation and some data on the snow and ice conditions are presented in the form of Nimbus 2 cloud mosaics, tables, and short descriptions. The most important orbital data of ESSA 2 and Nimbus 2 are included. November and December of 1966 are covered. K.W.

c20 080000 01

N68-35204# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DYNAMICAL ANALYSIS OF A THREE-BODY GRAVITY-GRADIENT SPACECRAFT
J. M. Whisnant and V. L. Pisacane May 1968 44 p refs
(Contract NOw-62-0604-c)
(APL-TG-1005; AD-673218)

This paper gives the results of a dynamical analysis of the in-orbit-plane motion of a three-body spacecraft. The linearized differential equations of motion and characteristic determinant are developed for gravity-gradient stabilization with passive damping of librational energy. Two damping techniques are considered: one depends on relative motion between the component bodies of the spacecraft, the other on the relative motion between the spacecraft and an ambient magnetic field. The general results are applied to an artificial earth satellite consisting of two rigid bodies connected by a cable which is several miles long. With only viscous damping at the cable pivots, it is demonstrated that an undamped libration mode exists unless the two rigid bodies have triaxial ellipsoids of inertia. Furthermore, the time constants of the motion are inadequate even for unrealistically large mass distributions. The second damping technique considered gives more favorable results. Acceptable transient performance is obtained by dissipating energy viscously through the geomagnetic field. In addition, triaxial inertia ellipsoids of the two end bodies are not required. Author (TAB)

c31 090000 48

N68-35934# Aerospace Corp., El Segundo, Calif. Lab. Operations.
OBSERVATIONS OF ENERGETIC ELECTRONS AT SYNCHRONOUS ALTITUDE. VOLUME 1: GENERAL FEATURES AND DIURNAL VARIATIONS
George A. Paulikas, J. Bernard Blake, Stanley C. Freden, and Sam S. Imamoto May 1968 40 p refs
(Contract F04695-67-C-0158)
(TR-0158(3260-20)-9, v. 1; SAMSO-TR-68-286, v. 1; AD-673878)

Energetic electron fluxes above four integral thresholds (E sub e greater than 300 keV, greater than 450 keV, 1.05 MeV, and 1.9 MeV) were measured at synchronous altitude (R = 6.6 R sub e) during the first half of 1967 on board the ATS-1 satellite (1966-110A). The fluxes show a diurnal variation, with the noon-to-midnight ratio being larger for the more energetic electron groups and being larger, on the average, for magnetically disturbed days. Magnetic storms produce a great deal of fine structure in the electron fluxes, with changes occurring on the time scale of minutes; the effect of such storms is to depress the fluxes. Recovery to pre-storm levels is an energy-dependent process which proceeds more slowly for more energetic electrons and apparently in a stepwise manner. Author (TAB)

c13 110100 06

N68-37369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METEOROLOGICAL DATA CATALOG FOR THE APPLICATIONS TECHNOLOGY SATELLITES, VOLUME 1, 1 JANUARY-30 JUNE 1967
Oct. 1967 469 p Prepared by Allied Res. Assoc., Inc.
(NASA-TM-X-61290) CFSTI: HC$3.00/MF$0.65 CSCL 22B

The ATS-1 Spin Scan Cloud Camera describes the ATS-1 system and offers an explanation of the data acquisition, categorization, cataloging and archiving processes. A computerized data service, based on the categorization scheme is also described. Data documentation is given for the period 1 January 1967 through 30 June 1967. The ATS meteorological data catalogs present the types of data available, a meteorological data log identifying pictures as to time and picture quality, orbital data and a daily example of the photographic data acquired. D.H.B.

c31 080000 04

N68-37832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CELL RADIATION DAMAGE ON SYNCHRONOUS SATELLITE ATS-1
Ramond C. Waddel Oct. 1968 22 p 14 refs
(NASA-TM-X-63379; X-710-68-408) CFSTI: HC $3.00/MF $0.65 CSCL 10A

Various types of solar cells were monitored during 416.8 days in synchronous orbit on satellite ATS-I. Judging by the remaining percentage of initial maximum power qualified conclusions were: (1) degradation was greater than expected; (2) optimum base resistivity was 10 ohm-cm; (3) optimum shield thickness was 6 mils; (4) sapphire and silica shields were comparable; (5) silica shields were superior to glass; (6) boron and aluminum doping were comparable; (7) that it was necessary to presume some radiation damage, some drop in illumination, and a development of series resistance to account for the results. Author

c03 110500 07

N68-38162# Environmental Science Services Administration, Boulder, Colo. Space Disturbances Lab.
PRELIMINARY TEST RESULTS OF A TIME DISSEMINATION SYSTEM USING THE VHF TRANSPONDER ON THE ATS 1 SATELLITE
R. N. Grubb and S. D. Gerrish Mar. 1968 38 p refs
(ERLTM-SDL-9; AD-674551)

Some preliminary test results are given of a time dissemination experiment using simple ground equipment communicating through ATS 1 satellite VHF transponder. It is demonstrated that an operational system with an accuracy of the order of 10 microseconds should be realizable. Author (TAB)

c07 070207 01

N69-10457# Woods Hole Oceanographic Institution, Mass.
AIRCRAFT METEOROLOGICAL DATA FROM THE LINE ISLANDS EXPERIMENT
Margaret A. Chaffee and Andrew F. Bunker Apr. 1968 68 p refs *Its* Reference No. 68-25
(Grant NSF GA-821)
Avail: Issuing Activity

The Line Island Experiment was an intensive program of meteorological observations made within the Intertropical Convergence Zone (ITC Zone) in the Pacific to supplement photographic coverage by the Advanced Technological Satellite-1. The specially instrumented C-54Q aircraft made observational flights in this Zone on 12 days during April–May 1967. The reduced data collected on these flights includes cloud cross-sections, short wavelength radiation sections, cloud echo maps from radar films and potential temperature and mixing ratio sections from dropsonde data. Author

c13 080700 02

N69-11822*# General Electric Co., Philadelphia, Pa. Valley Forge Space Technology Center.
UNIQUE MECHANISM FEATURES OF ATS STABILIZATION BOOM PACKAGES
R. A. Lohnes, D. N. Matteo, and E. R. Grimshaw (SPAR Aerospace Products, Ltd.) *In* JPL Proc. of the 3rd Aerospace Mech. Symp. 1 Oct. 1968 p 179–187 refs (See N69-11801 02-31)
(Contract NAS5-9042)
Avail: CFSTI

This paper describes the unique mechanism of the motorized primary boom packages and the damper-borne self-erecting secondary boom package utilized on the Applications Technology Satellite (ATS) gravity-gradient experiment. The spacecraft failed to achieve the required orbit, but the mechanism performed as planned. Author

c31 090000 50

N69-11858# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
MARITIME MOBILE SATELLITE COMMUNICATIONS TESTS PERFORMED ON S.S. SANTA LUCIA
1968 120 p refs
(Contract MA-4329)
(PB-179298) Avail: CFSTI CSCL 17B

This report covers the activities for the research and development of communications performed between a ship and NASA ground stations via NASA's ATS-1 and ATS-3 satellites. These communication tests consisting of voice, date, time synchronization, ranging, interference and propagation were conducted between a U.S. Merchant ship, the S.S. Santa Lucia and NASA ground stations at Rosman, North Carolina; Mojave, California; and Cooby Creek, Australia. These tests were conducted in the VHF range during an actual 36 day voyage from Port Newark, New Jersey throught the Panama Canal to Valparaiso, Chile and return. Author (USGRDR)

c07 070208 03

N69-12124# Chicago Univ., Ill. Satellite and Mesometeorology Research Project.
COMPUTATION OF HEIGHT AND VELOCITY OF CLOUDS FROM DUAL, WHOLE-SKY, TIME-LAPSE PICTURE SEQUENCES
Dorothy L. Bradbury and Tetsuya Fujita Mar. 1968 22 p refs
(Grants NSF GA-864; CWB-WBG-34)
(SMRP-PR-70; PB-178989) Avail: CFSTI CSCL 04B

The Satellite and Mesometeorology Research Project of the University of Chicago together with St. Louis University established a camera network of stations atop the northern rim of Haleakala on the island of Maui during the early part of March 1967. The network was in operation from 13 March through 3 April 1967. The purpose of the network was to gather photographic cloud data during the period of the Line Island Experiment and the ATS-I picture acquisition in order to study the time changes in mesoscale nephsystems and to compute heights and motions of clouds in the region of the Hawaiian islands. Author (USGRDR)

c20 081000 03

N69-12701# Institutes for Environmental Research, Boulder, Colo.
CONJUGATE POINT SYMPOSIUM, VOLUME 3, SESSION 4
Jul. 1967 241 p refs Conf. held at Boulder, Colo., 13–16 Jun. 1967; Sponsored by ESSA and High Altitude Obs.
(AD-661272; IERTM-ITSA-72) Avail: CFSTI

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12. GROSS LOCAL TIME PARTICLE ASYMMETRIES AT THE SYNCHRONOUS ORBIT ALTITUDE J. W. Freeman, Jr. and J. J. Maguire (Rice Univ.) 18 p refs (See N69-12713 03-13)

13. CONJUGATE EFFECTS ON ENERGETIC ELECTRONS BETWEEN THE EQUATOR AT 6.6 R_e AND THE AURORAL ZONE, PART 1 T. W. Lezniak, R. L. Arnoldy, G. K. Parks, and J. R. Winckler (Minn. Univ.) 11 p refs (See N69-12714 03-13)

14. CONJUGATE EFFECTS ON ENERGETIC ELECTRONS BETWEEN THE EQUATOR AT 6.6 R_e AND THE AURORAL ZONE, PART 2 . G. K. Parks, R. L. Arnoldy, T. W. Lezniak, and J. R. Winckler (Minn. Univ.) 19 p refs (See N69-12715 03-13)

15. EXAMINATION OF STORM TIME OUTER ZONE ELECTRON INTENSITY CHANGES AT 1100 KILOMETERS J. F. Arens and D. J. Williams (NASA. Goddard Space Flight Center) 4 p ref (See N69-12716 03-13)

c13 110800 02

N69-12711*# California Univ., Los Angeles. Dept. of Planetary and Space Science.

SIMULTANEOUS MAGNETIC FIELD VARIATIONS AT THE EARTH'S SURFACE AND AT SYNCHRONOUS, EQUATORIAL DISTANCE. 1: BAY-ASSOCIATED EVENTS

W. D. Cummings and P. J. Coleman, Jr. *In* Inst. for Environ. Res. Conjugate Point Symp., Vol. 3, Session 4 Jul. 1967 9 p (See N69-12701 03-13)
(Contract NAS5-9570)
Avail: CFSTI CSCL 08N

Reported are preliminary results of synchronous satellite magnetometer readings on simultaneous disturbances of magnetic fields perpendicular and parallel to the spin axis of the satellite. Data obtained show that at least some high latitude geomagnetic bays are associated with disturbances in the distant magnetosphere and that field aligned currents are influential in these events G.G.

c13 110800 04

N69-12712*# California Univ., Los Angeles. Dept. of Planetary and Space Science.

SIMULTANEOUS MAGNETIC FIELD VARIATIONS AT THE EARTH'S SURFACE AND AT SYNCHRONOUS, EQUATORIAL DISTANCE. 2: MAGNETIC STORMS

P. J. Coleman, Jr. and W. D. Cummings *In* Inst. for Environ. Res. Conjugate Point Symp., Vol. 3, Session 4 Jul. 1967 13 p ref (See N69-12701 03-13)
(Contract NAS5-9570)
Avail: CFSTI CSCL 04A

Magnetic field measurements onboard a synchronous equatorial earth satellite during geomagnetic storms show that the H component at the satellite was 20 to 30 γ above its quiet day values at the initial phase before it decreased to 70 γ below quiet day values during the main phase. This was always followed by a bay-related increase in H. G.G.

c13 110800 03

N69-12713*# Rice Univ., Houston, Tex. Dept. of Space Science.

GROSS LOCAL TIME PARTICLE ASYMMETRIES AT THE SYNCHRONOUS ORBIT ALTITUDE

J. W. Freeman, Jr. and J. J. Maguire *In* Inst. for Environ. Res. Conjugate Point Symp., Vol. 3, Session 4 Jul. 1967 18 p refs (See N69-12701 03-13)
(Contract NAS5-9561)
Avail: CFSTI CSCL 04A

A low energy charged particle detector has been flown aboard the geostationary ATS-1 satellite. A preliminary study of the data has revealed large local time variations in the particle fluxes observed during geomagnetically disturbed times. The salient features of the observed variations are: 1) During periods of moderate magnetic activity a high particle flux is seen near local midnight. This flux shows a strong pre/post-midnight asymmetry with the particle intensities being higher in the midnight to dawn quadrant. 2) During periods of high magnetic activity the enhanced particle flux distribution broadens out in local time to cover a larger fraction of the night side portion of the synchronous orbit. 3) During periods of enhanced magnetic activity the local time distribution of the particle fluxes shows a remarkable similarity to the local time distribution of high latitude magnetic substorm activity. Author

c13 110700 02

N69-12714*# Minnesota Univ., Minneapolis. Dept. of Physics and Astronomy.

CONJUGATE EFFECTS ON ENERGETIC ELECTRONS BETWEEN THE EQUATOR AT 6.6 R_e AND THE AURORAL ZONE, PART 1

T. W. Lezniak, R. L. Arnoldy, G. K. Parks, and J. R. Winckler *In* Inst. for Environ. Res. Conjugate Point Symp., Vol. 3, Session 4 Jul. 1967 11 p refs (See N69-12701 03-13)
(Contract NAS5-9542; Grant NSF GA-487)
Avail: CFSTI CSCL 04A

Synchronous satellite measurement data on energetic electron behavior during quiet and disturbed times show large positive deviations after local midnight with sharp commencement at local midnight. Particles which normally do not appear on quiet day passes suddenly are present at local midnight and in the sector from midnight to about noon as a result of magnetic disturbances. These particles have a life time on the particle shell passing through 6.6R_e at local midnight which is less than their drift time around the earth. G.G.

c13 110400 01

N69-12715*# Minnesota Univ., Minneapolis. Dept. of Physics and Astronomy.

CONJUGATE EFFECTS ON ENERGETIC ELECTRONS BETWEEN THE EQUATOR AT 6.6 R_e AND THE AURORAL ZONE, PART 2

G. K. Parks, R. L. Arnoldy, T. W. Lezniak, and J. R. Winckler *In* Inst. for Environ. Res. Conjugate Point Symp., Vol. 3, Session 4 Jul. 1967 19 p refs (See N69-12701 03-13)
(Contract NAS5-9542; Grant NSF GA-487)
Avail: CFSTI CSCL 04A

The comparison of energetic electron flux measurements at 6.6R_e equatorial plane with precipitated energetic electron fluxes measured by high altitude balloons established a correlation between time variations of trapped electrons with precipitation of energetic electrons in the auroral zone. G.G.

c13 110400 02

N69-13532*# Ohio State Univ., Columbus. ElectroScience Lab.
MILLIMETER-WAVELENGTHS PROPAGATION STUDIES Annual Status Report, Sep. 1, 1967–Aug. 31, 1968
Peter Bohley and Robert L. Riegler 1 Nov. 1968 30 p refs
(Grant NGR-36-008-080)
(NASA-CR-97926; ASR-2374-2) Avail: CFSTI CSCL 17B

Preparations for Ohio State University participation in the NASA ATS-E millimeter wave experiment are described. Two terminals are under construction and will be used for space diversity experiments. The results of a study to determine some of the effects of the atmosphere on earth/space communications links are presented. Author

c07 070300 05

N69-14966*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
SOLAR CELL RADIATION FLIGHT EXPERIMENT Quarterly Progress Report, 14 Aug.–2 Dec. 1968
W. P. Dawson 16 Dec. 1968 60 p Prepared for JPL
(Contracts NAS7-100; JPL-952351)
(NASA-CR-98715; SSD-80512R; QPR-1) Avail: CFSTI CSCL 10B

The detailed design of the Solar Cell Radiation Flight Experiment, scheduled for launch on the ATS-E spacecraft, Project Status and results of tests conducted to date are presented. Author

c03 100700 02

N69-15708*# National Aeronautics and Space Administration, Washington, D. C.
SIXTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JULY–31 DECEMBER 1966
31 Dec. 1966 290 p refs
(NASA-TM-X-61375) Avail: SOD $1.50; CFSTI CSCL 22

NASA activities and accomplishments are reviewed in the areas of manned space flights, scientific space investigations, applications technology satellites, advanced research and technology programs, nuclear propulsion and power generation, tracking and data acquisition, international cooperation, grants, information and education programs, personnel, management, procurement, and support functions. During this period the Gemini program was successfully completed with the Gemini X, XI, and XII flights. Lunar Orbiters I and II transmitted thousands of clear pictures of the moon. Intelsat II was orbited for the Communications Satellite Corporation, extending the network of commercial communications satellites and linking Hawaii with continental United States. The first Applications Technology satellite carried advanced meteorological and communications experiments into orbit. B.P.

c34 010000 08

N69-15712*# National Aeronautics and Space Administration, Washington, D. C.
SEVENTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JANUARY–30 JUNE 1967
30 Jun. 1967 277 p refs
(NASA-TM-X-61374) Avail: SOD $1.50; CFSTI CSCL 22

This period involved intensive development efforts on the Apollo spacecraft and the Saturn V launch vehicle, and was marked by a fire during a ground test of this spacecraft which claimed the lives of three astronauts. The Gemini program was closed out. Orbiting Solar Observatories monitor processes taking place within the sun, and Orbiting Geophysical Observatories are measuring the earth's magnetosphere and its upper atmosphere. The Lunar Orbiter and Surveyor spacecraft have paved the way for exploration of the moon by pinpointing possible landing sites for astronauts and by sampling its surface; Mariner spacecraft have furnished data on Mars and Venus. The first Applications Technology Satellite supplied data on tropical cloud motions and air circulations, took part in voice communications between aircraft and ground stations, and helped telecast a program by 17 nations reaching an estimated 14% of the world's population. Weather and geodetic satellites also provided a multitude of information. The above are some of the highlights from the NASA report to Congress for this period. B.P.

c34 010000 29

N69-15713*# National Aeronautics and Space Administration, Washington, D. C.
EIGHTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JULY–31 DECEMBER 1967
31 Dec. 1967 258 p refs
(NASA-TM-X-61384) Avail: SOD $1.25; CFSTI CSCL 22

The major achievement of this reporting period in the Manned Space Flight Program was the successful first unmanned flight test of the Apollo-Saturn V space vehicle on November 9. Emphasis was continued on the technical and engineering improvements identified as necessary following the Apollo 204 accident. Further progress was made in improving the management efforts, organization, and operating procedures associated with the Apollo Program, in addition to the design changes in the spacecraft itself. An interplanetary Explorer and a Pioneer space probe were launched. Other complex spacecraft launched were the last of the Lunar Orbiter photographic laboratories, three Surveyor soft lunar landers, Mariner V which flew by Venus, and the second Biosatellite. Also reviewed are the basic research programs, nuclear systems and space power activities, tracking and data acquisition, and all other accomplishments connected with the NASA space program. B.P.

c34 010000 32

N69-16475*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT: SPACE PROGRAMS SUMMARY, VOLUME 3
31 Oct. 1968 264 p refs
(Contract NAS7-100)
(NASA-CR-99217; JPL-SPS-37-53-Vol-3) Avail: CFSTI CSCL 22

Summary information is presented on the supporting research and advanced development projects pertaining to systems analysis and engineering, guidance and control, propulsion, space sciences, and telecommunication. For individual titles, see N69-16475 through N69-16497

c07 030004 14

N69-16483 *# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ENGINEERING
In its Supporting Res. and Advanced Develop 31 Oct. 1968 p 91-97 refs (See N69-16475 06-07)
Avail: CFSTI CSCL 21I

Experiments were conducted to ignite materials whose thermal and chemical properties are carefully controlled with a bridgewire at varying known energy input rates. It was felt that, with proper analysis, the conventional power versus time-to-fire curve would give an ignition temperature-time relationship, thereby providing a constant temperature ignition or a regular temperature-time-to-fire dependence. The results were largely negative, with no single ignition temperature found, nor was a single, fundamental relationship between ignition temperature and time-to-fire established. Static test data are also included on the Applications Technology Satellite motor. M.G.J.

c27 030004 13

N69-17057 *# Techtran Corp., Glen Burnie, Md.
WINTER CLOUD DISTRIBUTION OVER THE PACIFIC OCEAN ON THE BASIS OF AN ANALYSIS OF ATS PHOTOGRAPHS
Kiyoshi Tsuchiya et al Washington NASA Jan. 1969 13 p refs Transl. into ENGLISH from Tenki (Japan), v. 15, no. 5, May 1968 p 189-195
(Contract NASw-1695)
(NASA-TT-F-12026) Avail: CFSTI CSCL 04B

Analysis of Application Technology Satellite photographs covering the entire Pacific Ocean reveals the following characteristics in the wide scale distribution of cloud cover during the months of December and January: (1) There are few clouds along the equator east of 150°E., but large cloud bands, or cloud regions, on both sides of the equator extend to the east and west. (2) There are a large number of clouds in the highs, which center in the vicinity of 35°N. and 140°W., west of North America. (3) Few clouds exist below the axis of the high pressure belt in the medium latitudes in a 500 mb weather map. (4) The jet stream axis on the 200 mb surface is along the northern edge of the cloud band along the polar front. The cloud band which parallels the jet stream is narrow where the clouds are close-knit and wide where they are dispersed. (5) The line along which the relative vorticity at 500 mb is 0 nearly coincides with the line along the polar front. (6) A cloud band extends east and west to the east of 170°W. within the southern hemisphere. Author

c20 081000 12

N69-17232# Wisconsin Univ., Madison. Dept. of Meteorology.
STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS Annual Report
Verner E. Suomi May 1968 231 p refs
(Grant CWB-WBG-27)
(PB-180267) Avail: CFSTI CSCL 04B

The development introduces a technique for measuring cloud velocities from sequences of ATS photos. A comparison is made between cloud velocity measurements and corresponding rawinsonde wind measurements to test the usefulness of the technique of determining the wind velocities from selected cloud velocities. Author (USGRDR)

c13 080100 12

N69-17418# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SOLAR PROTON OBSERVATIONS AT SYNCHRONOUS ALTITUDE DURING 1967 Research Document, 1 Jan.-30 Jun. 1968
G. A. Paulikas and J. B. Blake Sep. 1968 32 p refs
(Contract F04701-68-C-0200)
(AD-679977; TR-0200(4260-20)-2; SAMSO-TR-68-444) Avail: CFSTI CSCL 4/1

Measurements of solar protons in the 5-70 MeV energy interval obtained at synchronous altitude during 1967 are presented. The major contributions to the integrated flux were the events of 28 January and 23 May 1967. Author (TAB)

c29 110100 08

N69-17934 *# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TYPE 3 RADIO BURSTS IN THE OUTER CORONA
J. K. Alexander, H. H. Malitson, and R. G. Stone Nov. 1968 25 p refs
(NASA-TM-X-63403; X-615-68-442) Avail: CFSTI CSCL 03B

Type III solar radio bursts observed from 3.0 to 0.45 MHz with the ATS-II satellite over the period April to October 1967 were analyzed to derive two alternative models of active region streamers in the outer solar corona. Assuming that the bursts equilibrium arguments lead to streamer Model I in which the streamer electron temperature derived from collision damping time falls off much more rapidly than in the average corona and the electron density is as much as 25 times the average coronal density at heights of 10 to 50 solar radii. In Model II the streamer electron temperature is assumed to equal the average coronal temperature, giving a density enhancement which decreases from a factor of 10 close to the Sun to less than a factor of two at large distances (> 1/4 A.U.). When the burst frequency drift is interpreted as resulting from the outward motion of a disturbance that stimulates the radio emission, Model I gives a constant velocity of about 0.35c for the exciting disturbance as it moves to large distances, while with Model II, there is a decrease in the velocity to less than 0.2c beyond 10 solar radii. Author

c29 111000 04

N69-18731 *# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA METEOROLOGICAL AND COMMUNICATIONS SATELLITE PROGRAMS
Herbert I. Butler Feb. 1969 39 p Presented at Natl. Council for Social Studies, Greenbelt, Md., 26 Nov. 1968
(NASA-TM-X-63461; X-482-69-16) Avail: CFSTI CSCL 22

A review of the meteorological and communications satellite programs is presented. The three major spacecraft projects in their support are: Tiros operational satellite, Nimbus, and Applications Technology Satellites. A brief description of each is given. Pictures of global cloud coverage are shown, and their use in weather forecasting is discussed. Possible use of the ATS in direct broadcasts, as educational television systems, is considered. F.O.S.

c31 080000 15

N69-19062*# Ohio State Univ., Columbus. ElectroScience Lab.
THEORETICAL STUDY OF V ANTENNA CHARACTERISTICS FOR THE ATS-E RADIO ASTRONOMY EXPERIMENT Final Report
J. H. Richmond 13 Feb. 1969 101 p refs
(Contract NAS5-11543)
(NASA-CR-100153; Rept-2619-1) Avail: CFSTI CSCL 09F

A theoretical analysis has been carried out for the V antenna system on the ATS-E Satellite for radio astronomy experiments. This report summarizes the techniques and presents numerical results for impedance, current distributions, patterns and radiation efficiency. Author

c30 111000 08

N69-19699*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
APPLICATIONS TECHNOLOGY SATELLITE Quarterly Progress Report, 1 Sep.–30 Nov. 1968
Nov. 1968 48 p refs
(Contract NAS5-3823)
(NASA-CR-100329; SSD-80523R; QPR-18) Avail: CFSTI CSCL 22B

Details of the Applications Technology Satellite (ATS) spacecraft program are presented. The basic spacecraft parameters and payloads are tabulated. The ATS development and launch program provides for the fabrication of basic spacecraft and system test equipment, using the techniques and subsystems developed under the Advance Technological Development Program. Appropriate combinations of equipment are integrated with the basic spacecraft to complete the flight vehicles. The planned program includes vehicle and subsystem developmental design verification testing and flight acceptance testing of each flight vehicle. In addition, launch center operations and mission operations in support of the vehicle launches and initial orbital operations are included. Author

c31 010000 17

N69-19755*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
IMAGE DISSECTOR CAMERA SUBSYSTEM, ASSOCIATED GROUND SUPPORT EQUIPMENT, AND INTEGRATION SUPPORT FOR APPLICATIONS TECHNOLOGY SATELLITE Final Report, May 17, 1966–Nov. 17, 1968
3 Dec. 1968 24 p
(Contract NAS5-10200)
(NASA-CR-100328; ITTIL-68-043) Avail: CFSTI CSCL 14E

A chronological review of activities covering the fabrication and testing of a flight model image dissector camera for the Applications Technology Satellite is presented. The design, fabrication, test, and installation of two sets of ground station equipment and the field service support of these equipments through integration, pre-launch, launch, and post-launch activities are discussed. Author

c14 080500 07

N69-19856# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
UTILIZATION OF TIME/FREQUENCY IN COLLISION AVOIDANCE SYSTEMS (CAS)
[1968] 166 p refs Meeting held at Washington, 27–28 Aug. 1968
Avail: Issuing Activity

CONTENTS:

c14 070207 04

N69-19870*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMARKS ON ATS TIME SYNCHRONIZATION
Straton C. Laios *In* FAA Util. of Time/Freq. in Collision Avoidance Systems (CAS) [1968] p 101-104 (See N69-19856 09-14)
Avail: Issuing Activity CSCL 22A

The application technology Satellite (ATS) will be used to time synchronize network ground stations by simultaneously transmitting timing signals between a master and a slave station. Each station starts a time interval counter by the signal it transmits and stops the counter by the signal it receives. The time error between the stations is the time interval measured at the slave divided by two. The stations can be synchronized to within 15 microseconds by this method. G.G.

c14 070207 05

N69-22321*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COLOR ENHANCEMENT OF NIMBUS HIGH RESOLUTION INFRARED RADIOMETER DATA

Earl R. Kreins and Lewis J. Allison Mar. 1969 28 p refs

(NASA-TM-X-63503; X-622-69-86) Avail: CFSTI CSCL 20F

Two examples of Nimbus High Resolution Infrared Radiometer (HRIR) data processed by a color display enhancement system demonstrate possible meteorological, oceanographic, and geomorphological applications of this technique for geophysical research. A commonly used means of displaying radiation temperatures mapped by the HRIR has been a black and white photofacsimile film strip. However, the human eye can distinguish many more colors than shades of gray, and this characteristic permits an analyst to evaluate quantitatively radiation values mapped in color more readily than in black and white. Author

c14 080100 22

N69-22813*# General Electric Co., Philadelphia, Pa. Missile and Space Div.

APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT STABILIZATION SYSTEM Quarterly Progress Report, 1 Nov. 1968–28 Feb. 1969

20 Feb. 1969 13 p refs

(Contract NAS5-9042)

(NASA-CR-100610; Doc-69SD4256) Avail: CFSTI CSCL 22B

The status of the design, test, and flight analysis of ATS-2, ATS-4, and ATS-E is documented in the form of an events summary. It is reported that: interlocked damper boom elements were developed, tested, and incorporated into the ATS-E combination passive damper/damper boom system; the ATS-E TV flight cable was lengthened; a series of design reviews on the primary boom system were undertaken, and thermal flutter investigations were concluded. P.A.B.

c31 090000 55

N69-23317*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR EFFECTS ON VHF COMMUNICATIONS BETWEEN A SYNCHRONOUS SATELLITE RELAY AND EARTH GROUND STATIONS

Sheldon Wishna and James R. Greaves (Allied Res. Associates, Inc., Concord, Mass.) Washington Apr. 1969 11 p

(NASA-TN-D-5100) Avail: CFSTI CSCL 17B

An investigation has been performed to correlate VHF interference as reported by participating ground stations, with the occurrence of certain solar phenomena. The participating ground stations were taking part in the Weather Facsimile (WEFAX) experiment, which utilizes the Applications Technology Satellite (ATS)-1 to relay processed meteorological data from a central weather station to the ground stations. The VHF communication system, located on board the satellite, is an active frequency translator with an uplink receive frequency of 149.22 MHz and a downlink transmit frequency of 135.6 MHz. The data were transmitted to the satellite from the ATS ground station located at Mojave, California. The ATS-1 satellite is at an altitude of 19,300 nautical miles and is located over the equator at 151° West longitude. Approximately 50 ground stations located in an area extending from the east coast of the United States to Australia and Japan participated in the program. The analysis was conducted over an 8-month period beginning on January 2, 1967 and continuing through August of the same year. Author

c07 080200 04

N69-24038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ATLAS-AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-1 MISSION

Washington May 1969 97 p refs

(NASA-TM-X-1784) Avail: CFSTI CSCL 22B

Flight performance is discussed from liftoff through the final attitude maneuver. The Atlas–Agena vehicle systems performed satisfactorily throughout the flight, including the standard Agena clamshell shroud which was used for the first time to provide aerodynamic shielding for the spacecraft during ascent through the atmosphere. Aerospace ground equipment operated properly during the countdown and launch, except that the 2-inch motion switch failed at liftoff, and the time of first motion had to be derived from the 8-inch motion switch. Detailed discussions are included on the following aspects of the flight: (1) trajectory and performance; (2) Atlas vehicle system performance; (3) Agena spacecraft system performance; and (4) launch operations. In addition, evaluation of the final Agena transfer orbit parameters demonstrated that these were within the requirements established for the ATS-1 mission. A.C.R.

c31 030100 03

N69-24053*# General Electric Co., Schenectady, N. Y. Research and Development Center.

ATS RANGING AND POSITION FIXING EXPERIMENT, 25 NOVEMBER 1968–25 AUGUST 1969 Quarterly Report

[1969] 52 p

(Contract NAS5-11634)

(NASA-CR-100732; S-69-1040; QR-1) Avail: CFSTI CSCL 17B

The measurement parameters for the ranging and position fixing equipment were confirmed. The bandwidth to be tested is compatible with mobile communications, and has a modulation bandwidth of 2.4414 kHz and a radio frequency of approximately 15 kHz. Equipment designs were confirmed and the following equipments were constructed: a tone-code signal generator, a phase matcher-correlator, and a responder unit for installation in a mobile van. A similar responder unit has been constructed previously for installation in the Sea Robin buoy that is to be tested near Bermuda. Construction was started on a responder unit intended for integration with a transmitter and receiver to be furnished by the FAA for flight tests during the second quarter of the experiment.

The units employ integrated circuits and are fabricated on printed circuit boards. Range measurements were made from the Radio-Optical Observatory near Schenectady, New York to satellites ATS-1 and ATS-3, and through ATS-3 to the Sea Robin unit at Bermuda and to the mobile van at Schenectady. Observations based on the data that has been processed are included in the appendix of this report. Author

c07 070211 03

N69-25365*# Hughes Aircraft Co., Culver City, Calif. Space Systems Div.
SOLAR CELL RADIATION FLIGHT EXPERIMENT Quarterly Progress Report, 2 Dec. 1968 – 14 Mar. 1969
W. P. Dawson 31 Mar. 1969 40 p Prepared for JPL
(Contracts NAS7-100; JPL-952351)
(NASA-CR-100836; SSD-90109R; QPR-2) Avail: CFSTI CSCL 10B

Data from the flight experiment and supplemental ground test program of the Solar Cell Radiation Flight Experiment, scheduled for launch on the ATS-E spacecraft, will provide design data required for extended spacecraft missions in synchronous orbit. The flight experiment consists of two small solar panels containing a total of 80 solar cells representing 16 solar cell configurations and two signal processors required to interface with the ATS-E telemetry system. The detail design of the Flight Experiment, Project Status and results of tests conducted to date are presented in this report for review by the Jet Propulsion Laboratory. Author

c03 100700 03

N69-25426*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE SPACECRAFT ELECTROMAGNETIC INTERFERENCE WORKSHOP
Joseph G. Bastow, ed. 15 Dec. 1968 254 p refs Conf. held at Pasadena, Calif., 6–8 Feb. 1968
(NAS7-100)
(NASA-CR-100697; JPL-TM-33-402) Copyright. Avail: CFSTI CSCL 09C

Electromagnetic compatibility criteria for electronic equipment and components in aerospace systems are discussed in the papers presented. For individual titles, see N69-25427 through N69-25447.

c10 110900 02

N69-25436*# Bell Telephone Labs., Inc., Murray Hill, N. J.
DESIGN OF VLF AND PARTICLE EXPERIMENTS FOR THE ATS-A SATELLITE, WITH SPECIAL REFERENCE TO ELECTROMAGNETIC INTERFERENCE
G. L. Miller and H. P. Lie *In* JPL Proc. of the Spacecraft Electromagnetic Interference Workshop 15 Dec. 1968 p 111–138 refs (See N69-25426 13-10)
Copyright. Avail: CFSTI CSCL 17B

The two experiments discussed were associated with one another from the point of view of their goals. Both were susceptible to noise pickup, while one of them was extremely sensitive in this respect. In addition, there existed the possibility of certain EMI incompatibilities between the two. The VLF radio experiment intended to measure the magnetic component of low frequency electromagnetic waves propagating in the electron plasma surrounding the earth. The second experiment consisted of a five element silicon p-n junction detector telescope designed to make measurements on the ionizing radiation in the Van Allen belts. The special steps which were taken to minimize the noise problems in the circuits and equipment are enumerated. The interpretation of data received from the experiments in orbit showed that a large part of it was from noisy spacecraft operation. B.P.

c07 110900 03

N69-25647*# Library of Congress, Washington, D. C. Science and Technology Div.
ASTRONAUTICS AND AERONAUTICS, 1967: CHRONOLOGY ON SCIENCE, TECHNOLOGY, AND POLICY
Washington NASA 1968 495 p refs Sponsored by NASA
(NASA-SP-4008) Avail: SOD $2.25; CFSTI CSCL 01B

Documentation is offered on happenings in aeronautics and astronautics in 1967, including such events as the deaths of astronauts Grissom, White, and Chaffee; the first colored pictures of the earth taken from the first Applications Technology Satellite; a new world's speed record of 4534 miles per hour by an X-15 rocket aircraft; the ratification of an international space law treaty, and the United Nations endorsement of a space rescue treaty. The United States launched a total of 87 spacecraft into earth orbit or on escape trajectories. A listing of satellites, space probes, and manned space flights is included as a chronicle of world space activity, along with a tabulation of the chronology of major NASA launchings. P.A.B.

c30 010000 44

N69-25723# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PENETRATIONS OF SOLAR PROTONS TO SYNCHRONOUS ALTITUDE Technical Report, Jan.–Oct. 1968
G. A. Paulikas and J. B. Blake Dec. 1968 29 p refs
(Contract F04701-68-C-0200)
(AD-682943; TR-0200(4260-20)-4; SAMSO-TR-69-22) Avail: CFSTI CSCL 4/1

Solar proton fluxes in two energy intervals (5-21 MeV and 21-70 MeV) were measured with detectors aboard the geostationary ATS-I satellite during the solar proton event which began on 28 January 1967. Comparison with data obtained by satellites outside the magnetosphere shows that: (a) protons with energies greater than 21 MeV have essentially free access to synchronous altitude; (b) protons in the 5-21 MeV energy interval show a diurnal variation with the flux approaching the interplanetary flux level near local midnight. The transmission efficiency of the magnetosphere is not well organized by either the local (synchronous) magnetic field or the K sub p index. Author (TAB)

c20 100500 18

N69-26282*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
FORMATION AND STRUCTURE OF EQUATORIAL ANTICYCLONES CAUSED BY LARGE SCALE CROSS EQUATORIAL FLOWS DETERMINED BY ATS-1 PHOTOGRAPHS
Tetsuya T. Fujita, Kazuo Watanabe (Meteorol. Res. Inst.), and Tatsuo Izawa (Meteorol. Res. Inst.) Jan. 1969 41 p refs
Prepared in part by Meteorol. Res. Inst.
(Grants NGR-14-001-008; E-198-68(G); NSF GF-255; JSPS GEO-29)
(NASA-CR-101140; SMRP-RP-78) Avail: CFSTI CSCL 04B

As a result of photographic experiments, fields of cloud motion over the eastern equatorial Pacific were mapped in detail. It was found that a large-scale flow from the Southern Hemisphere recurves after crossing the equator to form an anticyclone centered around 10N. Dynamical characteristics of this type of anticyclone were investigated by estimating the vorticity dissipating force from computed values of divergence and vorticity of low-cloud velocities determined from successive ATS-I pictures. Based upon evidence found through case studies, a model of an equatorial anticyclone is proposed in this paper. Numerical computations of cross-equatorial trajectories were performed by using the divergence-vorticity relationships and the vorticity dissipating force, which were obtained through numerical analyses. Author

c20 081000 13

N69-26422# Air Force Cambridge Research Labs., Bedford, Mass.
SCINTILLATION OBSERVATIONS OF SYNCHRONOUS SATELLITES
Jules Aarons, Herbert E. Whitney, and Richard S. Allen Jan. 1969 19 p refs
(AD-683241; AFCRL-69-0011) Avail: CFSTI CSCL 4/1

During 1967 and early 1968, it was possible to record amplitude scintillations from synchronous satellites over simultaneous periods of time from the Sagamore Hill Radio Observatory (54 degrees G.N.). Three satellites transmitted at 137 MHz; these were ATS-1 on the western horizon (-0.1 degrees to +0.75 degrees elevation), Canary Bird on the eastern horizon (7 degrees to 12 degrees elevation), and ATS-3 toward the south (greater than 200 degrees azimuth and greater than 39 degrees elevation). In addition, the beacon of the near synchronous satellite LES-5 was recorded at 228 MHz. The basic pattern of scintillation was for a maximum to occur at midnight for the satellite observed in the southerly direction, and two hours earlier for the satellite observed to the east showing the effect of the time difference for the two ionospheric regions. During the summer particularly, and occasionally at other times, a secondary peak of scintillation was observed near local noon. Winter nighttime scintillation indices were generally lower than summer values. LES-5 observations at this latitude show occasional fades down to 20 dB. Individual fades last from several seconds to several minutes. The duration of fading periods varied from a few minutes to several hours. Author (TAB)

c13 100500 25

N69-27155*# Ohio State Univ., Columbus. ElectroScience Lab.
MILLIMETER-WAVELENGTHS PROPAGATION STUDIES
Semiannual Status Report
15 Apr. 1969 17 p
(Grant NGR-36-008-080)
(NASA-CR-101228; SASR-2374-3) Avail: CFSTI CSCL 17B

Preparations for electroscience laboratory participation in the NASA ATS-E millimeter wave propagation experiment are described. Two receiving terminals, one fixed in location and one transportable, are under construction and will be essentially complete for the planned August, 1969 launch of the satellite. Author

c07 070300 06

N69-27260*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-2 MISSION
Washington May 1969 105 p refs
(NASA-TM-X-1800) Avail: CFSTI CSCL 22C

The Atlas-Agena launch vehicle boosted the Applications Technology Satellite ATS-2 into a transfer orbit with a perigee of 100 nautical miles (185 km) and an apogee of 6000 nautical miles (11 112 km). However, the Agena second burn did not occur, and the final circular orbit was not achieved. The Agena engine failed to restart for second burn because a propellant isolation valve malfunctioned. This report discusses the flight performance of the Atlas-Agena launch vehicle from lift-off through the Agena vehicle retromaneuver. A discussion of the propellant isolation valve failure is also included. Author

c31 030200 02

N69-27962*# National Academy of Sciences—National Research Council, Washington, D.C.
USEFUL APPLICATIONS OF EARTH-ORIENTED SATELLITES–FORESTRY, AGRICULTURE GEOGRAPHY
1969 76 p refs *Its* Forestry-Agric.-Geography 1
(Contract NSR-09-012-909)
(NASA-CR-101410) Avail: CFSTI CSCL 08F

The Report contains conservative estimates of the value satellite reporting systems might have to the agriculture and forestry industry, United States and world-wide. These add up to tens of millions of dollars per year. The intangible effects on increasing the efficiency of farming and forestry through new satellite technology are potentially significant, particularly as population pressures will require that the earth be treated as one agricultural cooperative. Remote sensing is now technically feasible for: (1) inventory and productivity evaluation of the world's food, fiber, and other natural resources; (2) assessment of environmental conditions and of man-environment interactions. F.O.S.

c13 080000 18

N69-27964# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung für Weltraumphysik.
VHF SIGNALS PROPAGATING THROUGH THE IONOSPHERE TRANSMITTED BY GEOSTATIONARY SATELLITES [ZUR AUSBREITUNG VON HOCHFREQUENTEN SIGNALEN GEOSTATIONAERER SATELLITEN IN DER IONOSPHAERE]
J. P. Schoedel Feb. 1969 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FB-W-69-11) Avail: CFSTI

Radiosignals of the geostationary satellite ATS-3 have been used for carrying out progagation investigations in the equatorial ionosphere. These measurements have been done on board the German research ship 'Meteor' during May and June 1968. The ship was cruising between 13 and 23 degrees north and 17 and 20 degrees west, while the satellite was at 60 degrees west 36,000 km above the equator. For measuring the Faraday rotation a commercially built polarimeter was used; the Differential Doppler Effect could not be measured for by technical reasons. The used theories successful periods of measurements are shown and results are discussed. The influence of the earth's magnetic field on the Faraday rotation is demonstrated, this is made by measurements which are done while the ship was moving along a constant longitude. Examples of transport effects in the ionosphere were taken and their magnitude was estimated. Author (ESRO)

c07 070212 03

N69-28102*# National Academy of Sciences--National Research Council, Washington, D.C.
USEFUL APPLICATIONS OF EARTH-ORIENTED SATELLITES
1969 83 p refs *Its* Meteorology 4
(Contract NSR-09-012-909)
(NASA-CR-101401) Avail: CFSTI CSCL 04B

The applications of satellites to meteorology is studied. Based on the contributions of the existing metorological satellites, forecasts of major weather phenomena of a week or two in advance are expected. The benefits of this program toward saving lives, preventing misery, and aiding many areas of the economy is estimated in billions of dollars. The data requirements for this program are the three-dimensional global distribution of temperature, moisture, and clouds. These are considered the weather variables most easily determined by satellite sounding. F.O.S.

c20 080000 17

N69-29710*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
EXPERIMENTAL VERIFICATION OF DRIFT SHELL SPLITTING IN THE DISTORTED MAGNETOSPHERE
K. A. Pfitzer, T. W. Lezniak, and J. R. Winckler Apr. 1969 13 p refs
(Grant NGL-24-005-008)
(NASA-CR-101641; CR-133) Avail: CSFTI CSCL 04A

Electron spectrometer data from the synchronous ATS-1 and data from an electron spectrometer and ion chamber on the elliptical orbit satellite OGO-3 can be used to test drift shell splitting in the non-dipolar distorted magnetosphere. Quiet day pitch angle distributions obtained by ATS-1 at 6.6 R_e qualitatively confirm the shell splitting by showing that near noon the pitch angle distribution is nearly isotropic whereas near midnight it is peaked toward small angles parallel to the field. Using the Mead model magnetic field for calculating the drift shells for electrons of pitch angle $\alpha = 65°$ and $\alpha = 90°$, as well as the measured pitch angle distribution and measured radial gradient for electrons at local noon, the pitch angle distribution can be calculated as a function of local time for the ATS-1 orbit. Calculated and measured fluxes agree not only in predicting the proper noon to midnight asymmetry (25 to 1 for 500 to 1000 keV electrons on February 15, 1967) but also in correctly predicting the pitch angle distribution as a function of local time (isotropic at noon but non-isotropic with a 3 to 1 ratio between $\alpha = 65°$ and $\alpha = 90°$ at midnight). However, in one case (15 February, 1967) an asymmetry is observed about local midnight with minimum count rate at 2200 LT. Author

c13 110400 10

N69-29779# Naval Research Lab., Washington, D.C. Radar Div.
AMPLITUDE SCINTILLATION AT RANDLE CLIFF DERIVED FROM ATS-1 TRANSMISSIONS
John M. Goodman and John E. Blundy 17 Mar. 1969 63 p refs
(AD-685632; NRL-6829) Avail: CFSTI CSCL 17/2.1

An amplitude scintillation analysis of vhf radiowave transmissions from the gepstationary satellite ATS-1 has been conducted. It has been found that the amplitude scintillation activity is generally less intense during the day than during nocturnal hours. In fact, the present 1967 summertime data indicate that the full scintillation condition is 50% more likely to occur during nighttime than during the day over Randle Cliff. The data have been compared with the Fort Belvoir ionosonde data, and, as expected, point-to-point correlations are inconclusive. Nevertheless, the trend of the data compares more favorably with the diurnal pattern of sporadic E over midlatitudes than the spread F condition. Author (TAB)

c07 100500 28

N69-29861# Advisory Group for Aerospace Research and Development, Paris (France).
SCINTILLATION OF SYNCHRONOUS SATELLITE TRANSMISSIONS AT 136 MHz
Jules Aarons (AFCRL) Nov. 1968 20 p
(AGARD-566) Avail: CFSTI

With the aim of studying techniques for using the upper portion of the VHF band for communications and navigation, a series of experimental synchronous satellites was launched. This preliminary survey aimed to add data on scintillations of signals at 136 MHz and to standardize methods of reducing results from a number of European observing stations. Initial qualitative results show that invariant latitude and conjugate point effects may play important roles in the scintillation process. Author

c07 100500 16

N69-29878*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
INTENSITY CORRELATIONS AND SUBSTORM ELECTRON DRIFT EFFECTS IN THE OUTER RADIATION BELT MEASURED WITH THE OGO-III AND ATS-1 SATELLITES
K. A. Pfitzer and J. R. Winckler Apr. 1969 38 p refs
(Grant NGL-24-005-008)
(NASA-CR-101640; CR-136) Avail: CFSTI CSCL 04A

During late December 1966 and January 1967 the elliptically orbiting satellite OGO-3 entered the magnetosphere within 30° of the subsolar point and within 10° of the geomagnetic equator. This permits the measurement of the distance to the magnetosphere boundary, which is a necessary parameter for the Mead model magnetic field calculations. The electron fluxes measured by an electron spectrometer and an ion chamber on OGO-3 are correlated with electron fluxes on the geostationary satellite ATS-1 at the exact time when both satellites are on the same drift shells as calculated from the Mead model magnetic field with separations on local time up to 180°. During quiet times an absolute comparison of the fluxes from 50 to 1000 keV gives a linear relationship indicating agreement of the measurements over a three order of magnitude range of intensities. During substorm increases the ATS-1 measurements have similar profiles but are delayed in time with respect to each other. The observed dealys are smaller for higher energy electrons and larger for greater separations in local time. As an example, the measured delays for 50, 150 and 400 keV electrons on January 11, 1967, when the local time separation was 110°, are 26, 13-17, and 5 minutes, respectively. Author

c13 110400 11

N69-32639*# General Electric Co., Schenectady, N.Y. Research and Development Center.
ATS RANGING AND POSITION FIXING EXPERIMENT Quarterly Report, 25 Feb. - 25 May 1969
25 May 1969 29 p
(Contract-NAS5-11634)
(NASA-CR-103667; S-69-1101; QR-2) Avail: CFSTI CSCL 17B

Tone-code ranging measurements were successfully made using a van equipped with a mobile radio such as is used in taxicabs and police cars. Range measurements were made from ATS-3 to the van as it proceeded northward along a country road. Flight tests were started using a DC-6 aircraft. The aircraft was equipped with a receiver and transmitter previously used in voice communication tests through satellites, with a tone-code responder connected between the transmitter and receiver. An oceanographic buoy (Sea Robin) was equipped with a tone-code ranging transponder. The buoy was moored near Bermuda where the ocean depth was 5,000 feet. Range measurements from ATS-3 were made to the buoy over a two-week period while the buoy was at its deep sea mooring. An initial evaluation of line of position accuracy was made with only a crude estimate of ionospheric bias and no correction for receiver time delay variations or actual movement of the buoy. Author

c07 070211 04

N69-33036*# National Aeronautics and Space Administration, Washington, D.C.
ATS-E: PRESS KIT
10 Aug. 1969 32 p
(NASA-News-Release-69-114) Avail: NASA Scientific and Technical Information Division CSCL 22B

Launch details and mission objectives are reported for Applications Technology Satellite-E (ATS-E). Background information is given on ATS-E gravity gradient stabilization and communications experiments, reaction control subsystems, spacecraft separation events, and the Atlas-Centaur launch vehicle characteristics. Earlier ATS accomplishments are reviewed. E.C.

c31 010000 47

N69-33056# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 84, NO. 2: WEATHER SATELLITE OBSERVANCE AND THEIR EVALUATION. THE EUROPEAN WEATHER PICTURE 1967 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND LXXXIV, HEFT 2: WETTERSATELLITENBEOBACHTUNGEN UN IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1967 TEIL II, 2. VIERTELJAHR]
Ingrid Haupt et al 1968 271 p refs In GERMAN; ENGLISH summary
(B-803; QR-2) Avail: CFSTI

This publication deals with the two American satellites ESSA 5 and ATS-2 and the Soviet weather-satellite cosmos 156. These three satellites were launched during the months of April to June 1967. Finally, some remarks on the snow- and ice-situation in the European-Atlantic area with the exception of the arctic regions are made. The daily "Das europäische Wetterbild" for the second quarter of 1967 is presented. The significant orbital data of ESSA 4, ESSA 2 and Nimbus 2 for the corresponding period are published. Author

c20 080000 16

N69-33561# Naval Research Lab., Washington, D.C.
ELECTRON-CONTENT VARIATIONS AND CHANGE RATES OBTAINED DURING THE SPRING AND SUMMER OF 1967 BY THE MEASUREMENT OF FARADAY ROTATION OF 137-MHz RADIO WAVES TRANSMITTED FROM ATS-1 Interim Report
John M. Goodman, Melvin W. Lehman, and Edward Piernik Mar. 1969 27 p refs
(AD-687395; NRL-6830) Avail: CFSTI CSCL 4/1

VHF radiowave transmissions (137.350 MHz) from the geostationary satellite ATS-1 (1966-110A) have been analyzed to determine the electron-content variations during the spring and summer of 1967. The regularities of the ionosphere during the observation period were found to be roughly the same as those which were observed during the Early Bird observation period of 1965. In particular it was found that there exist two extremal regions of the content-change rate function - one associated with sunrise and one associated with sunset. Irregularities in the electron content were observed to occur during both magnetically quiet and disturbed days, although extremely dramatic enhancements were recorded following two magnetic storms. Although a Chapman distribution is barely justifiable theoretically, it was found that the diurnal excursion is roughly proportional to the diurnal excursion in the square of FOF2 as predicted by simple Chapman theory. Author (TAB)

c13 100500 27

N69-33576*# Wisconsin Univ., Madison. Dept. of Meteorology.
METEOROLOGICAL SATELLITE INSTRUMENTATION AND DATA PROCESSING Final Scientific Report, 1958 - 1968
Verner E. Suomi and Robert J. Parent Dec. 1968 198 p refs
(Contract NASw-65)
(NASA-CR-103678) Avail: CFSTI CSCL 04B

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2. INVESTIGATION OF CLOUDS ABOVE SNOW SURFACES UTILIZING RADIATION MEASUREMENTS OBTAINED FROM THE NIMBUS 2 SATELLITE F. F. Hauth (Weather Squadron (5th), Detachment 7, San Francisco) and J. A. Weinman p 16 - 30 refs (See N69-33578 19-20)
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4. THE REFLECTION OF SUNLIGHT TO SPACE AND ABSORPTION BY THE EARTH AND ATMOSPHERE OVER THE UNITED STATES DURING SPRING, 1962 K. J. Hanson, T. H. Vonder Haar, and V. E. Suomi p 108 - 124 refs (See N69-33580 19-13)
5. RADIATION ANALYSIS OF A SUBTROPICAL HIGH J. O. Siebers p 125 - 150 refs (See N69-33581 19-20)
6. ON THE INTERPRETATION OF LONG-WAVE RADIATION DATA FROM EXPLORER 7 SATELLITE F. B. House p 151 - 164 (See N69-33582 19 - 20)

c20 080700 04

N69-33577*# Wisconsin Univ., Madison. Dept. of Meteorology.
DETERMINATION OF THE SEA SURFACE SLOPES DISTRIBUTION AND WIND VELOCITY USING SUN GLITTER VIEWED FROM A SYNCHRONOUS SATELLITE
N. Levanon *In its* Meteorol. Satellite Instrumentation and Data Process. Dec. 1968 p 1-15 refs (See N69-33576 19-20)
Avail: CFSTI CSCL 14E

An adaptation of the Cox-Munk technique of sea-slope distribution estimation, which uses sun glitter photographs taken from an aircraft, to pictures taken from a much higher altitude by a synchronous satellite is examined. The main modification involves the use of a sequence of photographs of a limited area (taken over a time period) rather than a single photograph of the whole sun glitter area. Data from the satellite were used to calculate the slope distribution, and from it the wind velocity, for the locations of Palmyra, Fanning, and Christmas Island, on 16 and 19 April 1967. The calculated values were compared to direct wind measurements obtained at these locations. Utilizing the data from the scanning-type electronic camera, it was possible to bypass the highly degrading photographic and photometric processes and to do all the quantitative work on the received video signal. K.R.G.

c14 080700 05

N69-33841*# Electro-Optical Systems, Inc., Pasadena, Calif. Aerospace Systems Div.
CONTACT ION ENGINE SYSTEM FOR ATS SATELLITES D AND E Annual Progress Report
R. M. Worlock 1 Jul. 1969 44 p refs
(Contract NAS5-10380)
(NASA-CR-103890; EOS-7202-A-2; APR-2) Avail: CFSTI CSCL 22B

A program to fabricate and test ion microthruster systems for Applications Technology Satellites D and E, provide appropriate ground support equipment, and provide technical support of spacecraft integration, launch, and operation is reported. Accordingly, support of ATS-D operations was continued, culminating in the successful operation of both microthruster systems in orbit. Flight hardware units for ATS-E were completed, acceptance tested, and delivered to the spacecraft contractor. Author

c31 020900 07

N69-33951*# Nevada Univ., Reno.
SPACE MAGNETIC EXPLORATION AND TECHNOLOGY Symposium, Aug. 1967
Ernest J. Iufer, ed. (NASA. Ames Res. Center) 1967 396 p refs Proc. of symp. sponsored by NASA. Ames Research Center and Nev. Univ., Gen. Univ. Extension Continuing Educ., Reno, Nev., 28-30 Aug. 1967
(NASA Order A-92986)
(NASA-CR-73350) Avail: CFSTI CSCL 20C

Presented is information on recent developments bearing on generation, compensation, measurement, and calculation of very low frequency magnetic fields. Results of recent spacecraft developments are described, together with reviews of recent research. For individual titles, see N69-33952 through N69-33978.

c23 110800 05

N69-33963*# California Univ., Los Angeles.
DIGITAL OFFSET FIELD GENERATOR FOR SPACECRAFT MAGNETOMETERS
R. C. Snare and G. N. Spellman (Marshall Labs.) *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 155-166 refs (See N69-33951 19-23)
(Contracts NAS5-9570; NAS5-9098)
Avail: CFSTI CSCL 14B

A digital offset field generator has been developed which accurately extends the dynamic range of a sensitive magnetometer. This system enables the use of a sensitive magnetometer to resolve small magnetic field fluctuations in the presence of fields of large value. The circuitry is described in some detail and its application in instruments for the first Applications Technology Satellite and the fifth Orbiting Geophysical Observatory is discussed. Author

c14 110800 07

N69-33973*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
MAGNETIC TESTS IN THE ATS-1 SPACECRAFT
L. L. Simmons *In* Nev. Univ. Space Magnetic Exploration and Technol. 1967 p 308-313 ref (See N69-33951 19-23)
(Contract NAS5-9570)
Avail: CFSTI CSCL 22B

The first Applications Technology Satellite was tested to determine its magnetic properties. The test methods and results are discussed. Author

c31 110800 06

N69-35748# Congress. Senate. Committee and on Aeronautical and Space Sciences.
NASA AUTHORIZATION FOR FISCAL YEAR 1970, PART 2
Washington GPO 1969 998 p Hearings before Comm. on Aeron. and Space Sci., 91st Congr., 1st Sess., 1, 6, and 9 May 1969
Avail: Comm. on Aeron. and Space Sci.

Testimony centered on NASA's important programs in unmanned scientific satellites, planetary probes, and applications satellites, with particular reference to the Applications Technology Satellites, the Orbiting Astronomical Observatory, and the Nimbus weather satellite. Existing and future applications programs were described by witnesses from the Environmental Science Services Administration, the U. S. Geological Survey, and the Agricultural Research Service, with interest focused on their participation in the earth resources technology area. The aeronautics and space programs of the Atomic Energy Commission and the Department of Defense were also reviewed. M.G.J.

c34 010000 50

N69-36522 World Meteorological Organization, Geneva (Switzerland).
WEFAX: A WEATHER DATA COMMUNICATIONS EXPERIMENT
1968 32 p *Its* World Weather Watch Planning Rept. No. 23
Copyright. Avail: Issuing Activity.

WEFAX (WEather FAcsimile eXperiment) is an experiment to explore the operational feasibility of direct transmission of meteorological data from a central source to widely scattered remote weather stations. The transmission medium used for the experiment is the VHF communication facilities of ATS-1 (Applications Technology Satellite). The receiving stations co-operating in the experiment are located over an area extending from the east coast of the United States to Australia and Japan. Processed meteorological data applicable to the area of communications coverage of the satellite are being transmitted to the participating ground stations. These include prepared weather map analyses and prognoses, as well as ESSA 3 and 5 and ATS-1 spin-can cloud-camera pictures processed by computer into APT formats. These data are transmitted directly to the ATS ground the spacecraft by the up-link transmitter. The VHF transponder aboard the spacecraft retransmits the data for reception at stations with APT equipment which have been modified to receive the ATS-1 frequency of 135.6 MHz. The APT stations participating in the experiment on a voluntary basis evaluate the effectiveness of the WEFAX experiment. It has been proposed that WEFAX be included in the ATS-3 program. An associated system is being used experimentally to collect river and rainfall readings from hydrological gaging stations. These stations report when interrogated by a command sent through the ATS-1 satellite. The responses from the stations through the satellite are received at Washington and recorded on a teleprinter. Preliminary indications are that satellites can be used successfully to relay hydrological data from relatively unattended remote sites to existing APT stations. Author (ESRO)

c20 080200 02

N69-37032*# California Univ., Los Angeles.
CALIFORNIA UNIVERSITY, PART 1 Semiannual Report, 1 Jan.–30 Jun. 1969
30 Jun. 1969 30 p refs
(Grant NGR-05-007-004)
(NASA-CR-105753) Avail: CFSTI CSCL 14B

Task summaries, a list of resulting publications and reports, and abstracts of presentations resulting from the research during this period are presented. The summaries of work in charged particle research mention launching of electron spectrometers on OGO 5 and 6, launching of a 40-keV electron monitor on OV5-6, design of a high-speed electron detector for the S^3 satellite, and results of the radiation measuring instruments on OV1-2 and OV1-12. In magnetic field research, efforts were directed primarily toward the study of magnetohydrodynamic phenomena in the tenuous plasmas above the ionosphere and in interplanetary space. A magnetometer development project, experimental studies with Alouette 1 and ATS 1, and a theoretical study of the solar wind are mentioned. K.W.

c14 110800 31

N69-37123# Harry Diamond Labs., Washington, D.C.
DESIGN AND THEORY OF OPERATION-SAFETY-IGNITION DEVICE FOR APPLICATIONS TECHNOLOGY SATELLITE ROCKET MOTOR
Edward N. Freeman Nov. 1968 61 p refs
(AD-688137; HDL-TM-69-3) Avail: CFSTI CSCL 19/7

This report describes and illustrates the design and operation of a safety-ignition device (SID) that was developed for use with a 750-lb solid-propellant apogee rocket motor. This device, used in combination with the Applications Technology Satellite for NASA, is primarily intended to prevent ignition of the rocket motor during ground handling and prelaunch operations, and in orbital flight provided reliable ignition of the apogee rocket motor with a high degree of safety and operational reliability. Author (TAB)

c28 030004 15

N69-37689*# Minnesota Univ., Minneapolis. Cosmic Ray Group.
THE ACCELERATION AND PRECIPITATION OF VAN ALLEN OUTER ZONE ENERGETIC ELECTRONS
George K. Parks Jun. 1969 87 p refs
(Contract NAS5-9542; Grant NSF GA-487)
(NASA-CR-105898; CR-138) Avail: CFSTI CSCL 04A

It is shown that the time profiles of trapped Van Allen electrons measured at synchronous altitudes and precipitated fluxes measured in the auroral zone are extremely well correlated. The freshly accelerated equatorial electrons are predominant in the 50-150 keV energies but when observed in 150-500 keV energies, they show different behavior. Equatorial electrons are created at all pitches but the pitch-angle distribution is peaked at 90° The anisotropy in pitch-angle distribution increases and decreases with increasing and decreasing electron fluxes. Lifetime calculations from these simultaneous measurements show that typically, electrons during substorms have typical lifetimes of $\cong 10^3$ seconds, but some events have lifetimes as short as $\cong$200 seconds. The similarity of time profiles in precipitation and trapped fluxes, the differing behavior of $\cong$50 and 150 keV electrons, the flat pitch-angle distribution, and the behavior of anisotropy are consistent with strong pitch-angle diffusion model of Kennel. Author

c29 110400 28

N69-37706*# Control Data Corp., Minneapolis, Minn. Edina Space and Defense Systems.
SELF-CONTAINED NAVIGATION EXPERIMENT Final Report
10 Jul. 1969 228 p refs
(Contract NAS5-9683)
(NASA-CR-105920; RD-2009) Avail: CFSTI CSCL 17G

Presented are results and conclusions of a series of experiments conducted for a self-contained navigation system. The system, consisting of a flight model star sensor and auxillary ground based data processing equipment, utilized star field mapping techniques in its experiments. Experiments were operated successfully for the determination of attitude, and useful data were obtained in full daylight when scanning motion of the satellite directed the optical axis away from the sun. Automatic reduction of the telemetered data, including star identification and attitude computation, was accomplished. Difficulties were experienced in obtaining the precision required to calculate orbital parameters from an ejected sphere. Satellite orbital position computed from moon transits was determined within an error band from -50 to +40 kilometers. Standard deviations are also included. Author

c21 100200 02

N69-37840*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT PERFORMANCE OF THE ATLAS-AGENA LAUNCH VEHICLE IN SUPPORT OF THE APPLICATIONS TECHNOLOGY SATELLITE ATS-3
Sep. 1969 114 p
(NASA-TM-X-1879) Avail: CFSTI CSCL 22B

Three Applications Technology Satellites were launched by Atlas–Agena vehicles for experimentation in communications, cloud cover photography, and spacecraft environment. The flight performance of the Atlas–Agena vehicle (for ATS-3) from lift-off through the Agena reorientation maneuver is discussed. This flight in November 1967 concluded the Applications Technology Satellite missions launched by the Atlas–Agena vehicle. Author

c31 030300 02

N69-39978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DOPPLER FREQUENCY SPREAD CORRECTION DEVICE FOR MULTIPLEX TRANSMISSIONS
David W. Lipke, inventor (to NASA) Issued 17 Jun. 1969 (Filed 22 Oct. 1965) 6 p Cl. 179-15
(NASA-Case-XGS-2749; US-Patent-3,450,842;
US-Patent-Appl-SN-502753) Avail: US Patent Office CSCL 17B

A device for automatic correction of the baseband Doppler spread encountered in communication systems designed for multiplex transmissions is described. Multiplex equipment receives incoming signals and "stacks" them one atop the other in frequency so that the output frequency spectrum extends to XN kilocycles per second where X = the bandwidth of each channel and N = the number of input channels. The device makes use of the method employed in the multiplex equipment for generating translation frequencies. In essence, it replaces the oscillator with a signal which has Doppler information. This signal is derived from pilot tones or frequencies. The new signal is equal in frequency to that of the replaced oscillator plus or minus the Doppler on the oscillator frequency, i.e., the one-way Doppler that the oscillator frequency would experience if it were transmitted to a moving vehicle. All harmonics will have corresponding multiples of the required Doppler spread correction and as a result, the Doppler spread will be compensated incrementally in X kilocycles per second steps across the baseband. Official Gazette of the U.S. Patent Office.

c07 020100 15

N69-41176# Congress. House. Committee on Science and Astronautics.
SUPPLEMENTAL REVIEW: NASA-OSSA PROJECTS
GPO 1969 40 p Hearings before the Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 9, 16 Oct. 1969
Avail: Subcomm. on Space Sci. and Appl.

NASA hearings presented pertain to a supplemental review of space science and applications projects. Emphasis is placed on developments in the Viking, Earth Resources Technology satellite, and Applications Technology Satellite programs and their economic implications and cost estimates. G.G.

c31 010000 48

N70-10153# Westinghouse Electric Corp., Baltimore, Md.
MARITIME MOBILE SATELLITE COMMUNICATIONS TESTS PERFORMED ON S. S. SANTA LUCIA Final Report
1969 114 p
(Contract MA-4329)
(PB-183971) Avail: CFSTI CSCL 17B

The feasibility of using space techniques for communication to an inexpensive shipboard terminal was demonstrated. It is shown that simplex, duplex or semi-duplex voice circuits; digital computer data; teletype, facsmile and time synchronization of a digital clock are feasible. Results of the propagation, voice channel, digital data, time synchronization and ranging tests are presented. The requirements for a shipboard antenna are analysed. Recommendations are made, based on observations made during the test program, for the effort required to provide an operational maritime mobile satellite system. Author (USGRDR)

c07 070208 07

N70-10792# Stanford Research Inst., Menlo Park, Calif.
COMPARISON OF CLOUD MOTION VECTORS AND RAWINSONDE DATA Final Report
S. M. Serebreny, R. G. Hadfield, R. M. Trudeau, and E. J. Wiegman Jul. 1969 66 p
(Contract E-193-68)
(PB-185457) Avail: CFSTI CSCL 04B

The objective of the report was to correlate rawinsonde data with observed cloud motions, delineated through the use of an electronic system. If such cloud motions are indeed representative of the wind field, geostationary satellite cloud photographs would be of great value for analysis of data-sparse regions. Author (USGRDR)

c20 080900 11

N70-11028*# Bell Telephone Labs., Inc., Murray Hill, N.J.
PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE 1 (ATS-1) Final Report
W. M. Augustyniak, I. Hayashi, H. E. Kern, R. W. Kerr, L. J. Lanzerotti et al 1 May 1969 273 p refs Prepared for Western Elec. Co., Inc., New York
(Contract NAS5-9635)
(NASA-CR-106637) Avail: CFSTI CSCL 04A

The experiment on ATS-B has been designed to measure the energy spectra of electrons and protons at the synchronous satellite altitude in order to study the systematic day-night variations in the trapped particles arising from the distortion of the earth's magnetic field by the magnetospheric boundary with the solar wind, the perturbations in the trapping associated with magnetic storms, and the long-term changes in the particles during the time of increasing solar activity. The telescope provides spectral information for electrons in the 0.4- to 3-MeV energy range and for protons in the 0.6- to 22-MeV energy range. The experiment also permits investigation of the possible existence of alpha particles within the magnetosphere in the energy range from approximately 6 to 85 MeV. Author

c29 110300 11

N70-12494# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.
USING THE RINGING IRREGULARITY AS AN ANALYTICAL TOOL
Frederick F. Slack Jul. 1969 27 p refs *Its* Phys. Sci. Res. Paper 387
(AD-693586; AFCRL-69-0297) Avail: CFSTI CSCL 17/2.1

The hypothesis is advanced that a high percentage of ionospheric scintillation is a distortion of a regular cyclic type of fading seen occasionally on chart recordings of HF and VHF radio frequency signals that have penetrated the ionosphere. Analysis of satellite signals containing this special type of anomaly leads to a better understanding of ionospheric scintillation in general. The paper shows how many properties of normal scintillation are consistent with the two ray interference formula derived for the more orderly pattern. As an illustration we have included the analysis of an ionospheric irregularity appearing over Thule that provides height and electron density measurements. Author (TAB)

c07 100500 32

N70-12550*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
ELECTRON PARTICIPATION PATTERNS AND THEIR RELATION TO SUBSTORM INCREASES IN 50 150 keV ELECTRONS AT THE SYNCHRONOUS ORBIT Cosmic Ray Technical Report
Lowell H. Rosen (M.S. Thesis) Aug. 1969 42 p
(Grants NGL-24-005-008; NSF GA-1508)
(NASA-CR-107162; CR-145) Avail: CFSTI CSCL 04A

Analysis of records from the seven station Alaskan Riometer Chain ($L = 3.9$ to $L = 8.$) shows that the median latitude location of the hard (above 40 keV) electron precipitation region extends from a low latitude edge (defined as maximum intensity/e) of L = 5 for all local times to a high latitude edge of beyond $L = 8$ during the morning and to between $L = 6$ or 7 during the afternoon. With the aid of the riometer chain, the poleward and equatorward progression in precipitation onset was studied. The poleward progression events were most frequently seen near local midnight, and on the average, the time lag for the events showing the equatorward progression increased with local time between midnight and noon. Comparisons of the electron precipitation events at the riometer chain with increases of electron fluxes at the ATS-1 synchronous orbit show that a good correlation in coincidence, intensity and latitude exists. The events used in this analysis indicate the source of much of substorm precipitation between 0400 and 1200 local time is an eastward drifting, dribbling electron cloud. However, for some substorms, acceleration occurring at all local times is not ruled out. Author

c29 110400 20

N70-12691# European Space Research Organization, Paris (France).
PROCEEDINGS OF THE SIXTH ESRO SUMMER SCHOOL. VOLUME 7: SPACE POWER SYSTEMS: APPLICATION
Jul. 1969 68 p refs Partly in FRENCH and partly in ENGLISH Conf. held at Noordwijk, Neth., 1968
(ESRO-SP-46) Avail: CFSTI

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1. POWER SYSTEMS IN ESRO SATELLITES A. W. Preukschatds (ESRTC) p 1-19 (See N70-12692 02-03)
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ORGANIZATION J. C. Bochet (ESRTC) p 21-36 refs (See N70-12693 02-03)

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c03 020201 04

N70-12694# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR CELL POWER SYSTEMS ON U. S. SATELLITES. PART 1: SATELLITES DESIGNED BY THE NASA, GODDARD SPACE FLIGHT CENTER

C. M. MacKenzie *In* ESRO Proc. of the 6th ESRO Summer School. Vol. 7: Space Power Systems: Appl. Jul. 1969 p 37-54 (See N70-12691 02-03)

Avail: CFSTI

This paper describes several types of conversion/energy storage systems in use at Goddard Space Flight Center, in particular those of Explorer 23, Nimbus 2, and ATS 1, satellites. Solar arrays, storage batteries, regulation and performance are discussed.

Author (ESRO)

c03 020201 05

N70-12925*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ACCELERATIONS ON 24-HOUR SATELLITES AND LOW ORDER LONGITUDE TERMS IN THE GEOPOTENTIAL

Carl A. Wagner Nov. 1969 21 p refs

(NASA-TM-X-63752; X-552-69-508) Avail: CFSTI CSCL 22C

The tracking record of six 24-hour satellites has been analysed and reduced to a set of 35 well determined accelerations due to the anomalous geopotential. The record covers the years 1963-1969 and has a fair distribution in longitude. From this record two "best" resonant geopotential fields to fourth order are derived as well as new locations of the four east-west equilibrium points for the geostationary satellite. There is considerable improvement in the low order field of other recent (1969) gravity models, in contrast to the "best" models in 1966, as judged by this 24-hour acceleration data.

Author

c30 050000 03

N70-13525# Stanford Research Inst., Menlo Park, Calif.

COMPARISONS OF MEASUREMENTS OF CLOUD MOTIONS Final Report

S. M. Serebreny, A. E. Brain, and R. G. Hadfield Aug. 1969 25 p

(Grant E-11-69-(N))

(PB-185672) Avail: CFSTI CSCL 04B

An optical apparatus was designed and constructed with which to study changes in cloud detail and to measure cloud displacement. With this apparatus four cloud photographs from ATS meteorological satellites can be projected individually, or simultaneously; time-lapse can be simulated. Cloud motion measurements previously obtained with a video console were compared with measurements obtained by the optical system.

Author (USGRDR)

c20 080900 13

N70-13850*# Electro-Optical Systems, Inc., Pasadena, Calif.

ION MICROTHRUSTER SYSTEM INVESTIGATION Final Report, 15 Oct. 1968 – 15 May 1969

15 May 1969 74 p refs

(Contract NAS5-11646)

(NASA-CR-107367) Avail: CFSTI CSCL 21C

Problems encountered in developing and testing contact ion microthruster systems for flight on Applications Technology Satellites D and E are discussed. Investigations were made of thruster performance degradation due to contamination of the ionizing surface. Selected circuit modifications were made and tested in the control logic and power conditioning unit of the contact ion microthruster systems. The transient response of the beam control feedback loop was investigated. Although no definite cause can be identified, ionizer contamination appears to be related to contamination of vacuum changer surfaces exposed to the thruster. Contamination by the control logic and power conditioning package appears unlikely. Circuit modifications that were made and tested resulted in an improved system. Investigation of feedback loop transient response improved the understanding of system behavior.

Author

c28 C20900 06

N70-17283# Illinois Univ., Urbana. Ionosphere Radio Lab.

STUDIES OF THE INOSPHERE AT GEOMAGNETICALLY CONJUGATE STATIONS Final Technical Report, 1 Aug. 1966 – 31 Aug. 1969

Kung C. Yeh, Bernard J. Flaherty, and Han R. Cho Sep. 1969 131 p r5fs

(Contract F19628-67-C-0028)

(AD-697055; AFCRL-69-0419; TR-37) Avail: CFSTI CSCL 4/1

The report consists of three parts. The first part describes a polarimeter system that has been developed and used to measure polarization of signals from geostationary satellites. Circuit diagrams and sample data are given. The system is a modification of a system described by Titheridge. The second part describes the Cold Bay operation. Electron content data have been scaled and processed for the period December 25, 1968, through April 30, 1969. When compared with Urbana, Cold Bay shows very flat content curves at winter night, very few pre-sunrise dips and wave-trains in electron content with periods varying from three to five minutes in addition to normal travelling disturbances. The day-to-day change in electron content is found to be anti-correlated at geomagnetically conjugate stations during magnetic quiet days and to be correlated furing magnetic disturbances. The third part describes some theoretical work. Several other effects such as the magnetic declination effect and the effect of a dynamo electric field have been studied.

Author (TAB)

c13 100500 50

N70-19302*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

L-BAND PERFORMANCE CHARACTERISTICS OF THE ATS-5 SPACECRAFT

Fredric Kissel Feb. 1970 73 p

(NASA-TM-X-63828; X-731-70-51) Avail: CFSTI CSCL 17B

Tests performed with the ATS-5 spacecraft have shown that, even though it is spin stabilized, essentially all of the original objectives can be met. The spacecraft operational characteristics have been measured, in a space environment, and the test results indicate that the system is functioning normally. Link calculations have been verified with test data and the utilization of a timing and synchronization unit allows accurate measurements to be made through the spacecraft during the time interval that the spacecraft antenna illuminate the earth station. Propagation tests have been performed which show that diurnal effects and short term fading at L-band are negligable (less than + or − 0.5 db). The test techniques described herein, together with the measured ATS-5 spacecraft operational characteristics, provide the basic information required in order to proceed with the development of tests to measure multipath effects. Author

c07 070700 03

N70-20652*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
MAGNETOSPHERIC SUBSTORM EFFECTS ON ENERGETIC ELECTRONS IN THE OUTER VAN ALLEN BELT (SUMMARY OF TECHNICAL REPORT CR-137)
T. W. Lezniak and J. R. Winckler Apr. 1969 11 p refs
(Grant NGL-24-005-008)
(NASA-CR-108993: CR-137) Avail: CFSTI CSCL 08N

Empirical evidence is discussed for a substorm-associated acceleration process to account for the large electron increases seen in the post-midnight sector of the outer radiation belt at sychronous orbit by ATS-1. The increases shown have recurrent fluctuations in intensity in the three given channels, the largest fluctuations occur just after local midnight and decrease in intensity as local time increases, and the largest transient increases are observed for the 50 to 150 keV electrons. The total geomagnetic field strength at the spacecraft and the angle between the geomagnetic and the north pointing vector are shown. Author

c13 110400 12

N70-20772*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE ROCKET MOTOR: A SUMMARY REPORT
R. G. Anderson 1 Feb. 1970 59 p refs
(Contract NAS7-100)
(NASA-CR-109123; JPL-TM-33-338) Avail: CFSTI CSCL 21H

This report documents the design, development, qualification testing, and flights of a spacecraft-stage solid propellant rocket motor that was used to transfer the NASA Goddard Space Flight Center Applications Technology Satellite from its initial elliptical trajectory to a near-synchronous earth orbit. The motor fires at the apogee position of a highly elliptical transfer orbit to place the spacecraft in a circular orbit at synchronous altitude (22,300 miles). The mission requirements for precise motor thrust vector alignment during the burn phase and for dynamic balance before, during, and after burning are unique and stringent; therefore, the development phase has focused on producing precision components. Most developmental tests used chambers fabricated from AISI 410 stainless steel; however, a later program requirement for nonmagnetic materials caused a change to chambers of 6A1-4V titanium alloy. Several development tests, all qualification units, and all flight motors have used the titanium chamber. The motor development phase consisted of a logical sequence of testing to confirm processing, component design, and survival ability in simulated booster and space environments, and to establish preliminary performance characteristics. The qualification phase, which consistec of testing eight units at simulated altitude while spinning at 100 rev/min with propellant grains conditioned to 40 or 100 F, established the exact performance characteristics of the motor. Author

c28 030004 16

N70-20893*# Stanford Research Inst., Menlo Park, Calif.
CONSTRUCTION OF ATS CLOUD CONSOLE Final Report
William E. Evans and Sidney M. Serebreny Dec. 1969 58 p
(Contract NAS5-11652; SRI Proj. 7711)
(NASA-CR-109082) Avail: CFSTI CSCL 14B

The design approach and final configuration of an experimental device to permit rapid analysis of cloud image sequences generated by synchronous meteorological satellites is described. A self-contained console includes a film input station, a television camera, 1000 frames of video disc memory, video mixing controls, and a television display. Electronic cursors permit digital readout of x and y displacements of identifiable cloud elements relative to a reference grid. Numerous display options, including time-lapse, variable magnification, and frame-to-frame differencing are provided to help a meteorologist/operator identify and track specific cloud elements. Other types of graphic material, e.g. charts, contours, and grids, can be entered and merged with the cloud images for comparative study. The equipment design is expandable to include data input from digital tapes and immediate feedback of processed results via an associated on-line digital computer. Examples of meteorological satellite imagery processed through the console are included. Author

c14 080000 19

N70-21426*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS OF THE 4th AEROSPACE MECHANISMS SYMPOSIUM
George G. Herzl ed. and Mary Fran Buehler ed 15 Jan. 1970 144 p refs Conf. held at Santa Clara, Calif., 22-23 May 1969 sponsored by Santa Clara Univ., JPL, and Lockheed Missiles and Space Co.
(Contract NAS7-100)
(NASA-CR-109092; JPL-TM-33-425) Avail: CFSTI CSCL 22B

Design principles, details, and applications with which the aerospace mechanism designer must be familiar are discussed. For individual titles, see N70-21427 through N70-21447.

c31 020000 22

N70-21428*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVOLUTION OF A SPACECRAFT ANTENNA SYSTEM
A. Kampinsky *In* JPL Proc. of the 4th Aerospace Mech. Symp. 15 Jan. 1970 p 13-18 refs (See N70-21426 09-31)
Avail: CFSTI CSCL 09E

The mechanically despun antenna for spin stabilized spacecraft has evolved from a simple, rotatable planar reflector to a more sophisticated multifrequency, attitude-sensing, high gain antenna for deep space probes, tactical communications, and community in space environment with simple mechanical mechanisms, low power consumption, high communications gain, and low noise and magnetic spillage. The design concepts are proved by the actual flight experiences of (1) the ATS III mechanical antenna system, which, since November 1967, has performed as predicted, (2) the Intelsat III antenna system derived from the predecessor reflective antenna design, and (3) the extension to a military high capacity despun antenna platform system. Author

c07 020000 24

N70-21441*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A FLOW-CONTROL VALVE WITHOUT MOVING PARTS
W. L. Owens, Jr. *In* JPL Proc. of the 4th Aerospace Mech. Symp. 15 Jan. 1970 p 115-120 refs (See N70-21426 09-31)
Avail: CFSTI CSCL 13K

The design and operation of a valveless flow-control device that was flown on Application Technology Satellites A and D are described. A considerable increase in reliability over a mechanical valve is possible in applications where response times on the order of minutes are acceptable at thrust levels below 10.01 lbf. Theoretical performance curves for flow termination time and mass loss rate are presented for several candidate subliming materials. Good agreement between calculated and experimental values of flow termination time and mass loss rates is demonstrated. Author

c15 020000 23

N70-21688*# General Electric Co., Schenectady, N.Y. Research and Development Center.
VHF RANGING AND POSITION FIXING EXPERIMENT USING ATS SATELLITES Interim Report, 25 Nov. 1968 9 Oct. 1969
9 Oct. 1969 186 p refs
(Contract NAS5-11634)
(NASA-CR-109205; S-70-1003) Avail: CFSTI CSCL 17B

The Applications Technology Satellites, ATS-1 and ATS-3, were used to test the feasibility of ranging and position fixing from synchronous satellites to small mobile terminals at VHF radio frequencies. The range measurements were made with a simple tone-code technique that proved to be efficient in the use of satellite energy and compatible with presently-used mobile communication equipment and bandwidth allocations. When a vehicle was to be located, a ground station transmitted a 0.43 second tone-code signal to one of the satellites, the interrogating satellite, usually ATS-3. The satellite repeated the signal on 135.6 MHz. All of the activated vehicle equipments received the signal, and each matched the phase of a locally generated audio tone to the received tone phase. The ground station received the returns from the satellites. It measured the time interval from its initial transmission of the signal to the first return from the interrogating satellite and to the two returns from the satellites as they were relayed back from the user. The ranges from the two known positions of the satellites together with vehicle altitude and corrections for ionospheric delay, were used to compute the vehicle location. Author

c07 070211 06

N70-22391# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany) Inst. fuer Satellitenelektronik.
EXPERIMENTS WITH THE ATS-3 SATELLITE WITH REGARD TO FUTURE USE OF NAVIGATION SATELLITES IN SURFACE NAVIGATION [EXPERIMENTE MIT DEM SATELLITEN ATS-3 IM HINBLICK AUF DIE SPAETERE NUTZUNG EINES NAVIGATIONS SATELLITEN IN DER SCHIFFAHRT]
F. Edbauer, W. Goebel, M. Raab, and H. Wuennenberg Sep. 1969 112 p refs In GERMAN; ENGLISH summary
(BMWF-FB-W-69-37) Avail: CFSTI

VHF communications via the ATS-3 satellite were tested during two expeditions in 1968 of the Meteor research ship. The experiments represent the German contribution to international efforts for obtaining experimental data on the use of satellites in aeronautical and maritime radio links. The following experiments were performed under shipboard conditions using a low cost commercial radiotelephony device: (a) antenna pattern measurements (vertical plane) by balloons (without satellite); (b) measurement of link properties by signal to noise readings; (c) voice tests; (d) data transmission with PCM and teletype-code; (e) line of position by side-tone-ranging measurements. It is emphasized that further experiments in the L-band (1.6 GHz) are desirable. Author (ESRO)

c21 070212 04

N70-22849*# Westinghouse Electric Corp., Baltimore, Md. Field Engineering and Support Dept.
GROUND RECORDING AND PLAYBACK SYSTEM Final Report, Jul. 1968 – Dec. 1969
Dec. 1969 30 p refs
(Contract NAS5-11597)
(NASA-CR-109254) Avail: CFSTI CSCL 09B

The Goddard Space Flight Center playback facility for generating photographic images on film from ATS spin scan camera data is described. The data handling units were designed to interface with a film recorder electrically equivalent to the color film recorder now part of the ATX MSSCC equipment now at Rosman. In addition, a mode exists whereby a black and white film recorder may be used in lieu of the color recorder. In this mode any single color of a recorded ATS SSCC tape may be played back to form a black and white film record. The data input to this facility consists of digital tapes recorded at the Rosman and Mojave data acquisition sites, and analog data transmitted via a GFE ground data link from the Rosman site. This equipment is capable of manipulating the data prior to film exposure to meet specific experimenter needs; this manipulation consists of both spatial and intensity (color) changes. In addition, a study to specify the selection and addition of a small computer to the proposed facility was performed. Author

c08 080100 34

N70-22958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-E MAGNETIC FIELD MONITOR INSTRUMENTATION
T. L. Skillman Jan. 1970 34 p refs
(NASA-TM-X-63852; X-645-70-54) Avail: CFSTI CSCL 14B

Instrumentation, tests and calibration, and data outputs of the magnetic field monitor (MFM) are described. The position of the MFM sensor and electronics package on the ATS-E spacecraft, and the fluxgate magnetometer coordinate system are illustrated. Rapid satellite spin rates and their effects on the telemetry outputs of the MFM are discussed. Four ground stations in Manitoba provide magnetograms for comparison with ATS-E data. M.H.E.

c14 100600 05

N70-24276# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 98, NO. 3: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION, THE EUROPEAN WEATHER PICTURE 1968 Quarterly Report [METEOROLOGISCHE ABHANDLUNGEN. BAND 98, HEFT 3: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG, DAS EUROPAEISCHE WETTERBILD 1968. TEIL 3, 3. VIERTELJAHR]
Ingrid Haupt, Bernhard Lindenbein et al 1969 306 p In GERMAN; ENGLISH summary
(QR-3-Pt-3) Avail: CFSTI

The results of weather satellite observations made in Berlin during the third quarter of 1968 are discussed. Part 1 reports briefly on the "Symposium on Radiation including Satellite Techniques" held in Bergen/Norway in August 1968. Emphasis is placed on lectures describing meteorological satellite instrumentation and radiation measurements. Also mentioned are the following lectures: (1) cloud cover and planetary albedo of the earth; (2) the emissivity of cloud surfaces; and (3) determination of stratospheric humidity by means of radiation measurement. Finally some comments are made on ATS-4 and ESSA 7 which have been launched during this period. Part 2 contains the daily "Das Europaeische Wetterbild" of the same period. Part 3 gives the main orbital data of ESSA 6 as well as picture taking time and geographical coordinates of satellite pictures received. Author

c20 080000 20

N70-24648# Chicago Univ., Ill. Dept. of Geophysical Sciences.
DEVELOPMENT OF A DRY LINE AS SHOWN BY ATS CLOUD PHOTOGRAPHY AND VERIFIED BY RADAR AND CONVENTIONAL AEROLOGICAL DATA
Dorothy L. Bradbury Nov. 1969 21 p refs
(Grants ESSA-E-41-22-69(G); ESSA-E-198-68(G))
(SMRP-RP-80) Avail: Issuing Activity

A series of applications technology satellite (ATS-III) cloud pictures shows the formation, development, and movement of a dry line. The line was detected on the ATS-III pictures long before it was observed on the radar screen and its development and motion was observed on consecutive ATS-III pictures at 14 min intervals over a period of six and one-half hours. A vertical cross-section through the dry dome shows that the isentropic layer extended up to the 500 mb surface and that the dry line was nearly vertical up to this height. The vertical distribution of the horizontal winds in the cross-section indicate jet maxima at three different levels, at and above the 600 mb surface, in addition to the low level jet located between 800 and 900 mb. The jet maxima most closely associated with the intense convective activity appears to be centered between 600 and 500 mb. Author

c20 081100 06

N70-24763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CORRELATION ANALYSIS AND SCINTILLATION FOR 15-GHz LINE-OF-SIGHT PROPAGATION CHANNELS
E. Mondre Washington Apr. 1970 16 p refs
(NASA-TN-D-5613) Avail: CFSTI CSCL 20N

Experiments have been carried out to measure the temporal nature of amplitude fluctuations under various weather conditions observed on a 15-GHz line-of-sight propagation channel. The path length is on the same order as the atmospherically influenced portion of an earth-spacecraft link which will allow direct comparison with data to be obtained from the ATS-E Millimeter Wave Propagation Experiment. Mean value, mean square value, and statistics of amplitude fluctuations are computed. It is concluded that a Rician distribution is adequate to describe the amplitude data. Channel correlation analysis is discussed. The computed echo correlation functions and echo powder spectral densities indicate a channel coherence time of 1.5 to 4 seconds and a fading bandwidth of less than 0.4 Hz. Magnitudes and spectral densities of amplitude scintillations are calculated from the experimental data and compared with theoretical results derived from the turbulence of the atmosphere. Author

c07 070300 11

N70-24859 Advisory Group for Aerospace Research and Development, Paris (France).
ADVANCED NAVIGATIONAL TECHNIQUES
W. T. Blackband (RAE, Farnborough) Slough, England Technivision Services Jan. 1970 354 p refs Proc. of the 14th Symp. of the Avionics Panel, Milan, 12-15 Sep. 1967
(AGARD-CP-28) Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications, Inc., 415 Fifth Ave., Pelham, New York 10803 (Attn. Mr. A. L. Candido)

Conference papers pertain to the future requirements for navigation for aircraft, and for hydrographic and oceanographic vessels; general ground-based navigational aids, with particular reference to Omega; Doppler-VOR modifications; and satellites for air and marine navigation and traffic control. For individual titles, see N70-24860 through N70-24885.

c21 070200 24

N70-24861 Pan American World Airways, Inc., New York.
AN INTERNATIONAL AIRLINE VIEWS NAVIGATION SATELLITES
B. F. Mc Leod *In* AGARD Advanced Navigation Tech. Jan. 1970 p 11-15 (See N70-24859 11-21)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications, Inc., 415 Fifth Ave., Pelham, New York 10803 (Attn. Mr. A. L. Candido)

Airline and ATC requirements and and plans for meeting requirements are discussed. It is felt that a reduction in separation is the only answer to the increased traffic, satellite navigation is welcomed as a supplementary aid, and a high quality, long range communications system is the most immediate pressing need. Plans for implementing a VHF communications system are outlined, and airlines experience with navigation satellites is mentioned. N.E.N.

c21 070200 23

N70-24866* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE RELAY OF OMEGA NAVIGATION SIGNALS BY SATELLITE TO A CENTRAL PROCESSING FACILITY
C. R. Laughlin *In* AGARD Advanced Navigational Tech. Jan. 1970 p 63-76 refs (See N70-24859 11-21)
Copyright. Avail: Technivision, Braywick House, Maidenhead, Berks, Engl. US Distributor: Circa Publications, Inc., 415 Fifth Ave., Pelham, New York 10803 (Attn. Mr. A. L. Candido)

An experimental system known as the Omega Position Location Equipment (OPLE) is being developed. The OPLE experiment will commence with the launching of the Applications Technology Satellite scheduled for mid-November of 1967. The purpose of the OPLE experiment is to demonstrate the operational feasibility of a centralized global meteorological data collection system utilizing the Omega navigation network in conjunction with geosynchronous satellite-borne repeaters. A significant feature of the OPLE is that Omega signals, as received at remote locations, are relayed through the satellite to a central processing center; the positions of the remote receivers are then automatically determined by a computer facility. The remote equipments function essentially as VLF to VHF transponders and the simplicity of their operation makes them compatible with a variety of mobile platforms. While the OPLE experiment is specifically designed for application with a balloon-borne meteorological data collection system, other potential applications include oceanographic exploration, marine and air traffic control, and reentered space vehicle recovery. Author

c21 080400 06

N70-25810# Aerospace Corp., El Segundo, Calif. Lab. Operations.
EFFECTS OF SUDDEN COMMENCEMENTS ON SOLAR PROTONS AT THE SYNCHRONOUS ORBIT
George A. Paulikas and J. Bernard Blake 25 Oct. 1969 31 p refs
(Contract F04701-69-C-0066)
(AD-698748; TR-0066(5260-20)-7; SAMSO-TR-69-387) Avail: CFSTI CSCL 4/1

Increases in solar proton flux coincident with sudden commencements have been observed by detectors aboard the geostationary ATS-1 satellite during 1967 and 1968. The flux increases are of short duration (30 minutes) and are of magnetospheric origin. Decay of the proton flux after the sudden commencement enhancement is consistent with pitch angle scattering by hydromagnetic waves. Author (TAB)

c29 110100 14

N70-26410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL REPORT ON 16 GHZ AND 35 GHZ RADIOMETERS ASSOCIATED WITH THE ATS-V MILLIMETER WAVE EXPERIMENT
Yuichi Otsu Nov. 1969 76 p refs
(NASA-TM-X-63834; X-733-69-554) Avail: CFSTI CSCL 17B

An experiment on the 16 GHz and 35 GHz radiometers that are to be used in connection with the ATS-V Millimeter Wave Experiment was carried out during June and July 1969 to measure sky temperature, and to estimate the antenna loss factor and the long time drift, which cause antenna temperature increase and error in temperature measurements, respectively. The relation between rainfall rate at one point and the temperature increase due to rain and rain cloud is described. Some aspects about the temperature scintillation due to cloud are also discussed. Sky temperature calculations have been made for a standard atmospheric model and other precipitation conditions. Author

c07 070300 08

N70-26893# New Hampshire Univ., Durham. Dept. of Physics.
RESEARCH DIRECTED TOWARD EVALUATION OF RADIATION ENVIRONMENT OF NEAR-EARTH SPACE Final Report, 17 Jun. 1968 – 15 Dec. 1969
Roger L. Arnoldy 15 Dec. 1969 38 p refs Submitted for publication
(Contract F19628-68-C-0294)
(AD-701640; AFCRL-70-0087) Avail: CFSTI CSCL 4/1

As a result of the correlation study of the sudden intensity increases seen by the ATS-1 electron spectrometer with the occurrence of magnetic substorms the following conclusions are reached: (1) Electrons are produced in the 50-150 kev energy range as observed at 6.6Re during a magnetic substorm. (2) The electrons are produced at or near the midnight meridian and then drift on closed field lines around the earth. (3) The electron bunch produced as a result of the substorm in 75% of the 60 events studied is associated with precipitation observed by riometers as it drifts. (4) The frequency of occurrence of such particle substorms indicates that they might represent a quasi-steady source of electrons for the trapped radiation. Rapid fluctuations in the intensity of precipitated energetic particles during a bright aurora have been studied. The fluctuations occurred only during the period of peak precipitation and in close correlation with the peak precipitation and in close correlation with the westward surge of a bright auroral band preceding break-up. Dynamic spectral analysis of the data showed no sustained periodicities. Author (TAB)

c29 110400 25

N70-26957# Environmental Science Services Administration, Washington, D.C. National Environmental Satellite Center.
APPLICATIONS OF ENVIRONMENTAL SATELLITE DATA TO OCEANOGRAPHY AND HYDROLOGY
E. Paul McClain Jan. 1970 16 p refs
(ESSA-NESCTM-19) Avail: CFSTI

Techniques for large-scale mapping of sea surface temperatures in clear and partly cloudy regions are being developed with the aid of high-resolution infrared data from Nimbus satellites. Digitized television pictures from the ESSA operational satellites and Applications Technology Satellites are being studied in conjunction with the relation between sunglint patterns and the ocean wave spectrum and low-level wind stress. New methods for the mapping of major snow and ice boundaries from satellite altitude have been devised and are being tested. Author

c13 070209 03

N70-27599# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
ULTRA LOW FREQUENCY WAVES IN THE MAGNETOSPHERE
J. W. Dungey and D. J. Southwood Aug. 1969 38 p refs
Avail: CFSTI

A brief summary is first given of the more important properties (latitude, dependence, diurnal variation, polarization) of continuous pulsations (pc 2-5) observed on the ground. The remainder of the paper is devoted to recent developments in the theory of resonant modes of magnetospheric models, magnetospheric instability and low frequency waves in the magnetosphere. The theoretical results are in good agreement with observations from Explorer 33 and ATS 1. Author (ESRO)

c13 100500 40

N70-27699# Edgerton, Germeshausen and Grier, Inc., Bedford, Mass. Eastern Science and Technology Div.
AIRBORNE SATELLITE COMMUNICATIONS DURING AURORAL STUDIES Final Report
Carl F. Sundstrom and Manual M. Garcia Sep. 1969 19 p refs
(EGG-1183-524; B-4101) Avail: CFSTI

A series of auroral studies flights flown during March 1968 included communications equipment experiments designed to test the efficacy of incorporation of a satellite link in maintaining two-way communications between aircraft flying at high altitude at conjugate auroral points located in opposite hemispheres. The ground test, flight check, and actual auroral missions communications showed that marked improvement in coordination between the aircraft and between the experimental systems aboard the separate aircraft was possible using the ATS-1 satellite. Author (NSA)

c07 070210 01

N70-30131# National Environmental Satellite Center, Washington, D.C.
MAPPING OF GEOSTATIONARY SATELLITE PICTURES: AN OPERATIONAL EXPERIMENT
R. C. Doolittle, C. L. Bristor, and L. Lauritson Mar. 1970 45 p refs
(ESSA-TM-NESCTM-20) Avail: CFSTI

Spin scan cloud pictures from the ATS-1 geostationary satellite were mapped for daily operational experimental use during the period from June to December 1969. The details of this continuing experiment are discussed. Computer programs are used, first to preprocess the digitized image data to produce a geometrically normalized picture, then to map the normalized image on Mercator or polar stereographic projections. Author

c20 080900 19

N70-30432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
L-BAND PERFORMANCE CHARACTERISTICS OF THE ATS 5 SPACECRAFT
Frederic Kissel May 1970 87 p Revised
(NASA-TM-X-63828-Rev; X-731-70-51-Rev.) Avail: CFSTI CSCL 17B

The results are summarized of initial L-band experimentation utilizing NASA's Applications Technology Satellite ATS-5 and the STADAN ground station located near Barstow, California. Experimentation was performed over a three month period to determine the spacecraft performance characteristics and to perform limited propagation tests. Included in the report are appendices containing information concerning propagation effects as well as measurement techniques. Author

c07 070700 03

N70-30644# Aerospace Corp., El Segundo, Calif. Lab. Operations.
THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE, JANUARY-JUNE 1969
George A. Paulikas and J. Berhard Blake 31 Dec. 1969 63 p refs
(Contract F04701-69-C-0066)
(AD-702799; TR-0066(5260-20)-15; SAMSO-TR-70-78) Avail: CFSTI CSCL 4/1

The particle environment at the synchronous orbit is summarized. Included in this report is a discussion of the properties of the trapped relativistic electron fluxes and the phenomenology of the penetration of solar protons to the synchronous orbit. Author (TAB)

c30 110100 17

N70-30830*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EQUATORIAL SCINTILLATIONS EXPERIENCED DURING APOLLO 11 SUPPORT, 12-24 JULY 1969
George K. Kuegler Sep. 1969 47 p refs
(NASA-TM-X-63944; X-460-69-534) Avail: CFSTI CSCL 17B

The ATS-1 VHF transponder was used as a communication link between ships of the Apollo 11 task force and the U.S. mainland from July 12 to 24. During 13 days of testing, several fading and changes in apparent angle of arrival of signals were experienced. The fading is attributed to equatorial scintillations, but the changes in the apparent angle of arrival are difficult to account for. Some changes can be attributed to the effects of the ship's structure on the antenna radiation patterns, but it does not account for all the changes. Tables of the angle of arrival data are presented along with charts of the signal levels recorded during the test period. Author

c07 100513 01

N70-31984*# Allied Research Associates, Inc., Concord, Mass.
NASA/ESSA WEFAX EXPERIMENT, ATS-1 Evaluation Report
Arthur R. Hall and Lawrence Berry [1970] 213 p
(Contract NAS5-10204)
(NASA-CR-110529; TR-3) Avail: CFSTI CSCL 04B

The Weather Facsimile (WEFAX) experiment was conducted to determine by actual demonstration, the feasibility of disseminating meteorological data and satellite cloud camera pictures from a central weather station source to widely scattered remote weather stations or receiving units. Evalustions of the WEFAX transmissions during January through December 1967 are discussed and documented in separate monthly sections. The actions taken by the experimenters during December 1966 to prepare and test the WEFAX transmission system in both normal and emergency modes are briefly discussed. The major problems encountered during the experiment, and the experiment conclusions are also presented. Author

c20 080204 02

N70-32027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM LAUNCH TRAJECTORIES FOR THE ATS-E MISSION
Omer F. Spurlock and Fred Teren [1970] 17 p refs Proposed for presentation at Astrodynamics Conf., Am. Astronautical Soc. and AIAA, Santa Barbara, Calif., 20-21 Aug. 1970
(NASA-TM-X-52836) Avail: CFSTI CSCL 22C

Optimum trajectories for the Applications Technology Satellite (ATS)-E mission are obtained. Analysis, procedure, and results are presented. The trajectories are numerically integrated from launch to insertion into the final orbit. As a result of a much smaller than optimum apogee motor, these trajectories, unlike conventional synchronous orbit trajectories, require non-circular parking orbits and large amounts of inclination reduction before the solid motor burn at apogee. Constraints on parking orbit perigee radius and duration are included. Figures are presented describing the results. Author

c30 050501 01

N70-32234# Advisory Group for Aerospace Research and Development, Paris (France).
A SURVEY OF SCINTILLATION DATA AND ITS RELATIONSHIP TO SATELLITE COMMUNICATIONS
Aug. 1969 97 p refs
(AGARD-571) Avail: CFSTI

CONTENTS:

c07 100500 34

N70-32235# Advisory Group for Aerospace Research and Development, Paris (France).

VHF ATMOSPHERIC STUDIES AND COMMUNICATIONS AND NAVIGATION SYSTEMS

John P. Mullen *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 1–2 ref (See N70-32234 17-07)

Avail: CFSTI

The use of communication satellites for onboard navigation, and air traffic control over the North Atlantic are discussed. The expected improvement in navigation would increase the number of tracks and permit more nearly optimal crossings resulting in fuel savings. F.O.S.

c07 070200 20

N70-32236# Advisory Group for Aerospace Research and Development, Paris (France).

THE DEFINITION OF SCINTILLATION INDEX AND ITS USE FOR CHARACTERIZING IONOSPHERIC EFFECTS

Herbert E. Whitney *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 3–11 refs (See N70-32234 17-07)

Avail: CFSTI

The scintillation index (SI) is given as: SI = P(max) P(min)/P(max) + P(min) where P(max) is the power amplitude of the third peak down from the maximum excursion and P(min) is the power amplitude of the third level up from the minimum excursion. It is concluded that only a relative measure of scintillation index is necessary to describe amplitude fluctuations caused by ionospheric irregularities, and this SI should be used for statistical studies. F.O.S.

c13 100500 35

N70-32237# Advisory Group for Aerospace Research and Development, Paris (France).

SUMMARY OF PROPERTIES OF F-REGION IRREGULARITIES

Terrence J. Elkins *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 13–37 refs (See N70-32234 17-07)

Avail: CFSTI

The F-region irregularities are studied for improving its use as a communication medium. For this study, the ionospheric structure is divided into three geomagnetic latitude regions: equatorial zone, polar zone, and temperate zone. The characteristics of each of these regions is reviewed, and the methods of observation are listed. The distribution, size and shape, and movement are discussed with the diurnal, seasonal, and solar activity effects. F.O.S.

c13 100500 36

N70-32238# Advisory Group for Aerospace Research and Development, Paris (France).

APPLICATION OF THE STATISTICS OF IONOSPHERIC SCINTILLATION TO VHF AND UHF SYSTEMS

Richard S. Allen *In its* Commun. Aug. 1969 p 39–53 refs (See N70-32234 17-07)

Avail: CFSTI

Statistical summaries and reliable techniques for predicting the effects of ionospheric irregularities at remote locations are studied for application to systems now in use on new radio frequencies. Variations of fluctuations that can be isolated in statistical data are described in terms applicable to communications. These are: stimulus variables that represent changes in forces that produce the irregularities, trait variables, and experimental variables. The magnetic K index is used to relate the variation in response irregularities to variation in the solar energy carried by the solar wind. Charts summarizing the effect of variable factors on the scintillation index are included. F.O.S.

c13 100500 37

N70-32239# Advisory Group for Aerospace Research and Development, Paris (France).

SPECIAL PROBLEMS IN SCINTILLATIONS

Jules Aarons *In its* A Survey of Scintillation Data and its Relationship to Satellite Commun. Aug. 1969 p 55–88 refs (See N70-32234 17-07)

Avail: CFSTI

Scintillations in the equatorial region are studied using the stations of Africa and South America. The appearance of scintillations on satellite records, and the effects of diurnal and seasonal influences are discussed. It is concluded that as the midnight sector moves along the geomagnetic equator, irregularities form. The direction of winds within the irregularity structure is eastward at night even though the large scale excitation of the ionosphere into the irregularity formation mode is westward. F.O.S.

c13 100500 38

N70-32240# Advisory Group for Aerospace Research and Development, Paris (France).

PROPAGATION DELAYS OF VHF WAVES

John A. Klobuchar *In its* A Survey of Scintillation Data and Its Relationship to Satellite Commun. Aug. 1969 p 89–92 (See N70-32234 17-07)

Avail: CFSTI

Data showing that the time delay of VHF radio waves traveling through the ionosphere varies as a function of several parameters are presented with the problems in predicitng the time delay. Two methods of determining the time delay of a VHF radio wave are discussed. These are: data from stations are used to construct an analytic model of the time delay along a required path, and the time delay is related to some other ionospheric parameter which is measured and predicted on a world-wide basis. Ionospheric parameters studied are: Faraday effect, total electron content, and elevation angle. F.O.S.

c07 100500 39

N70-32461*# Ohio State Univ., Columbus. Dept. of Electrica Engineering.
MILLIMETER-WAVELENGTHS PROPAGATION STUDIES Semiannual Status Report
30 Apr. 1970 25 p
(Grant NGR-36-008-080)
(NASA-CR-110649; SASR-2374-4) Avail: CFSTI CSCL 20N

The multiple terminal facility developed for the ATS-E millimeter wave propagation experiment is described. This facility is presently operational. Sample data have been recorded and preliminary analyses have been performed. The current status of the program is reviewed and some discussion of the significance of the data being obtained is included. Author

c07 070300 12

N70-32578# Hawaii Univ., Honolulu. Radioscience Lab.
ATLAS OF TOTAL ELECTRON CONTENT PLOTS. VOLUME 4: 1 JANUARY 31 DECEMBER 1968
P. C. Yuen and T. H. Roelofs [1969] 385 p
(Grants NSF GP-5404; NSF GA-1113)
Avail: Issuing Activity

Presented are diurnal plots of total electron content versus time obtained at Hawaii by measuring the Faraday rotation of the polarization of VHF telemetry carrier tranmissions from the geostationary satellites Syncom-3 and ATS-1. The diurnal plots contained in this volume have missing data. These have been caused by interruptions in satellite transmissions, breakdowns of our equipment, interference, and other factors. It should be noted that the data are plotted in Hawaiian Standard Time and that if results are needed for the local mean time at the sub-ionospheric point for either satellite-to-Hawaii path, then the proper time correction must be made. The scales used on the plots do not permit the fine structure of the variations in content to be shown. Scintillations are present in the data and can be determined if the data recorded on cards are used. Monthly averages of the content data are included at the end of this volume. Author

c13 100500 31

N70-32683*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
GRAVITY GRADIENT BOOM STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-E), VOLUME 2 Final Report
Nov. 1969 280 p refs
(Contract NAS5-10285)
(NASA-CR-109581; ATL-338) Avail: CFSTI CSCL 22B

Electrical and mechanical functional tests were performed on a prototype unit of the gravity gradient boom system and included vibration, acceleration, and thermal-vacuum measurements. A detailed summary is presented outlining environmental exposures, facilities and instrumentation used, procedures employed, test data, and the results of environmental qualification testing. Author

c31 090000 58

N70-32728*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
GRAVITY GRADIENT BOOM STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-E), VOLUME 1 Final Report
B. S. Shephard, D. W. Zehner, and O. R. Shively Jan. 1970 275 p refs
(Contract NAS5-10285)
(NASA-CR-109580) Avail: CFSTI CSCL 13M

The material presented is intended to describe the ATS-E boom system and how it functions; to discuss the capability of the system to withstand vibrational and operational loads; to describe the qualification and acceptance testing and the results thereof; and to evaluate the boom system in light of the testing and analysis. Author

c32 090000 62

N70-32824*# Techtran Corp., Glen Burnie, Md.
SSB-PM AND PCM.PM-FT SATELLITE COMMUNICATION SYSTEMS COMPARISON
Syuntaro Niwa Washington NASA Dec. 1969 15 p Transl. into ENGLISH from Rev. of the Radio Res. Labs. (Japan), v. 15, no. 76, Jan. 1969 p 1-15
(Contract NASw-1695)
(NASA-TT-F-12384) Avail: CFSTI CSCL 17B

A comparison of satellite multiple access communication systems is presented. Single side band-pulse modulation and pulse code modulation systems are considered. The basis for comparison of the systems is: (1) channel accomodation capacity, (2) channel network composition flexibility, (3) adaptability to coexistence of participating stations of different scales, (4) adaptability of access external communication networks, and (5) adaptability to future channel increases. Author

c07 070400 04

N70-32909*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WORLDWIDE VHF SATELLITE SCINTILLATION/FADING TESTS: ATS PROJECT
Apr. 1970 32 p refs
(NASA-TM-X-63957; X-460-70-127) Avail: CFSTI CSCL 20N

On November 11, and December 2, 9, 16, and 23, 1969, several stations throughout the world monitored the VHF telemetry signals from ATS 1, ATS 3, and ATS 5 in an attempt to characterize the effects of the ionosphere on propagation of VHF signals through the ionosphere. These tests under the sponsorship of NASA were the first in a series to be continued during the solar eclipse period in March 1970. The simultaneous participation of many stations permits identifying the effects of station location, satellite elevation angle, and diurnal effects. Graphical summaries are presented for each station. Author

c07 070213 02

N70-33161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOPAUSE CROSSING OF THE GEOSTATIONARY SATELLITE ATS 5 AT 6.6 EARTH RADII
T. L. Skillman and M. Sugiura Jun. 1970 19 p refs Submitted for publication
(NASA-TM-X-63975; X-645-70-262) Avail: CFSTI CSCL 22C

During the moderate magnetic storm of September 29 – 30, 1969 an unusually large magnetic field decrease preceded by an impulsive increase of about 100 gamma was observed by the geostationary satellite ATS 5 at about 1733 UT on September 29. The field remained low for about 1 minute and returned to the pre-event level as abruptly as it decreased. From the ATS 1 and 5 observations and magnetograms from ground observatories, it is inferred that the magnetosphere was greatly compressed prior to the above event; the magnetopause distance was probably near 7 earth radii at the subsolar point. Comparing the changes observed by ATS 5 with the field measured by ATS 1 which was 3 hours behind ATS 5 in local time, the event is interpreted as being a magnetopause crossing of ATS 5, caused by a localized, rapid inward motion of the magnetopause and its subsequent recession, creating temporarily an indentation on the magnetopause surface and exposing ATS 5 to the magnetosheath field for a brief period of time. Author

c30 100600 02

N70-33175*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW RESULTS AND TECHNIQUES IN SPACE RADIO ASTRONOMY
J. K. Alexander Jul. 1970 51 p refs Presented at the IAU Symp. No. 41, Munich, 10 – 14 Aug. 1970
(NASA-TM-X-63976; X-693-70-267) Avail: CFSTI CSCL 03A

A summary of all space radio astronomy experiments is presented. Major advances in space radio astronomy have come mainly from experiments conducted on the satellites Alouette-2, Luna-11 and 12, OGO-3 and 5, ATS-2, and RAE-1. Among the most significant technological developments has been the continuing refinement in the accuracy of absolute intensity measurements from approximately + or – 50 percent in the early experiments to + or – 15 to 25 percent in more recent ones. Another important new technique has been the successful use of 229 meter long travelling wave V antennas on the RAE-1 to obtain directive observations of a large portion of the sky at low frequencies. The planned launching of a second RAE spacecraft into a lunar orbit will permit radio astronomical measurements at frequencies down to 30 kHz, facilitate use of the moon as an occulting disk for source position measurements, and provide new information on the cislunar noise environment required to assess the feasibility of future lunar radio observatories. Author

c30 111000 07

N70-34099*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
DYNAMICAL ANALYSIS OF OUTFLOW FROM TORNADO-PRODUCING THUNDERSTORMS AS REVEALED BY ATS 3 PICTURES
K. Ninomiya Dec. 1969 45 p refs
(Grants Ngr-14-001-008; ESSA-E22-41-69(G); ESSA-E-198-68(G))
(NASA-CR-109790; SMRP-81) Avail: CFSTI CSCL 04B

Detailed synoptic and dynamic analyses of outflow from tornado-producing thunderstorms of April 23, 1968 were made by using conventional rawinsonde data combined with ATS III pictures. It was found that the pre-existing flow at the cirrus level over storm areas changed dramatically into outflow as the storms developed. When the storms reached their mature stage, the horizontal dimensions of the outflow increased to about 500 km. Detailed analyses of rawinsonde data inside the outflow area revealed the existence of a mid-tropospheric warm core accompanied by a significant field of convergence below the 700-mb surface. Quantitative analysis of the thermodynamical and dynamical aspects of the outflow field showed that the outflow was induced and maintained by convective warming. Author

c20 081100 07

N70-34276*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 1: SYSTEM SOFTWARE AND ANALYSIS Final Technical Report
31 Mar. 1970 564 p refs
(Contract NAS5-9042)
(NASA-CR-109893; DOC-69SD4372-Vol-1) Avail: CFSTI HC $10.00/MF $0.65 CSCL 17G

Gravity gradient stabilization systems were developed for three Applications Technology Satellites and flight analysis and data reduction support were provided when each system was flown. Each gravity gradient system included a set of motor-driven, extendable/retractable primary booms and tip masses which could be scissored in orbit to change the geometry of the deployed-boom configuration. System design, development, test, and flight analysis are summarized. This volume contains the background analysis which established the basic hardware parameters and performance estimates and provided estimates of performance variations due to design modifications. A description of software is also given. Volume 2 contains a summary of the engineering effort associated with the development and testing of each subsystem and includes a description of the hardware requirements and assumptions. Author

c21 090000 63

N70-34277*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 2, BOOK 1: HARDWARE DEVELOPMENT AND TEST Final Technical Report
15 Jan. 1970 202 p refs
(Contract NAS5-9042)
(NASA-CR-109898; DOC-69SD4372-Vol-2-Bk-1) Avail: CFSTI CSCL 17G

For abstract see N70-34276.

c21 090000 64

N70-34278*# General Electric Co., Philadelphia, Pa.
GRAVITY GRADIENT STABILIZATION SYSTEM FOR THE APPLICATIONS TECHNOLOGY SATELLITE. VOLUME 2, BOOK 2: HARDWARE DEVELOPMENT AND TEST Final Technical Report
15 Jan. 1970 241 p refs
(Contract NAS5-9042)
(NASA-CR-109899; DOC-69SD4372-Vol-2-Bk-2) Avail: CFSTI CSCL 17G

For abstract see N70-34276.

c21 090000 65

N70-34300*# Applied Information Industries, Moorestown, N.J.
L-BAND ATS 5/ORION/S. S. MANHATTAN MARINE NAVIGATION AND COMMUNICATION EXPERIMENT Final Report
O. J. Hanas, M. E. Illikainen, D. L. Kratzer, and E. A. Spaans Jun. 1970 150 p
(Contract NAS12-2260)
(NASA-CR-109877) Avail: CFSTI CSCL 17G

A unique experiment is described in which L-band signals relayed by synchronous satellite were successfully used for navigation and data communication. RF signals containing ranging modulation were transmitted from NASA's STADAN Station at Mojave, California, relayed through the ATS-5 synchronous satellite and received by two stations. One was stationary, located in Moorestown, New Jersey, and the other was marine mobile. The feasibility of position fixing was demonstrated by making range measurements between a fixed ground station, a satellite in a known position, and a moving platform on the surface of the earth. The simultaneous transmission and reception of data communications on the ranging signal is also noted. The results and conclusions are described in terms of carrier-to-noise ratios of the signal, the precision of the system, a relative comparison of accuracy, the effects attributed to multipath and the quality of data transmission. Author

c21 070704 02

N70-34902*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
APPLICATIONS TECHNOLOGY SATELLITE 1 (ATS-1) PARTICLE DATA REDUCTION AND ANALYSIS Final Report, 6 Dec. 1966 30 Apr. 1968
31 Dec 1969 204 p refs Prepared for Western Elec Co., Inc., New York
(Contract NAS5-9635)
(NASA-CR-112500) Avail. CFSTI CSCL 04A

CONTENTS:

c29 110300 15

N70-34903*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
CALIBRATION OF A SEMICONDUCTOR DETECTOR TELESCOPE FOR SPACE EXPERIMENTS
L. J. Lanzerotti *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 1 18 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 09E

The procedures and results of the electron and proton calibrations of two identical satellite experiments are reported. The experiments each consisted of a six-element solid-state detector telescope and electronics, designed to investigate the particle flux and population in the earth's magnetosphere. Author

c14 110300 16

N70-34904*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
TEMPORAL VARIATIONS IN THE ELECTRON FLUX AT SYNCHRONOUS ALTITUDES
L. J. Lanzerotti, C. S. Roberts, and W. L. Brown *In its* Appl. Technol. Satellite (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 19 35 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 04A

A six-element solid-state detector telescope sensitive to electrons and heavier particles was flown on the synchronous orbit ATS-1 satellite. The electron data from the experiment for the time period from day 351, 1966, through day 2, 1967 is discussed. The electron data for electron energies ranging from about 0.4 to 2 MeV shows a diurnal effect in the intensity with a minimum near local midnight. The electron spectrum was generally softer on the night side. The magnitude of the diurnal effect was frequently a factor of 10 for 1.5-MeV electrons and appeared to increase with an increase in the magnetic index. The diurnal effect in the electron flux is qualitatively explained by considering a distorted dipole model of the earth's magnetic field. On several occasions electron oscillations with 7 to 25 minute periods were observed in the data. From a simplified analysis of the oscillation periods as a function of electron energy the oscillations are attributed to the longitudinal drift of bunches of electrons. Author

c29 110300 17

N70-34905*# Bell Telephone Labs., Inc., Murray Hill, N J Radiation Physics Research Dept

ENERGETIC OUTER BELT ELECTRONS AT SYNCHRONOUS ALTITUDE

W. L. Brown *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 37 49 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)

Avail: CFSTI CSCL 04A

Observations were made of the temporal variation in the energetic electron flux at synchronous altitude with a multi-element semiconductor detector telescope on the ATS-1 satellite. Systematic diurnal variations and electron flux oscillations that are attributable to the longitudinal drift of bunches of electrons were studied. The diurnal variations on a magnetically quiet day were compared with the calculations of adiabatic motion in a distorted field, assuming simple radial and pitch-angle distributions of electrons in the noon meridian. This model was too simple to explain the observations satisfactorily, and several modifications were considered. The electron-flux oscillations had periods approximately inverse with electron energy as expected. The absolute magnitudes of the periods, while close to the values calculated, differed enough to indicate the need for alteration of the model of the distorted field. Author

c29 110300 18

N70-34906*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.

ORIGIN OF DRIFT-PERIODIC ECHOES IN OUTER-ZONE ELECTRON FLUXES

H. R. Brewer, M. Schulz, and A. Eviatar *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 51 67 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)

Avail: CFSTI CSCL 04A

The time-dependent flux of equatorial electrons (0.4 MeV less than or equal to E less than or equal to 2.2 MeV) observed on ATS-1 often exhibited drift-periodic structures that could be traced back to a sudden expansion or compression of the magnetosphere. The magnetospheric disturbance redistributed the energetic electrons among drift shells in an asymmetrical manner, and this spatial asymmetry between noon and midnight revealed itself as a temporal variation in particle flux as the electrons subsequently drifted past the observer. A mathematical model for the dynamics of this azimuthal bunching of energetic electrons revealed the microstructure of the redistribution of electrons among drift shells and indicated qualitatively the relation of this microstructure to the diffusion of particles across L. Author

c29 110300 19

N70-34907*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.

ENERGETIC ELECTRONS AT 6.6 R SUB E DURING THE 13-14 JANUARY 1967 GEOMAGNETIC STORM

L. J. Lanzerotti, W. L. Brown, and C. S. Roberts *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 73 88 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)

Avail: CFSTI CSCL 04A

The trapped, energetic (E sub e > 0.4 MeV to > 3.0 MeV) electron fluxes at synchronous altitude, observed by ATS-1 during the January 13-14, 1967, geomagnetic storm, are discussed. Except for a short period after the sudden commencement (sc) at 1202 UT, data 13 (0202 local time), the measured electrons were observed to be stabily trapped for about the first 12 hours after the sc. However, the values of the electron fluxes in the local morning and at local noon were quite different from those generally observed during quite periods. About 2 hours after local noon, at 2324 UT, day 13, the electron flux dropped sharply by two orders of magnitude in response to a sudden decrease in the magnetic field observed at the satellite. Recovery of the electron flux occurred in a few minutes. About 40 minutes later, 0007 UT, day 14, the electron fluxes were essentially wiped out at the time of an observed reversal in the magnetic field at the satellite. During two separate approximately 10-minute periods after this 0007 UT, day 14, wipeout, the observed particle fluxes indicated the satellite encountered a region of space with characteristics very different from the normal magnetospheric trapping region. The data during these times were consistent with the interpretation from the magnetic field observations that the satellite was outside the magnetopause. Correlation of the electron data during the storm was made with the satellite magnetometer data and with the magnetometer data from several ground stations. Author

c29 110300 20

N70-34908*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.

PENETRATION OF SOLAR PROTONS AND ALPHAS TO THE GEOMAGNETIC EQUATOR

L. J. Lanzerotti *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 89 99 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)

Avail: CFSTI CSCL 04A

Simultaneous spectral observations of low-energy solar particles in interplanetary space and in the magnetosphere on the equator strongly imply that these particles have essentially free access to the outer magnetosphere through a very effective diffusion mechanism which preserves the spectral shapes and the flux magnitudes. These observations further imply that measurements of solar-particle arrival time over the polar caps are not sufficient to distinguish between open or closed magnetosphere models. Author

c29 110300 21

N70-34909*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.

ACCESS OF SOLAR PARTICLES TO SYNCHRONOUS ALTITUDE

L. J. Lanzerotti *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 101 129 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)

Avail: CFSTI CSCL 04A

The temporal and spectral changes in the access of solar protons and alpha particles to synchronous altitude are discussed and reviewed. Possible consequences of the presence of substantial fluxes of low energy solar protons deep inside the magnetosphere are also discussed. Author

c29 110300 22

N70-34910*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
DRIFT MIRROR INSTABILITY IN THE MAGNETOSPHERE: PARTICLE AND FIELD OSCILLATIONS AND ELECTRON HEATING
L. J. Lanzerotti, A. Hasegawa, and C. G. Maclennan *In its* Appl. Technol. Satellite (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 131 153 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 04A

The published L = 5 equatorial magnetosphere particle and field data from the April 18, 1965, geomagnetic storm were reanalyzed in the contest of the drift mirror instability theory developed by Hasegawa. This data, together with previously unpublished electron pitch angle data, are shown to satisfy the requirements and consequences of the instability. Additional particle data observed during a 1967 substorm by an experiment on ATS-1 are also presented to show that the observation of the April 18 instability was not an isolated occurrence in the magnetosphere. The data also contain evidence for electron heating during the time of the instability. Author

c29 110300 23

N70-34911*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
SOLAR-PROTON RADIATION DAMAGE OF SOLAR CELLS AT SYNCHRONOUS ALTITUDES
L. J. Lanzerotti *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 155-161 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSLC 04A

The radiation damage effects from low-energy solar protons penetrating to synchronous altitude are calculated for n-on-p type solar cells on a synchronous-altitude satellite. The damage rate to unshielded solar cells due to a low-intensity solar event can be 10 to 100 times the damage rate due to the normal, synchronous-altitude electron fluxes. Author

c29 110300 24

N70-34912*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
SYNCHRONOUS-ALTITUDE PROTONS AND ELECTRONS, 26 OCTOBER-8 NOVEMBER 1968
L. J. Lanzerotti and C. M. Soltis *In its* Appl. Technol. Satellite 1 (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 163-169 refs Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 04A

Synchronous-altitude particle data for a particularly stormy geomagnetic period in 1968 is presented. The stormy period resulted in large flux changes and large diurnal variations in the ATS-1 electron fluxes. The solar protons resulting from the several solar flares during this period were also observed continuously at synchronous altitude. Author

c29 110300 25

N70-34913*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
PENETRATION OF SOLAR PROTONS INTO THE MAGNETOSPHERE AND MAGNETOTAIL
L. J. Lanzerotti, M. D. Montgomery (LASL), and S. Singer (LASL) p 171-182 refs Sponsored in part by ARPA and AEC Prepared for Western Elec. Co., Inc., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 04A

Three sets of satellite measurements are used to compare solar proton fluxes in the magnetotail, in the outer magnetosphere, at synchronous altitude, and in interplanetary space. Comparisons of the interplanetary and magnetosphere proton fluxes show that outer magnetosphere disturbances play a strong role in the initial access of near-90 deg pitch angle protons to synchronous altitude. One comparison of the magnetotail and synchronous altitude fluxes suggests that the latter fluxes may not always result from a scattering of the protons in from the tail. The interplanetary-magnetotail proton comparisons further confirm the results of Montgomery and Singer who found that delays in the proton access to the magnetotail were always present. Author

c29 110300 26

N70-34914*# Bell Telephone Labs., Inc., Murray Hill, N.J. Radiation Physics Research Dept.
DESCRIPTION OF THE BELL LABORATORIES DATA REDUCTION PROCESS, APPENDIX 1
In its Appl. Technol. Satellite (ATS-1) Particle Data Reduction and Analysis 31 Dec. 1969 p 183-193 Prepared for Western Elec. Co., New York (See N70-34902 19-29)
Avail: CFSTI CSCL 09B

A comprehensive data reduction program which was developed to process telemetry tapes received from Goddard Space Flight Center is described. Tasks accomplished by this program include the following: converting and repacking the telemetry sequences, checking the telemetry tape for illegal characters and errors in format, removal of duplicate telemetry sequences, and keeps records for data that has been processed. A general description of the organization of the program is also included. F.O.S.

c08 110300 27

N70-35674*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Report, 1 Dec. 1969 28 Feb. 1970
28 Feb 1970 17 p refs
(Contract NAS5-10392)
(NASA-CR-110027; LMSC-695514; QR-2) Avail: CFSTI CSCL 20I

Work on the reduction and analysis of the data from the low energy particle experiment on ATS 5 is reported. The experiment is continuing in operation and is providing much new information on the particle environment at synchronous altitude. Some preliminary results are described on some of the characteristics of magnetospheric substorms, the properties of the quasi-periodic particle modulations which are a relatively common feature of the data, and the average properties of the ambient plasma. Author

c25 111302 03

N70-35689*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Report, 1 Mar. -31 May 1970
31 May 1970 67 p refs
(Contract NAS5-10392)
(NASA-CR-110029; QR-3) Avail: CFSTI CSCL 04A

This report covers the third quarter of work on the reduction and analysis of the data from the auroral particle experiment on ATS-5. The experiment is continuing in its successful operation. Primary emphasis in the data analysis has been placed on studies of the characteristics of magnetospheric substorms and of quasi-periodic oscillations of the particle fluxes. Several newly developed computer programs are described. Author

c29 110302 04

N70-36162# Congress. house. Committee on Science and Astronautics.
SUPPLEMENTAL REVIEW: NASA-OSSA PROJECTS
Washington GPO 1969 40 p Hearings before Comm. on Sci. and Astronaut., 91st Congr., 1st Sess., No. 9, 16 Oct. 1969
Avail: Subcomm. on Space Sci. and Appl.

Congressional testimony is reported on the status of the Viking, ERTS, and the ATS programs. Cost estimates for the programs are discussed and changes made in the mission requirements are presented. R.B.

c34 010000 48

N70-36577*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPER-HIGH-FREQUENCY (SHF) COMMUNICATIONS SYSTEM PERFORMANCE ON ATS. VOLUME 1: SYSTEM SUMMARY
Aug. 1970 229 p refs
(NASA-TM-X-65304; X-460-70-299) Avail: CFSTI CSCL 17B

The SHF communications system which encompasses a program of design, manufacture, operation and evaluation is studied. This system provides two modes of operation, multiple access (SSB-FDMA/PhM) and frequency translation (FM/FM). The SSB-FDMA/PhM mode is designed to handle frequency division multiplex (FDM) signals while the FM/FM mode is designed to handle television signals as well as FDM. The test program was based on five satellites and three earth stations representing different capabilities and locations. Author

c07 070101 01

N70-36584*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EQUATORIAL SCINTILLATIONS EXPERIENCED DURING APOLLO 13 SUPPORT, 30 MARCH - 18 APRIL 1970
George K. Kuegler (Westinghouse Electric Corp.) Jun. 1970 30 p refs Submitted for publication
(Contract NAS5-21129)
(NASA-TM-X-65302; X-460-70-240) Avail: CFSTI CSCL 17B

During Apollo 13 support by the ATS project, three signal levels were recorded at either of the ATS ground stations. Selected data from the recordings are depicted to indicate the fine grain structure of equatorial scintillations as well as the peak-to-peak variations encountered. Signal level recordings made during the Apollo 11 support and the world wide VHF tests are also included to confirm the fine grain structure of the equatorial scintillations encountered in the Apollo 13 support. The effects of the ships roll on the recorded signal level is also indicated. Author

c07 100517 01

N70-36828*# Bell Telephone Labs., Inc., Murray Hill, N.J.
VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2) Final Report
1 Aug. 1969 291 p refs Prepared for Western Electric Co., Inc., N.Y.
(Contract NAS5-9635)
(NASA-CR-112346) Avail: CFSTI CSCL 17B

CONTENTS:

1. THE VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2) 36 p refs (See N70-36829 20-07)
2. DESIGN OF VLF AND PARTICLE EXPERIMENTS FOR THE ATS-A SATELLITE WITH SPECIAL REFERENCE TO ELECTROMAGNETIC INTERFERENCE, APPENDIX 1 G. L. Miller and H. P. Lie 44 p refs (See N70-36830 20-07)
3. PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-1 (ATS-1), APPENDIX 2 W. M. Augustyniak, W. L. Brown, I. Hayashi, H. E. Kern, R. W. Kerr et al 270 p refs (See N70-36831 20-09)

c07 110901 03

N70-36829*# Bell Telephone Labs., Inc., Murray Hill, N.J.
THE VLF EXPERIMENT EQUIPMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-2 (ATS-2)
In its VLF Expt. Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 36 p refs Prepared for Western Electric Co., Inc., N.Y. (See N70-36828 20-07)
Avail: CFSTI CSCL 17B

A description of the packaging of the VLF radio experiment and its integration with the energetic particle experiment in a common housing is given. Areas discussed include the experiment-spacecraft interface, main housing design, VLF electronics packaging, antenna coil, and antenna electronics. A full component of diagrams illustrate the text. P.A.B.

c07 110901 04

N70-36830*# Bell Telephone Labs., Inc., Murray Hill, N.J.
DESIGN OF VLF AND PARTICLE EXPERIMENTS FOR THE ATS-A SATELLITE WITH SPECIAL REFERENCE TO ELECTROMAGNETIC INTERFERENCE, APPENDIX 1
G. L. Miller and H. P. Lie *In its* VLF Expt. Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 44 p refs Prepared for Western Electric Co., Inc., N.Y. (See N70-36828 20-07)
Avail: CFSTI CSCL 17B

A description of the VLF experiment and its special integration problems with the spacecraft is presented. Special steps taken to minimize noise problems are given, and laboratory radio frequency interference measurements on the experiments and around the operating spacecraft are described. Analysis of the data received from the experiment in orbit is discussed with relation to positive identification of spacecraft noise, including identification of signals by the AND and PHASE conditions and the function of the inflight calibration system. The five detector telescope experiment used to differentiate between electrons, protons, and alpha particles and to measure their energy spectra is also described. Noise considerations and electromagnetic interference protection methods are summarized. P.A.B.

c07 110901 05

N70-36831*# Bell Telephone Labs., Inc., Murray Hill, N.J.
PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE-1 (ATS-1), APPENDIX 2
W. M. Augustyniak, W. L. Brown, I. Hayashi, H. E. Kern, R. W Kerr et al *In its* VLF Expt Equipment for Appl. Technol. Satellite-2 (ATS-2) 1 Aug. 1969 270 p refs Prepared for Western Electric Co., Inc., N.Y.
Avail: CFSTI CSCL 09E

The ATS-1 particle experiments instrumentation is documented in detail, including the experimental scheme, the detector system, the electronic system, the experiment package design, components, reliability analysis, construction, ground support equipment, environmental testing, and the experiment carrying case. Block diagrams and schematic drawings are included. P.A.B.

c09 110901 06

N70-36949# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ATS-1 VHF COMMUNICATIONS EXPERIMENTATION Final Report, May 1967 – Dec. 1969
F. W. Jefferson Jun. 1970 87 p
(FAA-RD-70-12; FAA-NA-70-22) Avail: CFSTI

Eight flight tests were conducted utilizing the Applications Technology Satellite-1 (ATS-1) to obtain characteristic data of VHF communications links via satellite relay for use in over-ocean air traffic control subsystem design studies. Measurements of signal level, signal plus noise-to-noise radio, multipath propagation, voice intelligibility, adjacent channel interference, and 75, 1200, and 2400 bits-per-second digital communications performance were obtained. In general, overall communications reliability using the ATS-1 link was considered marginal. Author

c07 070203 04

N70-37167# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
MESOSCALE MODIFICATION OF SYNOPTIC SITUATIONS OVER THE AREA OF THUNDERSTORMS' DEVELOPMENT AS REVEALED BY ATS 3 AND AEROLOGICAL DATA
Kozo Ninomiya (Meteorol. Res. Inst.) Apr. 1970 44 p refs
(Grants ESSA-E-198-68(G); ESSA-E22-4-69(G))
(SMRP-RP-85) Avail: CFSTI

Synoptical and dynamical aspects of the development of the tornado-producing thunderstorms of April 23, 1968 were studied by combining conventional observation data with ATS 3 pictures, with special emphasis on the interaction between the thunderstorms and large-scale field. Results of the analysis reveal a significant modification of moisture, thermal, and wind fields in the vicinity of the area where storms developed. The formations of the large-scale cloud band and moist tongue are due to the mesoscale convective disturbances that developed along the frontal zone. It is concluded that the formation of a mid-tropospheric warm core accompanied by a strong upper outflow is the result of a process of so-called convective warming. Results of the analyses suggest that both the jet stream and the core of positive vorticity to the left of the jet stream are formed by the increased thermal gradient to the left of the warm core. It is inferred that the modified thermal field and vorticity field force downward motion and produce the dry area to the rear of the storm area. Author

c20 081100 08

N70-38482# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
DETERMINATION OF THE GROUP VELOCITY DELAY OF A VHF SIGNAL PENETRATING THE IONOSPHERE BY MEASURING THE FARADAY ROTATION USING SIGNALS OF THE ATS-3 SATELLITE [BESTIMMUNG DER GRUPPENLAUFZEITVERZOEGERUNG EINES VHF-SIGNALES IN DER IONOSPHAERE AUS MESSUNGEN DER FARADAY-ROTATION MIT SIGNALEN DES SATELLITEN ATS-3]
W. Dieminger, G. Schmidt, and K. Oberlaender Apr. 1970 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Bildung und Wiss.
(BMBW-FB-W-70-24) Avail: CFSTI; ZLDI Munich: 6.30 DM

In order to determine the group-velocity delay of a VHF-signal in the ionosphere, which was required for a navigation experiment, measurements were made of the Faraday-effect on VHF-signals from the geostationary satellite ATS-3. In addition critical frequencies foF2 from Breisach (West Germany) and Tortosa (Spain) were also used. Author (ESRO)

c07 100500 61

N70-38570*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMUM TRAJECTORIES TO CIRCULAR SYNCHRONOUS EQUATORIAL ORBIT FOR SMALLER-THAN-OPTIMUM APOGEE MOTORS
Omer F. Spurlock and Fred Teren Washington Sep. 1970 28 p refs
(NASA-TN-D-5998; E-5732) Avail: CFSTI CSCL 22C

Analysis, procedure, and results are presented for maximizing payload capability for trajectories to circular synchronous equatorial orbit where the apogee motor total impulse is much smaller than optimum. The trajectories begin at launch and are numerically integrated to insertion into the final orbit. Constraints on parking orbit perigee radius and duration are included. These trajectories, unlike conventional synchronous orbit trajectories, were found to require noncircular parking orbits and large amounts of inclination reduction before the apogee burn. The analysis and procedure were also applied to the conventional circular synchronous equatorial orbit problem where the burn and coast durations are optimum. Results are presented for the Applications Technology Satellite (ATS)-E mission, which is an example of a problem where the apogee motor is small, and for the conventional case where the apogee motor is of optimum size. Author

c30 050500 02

N70-38911 Rice Univ., Houston, Tex.
AURORAL ZONE ELECTRON PRECIPITATION ASSOCIATED WITH ELECTRON BURSTS OBSERVED IN THE MAGNETOSPHERE AND THE MAGNETOTAIL
John Donald Pierson (Ph.D, Thesis) 1969 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-19327

A series of balloon flights was conducted from Ft. Yukon, Alaska during August 1967 to study auroral X-rays. During this period, the ATS-1 satellite was in synchronous orbit and one or more of the Vela satellites passed through the plasma sheet in the magnetotail near the midnight meridian. On August 25-26, Vela satellites 3A and 4A were near the midnight meridian at geocentric distances of approximately 17.7 and approximately 18.2 earth radii when each detected bursts of energetic electrons and variations in the plasma properties which were subsequently related to bursts of energetic electrons sensed concurrently by the ATS-1 satellite and by instruments on a balloon at 1400 local time. There were negative magnetic bays on the Leirvogur and Sodankyla magnetograms during this event. From a detailed study of this particularly complicated event several conclusions regarding the behavior of electrons in the magnetotail and in the magnetosphere were reached. Dissert. Abstr.

c30 110700 21

N70-39306*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOTAL ELECTRON CONTENT MEASUREMENT WITH A GEOSTATIONARY SATELLITE DURING THE SOLAR ECLIPSE OF 7 MARCH 1970
S. Rangaswamy (NAS) and P. E. Schmid Aug. 1970 21 p refs
Presented at the Upper Atmospheric Currents and Elec. Fields Symp., Boulder, Colo., 17–21 Aug. 1970
(NASA-TM-X-65330; X-551-70-322) Avail: NTIS CSCL 04A

Reported is the measurement of the total electron content of the ionosphere at the Goddard Space Flight Center, looking towards the geostationary satellite ATS-3 during the solar eclipse of March 7, 1970. Obscuration at this site was near total. Faraday rotation was measured using a stationary circularly polarized antenna and a dual channel phase lock receiver tuned to 137.350 MHz. By comparing the electrical phase of the two opposite circularly polarized components a continuous chart recording was made of Faraday rotation versus local time. A depletion of about 25% in electron content was observed from first contact to the time of minimum electron content. The time variations of the electron content during the eclipse are briefly examined in the light of current theories of ionospheric processes. Author

c29 100500 78

N70-40230*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DELTA AND THOR/AGENA LAUNCH VEHICLES FOR SCIENTIFIC AND APPLICATIONS SATELLITES
Charles R. Gunn Sep. 1970 45 p
(NASA-TM-X-65333; X-470-70-342) Avail: NTIS CSCL 22B

The Delta and Thor/Agena medium class launch vehicles are described for potential users. Functional description of the vehicles, their performance, flight environment, organizational interfaces, spacecraft integration requirements, launch operations and costs are provided for Delta Model 904, and Thor/Agena Model 9A4. Projected vehicle growth currently under study is highlighted. Author

c31 030002 01

N70-40792# Chicago Univ., Ill. Dept. of Geophysical Sciences.
AIRCRAFT, SPACECRAFT, SATELLITE, AND RADAR OBSERVATIONS OF HURRICANE GLADYS, 1968
Tetsuya T. Fujita, R. Cecil Gentry (Natl. Hurricane Res. Lab.), and Robert C. Sheets (Natl. Hurricane Res. Lab.) May 1970 27 p refs
(Grants ESSA-E22-69-70(G); ESSA-E22-41-69)
(SMRP-RP-83) Avail: Issuing Activity

Hurricane Gladys, 17 October 1968, is studied with data collected by the Apollo 7 manned spacecraft, ESSA's especially instrumented aircraft, weather search radar, the ATS3 and ESSA 7 satellites and the conventional weather networks. This is the first time data from all of these observing tools were used to study the structure and dynamics of a hurricane. Techniques used in computing and integrating the various types of data are described and illustrated. A dominant feature of this immature hurricane was a large cloud which provided a major link between the low and high level circulations of the storm. Evidence is presented to suggest this type of cloud and its attendant circulation are features representative of tropical cyclones passing from the tropical storm to the hurricane stage. Author

c20 081200 07

N70-40996*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN, FABRICATION, AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR INSULATION
Richard A. Grippi, Jr. 15 Sep. 1970 49 p refs
(Contract NAS7-100)
(NASA-CR-113820; JPL-TM-33-341) Avail: NTIS CSCL 21H

The design, development, formal qualification, and flight phases of the Applications Technology Satellite (ATS) solid propellant apogee motor program are reported. The design concept, type of material, fabrication, and performance of the titanium motor chamber insulation system are described in detail. The motor is insulated with Gen-Gard V-52, which is a material formulated of polybutadiene-acrylonitrile rubber, hydrated silica, asbestos fiber, reinforcing resin, plasticizer, antioxidant, and processing and vulcanizing agents. To develop and confirm the insulation design, numerous motor chambers were instrumented with thermocouples on the external surface to obtain temperature data during and after motor firing. The temperature results of these tests are presented for units instrumented in the motor development and qualification phase. Author

c28 030004 17

N70-41219# National Environmental Satellite Center, Washington, D.C.
OPERATIONAL BRIGHTNESS NORMALIZATION OF ATS-1 CLOUD PICTURES
V. R. Taylor Aug. 1970 18 p refs
(ESSA-TM-NESCTM-24) Avail: NTIS

An empirical brightness normalization scheme, designed for the operational processing of ATS1 data, is described. It is based on an analysis of the dependence of brightness upon the solar zenith angle. The brightest clouds are adjusted to be equally bright over the entire picture and other darker values are proportionately adjusted by linear interpolation. Author

c20 080900 24

N70-41386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPER-HIGH-FREQUENCY (SHF) COMMUNICATIONS SYSTEM PERFORMANCE ON ATS. VOLUME 2: DATA AND ANALYSIS
Aug. 1970 582 p refs Prepared by Westinghouse Elec. Corp. and the ATS Proj. Office
(NASA-TM-X-65341; X-460-70-300) Avail: NTIS HC $10.00/MF $0.65 CSCL 17B

The results of experiments performed at three ground stations utilizing the ATS-1, ATS-3, and ATS-5 are presented. Individual analyses of these experiments are given based on an evaluation of large quantities of data obtained under various controlled and uncontrolled conditions. The conclusions obtained from these data are discussed, and the statistical approach is described. D.L.G.

c07 070101 02

N70-41896*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Report, 1 Jun.–31 Aug. 1970
R. D. Sharp 31 Aug. 1970 31 p refs
(Contract NAS5-10392)
(NASA-CR-114108; QR-4) Avail: NTIS CSCL 03B

The experiment on ATS-5 has been operating successfully for over a year and is continuing to provide much useful information on the low-energy (auroral) particle environment at synchronous altitude. One prominent feature of the data is an energy dependent time dispersion observed in the onset of the electron flux enhancements during magnetospheric substorms. A method is described for inferring plasma sheet convection velocities from these observations. Author

c29 111302 05

N70-41910 Rice Univ., Houston, Tex.
STRUCTURE OF THE DAYSIDE EQUATORIAL MAGNETOSPHERIC BOUNDARY AS DEDUCED FROM PLASMA FLOW
Carlos Scott Warren (Ph.D. Thesis) 1969 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-19337

On January 13 and 14, 1967, during an intense magnetic storm, anisotropic fluxes were detected by the Rice suprathermal ion detector for several hours beginning at apprix𝑖mately 1300 local time. The detector is onboard the geostationary satellite ATS-1 that is located at 6.6 earth radii. It was established that the varied magnetic fields and plasma flow observed at the satellite were due to a compression of the magnetospheric boundary to the ATS-1 orbit. During the time of the compression, plasma data were recorded inside the magnetosphere, the magnetosheath, and inside the magnetospheric boundary itself. The data generally support the view that a convective-type interaction exists between the magnetosheath plasma and the magnetospheric plasma. Just inside the boundary region, where the maximum interaction is expected, ion flow characteristics are similar to those in the magnetosheath. Dissert. Abstr.

c29 110700 20

N70-42362*# Chicago Univ., Ill. Satellite and Mesometeorology Research Project.
LUBBOCK TORNADOES OF 11 MAY 1970
Tetsuya Theodore Fujita Jul. 1970 24 p refs Submitted for publication
(Grants NGR-14-001-008; ESSA-E-198-68(G))
(NASA-CR-110786; SMRP-RP-88) Avail: NTIS CSCL 04B

Visual, satellite, and weather station data on the Lubbock, Texas tornadoes of 11 May 1970 are presented. Recommendations are made for observation and warning of possible destructive storms. The data indicate that destructive tornadoes can be identified by the tornado-bearing hook echoes appearing on radar screens. R.B.

c20 081100 10

N71-10364*# Electro-Optical Systems, Inc., Pasadena, Calif.
THE REFLECTOMETER EXPERIMENT FOR APPLICATION TECHNOLOGY SATELLITE, PHASE 2 Annual Report, 1 Nov. 1967 – 1 Jan. 1969
1 Jan. 1969 87 p refs
(Contract NAS5-9669)
(NASA-CR-107063; Rept-7003-AR) Avail: NTIS CSCL 14B

A brief description is given of the reflectometer instrument; the measurement techniques for determining the sample degradation, and reduced flight data from the first year of operation. Reflective surface degradation data gathered from 18 test samples flown on the Applications Technology Satellite (ATS-3) are presented. The reflectometer instrument measures specular sample reflectivity in four spectral bands plus one broadband. The measurements cover a spectral range of 0.3 to 3 microns. The primary objective is to test, in actual space environment, the durability of selected specularly reflective surface materials to obtain data for use in equipment design. A secondary aim is to obtain data on the degradation process. Author

c14 100300 01

N71-10654*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATS-5 MILLIMETER WAVE EXPERIMENT DATA REPORT, JANUARY – AUGUST 1970, VOLUME 2
Louis J. Ippolito Oct. 1970 54 p refs
(NASA-TM-X-65371; X-751-70-369-Vol-2) Avail: NTIS CSCL 20N

The ATS-5 experiment, launched August 12, 1969, is providing the first propagation data from an orbiting geosynchronous spacecraft in the 15 GHz (downlink) and 32 GHz (uplink) frequency bands. Updated are measurements reported in the first data report and provided are the first results of high rainfall measurements at the NASA Rosman station. Correlation of measured attenuation with ground measured rainfall rate was low for a single gauge but improved significantly with height averaging of 10 gauges. Correlation of measured attenuation with sky temperature recorded on a small aperture radiometer was very good for most storms. Valid predictions of attenuation from 16 GHz sky temperature measurements were observed for up to 15 db of measured attenuation. The uplink to downlink attenuation ratio varied with each precipitation event and often varied during a single storm. Author

c07 070300 17

N71-10655*# Hughes Aircraft Co., El Segundo, Calif. Space Systems Div.
ATS SPACECRAFT POWER SYSTEM CONFIGURATION STUDY Final Report, 1 Jan. – 31 Aug. 1970
Sep. 1970 179 p
(Contract NAS5-21123)
(NASA-CR-111140; SSD-00428) Avail: NTIS CSCL 10B

Presented are data which will aid in the optimization of regulation and conversion of spacecraft electrical power. The study is based on applications technology satellite mission requirements and power system designs. The ATS power systems use a decentralized bus with remotely located regulators and converters. A detailed analysis and discussion of the existing systems is provided with unit level data tabulations of size, weight, parts count, efficiency, reliability, and electrical performance. Three competing centralized systems are designed to provide equivalent electrical performances. Similar details of these designs are tabulated for comparison with the present decentralized design. The major changes occur when comparing a centralized DC regulator design to the present decentralized design. Adding a centralized converter to the DC centralized regulation system had negligible additional impact. Use of a centralized AC distribution system is shown to be heavier and less efficient than other centralized systems. The study concludes with an examination and tabulated discussion of all factors which have a bearing on the power system design and centralization decision. Author

c03 020200 03

N71-11255*# General Electric Co., Schenectady, N.Y. Research and Development Center.
ATS RANGING AND POSITION FIXING EXPERIMENTS Progress Report, 1 May – 31 Jul. 1970
31 Jul. 1970 43 p refs
(Contract NAS5-11634)
(NASA-CR-111392; S-70-1094) Avail: NTIS CSCL 17I

The ground reference transponder at Gander, Newfoundland was used together with the Radio-Optical Observatory at Schenectady, New York to perform a twenty-four hour ranging test. Signals transmitted from the Radio-Optical Observatory were relayed by ATS-3 and range measurements were made from the satellite to the Gander ground reference transponder as well as to the Observatory at Schenectady. The results showed that the difference between the measured and computed slant ranges could be used as a first order correction for ionospheric delay and satellite position uncertainty to correct the range measurements from the satellite to Gander. Gander is approximately 900 miles east-northeast. When the Schenectady-derived corrections were applied to the Gander range measurements, allowing for a difference in the local times of the two locations, approximately 3000 latitude determinations for the Gander transponder were all within + or – 1 nautical mile of the true position of the transponder. A two-hour period of severe scintillation was experienced during the twenty-four hour test. Author

c07 070211 11

N71-11601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS TECHNOLOGY SATELLITE METEOROLOGICAL DATA CATALOG, VOLUME 1, 1 JANUARY – 30 JUNE 1967
Oct. 1967 468 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66466) Avail: NTIS CSCL 04B

Photographic and tape meteorological data acquired from the ATS-1 satellite are presented. The data catalog includes: (1) the type of data available; (2) a meteorological data log identifying pictures as to time and picture quality; (3) orbital data; and (4) a daily example of the photographic data acquired. A separate section contains the ATS-1 spin scan cloud camera data user's guide which describes the ATS-1 system and offers an explanation of the data acquisition, categorization, cataloging and archiving processes. A computerized data service, based on the categorization scheme is also described. D.L.G.

c20 080000 04

N71-11602*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA GUIDE

[1969] 358 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66467) Avail: NTIS CSCL 04B

The ATS-3 system is discussed including the spacecraft, experiments, spacecraft orbit, spacecraft attitude effects, and data acquisition. Descriptions of the multicolor spin scan cloud camera system and the image dissector camera system are given covering the cameras, their operation, meteorological data acquisition, magnetic tape recording, data documentation and processing, time determination, and attitude effects. Meteorological data catalogs for the ATS-3 and ATS-1 satellites are summarized including orbital data and MSSCC, SSCC, and IDCS tape listings. The ATS-2 is also mentioned. J.M.

c20 080000 05

N71-11603*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 3, 1 FEBRUARY-31 DECEMBER 1968

Mar. 1969 601 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66468) Avail: NTIS HC $10.00/MF $0.65 CSCL 04B

The third volume, in a series of catalogs published to document the meteorological data acquired from the Applications Technology Satellites is presented. Part 1, of the catalog documents data from ATS-1 stationed over or near 151 deg W longitude; Part 2, documents data from ATS-3 stationed at a number of positions between 95.1 deg W longitude and 44.5 deg W longitude. Comments on satellite operation, meteorological data acquisition, and documentation and archival are provided, also a list of the orbital elements. The meteorological data acquired and comments on photographic quality and meteorological and geomorphological content are tabulated, and examples of the cloud photographs are included opposite the daily data listing. In addition, analog and/or digital tapes which are on file are reported. Author

c20 080000 06

N71-11604*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 4, 1 JANUARY-31 JULY 1969

Dec. 1969 588 p Prepared by Allied Res. Assoc., Inc.
(Contract NAS5-10343)
(NASA-TM-X-66469) Avail: NTIS HC $10.00/MF $0.65 CSCL 04B

Data acquired from ATS-1 and ATS-3 are given. The material is presented in four sections that include: (1) comments on satellite operation, data acquisition, documentation, and archiving; (2) lists of the orbital elements; (3) tabulations of the meteorological data, comments on photographic quality, and examples of the photographs; and (4) a listing of the analog and/or digital tapes which are on file. D.L.G.

c20 080000 07

N71-11613*# Wisconsin Univ., Madison. Space Science and Engineering Center.

METEOROLOGICAL MEASUREMENTS FROM SATELLITE PLATFORMS Annual Scientific Report, 1968-1969

Verner E. Suomi and Thomas H. Vonder Haar Aug. 1970 383 p refs
(Contract NAS5-11542)
(NASA-CR-111369) Avail: NTIS CSCL 04B

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3. CONVECTIVE HEAT TRANSPORT OVER THE TROPICAL MID-PACIFIC AS ESTIMATED FROM A GEOSYNCHRONOUS SATELLITE ALTITUDE D. N. Sikdar p 77-160 refs (See N71-11616 02-20)
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9. A STUDY OF THE INDIAN MONSOON USING SATELLITE MEASURED ALBEDO AND LONG WAVE RADIATION p 255-281 refs (See N71-11622 02-20)
10. SIMULATION AND ANALYSIS OF MICROWAVE PROPAGATION BETWEEN OCCULATION SATELLITES D. H. Sargeant p 283-345 refs (See N71-11623 02-20)
11. BALLOON-BORNE RADIO ALTIMETER N. Levanon p 349-377 refs (See N71-11624 02-14)
12. WOBBLE-SPIN TECHNIQUE FOR SPACECRAFT INVERSION AND EARTH PHOTOGRAPHY N. H. Beachley and J. J. Uicker, Jr. p 379-388 ref (See N71-11625 02-21)

c20 080100 51

N71-11614*# Wisconsin Univ., Madison. Space Science and Engineering Center.

GEOSYNCHRONOUS METEOROLOGICAL SATELLITE

Verner E. Suomi and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 1-7 ref Presented at AIAA 5th Ann. Meeting and Tech. Display, Philadelphia, 21-24 Oct. 1968 Revised *Its* Paper 68-1094 (See N71-11613 02-20)
Avail: NTIS CSCL 22B

The processes involved in taking cloud photographs from ATS 1 and ATS 3, and the quality of the photographs are described. The meteorological applications in general, and those for severe weather watch and quantitative measurements in particular,

are discussed. It is felt that the advantages of the spin scan cloud camera are no optics distortion, equal sensitivity everywhere, wide dynamic range, and contrast limited by scatter in the optics only.
N.E.N.

c20 080100 52

N71-11615*# Wisconsin Univ., Madison.
APPLICATIONS FOR BISPECTRAL RADIANCE MEASUREMENT FROM A SATELLITE
Kirby J. Hanson *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 9–75 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

The use of Rayleigh scattering as a measure of atmospheric parameters from a geostationary satellite is discussed. Two cases are considered: one for clouds with high reflectance, and the other for the ocean surface with low reflectance. Cloud top height and total mass above the sea level surface, or sea level pressure, are determined. It is emphasized that the model did not account for particulates. It is shown that with typical instrument performance parameters, the altitude could be determined to 200 ft and sea level pressure to less than 2 mb, providing a large number of measurements were used. It is essential, in surface pressure determination, that no clouds are in the optical path. Means to optimize the instrument performance parameters are included.
Author

c20 080100 53

N71-11616*# Wisconsin Univ., Madison.
CONVECTIVE HEAT TRANSPORT OVER THE TROPICAL MID-PACIFIC AS ESTIMATED FROM A GEOSYNCHRONOUS SATELLITE ALTITUDE
Dhirendra Nath Sikdar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 77–160 refs (See N71-11613 02-20)
(Grant CWB-WBG-27)
Avail: NTIS CSCL 04B

An objective technique is developed to estimate the mass and energy exchange in a convection system corresponding to congestus and cumulonimbus intensities. The technique involves measuring the area change of the cirrus outflow on a sequence of satellite cloud photographs. The data show that the technique is able to isolate vigorous and moderate convection regimes on the ATS 1 and ATS 3 satellite photographs, and values of mass and energy flux are consistent with ground based measurements. The technique is then applied to a large scale convective mass and energy exchange over the tropical mid-Pacific. The results show that the releases of convection on a mesosynoptic to subsynoptic scale are controlled by the large scale motion field and that the convective heat transport pulsates with an approximate periodicity of five days. In the short range time scale (minutes to one day) on some days intense variations in the daytime convective activities are observed, but these variations seem to have no relation with the diurnal heating cycle. Convective activity occurrence is random in character in the short range time scale but is well organized on a time scale of a few days to a month.
Author

c20 080100 54

N71-11617*# Wisconsin Univ., Madison.
A CENSUS OF CLOUD SYSTEMS IN THE TROPICAL PACIFIC OCEAN
Otto J. Karst *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 161–185 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

As a supporting study to a GARP tropical meteorology experiment a census was made on cloud systems using ATS 1 and ESSA 3 satellite photographs. Organized cloud systems were classified by geometric patterns into an oval, line, wave, or spiral vortex. There are large differences between the northern and southern hemisphere in the level of organization and the frequency of cloud systems. The northcentral Pacific region has a lower level of organization than the two other regions in the northern hemisphere. The study shows that there are high frequencies of waves and vortices for the northeast and northwest tropical Pacific regions during the summer and early fall months. In terms of the frequency of organized cloud systems the northeast region and the northwest region would seem to be about equally suitable for a prospective tropical field experiment.
Author

c20 080100 55

N71-11618*# Wisconsin Univ., Madison.
A CENSUS OF SYNOPTIC SCALE DISTURBANCES OVER THE CENTRAL AND EASTERN PACIFIC DURING MARCH 1967–FEBRUARY 1968
A. Staver, Thomas H. Vonder Haar, R. Cram, and R. DeDecker *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 187–200 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Results of cloud census taking obtained by two people independently reading the same data are presented and compared. Data are given for the tropics and subtropics, and the interchange between hemispheres and between the tropics and subtropics are described. The best regions and seasons for studying different types of weather are indicated. It is felt that census taking leads to a certain amount of ambiguity when different individuals interpret the same satellite cloud photographs, caused mostly by disorganized cloud clusters.
N.E.N.

c20 080100 56

N71-11619*# Wisconsin Univ., Madison.
POSSIBILITIES FOR QUANTITATIVE RADIANCE MEASUREMENTS IN THE 450-650 nm REGION FROM THE ATS-1 SATELLITE
Susan K. Peekna, Robert J. Parent, and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 201–217 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Equations that could be used in the prelaunch calibration of satellite cameras such as that flown on the ATS 1 are developed. Information about applying ATS 1 data is presented, and the procedure for obtaining absolute values of reflected spectral radiance is discussed. The steps required to convert digital count values to the effective radiance of the source as viewed by the camera are described. It is concluded that measurements of the spectral radiance from an area of source radiation can be derived from the ATS 1 observations, and the relationship between these reflected radiance value and the camera voltage output or digital counts is shown. The digitized ATS data must be considered in terms of the following: the camera measures only the effective radiance between 450 and 650 nanometers; the camera has a nonuniform response across its nominal field of view; and the relation between the digital count values and the camera output voltage depends on two gain settings. N.E.N.

c20 . 080100 57

N71-11620*# Wisconsin Univ., Madison.
A STUDY OF CLOUD DISTRIBUTIONS USING REFLECTED RADIANCE MEASUREMENTS FROM THE ATS SATELLITES
Alfred J. Stamm and Thomas H. Vonder Haar *In its* Meteorol. Meas. from Satellite Platforms Aug. 1970 p 219-238 refs (See N71-11613 02-20)
Avail: NTIS CSCL 04B

Reflected radiance measurements from the multicolor spin-scan cloud camera on ATS 3 are used to determine the percentages of selected areas of the earth that are cloudfree. The areas chosen are meteorologically active and represent common cloud patterns. Use of several data unit sizes shows how the observed percent clear area decreases with decreasing saptial resolution of a simulated sensor. Methods of determining a cloud-no cloud threshold are discussed. The change of cloud cover over a period of a few hours is examined. It is found that clouds smaller than the instantaneous field of view are often not recognized as clouds and therefore tend to affect the interpretation of spacecraft camera measurements. The results of this investigation are used to suggest the optimum spatial resolution for radiometrically sounding the atmosphere from a geosynchronous satellite. Author

c20 080100 58

N71-11626*# Wisconsin Univ., Madison.
WOBBLE-SPIN TECHNIQUE FOR SPACECRAFT INVERSION AND EARTH PHOTOGRAPHY
Norman H. Beachley and John J. Uicker, Jr. *In its* Meteorol. Meas. from Satellite Platforms Aug. 1967 p 379-388 ref Revised (See N71-11613 02-20)
Avail: NTIS CSCL 17G

If certain prescribed spacecraft moment of inertia relationships are maintained, a small cylindrical flywheel can be used to tilt a spin stabilized satellite with respect to its fixed angular momentum vector without inducing nutation and without changing the basic spin rate. A camera rigidly attached to such a tilting vehicle will have the same view as a pivoting camera in a satellite whose spin axis is fixed. This technique can be extended, if desired, to turn the satellite upside down, a very useful capability for spin-scan camera satellites using radiation-cooled instruments. The control flywheel, which can be located anyplace in the satellite, must have its axis of rotation perpendicular to the satellite spin axis. The total vehicle must have a cylindrical moment of inertia configuration, with its axis of symmetry also perpendicular to the vehicle spin axis, and parallel to the flywheel's axis of rotation. Author

c21 080100 59

N71-12181# National Environmental Satellite Center, Washington, D.C.
ARCHIVING AND CLIMATOLOGICAL APPLICATIONS OF METEOROLOGICAL SATELLITE DATA
John A. Leese, Arthur L. Booth, and Frederick A. Godshall Jul. 1970 133 p refs Presented at 5th Session of the WMO Comm. for Climatol., Geneva, 20-31 Oct. 1969
(ESSA-TR-NESC-53) Avail: SOD $1.25; NTIS

A working paper is presented for the fifth session of the WMO Commission for Climatology, describes the meteorological satellite program of the United States, the data acquired, the applications of the data to climatology, the procedures for archiving the data, and plans for future meteorological satellites. Author

c20 080000 24

N71-12182# National Environmental Satellite Center, Washington, D.C.
SATELLITE AND SENSORS FLOWN IN ORBIT, APPENDIX A
In Its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 16 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The meteorological satellites launched to date are described. Pertinent factors which determine the type of data acquired from each are given. These include the satellite orbits and the types of sensors used. A significant number of the satellites launched to date were research and development (R&D) rather than operational. The ESSA satellites used in the TIROS Operational Satellite (TOS) system are the only satellites classed as operational. The potential users of meteorological satellite observations for climatological applications need to understand how the data were acquired to assure compatibility with the objectives of their analysis. Pertinent information in sufficient detail to permit the development of borad-scale plans for application of the data to climatology is provided. Author

c20 080000 25

N71-12183# National Environmental Satellite Center, Washington, D.C.
COMPUTER PROCESSING OF SATELLITE CLOUD PICTURES, APPENDIX B
In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 7 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The current data processing procedures of the National Environmental Satellite Center are described. The procedures described include: (1) input data processing, (2) earth location, (3) picture gridding, and (4) picture mapping. F.O.S.

c20 080000 26

N71-12184# National Environmental Satellite Center, Washington, D.C.
CURRENT OPERATIONAL PRODUCTS FROM THE NATIONAL ENVIRONMENTAL SATELLITE CENTER, APPENDIX C
In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 5 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The computer-derived products from the National Environmental Satellite Center are listed. Included are: (1) high resolution mapped video photoprints, (2) weather facsimile mapped video segments, (3) averages and composites, (4) semi-automated products, and (5) manual analysis products. F.O.S.

c20 080000 27

N71-12185# National Environmental Satellite Center, Washington, D.C.
ARCHIVING PROCEDURES AND DOCUMENTATION, APPENDIX D
In its Archiving and Climatological Appl. of Meteorol. Satellite Data Jul. 1970 32 p (See N71-12181 02-20)
Avail: SOD $1.25; NTIS

The archival procedures in use are summarized and satellite data available is listed in sufficient detail for planning climatological applications. The TIROS and ESSA data archiving have been grouped together for convenience. Archiving of ESSA satellite data follows a series of procedures developed sequentially, with the latest method incorporating the best features of the earlier archival procedures. The combination of TIROS and ESSA data archives provide the longest sequence available. The Nimbus and ATS data archives are described. Nimbus data archives provide unique data from this polar-orbiting satellite because the primary purpose of the Nimbus series is to flight-test advanced sensors. Spin-scan camera pictures available from ATS geosynchronous satellites provide unique data because of their frequent observations over the same geographical area. Author

c20 080000 28

N71-12774*# California Univ., La Jolla.
PLASMA CLOUDS IN THE MAGNETOSPHERE
S. E. De Forest and C. E. McLlwain Sep. 1970 56 p
(Grant NGL-05-005-007)
(NASA-CR-111609; UCSD-SP-70-04) Avail: NTIS CSCL 20I

Equatorial observations by the geostationary satellite ATS-5 of the charged particles on auroral lines of force reveal the frequent injection of plasma clouds into the magnetosphere. These intrusions of hot plasma are found to have a one to one correspondence with magnetospheric substorms. The clouds are dispersed by the earth's magnetic and electric fields in a fashion which generates complicated energy structure. Author

c13 111400 07

N71-13174# Wisconsin Univ., Madison. Space Science and Engineering Center.
STUDIES IN ATMOSPHERIC ENERGETICS BASED ON AEROSPACE PROBINGS Annual Report, 1968
Verner E. Suomi Nov. 1969 162 p refs
(Grant ESSA-E-230-68(G))
(PB-192447) Avail: NTIS CSCL 04B

Contents: An objective technique of evaluating mesoscale convective heat transport in the tropics from geosynchronous satellite cloud photographs; A census of cloud systems over the tropical Pacific; A photographic summary of the earth's cloud cover for the year 1967; Meteorological applications of reflected radiance measurements from ATS-1 and ATS-3; Analysis of a stratospheric haze phenomenon photographed on the Gemini 5 spaceflight; Mechanisms of large-scale wave propagation through the tropics; Three-dimensional, numerical solution of the atmospheric deep-convection problem; On the transient behavior of a simple model of convection; Measurements of solar radiation absorption in the tropical atmosphere; Prototype alignment jig for use in registering ATS pictures. USGRDR

c20 080100 29

N71-14419*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Progress Report, 1 Sept. - 30 Nov. 1970
30 Nov. 1970 23 p refs
(Contract NAS5-10392)
(NASA-CR-115779; QPR-5) Avail: NTIS CSCL 03B

The results of a series of simultaneous coordinated measurements of the low energy electrons on both ATS-5 and the low altitude polar orbiting satellite OV1-18 indicate significant spectral differences between the two locations. A detailed examination of the quasi-periodic oscillations of the particle fluxes and magnetic field, as measured on ATS-5 during a Pc-5 micropulsation event has been performed. A comparison with rapid run magnetograms from both northern and southern hemisphere conjugate stations is illustrated. Author

c29 111302 06

N71-14492*# General Electric Co., Schenectady, N.Y. Research and Development Center.
ATS RANGING AND POSITION FIXING EXPERIMENTS Periodic Progress Report, 1 Aug. - 31 Oct. 1970
31 Oct. 1970 25 p refs
(Contract NAS5-11634)
(NASA-CR-115782; S-70-1107) Avail: NTIS CSCL 17G

Ranging tests with the transponders in the North Atlantic are discussed with the successful testing of the VHF SATCOM equipment by two-satellites. The occurrences of ionospheric scintillation during this period are reported. The effects of sea reflection multipath on position fixes determined by range measurements from two satellites were also tested, and the results are summarized in tables. It is concluded that the test results indicate a position fix accuracy of one nautical mile within range distances of 900 nautical miles. F.O.S.

c21 070211 13

N71-14738*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MILLIMETER-WAVE PROPAGATION EXPERIMENTS UTILIZING THE ATS-5 SATELLITE Papers from the Fall 1970 Ursi Meeting
Louis J. Ippolito, comp. Nov. 1970 124 p refs Conf. held in Columbus, Ohio
(NASA-TM-X-65404; X-751; 70-428) Avail: NTIS CSCL 17B

A Millimeter Wave Propagation Experiment was launched aboard the Applications Technology Satellite (ATS-5), on August 12, 1969, and is providing the first propagation measurements from an orbiting satellite in the Ku (12.5 to 18 GHz) and Ka (25.5 to 40 GHz) frequency bands. The prime objective of this experiment is to provide sufficient information on the propagation characteristics of the earth's atmosphere so that this relatively unexplored and unused portion of the electromagnetic spectrum can be most effectively utilized for communications and data handling applications. The ATS-5 Millimeter Wave Experiment is providing amplitude and phase measurements on two independent test links at 15.3 GHz (satellite-to-earth) and at 31.65 GHz (earth-to-satellite) during measured and defined meteorological conditions. Several stations in the continental U.S. and Canada have been operating with the satellite transmission since October 1969. The overall experiment configuration and present data results from the first 10 months of measurements are briefly described. Author

c07 070300 27

N71-14801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PERFORMANCE OF ATS SPIN-SCAN CLOUDCOVER CAMERA (SSCC) EQUIPMENT AT MOJAVE GROUND STATION. ATS PROJECT

Oct. 1970 74 p refs

(NASA-TM-X-65401; X-460-70-386) Avail: NTIS CSCL 14E

Results are presented of an evaluation of spin-scan cloudcover equipment used for the ATS-1 at the Mojave, California, ground data acquisition station. The equipment investigated included the phase-lock loop, the video subsystem, the photofacsimile subsystem, and the digital recording sub-system. Author

c14 080105 01

N71-14994# Hawaii Univ., Honolulu. Radioscience Lab.

ATLAS OF TOTAL ELECTRON CONTENT PLOTS. VOLUME 5: 1 JANUARY–31 DECEMBER 1969

Paul C. Yuen and Thomas H. Roelofs [1970] 384 p refs

(Grants NSF GP-5404; NSF GA-1113; and NSF GA-17330) Avail: Issuing Activity

This is Volume 5 of a series of volumes containing diurnal plots of total electron content versus time obtained at Hawaii by measuring the Faraday rotation of the polarization of VHF telemetry carrier transmissions from the geostationary satellites Syncom-3 and ATS-1. Volume 1 contains total electron content data for the period September 1, 1964 through December 31, 1965 as well as a brief description of the instrumentation and data reduction method. Volumes 2, 3, and 4 contain content data for the calendar years 1966, 1967, and 1968, respectively. The diurnal plots contained in this volume have missing data. These have been caused by interruptions in satellite transmissions, breakdowns of our equipment, interference, and other factors. It should be noted that the data are plotted in Hawaiian Standard Time and that if results are needed for the local mean time at the sub-ionospheric point for either satellite-to-Hawaii path, then the proper time correction must be made. For Volumes 1, 2, 3, and 4, see N68-88516, N69-73945, N69-77463, and N70-32578, respectively. Author

c13 100500 77

N71-15934# Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.

METEOROLOGICAL DATA. VOLUME 73, NO. 1: INTERPRETATION OF SATELLITE PHOTOGRAPHS OF THE EARTH'S SURFACE [METEOROLOGISCHE ABHANDLUNGEN. BAND 73, HEFT 1: DIE INTERPRETATION VON SATELLITENAUFNAHMEN DAS BILD DER ERDOBERFLAECHE]

Ingrid Haupt 1970 327 p refs In GERMAN; ENGLISH summary

Avail: Issuing Activity

The pictures chosen were mainly supplied by the weather satellites of the TIROS, NIMBUS, and ESSA series. In special cases and for purposes of comparison, pictures taken during manned space flights in the Gemini program and those taken by the Applications Technology Satellites (ATS) have been referred to as well. Pictures are used which show little or no clouding. Some examples show that orographical conditions such as islands distinguish themselves by means of meteorological phenomena. Techniques are presented for quick localization and interpretation of the pictures. A comprehensive collection of single pictures and a detailed description of the shape and nature of the surface as well as the relations of the vegetation in the European, Asian and African sphere are given. The duration and extent of snow and ice conditions are indicated to clarify the difficult distinction between snow, ice, and clouds. Author

c20 080000 21

N71-16226# Advisory Group for Aerospace Research and Development, Paris (France).

APPLICATION OF PROPAGATION DATA TO VHF SATELLITE COMMUNICATION AND NAVIGATION SYSTEMS Material Assembled to Support a Lecture Series

Nov. 1970 176 p refs Lectures Presented in Eindhoven, Neth. and Ottawa, Jun. Jul. 1970; sponsored by AGARD Electromagnetic Wave Propagation Panel and the Consultant and Exchange Programme

(AGARD-LS-41) Avail: NTIS

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3. THE FORMATION OF IONOSPHERIC IRREGULARITIES P. A. Forsyth (Western Ontario Univ.) 6 p refs (See N71-16229 06-13)
4. AMPLITUDE, PHASE AND ANGLE-OF-ARRIVAL FLUCTUATIONS P. A. Forsyth (Western Onterio Univ.) 7 p refs (See N71-16230 06-07)
5. LOW ANGLE FLUCTUATION G. Hartmann (Max-Planck-Inst. fuer Aeronomie, Lindau ueber Northeim, W.Ger.) 12 p refs (See N71-16231 06-07)
6. WORLD WIDE MORPHOLOGY OF SCINTILLATIONS J. Aarons, H. E. Whitney, and R. S. Allen (AFCRL, Bedford, Mass.) 23 p refs (See N71-16232 06-07)
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8. EFFECTS OF HORIZONTAL GRADIENTS AND FURTHER CONSIDERATIONS OF TOTAL ELECTRON CONTENT MEASUREMENTS L. Kersley (Univ. Coll. of Wales) 7 p refs (See N71-16234 06-13)

9. WORLD WIDE MORPHOLOGY OF TOTAL ELECTRON CONTENT J. A. Klobuchar (AFCRL, Bedford, Mass.) 21 p refs (See N71-16235 06-07)

10. IONOSPHERIC MULTIPATH M. D. Grossi (Raytheon Co., Burlington, Mass.) 31 p refs (See N71-16236 06-07)

11. GUIDED PROPAGATION OF RADIO WAVES IN THE IONOSPHERE M. D. Grossi (Raytheon Co., Burlington, Mass.) 24 p refs (See N71-16237 06-07)

12. EXPERIMENTAL RESULTS P. F. Checcacci (Florence Univ.) 4 p refs (See N71-16238 06-07)

c07 100500 83

N71-16227# Air Force Cambridge Research Labs., Bedford, Mass.
INTRODUCTION TO VHF SATELLITE NAVIGATION AND COMMUNICATIONS SYSTEMS
John A. Klobuchar *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 4 p refs (See N71-16226 06-07)
Avail: NTIS

Proposed VHF satellite navigation and communications systems are briefly described. In addition, results of tests carried out at VHF, using the NASA Applications Technology Satellites are mentioned. Author

c07 070200 27

N71-16228# Air Force Cambridge Research Labs., Bedford Mass.
IONOSPHERIC LIMITATIONS ON PERFORMANCE ON VHF NAVIGATION AND COMMUNICATION SATELLITE SYSTEMS
Jules Aarons *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 10 p refs (See N71-16226 06-07)
Avail: NTIS

Effects on radio signals traversing the atmosphere are summarized. They include absorption, simple refraction, scintillation, group and phase path delay and Farraday rotation. Absorption, refraction and scintillation have both lower and upper atmosphere components. At low angles of elevation the lower atmosphere attenuates the signal to a minor extent, refracts it downward, and produces considerable amplitude fluctuation. At higher elevation angles, the ionosphere is the major contributor to atmospheric problems for VHF-UHF satellite beacon transmissions. Author

c07 100500 84

N71-16232# Air Force Cambridge Research Labs., Bedford, Mass.
WORLD WIDE MORPHOLOGY OF SCINTILLATIONS
Jules Aarons, Herbert E. Whitney, and Richard S. Allen *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 23 p refs (See N71-16226 06-07)
Avail: NTIS

The irregularity properties of the F layer of the ionosphere at various latitudes are discussed. In a fine scale theoretical development of scintillation mechanisms the propagation angle relative to the earth's field must be considered. The dominant factors in the morphology of the irregularity structure are geophysical, i.e. the geomagnetic coordinates of the site and the magnetic variations. Author

c07 100500 87

N71-16235# Air Force Cambridge Research Labs., Bedford, Mass.
WORLD WIDE MORPHOLOGY OF TOTAL ELECTRON CONTENT
John A. Klobuchar *In* AGARD Appl. of Propagation Data to VHF Satellite Commun. and Navigation Systems Nov. 1970 21 p refs (See N71-16226 06-07)
Avail: NTIS

A plot of time delay versus ionospheric total electron content (TEC) is given. It may be that for operational requirements of particular systems, at the times of high TEC values, corrections to ranging systems data will have to be made for the additional ionospheric time delay. The purpose is to give a picture of the world wide behavior of TEC, and to review the data available for time delay predictions on a world wide basis. Results of some data, taken on both sides of the North Atlantic Ocean, are presented to illustrate corrections that can be made with existing data. Author

c07 100500 88

N71-16447*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETER (VLBI) EXPERIMENTS USING ATS-3 AND ATS-5 SATELLITES
J. Ramasastry, P. E. Schmid, Jr., and B. Rosenbaum Nov. 1970 33 p refs Submitted for publication
(NASA-TM-X-65428; X-551-70-432) Avail: NTIS CSCL 14B

A proposal is presented for making Very Long Base Line Interferometer (VLBI) measurements at L-band and C-band frequencies using the ATS-5 and ATS-3 satellites, respectively. The proposed experiments will be performed jointly between GSFC and the Smithsonian Astrophysical Observatory. The specific objective of the proposed experiments is to evaluate the usefulness of the VLBI System as a high precision tracking technique. The system is envisioned not only as a potential tracking technique but also as a technique for the study of station location, polar-motion, continental drift and other geodetic problems. Author

c14 070103 03

N71-17771*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
COMMUNICATIONS SATELLITE HANDBOOK: A BRIEF REFERENCE TO CURRENT PROGRAMS, REVISION 3
Jul. 1970 66 p
(NASA-TM-X-66711) Avail: NTIS CSCL 22B

The configurations and performance of various communications satellites are presented. Satellites discussed are: (1) Intelsat 1 (Early Bird), (2) Intelsat 2, (3) Intelsat 3, (4) Intelsat 4, (5) Applications Technology Satellites, (6) Tracking and Data Relay Satellites, (7) Defense Communication Satellites, and (8) Tactical Satellite Communications Program. Author

c31 010000 31

N71-17884# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LOW-ENERGY PROTON DAMAGE TO SILICON SOLAR CELLS Technical Report, Jan. 1969 – Jan. 1970
Edwin J. Stofel and David E. Joslin 15 Oct. 1970 40 p refs
(Contract F04701-70-C-0059)
(AD-715261; TR-0059(6250-20)-8; SAMSO-TR-70-407) Avail: NTIS CSCL 10/2

The effect of low-energy (<2 MeV) proton irradiation upon the junction properties of silicon solar cells has been measured. These measurements are used to explain the large power loss observed on the ATS-1 and Intelsat II-4 satellites. Author (GRA)

c03 110100 18

N71-18453# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL TRANSACTIONS, VOLUME 73, NO 1. THE INTERPRETATION OF SATELLITE PICTURES: THE PICTURE OF THE SURFACE OF THE EARTH [METEOROLOGISCHE ABHANDLUNGEN, BAND 73, HEFT 1: DIE INTERPRETATION VON SATELLITENAUFNAHMEN: DAS BILD DER ERDOBERFLAECHE]
Ingrid Haupt 1970 334 p refs In GERMAN; ENGLISH summary Original contains Color Illustrations
Avail: NTIS HC$6.00/MF$0.95

The basis is given for an interpretation of satellite pictures of Europe, Asia, and Africa., taken by the Tiros, Nimbus, and Essa weather satellites. In special cases and for purposes of comparison, pictures taken during Gemini space flights and those taken by the Applications Technology Satellite (ATS) are referred to. ESRO

c20 080000 21

N71-18502*# Stanford Univ., Calif. Radioscience Lab.
A STUDY OF POLAR SUBSTORM RELATED TRAVELING IONOSPHERIC DISTURBANCES BASED ON COLUMNAR ELECTRON CONTENT MEASUREMENTS
Michael J. Davis Aug 1970 147 p refs
(Contract NAS5-10102; Grant NGR-05-020-001)
(NASA-CR-116784; SU-SEL-70-051; TR-12) Avail: NTIS CSCL 04A

The disturbances exhibit a diurnal variation in their direction of arrival at a midlatitude observing site, explained by an average source location in the evening sector of the auroral oval. It is possible to relate their occurance to the occurance of polar substorms and to determine the location of the source of individual disturbances. These disturbances are not generally observed to travel across the equator, explained on the basis of the high rate of damping of the disturbances in the neutral atmosphere which produce them. A possible source related to the westward traveling surges observed in auroras is discussed. Numerical results are obtained for the height range 200 to 600 km. considered. The effects of perturbations in loss and diffusion is shown to produce considerable changes in the perturbation in the ionization caused by internal atmospheric gravity waves; in particular, it results in a large depression of the perturbed electron concentration at high levels. The effect of atmospheric gravity waves on electron content is also considered. Author

c13 100500 79

N71-18534# Air Force Cambridge Research Labs., Bedford, Mass.
A SURVEY OF SCINTILLATION DATA AND IT'S RELATIONSHIP TO SATELLITE COMMUNICATIONS
Jules Aarons Jan. 1970 119 p refs
(AD-715891; AFCRL-70-0053; AFCRL-SR-106) Avail: NTIS CSCL 17/2

In order to provide a state-of-the art survey of amplitude fluctuations produced by irregularities at F-layer heights in the ionosphere, a survey and review of scintillation phenomena was produced. The survey starts with a definition of scintillation index and a means of characterizing the effect of the amplitude fluctuations on transmissions from a satellite beacon. Various mechanisms proposed for the origin of the irregularity structure are reviewed in light of the observations. The translation of the geophysical information into engineering terms is made so that both depth of fade as a function of latitude and fading rate can be determined. These in turn are used to determine percentage of time scintillations. Characteristics of scintillation dictate modulation systems to be specified for communication and navigation systems employing synchronous satellite beacons at VHF and UHF. Specific problems are addressed. These include low angle or tropospheric scintillations, polar observations, and equatorial irregularities. Variations of scintillation index with magnetic latitude areas are given. Another atmospheric effect on satellite transmissions is discussed in the final chapter, that is, propagation delays of VHF waves produced by the time delay of radio waves traversing the ionosphere. Author (GRA)

c07 100500 55

N71-18672# Wisconsin Univ., Madison. Space Science and Engineering Center.
A PILOT STUDY ON THE APPLICATION OF GEOSYNCHRONOUS METEOROLOGICAL SATELLITE DATA TO VERY SHORT RANGE TERMINAL FORECASTING Final Report, 1 Apr. – 31 Aug. 1970
Thomas H. Vonder Waar and Richard S. Cram 30 Sep. 1970 118 p refs
(Contract F19628-70-C-0207)
(AD-715921; AFCRL-70-0493) Avail: NTIS CSCL 4/2

The study assembles a unified body of data consisting of very high space and time resolution reflected radiance measurements from a geosynchronous satellite (ATS-3) along with concurrent meteorological radar, ceiling, visibility and surface pressure reports at selected air terminals in the central United States. This data set allows familiarization with the meteorological potential of nearly continuous observation of cloud conditions from a geosynchronous platform. It may also serve as initial input to quantitative techniques for evaluating the satellite data and/or for testing its usefulness in very short range weather forecasting. In this regard, a second portion of the study presents arrays of statistical descriptors of the satellite data. Author (GRA)

c20 080100 60

N71-19082*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GENERAL COMPUTER DATA PROCESSING SYSTEM: DOCUMENTATION OF THE ATS-5 GROUND STATION MAGNETOMETER PROGRAM
H. J. Gillis Nov. 1970 100 p
(NASA-TM-X-65457; X-645-70-458) Avail. NTIS CSCL 09B

A computer program capable of transforming and displaying specific time-dependent data recorded on an indefinitely large number of tape reels is discussed. The general data operations, the type of data processing accomplished, and the data source and tape format are described. The subroutines and their functions are itemized, and the program logic is explained. The various display outputs are illustrated. A concept-level plain language flow chart and a commented listing of the production program are presented. It is felt that the data operations accomplished by the system are of sufficiently general application that the system could be used to process other types of data with little modification. Author

c08 100600 03

N71-21409# Advisory Group for Aerospace Research and Development, Paris (France).

TROPOSPHERIC RADIO WAVE PROPAGATION, PART 1 Conference Proceedings

H. J. Albrecht, ed. Feb. 1971 309 p refs Mostly in ENGLISH; partly in FRENCH AGARD Avionics Panel 16th Tech. Symp. held in Dusseldorf, 31 Aug.-4 Sept. 1970

(AGARD-CP-70-71-Pt-1) Avail: NTIS

Electromagnetic wave propagation through the troposphere is analyzed for the effects of tropospheric characteristics on wave refelection and refraction, scatter propagation, and propagation vediction methods. For individual titles, see N71-21410 through N71-21433.

c07 070300 29

N71-21418# Texas Univ., Austin. Electrical Engineering Research Lab.

COMPARISON OF 15 GHz PROPAGATION DATA FROM THE ATS 5 SATELLITE WITH GROUND BASED RADIO AND METEOROLOGICAL DATA

A. W. Straiton and B. M. Fannin *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 10 p refs (See N71-21409 10-07)

Avail: NTIS

15 GHz signals transmitted from the ATS-5 satellite and related ground based observations are discussed. The purpose of the experiments is to determine the reliability and predictability of communication from space at frequencies higher than presently used. The ATS-5 satellite was put in synchronous orbit at 108 deg West longitude. Failure in one of the positioning jets prevented stabilization with a resulting rotation 76 cycles per minute. However, it was possible to determine significant information on the transmission characteristics of the atmosphere. Various ancillary data were taken including wind speed and direction, temperature, rain rate and distribution, sky temperature and surface radio wave attenuation. Author

c07 070300 30

N71-21419# Communications Research Centre, Ottawa (Ontario).

MICROWAVE ATTENUATION MEASUREMENTS USING THE ATS 5 SATELLITE

J. I. Strickland and J. W. B. Day *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 7 p refs (See N71-21409 10-07)

Avail: NTIS

The attenuation by precipitation a 15.3 GHz signal is being measured for slant paths of 30 degrees elevation angle using the beacon transmissions of the ATS-5 satellite. The sky temperature at 15.3 GHz along the propagation path is measured simultaneously with a total power radiometer. Predicted attenuations are calculated from measured values of the sky temperature. Backscatter of radiation of 2.9 GHA GHz is measured with a collocated S-band radar. Values of mean radar reflectivity are calculated and path attenuations at 15.3 GHz derived. Generally good agreement between radiometer predicted, radar predicted, and directly measured attenuations is obtained. Author

c07 070300 31

N71-21420# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung Weltraumphysik.

INFLUENCE OF THE TROPOSPHERE ON LOW INCIDENT SATELLITE SIGNALS IN THE RANGE OF WAVELENGTH 15 TO 2 m

G. K. Hartmann *In* AGARD Tropospheric Radio Wave Propagation, Pt. 1 Feb. 1971 11 p (See N71-21409 10-07)

Avail: NTIS

The amplitude of radio signals from the beacon satellite Explorer 22 has been recorded since November 1964 for the purpose of obtaining the ionospheric electron content from the Faraday effect. On a considerable number of occasions when the satellite was at low elevation angles, sudden increases in signal amplitude were observed. Detailed investigations show that these enhancements are the results of diffractions of the radio waves by structuers within the troposphere. These effects were observed on 20 MHz, 40 MHz, 41 MHz and 136 MHz. Detailed investigations of Explorer 22 records from 1965-1968 revealed that about 6% of all recordings showed these tropospheric effects. Very recent observations with signals from the geostationary satellite ATS 3 on 137.350 MHz and 412.05 MHz clearly demonstrated that similar effects were detectable. Author

c07 100500 100

N71-21727# General Electric Co., Philadelphia, Pa. Missile and Space Div.

PROGRESS AND GOALS FOR AERONAUTICAL APPLICATIONS OF SPACE TECHNOLOGY

Daniel J. Fink and Roy E. Anderson [1970] 9 p Presented at EUROSPACE (4th US-European Conf.), Venice, 25 Sep. 1970

(PIB-A-57) Avail: Issuing Activity

Current and projected technological applications are briefly described, using VHF satellite communication as an example. Ranging experiments with ATS 1 and ATS 3 satellites are explained and illustrated with lattitude determinations of Gander, Newfoundland, and position fixing for an aircraft over the North Atlantic. The quality of voice communication is compared for HF with no satellite link, ground to ground with ATS 3 satellite link, aircraft to ground via ATS 3 link, and ship to land with ATS 3 link. It is recommended that a comparison should be made of the performances of HF and VHF for transoceanic communications, the VHF satellite performance should be weighed against cost, and the L-band technology should be developed. N.E.N.

c30 070211 12

N71-24913*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 1540 TO 1660 MHz PROPAGATION BETWEEN GEOSTATIONARY SATELLITES AND AIRCRAFT Summary Report
C. E. Wernlein (Westinghouse Elec. Corp., Baltimore, Md.) Nov. 1970 50 p refs
(NASA-TM-X-65508; X-490-71-72) Avail: NTIS CSCL 17I
The propagation and system factors influencing the validity of an L band communication system between geostationary satellites and aircraft terminals, are discussed. Also discussed are the effects of ionospheric and tropospheric absorption, scintillation, range bias, Faraday rotation, earth reflected multipath, and system noise.
E.H.W.

c07 070700 08

N71-24914*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSORPTION EFFECT ON VHF PROPAGATION BETWEEN SYNCHRONOUS SATELLITE AND AIRCRAFT Summary Report
Edward J. Mueller (Westinghouse Elec. Corp., Baltimore, Md.) Dec. 1970 50 p refs
(NASA-TM-X-65507; X-490-71-44) Avail: NTIS CSCL 17B
Ionospheric and tropospheric absorption, in terms of geographical contour, are discussed for the very high frequencies in an aeronautical satellite system. The North Atlantic region was chosen as the test area. The system comprises two geostationary satellites. Conclusions indicate no allowances need be made for tropospheric absorption, but that auroral and ionospheric absorption should be considered in North Atlantic design. Results also show that aeronautical routing, operational procedures, and telecommunications systems design must be considered. E.H.W.

c07 100500 94

N71-25025*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL RESULTS OF SIMULTANEOUS MEASUREMENT OF INOSPHERIC AMPLITUDE VARIATIONS OF 136 MHz and 1550 MHz SIGNALS AT THE GEOMAGNETIC EQUATOR
E. E. Crampton, Jr. (Westinghouse Elec. Corp.) and W. B. Sessions (Westinghouse Elec. Corp.) 7 Jan. 1971 35 p refs
(NASA-TM-X-65505; X-490-71-54) Avail: NTIS CSCL 03B
Data was collected on VHF and L-Band scintillation fading characteristics in the equatorial regions as part of a continuing experiment. The satellite communication system designer is provided this technical data to determine optimum spectrum bands and fade margins required for desired system reliabilities. The data retrieval technique utilized was the manual reduction of infor ation from strip chart recordings. Automated data programs a. e also being developed to extract the statistical characteristics from the received data.
Author

c29 100500 97

N71-25082*# Lockheed Missiles and Space Co., Palo Alto, Calif. Space Sciences Lab.
LOCKHEED EXPERIMENT ON ATS-5 Quarterly Progress Report, 1 Dec. 1970 28 Feb. 1971
8 Mar. 1971 60 p refs
(Contract NAS5-10392)
(NASA-CR-118319; QPR-6) Avail: NTIS CSCL 03B
The experiment on ATS-5 continues to monitor the low energy particle environment at the synchronous altitude. The average properties of this environment are studied on a statistical basis, and systematic dependences on local time and magnetic activity are discussed. A study of coordinated ATS-5 and OV1-18 particle measurements has provided evidence for an auroral electron acceleration mechanism operating between synchronous altitude and the ionosphere.
Author

c13 111302 07

N71-25123# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GLOBAL PHOTOGRAPHY OF THE EARTH AND POSSIBILITIES FOR INTERPRETING ITS DATA
B. V. Vinogradov et al 10 Nov. 1970 22 p refs Transl. into ENGLISH from the Russian
(AD-719781; FTD-HT-23-505-70) Avail: NTIS CSCL 8/2
The global photographs obtained from high-orbiting satellites Molniya, ATS, and spaceships Zond and Apollo represent super-small-scale space photographs or televised images of the Earth. Methods of using them for obtaining both global and area information on the natural complexes of the Earths surface - the geographical zones and topography are discussed.
Author (GRA)

c13 080100 70

N71-25256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN SCIENCE AND TECHNOLOGY AT GODDARD SPACE FLIGHT CENTER, 1969
Washington 1970 376 p Proc. of a Symp. held at Greenbelt, Md., 3-4 Dec. 1969 Original contains color illustrations
(NASA-SP-251) Avail: NTIS HC$6.00/MF$0.95 CSCL 04A
Accomplishments in space science and technology for the year 1969 are reviewed. Topics include satellite sensing and tracking systems, spaceborne observations of planetary atmospheres, and theoretical and experimental evaluations of spacecraft equipment. For individual titles, see N71-25257 through N71-25341.

c34 000000 07

N71-25311*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS FROM THE ATS 3 REFLECTOMETER EXPERIMENT
James B. Heaney *In its* Significant Accomplishments in Sci. and Technol. at Goddard Space Flight Center 1970 p 238-240 (See N71-25256 13-34)
Avail: NTIS HC$6.00/MF$0.95 CSCL 04A
Highly reflective specular materials having aluminum or silver surfaces either uncoated or protectively coated together with Alzak, the material that comprises the outer shell of the OAO spacecraft, were evaluated. Coating samples were thermally insulated from their surroundings and their surface reflectances relative to a standard surface were monitored periodically by ATS 3 reflectometer. Spectral variations in the degradation processes and

identifications of damage causes and mechanisms were observed. Alzak data confirmed laboratory tests that proved this material to be potentially unstable; solar absorptance of unshielded samples increased from initially 15% to 26% after 2000 hours of solar exposure in orbit. Results demonstrated that dielectric film coated aluminum produces a thermal control surface comparable to white paint but of better stability. G.G.

c29 100300 04

N71-25340*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ELECTRON BEAM RECORDER FOR SPACE APPLICATIONS DATA
Harvey Ostrow *In its* Significant Accomplishments in Sci. and Technol. at Goddard Space Flight Center 1970 p 350 353 (See N71-25256 13-34)
Avail: NTIS HC$6.00/MF$0.95 CSCL 14B

The performance characteristics of an electron beam recorder for the ATS spin-scan camera system are reported. The system uses electron strikes on silver-halide photographic material to produce a latent image that is subsequently developed by usual film processing techniques. Resolutions of 4000 TV lines at 90% response and 8000 TV lines at 70% response have been measured on a 70-mm format recording; this represents a limiting resolution of more than 16,000 TV lines. Scan linearity of better than 0.2% in both directions and a dynamic range of 200:1 have been achieved and recorded densities of up to 3.0 provide more than 20 shades of gray. G.G.

c14 080100 73

N71-25424*# Wisconsin Univ., Madison. Space Science and Engineering Center.
BALLOON-BORNE RADIO ALTIMETER AND SATELLITE METEOROLOGICAL DATA APPLICATIONS Quarterly Report, 1 Sep. - 31 Dec. 1970
V. E. Suomi 1970 12 p refs
(Contract NAS5-11542)
(NASA-CR-118337) Avail: NTIS CSCL 04B

The research for the period September 1 to December 31, 1970 is reported. Major reporting areas include: (1) miniaturizing the balloon borne radio altimeter, (2) correlating the cloud brightness with meso to subsynoptic scale rainfall intensity and amount in the mid-latitude as well as in the tropical disturbance regime, (3) the feasibility of an inexpensive real-time communication of ATS enhanced pictures to data sparse remote places in the tropics, (4) some applications of satellite data on the study of atmospheric dynamics, and (5) a feasibility study on the ATS time domain data access systems. Author

c20 080000 30

N71-25782*# National Aeronautics and Space Administration, Washington, D.C.
WEATHER IN MOTION
1970 8 p
(NASA-EP-79) Avail: SOD $0.50; NTIS CSCL 04B

Meteorological satellites and cloud photography are summarized briefly. The ATS 3 satellite and it's camera are described including the photographic, display and picture formation of earth shadow; cloud formation, decay, and motion; and sun glitter. The meteorological benefits from the use of earth synchronous satellites are outlined including severe storm detection, remote sensing of atmospheric winds, and global measurements. J.M.

c20 080100 72

N71-25965*# Electro-Optical Systems, Inc., Pasadena, Calif.
REFLECTOMETER EXPERIMENT FOR APPLICATION TECHNOLOGY SATELLITE, PHASE 2 Final Report
1 Jan. 1971 185 p refs
(Contract NAS5-9669)
(NASA-CR-118632; Rept-7003-Final) Avail: NTIS CSCL 22A

The reflectometer instrument, the measurement techniques involved in determining the sample degradation, and reduced flight data obtained during the period of operation are described. Reflective surface degradation data gathered from 18 test samples flown on the Applications Technology Satellite (ATS-3) are presented. The reflectometer instrument measured specular sample reflectivity in four spectral bands plus one broadband. The measurements covered a spectral range of 0.3 to 3 microns. The primary objective of this instrument was to test, in actual space environment, the durability of selected specularly reflective surface materials in order to obtain directly applicable data for use in equipment design. A secondary aim of the experiment was to obtain data of scientific value relating to the degradation process. Author

c30 100300 05

N71-26621*# Allied Research Associates, Inc., Concord, Mass.
THE APPLICATIONS TECHNOLOGY SATELLITES METEOROLOGICAL DATA CATALOG, VOLUME 5 Final Catalog, 1 Aug. 1969 - 25 May 1970
Oct. 1970 462 p refs
(Contract NAS5-10343; Proj. ATS)
(NASA-CR-118653) Avail: NTIS CSCL 04B

Meteorological data obtained from ATS-3 are cataloged. The material is presented in separate sections that include: (1) data applications examples, (2) orbital data, (3) Multicolor Spin Scan Cloud Camera (MSSCC) meteorological data, and (4) MSSCC tape listings. In addition, a 28 month summary of ATS-1 operations is given. D.L.G.

c20 080000 08

N71-26713*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
ATS RANGING AND POSITION FIXING EXPERIMENTS Progress Report, 1 Nov. 1970 - 31 Jan. 1971
31 Jan. 1971 25 p refs
(Contract NAS5-11634)
(NASA-CR-118648; S-71-1024) Avail: NTIS CSCL 17G

Ranging tests were conducted using transponders at Shannon, Ireland; Reykjavik, Iceland; Gander, Newfoundland; Buenos Aires, Argentina; and Seattle, Washington. The effects of sea reflection multipath and the ability to track two aircraft relative to each other were investigated by comparing two-satellite position fixes with precision radar fixes for two aircraft flying at 5000 and 20,000 feet over the Atlantic Ocean off the coast of New Jersey and over land within range of the EAIR precision radar at Atlantic City. Synoptic measurements of the ionosphere were made at intervals throughout each day of a four-day period using the transponders at Shannon, Gander, Schenectady, and Seattle, and continuously over a 24-hour period with transponders at Gander, Reykjavik, Schenectady, and Thule. Measurements of ranging precision to ATS 1, which is below 2 deg elevation angle, were conducted during sunrise along the ray path in the ionosphere. Synoptic data were collected during four days following a solar flare, and range measurements were made from ATS 3 to Shannon, Gander, Schenectady, and Seattle throughout each day. No effects of the solar flare were apparent. Author

c21 070211 14

N71-28426# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ELECTRON CONTENT MEASUREMENTS AND F REGION MODELING APPLIED TO IONOSPHERIC PARAMETER DETERMINATION
F. L. Smith, III Mar. 1971 63 p refs
(Contract F19628-70-C-0035)
(AD-722042; AFCRL-71-0083; SR-4) Avail: NTIS CSCL 4/1

The theory relating the ionospheric electron content to electromagnetic propagation effects along transionospheric paths is reviewed and measurements of the diurnal variation of the electron content are presented. The possibility of using continuous electron content measurements to determine basic F region parameters, such as ionization and recombination rates, as well as to explain anomalous features of F region behavior is discussed. An appendix contains graphical and numerical presentations of electron content values derived from observations of VHF transmissions from the ATS-I satellite between October 1, 1968 and December 31, 1969. Author (GRA)

c13 100500 103

N71-28593# Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC EFFECTS (POSSIBLY FROM INTERNAL GRAVITY WAVES) UPON TOTAL ELECTRON CONTENT DURING THE SOLAR ECLIPSE OF 7 MARCH 1970
P. R. Arendt Dec. 1970 24 p refs
(AD-721589; ECOM-3376) Avail: NTIS CSCL 4/1

Variations of the total ionospheric electron content are assumed to indicate the motion of eclipse-produced internal atmospheric gravity waves. Variation of the electron content before, during, and after the eclipse of 7 March 1970 was obtained from polarizatent data is better than 2 degrees in polarization or 5 x 10 (to the power of 10) e/sq. cm in content. The maximum possible error of the content-variation measurements using our automatic ATS system is less than plus or minus 6 degrees of polarization or less than plus or minus 1.4 x 10 (to the power of 11) e/sq. cm in electron content. The average period of the content variations was found to be 18 plus or minus 3 minutes. From BEC observations across the predicted wake of the gravity waves, an estimate was made of the wavelength and velocity of the atmospheric undulations and found to be 320 km and 296 m/s, respectively. Author (GRA)

c29 100500 93

N71-28597# Control Data Corp., Minneapolis, Minn. Research Div.
CHARACTERISTICS OF TROPICAL WIND FLOW PATTERNS Final Report, 1 Feb. 1969 - 31 Jan. 1971
D. G. Dartt 15 Feb. 1971 50 p refs
(Contract DAHC04-69-C-0046)
(AD-721365; AROD-7725:3-EN) Avail: NTIS CSCL 4/2

The Final Report consists of three parts: (1) Automated Streamline Analysis Utilizing Optimum Interpolation. (Revised version of paper presented at the WMO Tropical Symposium, Honolulu, 1971, and submitted for publication to Journal of Applied Meteorology.) (2) Appendix to above paper, consisting of examples of automated analysis of streamlines, streamfunctions, divergence and vorticity in the tropics. (3) Feasibility of Objective Wind Analysis Using satellite Cloud Data. This was a preliminary experiment to related digitized ATS-1 cloud brightness to the vorticity and divergence fields of the tropic winds. Author (GRA)

c20 081000 19

N71-28598# Wisconsin Univ., Madison. Space Science Engineering Center.
STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBINGS Annual Report, 1969
Verner E. Suomi Nov. 1970 249 p refs
(Grant ESSA-E-230-68-(G))
(COM-71-00216; NOAA-71020806) Avail: NTIS CSCL 04B

The major portion of the annual report is concerned with theoretical studies of atmospheric dynamics. Such notions as three dimensional convection models, inertial instability, the influence of latitudinal wind shear, Ekman layer convergence, and boundary layer dynamics are discussed. Application of satellite data to cyclone motion and severe local storm is included. An engineering study of real time ATS data processing is also included. Author (GRA)

c20 080100 61

N71-28655# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
AN EASY METHOD OF RECEIVING PICTURE SIGNALS FROM SATELLITES
Hajimu Sakagami, Tadahiko Yoshida, Yasuharu Arima, and Yoshiaki Nakata 19 Feb. 1971 32 p refs Transl. into ENGLISH from Dempa Kenkyujo Kiho (Japan), v. 14, no. 72, 1968 p 357-367
(Contract F19628-68-C-0251)
(AD-722045; EMM-256; Rept-70-3; AFCRL-71-0061; AFCRL-TRANS-88) Avail: NTIS CSCL 17/2

Experiments were carried out to obtain an easy method of receiving picture signals from ESSA4 NIMBUS, and ATS satellites and to determine the quality of apparatus required for the purpose. The experiments involved measurement of the electric field intensity from the satellites and examination of the contrast, resolution, and fineness of the reproduced pictures that were sent back to the earth by the satellites automatic picture transmission system whose signals were carried at a frequency of 136 MHz and modulated to AM-FM by video signals. The signals, received by simple antennas such as the doublet, turnstile or helical antenna and through an FM receiver, were reproduced by a facsimile machine. It was necessary to insert a modulation-increasing circuit between the FM receiver and the facsimile reproducer when the modulation index of the video signals was as low as the NIMBUS signals. Faraday fading, scintillation fading, the environmental effect on the antennas interruption of interference, and external noises were also considered. Author (GRA)

c07 080000 31

N71-29089*# National Aeronautics and Space Administration, Washington, D.C.
MODELS OF THE TRAPPED RADIATION ENVIRONMENT. VOLUME 7: LONG TERM TIME VARIATIONS
1971 62 p refs Presented at Intern. Assoc. of Geomagnetism and Aeronomy Comm. 5 Sci. Session on Models of the Earth's Radiation Environ., Madrid, Sep. 1969
(Contract F04701-69-C-0066)
(NASA-SP-3024) Avail: NTIS CSCL 03B

CONTENTS:

1. THE LOW ALTITUDE RADIATION ENVIRONMENT W. L. Imholf (Lockheed Missiles and Space Co., Palo Alto, Calif.) p 3-21 refs (See N71-29090 16-29)

2. TIME HISTORY OF THE INNER RADIATION ZONE, OCTOBER 1963 - DECEMBER 1968 C. O. Bostrom, D. S. Beall, and J. C. Armstrong (Appl. Phys. Lab.) p 23-35 (See N71-29091 16-29)

3. LONG-TERM BEHAVIOR OF ENERGETIC INNER BELT PROTONS H. H. Heckman (Calif. Univ., Berkeley, Lawrence Radiation Lab.) P. J. Lindstrom (Calif. Univ., Berkeley. Space Sci. Lab.) and G. H. Nakano (Lockheed Missiles and Space Co.) p 37–47 refs (See N71-29092 16-29)

4. THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE G. A. Paulikas and J. B. Blake (Aerospace Corp., El Segundo, Calif.) p 49–67 refs (See N71-29093 16-29)

c29 100500 101

N71-29093*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.

THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE

G. A. Paulikas and J. B. Blake *In* NASA, Washington Models of the Trapped Radiation Environ., Vol. 7 1971 p 49–67 refs
Supported in part by NASA (See N71-29089 16-29)
(Contract F04701-69-C-0066)
Avail: NTIS CSCL 03B

A state-of-knowledge report on the trapped energetic electrons and energetic solar protons observed at the synchronous altitude is presented. Important progress has been made in understanding the behavior of the particle population at this altitude, although large gaps still exist in our knowledge. The increase in knowledge has been exceptionally rapid because of the availability of a large volume of high-quality (nearly continuous) data from ATS 1 and other satellites. Author

c29 100500 102

N71-31784# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Sonderprojekte.

UTILIZATION OF SIMPLE OMNIDIRECTIONAL VHF ANTENNAS ON BOARD OF SHIPS FOR SATELLITE RECEPTION BY ELIMINATING THE MULTIPATH EFFECTS THROUGH A DIVERSITY SYSTEM [VERWENDUNG EINFACHER OMNIDIREKTIONALER UKW-ANTENNEN AUF SCHIFFEN FUER DEN SATELLITENEMPFANG UNTER AUSSCHALTUNG DES MEHRWEGEEFFEKTS MITTELS EINES DIVERSITY-SYSTEMS]

Walter Goebel 1971 75 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-05) Avail: NTIS; DFVLR Porz: 22,40 DM

Further development of the experiments in 1968, carried out on board of the research ship METEOR are reported. The mathematical interrelationship of multipath effects is demonstrated. This knowledge allows a very simple configuration of omnidirectional antennas for fading avoidance by antenna diversity. By inclusion of the reflected beam the limit of usable elevation angles for satellite reception, normally regarded to be 10 deg, is reduced down to the Brewster angle (VHF: 3 deg). Furthermore, margins against multipath-fading may be omitted. However, a satellite with a circularly polarized antenna must be assumed. Improved distance measurements according to tone-ranging method are described. An accuracy of position finding of from 1 to 2 nautical miles seems to be attainable even though ionospheric distance errors exist. A contribution is given to the question, under what conditions satellite and terrestrial communication may exist within the same frequency band without mutual interference. The results are promising. Author (ESRO)

c07 070212 09

N71-32293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SCINTILLATION, POLARIZATION, AND MULTIPATH EFFECTS ON VHF PROPAGATION BETWEEN SYNCHRONOUS SATELLITES AND AIRCRAFT

E. J. Mueller Dec. 1970 45 p refs
(NASA-TM-X-65628; X-490-71-45) Avail: NTIS CSCL 20N

A summary of tropospheric and ionospheric scintillation and multipath data at VHF frequencies of interest for an aeronautical system is presented. The north Atlantic oceanic region is considered. Only the effect of these factors on signal level fluctuations are considered, and without involvement in aeronautical operational procedures or specific aeronautical telecommunications systems designs. Author

c07 100500 95

W ABSTRACTS (W-)

W65-001

APPLICATIONS TECHNOLOGICAL SATELLITE RANGE AND RANGE RATE - DESIGN EVALUATION REPORT

General Dynamics/Electronics

Contract No. NAS 5-9808

Date: 1965

This report contains the results of a design evaluation study of the Applications Technological Satellite Range and Range Rate System (ATSR), which was developed to fulfill the mission tracking requirements of the ATS programs.

The main areas of the design evaluation are Design Summary, System Description, and System Design Analysis.

The Design Summary includes descriptions of the system objectives, system concepts, system operation, a summary of predicted performance, and a simplified functional description.

The System Description consists of descriptions of the seven major subsystems: timing, signal generation, modulation, carrier receiver/demodulator, sidetone tracking and extraction, data, and test simulation.

The System Design Analysis describes ATS mission tracking requirements, modulation and signal level analysis, range rate tone frequency selection, receiver analysis, range rate analysis, and range error analysis.
(240 pages, 91 figures)

c21 060000 01

W65-002

THE APPLICATIONS TECHNOLOGY SATELLITE ENCODER-AN ADVANCED FLEXIBLE FORMAT TELEMETERING UNIT

T. J. Kosco, D. C. Mead, and L. C. Raiff

Hughes Aircraft Company

Contract: NAS 5-3823

Date: July 1, 1965

Presented to: International Space Electronics Symposium, Miami Beach, Florida, Nov. 2, 1965

Published in: The Proceedings of the Symposium

Hughes Aircraft Company developed the Applications Technology Satellite under contract from the NASA Goddard Space Flight Center. The ATS encoder series as prime telemetry for both engineering and experimenter subsystems. The encoder is composed of a PCM unit and a hybrid PFM/PM-FM/PM real-time data subassembly. The PCM is unique in that its multiplexer can be commanded to dwell on a single channel. Additional features of the encoder include use of a junction field effect transistor (FET) multiplexer, a single component multiplexer unloader, an A/D converter with self-calibrate capability and a FET stabilized IRIG channel 12 subcarrier oscillator.
(28 pages, 15 illustrations)

c07 020300 01

W65-003

METEOROLOGICAL EXPERIMENT USING THE OMEGA SYSTEM FOR POSITION LOCATION

G. Hilton, R. Hollenbaugh, C. Laughlin, R. Lavigne

NASA/GSFC, Greenbelt, Maryland

Report No.: X-731-65-416

An Omega Position Location Equipment (OPLE) experiment is proposed which combines the Omega Navigation System, recently developed by the U. S. Navy, with existing satellite technology for the purpose of establishing a basis for the design of a world-wide meteorological platform location and data collection system. This experiment is designed to demonstrate that the position of a large number of free-floating meteorological platforms despersed over the earth can be located, and that weather data can be collected from them synoptically or quasi-synoptically. The simplicity of the Omega System provides confidence that the weight and safety limitations imposed by the Federal Aviation Agency on constant-level balloons can be satisfied.

This proposed experiment is based on overall operational considerations and is not designed to explore the full range of possible applications but rather to prove the feasibility of the basic concepts. However, the proposed experiment provides for expansion of the basic ideas into a highly versatile world-wide system of major importance to the ever increasing needs of meteorologists and oceanographers. In addition, future expansion could include the location and collection of data from super-sonic aircraft, as well as other moving vehicles, to provide a significant contribution toward solving the growing air traffic control problem.

c20,c21 080400 02

W65-004

OMEGA LOCATION AND SATELLITE REPORTING FOR WORLD-WIDE OBSERVATION SYSTEMS

G. E. Hilton, C. R. Laughlin

NASA/GSFC, Greenbelt, Maryland

Presented to: Twelfth Annual East Coast Conference on Aerospace and Navigational Electronics, Oct. 27-29, 1965, Balto., Md.

An earth satellite system is described for collecting position information from the Omega navigational network and sensor data from meteorological balloons, ocean buoys, aircraft, or other moving vehicles. The Omega Navigation System, being implemented by the U. S. Navy, combined with earth satellite technology holds the promise for providing a world-wide observation system of major importance.

System concepts are presented and design parameters are established for both low orbiting and synchronous satellite systems. Specific experiments are discussed which could utilize the NASA Nimbus and Application Technology Satellite (ATS) services. Comsat Corporations synchronous communications satellites and the Weather Bureau's Tiros Operation Satellites (TOS) could provide a basis for operational reporting by 1969 when the entire Omega network will be available.

c20, c21 080400 08

W65-005

GRAVITY GRADIENT STABILIZATION OF SYNCHRONOUS SATELLITES

R. G. Moyer, H. F. Foulke

General Electric Company, Philadelphia, Pa.

Presented to: IEEE 11th Annual East Coast Conference on Aerospace and Navigational Electronics, Oct. 21-23, 1964

This paper presents a broad examination of the problem of passive, three axis stabilization of synchronous altitude earth satellites. Payload weights ranging from 100 to 10,000 lbs. were examined to 1) determine the approximate weight of attitude control equipments required, and 2) to establish the manner in which the weight efficiency factor varies. For this study, a payload packing density of 10 pounds per cubic foot was assumed and the satellites assumed to be spherical. Also, radius and movement of inertia assumed for these typical payloads is given as a function of weight in Figure 1. Designs were based on accuracy objectives of ±3 degrees in pitch and roll and ±10 degrees in yaw.

With the exception of solar pressure torque, the majority of significant disturbance torques on a gravity stabilized satellite decrease with increasing altitude by the same factor as do gravity gradient orientation torques.

To keep errors due to thermal banding of the gravity rods to a minimum, the rod lengths must be kept reasonably short and weights used on the ends of the rods.

Solar activity produces changes in the local magnetic field at synchronous altitude and some variation in effective solar pressure, but these are second order effects on performance of the stabilization system.

Station keeping must be accomplished by a microthrust rocket engine, as any offset of the center of mass from the thrust axis will produce disturbance torques proportional to the thrust level. Generally, the yaw axis, because of its relative weakness, is affected most; but with careful design this error can be held to within ten degrees.

c31 090000 06

W66-001

APPLICATIONS TECHNOLOGY SATELLITE, ATS SYSTEM SUMMARY

Hughes Aircraft Company

SSD 60028R

Contract: NAS 5-3823

February 1966

The Applications Technology Satellite provides a relatively large, adaptable payload capability designed to achieve long life in circular, medium altitude orbits or in the synchronous, equatorial orbit. This summary is a general overall systems document and contains the following categories of information.

Program Summary
Systems Performance Summary and Charts
Launch and Orbit Analysis
Reaction Control Systems
S/S, S/G and M/G Agena Adapters
Thermal Control System
Electric Power System Design
Telemetry and Command System
Communications System
Apogee Motor
Spacecraft Structure and Integration
Ground Support Equipment
Qualification and Acceptance Testing
Quality Control and Reliability
(213 pages, 91 illustrations, 36 tables)

c34 010000 01

W66-002

DETAIL SPECIFICATION FOR ATLAS STANDARD LAUNCH VEHICLE SLV-3 CONVAIR MODEL 69, ADDENDUM XI

J. D. Fitzgerald (Report No. 69-00200C-Add-11)

General Dynamics/Convair

USAF Contract AF 04(695)-710

Distribution: Defense Documentation Center. No foreign distribution without approval of Headquarters, Space Systems Division, Los Angeles Air Force Station, California.

Accession No.: AD-489 307

1 March 1966

The Atlas Standard Launch Vehicle consists of a basic launch vehicle and mission peculiar kits for installation and test. This addendum covers the specific launch vehicle configuration for the ATS Program which is designated End Item Description (EID) 69-0051. The launch vehicle shall be used as a Standard Launch Vehicle (SLV-3) to boost an upper stage and payload into a predetermined trajectory.

c31 030001 01

W66-003

ATS PROJECT SEEKS PRACTICAL PAYOFFS

W. S. Beller

Article Published in "Missile and Rockets," 7 March 1966

This article is a summary of the program plan and objectives of the Applications Technology Satellite project. Included in this summary are a discussion of satellite features, experiments planned and the efforts of some of the leading scientific experimenters on this project.
(3 pages, 3 illustrations)

c34 010000 04

W66-004

APPLICATIONS TECHNOLOGY SATELLITE TRANSPORTABLE STATION TELEMETRY AND COMMAND SYSTEM OPERATIONS MANUAL (COOBY CREEK, AUSTRALIA)

Goddard Space Flight Center

OM-533-5 May 1966

Avail: NASA/GSFC

This manual provides a detailed description of the transportable ground station ATS Telemetry and Command System installed at Cooby Creek, Toowoomba, Australia. The following information is included in this manual:

1. General Description of the ATS Telemetry and Command (T&C) Station
2. Road Performance and Structural Design of ATS T&C system trailers
3. ATS Transportable Station T&C Subsystems
4. ATS Transportable Station T&C System Test

Section 3 on T&C Subsystems provides a description of each electronic subsystem including equipment characteristics, features and specifications, and the purpose and theory of operation of each of the subsystems.

Section 4 on Systems Testing is provided to evaluate whether the ATS transportable station Telemetry and Command System is operating at acceptable performance levels and is RF compatible under system operating conditions to support the ATS satellites.
(198 pages, 36 illustrations, 6 tables)

c07 060300 01

W66-005

FINAL REPORT FOR ATS SSB AND FM TRANSMITTERS (19 JUNE 1963 - 1 MARCH 1966)

Raytheon Company, Equipment Division, Communications and Data Processing Operation

NAS 5-3464

Avail: Goddard Space Flight Center, Greenbelt, Maryland

This report summarizes the design and development of SSB and FM Ground Communication Transmitters for the NASA Applications Technology Satellite (ATS) Program. Equipment summaries and ground station interfaces are tabulated for each site, followed by a description of the various units. Theory of operation for the multiple access and frequency translation modes is explained using simplified block diagrams. Electrical and mechanical design problems and solutions are discussed including the frequency, power control, and monitoring subsystems. Significant design and operational features are explained including performance requirements.

Also discussed are installation and field operations, reliability and failure analysis, factory and acceptance test data.

Included as appendices are supplementary reports, letters, and technical notes.
(444 pages, 147 illustrations)

c07 060000 02

W66-006

ATLAS TRAJECTORY AND PERFORMANCE ANALYSIS SLV-3/AGENA/ATS PROGRAM

C. J. Bertz (Report No. GDC-BTD66-096)

General Dynamics/Convair

U. S. A. F. Contract AF 04(695)-710

Distribution: Defense Documentation Center. No foreign distribution without approval of Space Systems Division, Los Angeles Air Force Station, California 99045

Accession No.: AD-485-828

6 July 1966

This document contains the open-loop design reference trajectory data used to analyze the capability of the SLV-3 to perform its role for the Applications Technology Satellite mission. This information is required by the various design groups for computation of aerodynamic heating and of structural, dynamic, and aerodynamic loads. The principal trajectory design data presented include: (1) mission profile and SLV-3 mission requirements; (2) launch vehicle description; (3) aerodynamics, propulsion, weights, and environmental data; (4) trajectory design constraints; and (5) exchange coefficients. The data contained in this report are the most recent available at the time the study was performed. The final mission requirements and the manner in which the SLV-3 will be programmed to fly this mission are the responsibility of the program System Integrator. The settings may therefore change slightly by the time the vehicle is launched and are not to be used for checking or revising the hardware design. (Author)

c34 030100 01

W66-007

MASTER CONTROL CONSOLE SUBSYSTEM, ROSMAN, N. C., INTEGRATION REPORT

Westinghouse Electric Corp., Baltimore, Md.

NAS 5-3980

July 1966

This report covers the activities of the Communications Integration Contract for the Applications Technology Satellite (ATS) Program at the Rosman, N. C., facility during implementation of the Westinghouse Master Control Console (MCC) as part of the ATS ground station system.

The console layout consists of the following Westinghouse designed and built panels and displays:

1. Command - Verification Display
2. Telemetry and Command Panel
3. Spacecraft Command Control Panel
4. Spacecraft Attitude and Spacecraft Status Displays
5. FM Transmitter Status Panel
6. FM Metering Panel
7. Elevation Interlock Panel
8. Audio and Test Configuration Panel
9. Multiplex Status Panel
10. Tracking LO Metering Panel
11. SSB Transmitter Status Panel
12. PM Metering Panel

Government furnished equipment for the MMC includes:

1. Intercom System
2. X, Y - Axis Antenna Position Indicators
3. Uplink and Downlink TV Monitors
4. Greenwich Mean Time (GMT) Display
5. Range and Range Rate Display
6. Uplink and Downlink Waveform Monitors
7. Strip Chart Recorder

A series of measurements and tests were performed during the period 16 May through 27 May 1966 to evaluate the ability of the console to meet NASA requirements to support the ATS experiment program. All the MCC equipment components have been tested according to component functional requirements. After evaluation of all test categories it has been determined that the Westinghouse Master Control Console will satisfactorily support the ATS program. The MCC subsystem can now be utilized for system integration as outlined in the Westinghouse Readiness Test Plan for the Rosman facility.
(36 pages, 11 figures)

c11 060100 01

W66-008

OPERATIONAL MANUAL FOR APPLICATIONS TECHNOLOGY SATELLITE TELEMETRY AND COMMAND SYSTEM (ROSMAN II AND MOJAVE GROUND STATIONS)

Goddard Space Flight Center

OM-533-12 August 1966

Avail: NASA, GSFC

This manual offers a physical and functional description of the ATS telemetry and command (T&C) systems at the Rosman II and Mojave ATS ground stations. The manual is designed as a reference for operating personnel of the two T&C systems. Since the two stations are almost identical functionally both are described as one. System differences are identified and explained within the text of the manual.
(396 pages, 69 illustrations, 65 tables)

c11 060000 04

W66-010

AN INTRODUCTION TO NASA

L. M. Stuart, Jr.

GSFC

ATS-TP-1

Presented to: ATS System Engineers Training Program, GSFC, August 22, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

This introduction to NASA defines the programs, responsibilities, tracking networks, flight centers, test ranges, facilities, launch vehicles, and missions applicable primarily to Goddard activities. Special consideration is given to descriptions of GSFC test facilities, computerized control centers, and data acquisition networks. Emphasis is placed upon scientific exploration of space and the application of knowledge gained. The Applications Technology Satellite (ATS) series includes communication, meteorological, and survey experimental programs.
(17 pages, 29 illustrations)

c34 000000 01

W66-001

NUTATION SENSOR EXPERIMENT

J. P. Corrigan

GSFC

ATS-TP-18A

Presented to: ATS Systems Engineering Training Program, GSFC, August 22, 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

The nutation sensor on the ATS spacecraft was designed and built by GCA of Bedford, Mass. It consists of a low-frequency piezoelectric accelerometer and a logarithmic amplifier, mounted near the periphery of the vehicle with its sensing axis parallel to the spin axis of the spacecraft. On the ATS-B, two units are mounted at 90 degrees relative to each other, primarily for redundancy. The sensor units are 4.8 by 2 by 2 1/4 inches, weigh approximately 1 1/3 pounds, and will detect a range of angles from 1/1000 of a degree up to 5 degrees with effectively 10 percent accuracy. This discussion of the nature of nutation and the capabilities and operation of the sensor is in an informal lecture form, with interspersed questions and answers.
(9 pages, no illustrations)

c14 100100 01

W66-012

WEATHER FACSIMILE EXPERIMENT

R. R. Drummond

GSFC

ATS-TP-7

Presented to: ATS Systems Engineers Training Program, GSFC, August 26, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The Applications Technology Satellite (ATS) Program is concerned with a number of meteorological experiments. This lecture describes one of the experiments called WEFAX - an experiment in weather facsimile relay. The objectives of the WEFAX experiment are aimed at the future mass distribution of weather data. The feasibility tests to be conducted by WEFAX are:

- Mass Distribution of Weather Data Direct to APT User (VHF)
- Rebroadcasting Synchronous Altitude Earth Pictures via APT Format (VHF)
- Proposed Mass Collection of Hydrology Data via ATS-B Relay (VHF)
- Proposed Line Islands Experiment by the National Center for Atmospheric Research

(8 pages, 4 illustrations)

c20 080200 01

W66-013

TWO-CAMERA ADVANCED VIDICON CAMERA SUBSYSTEM (AVCS) FOR THE APPLICATIONS TECHNOLOGY SATELLITE (ATS)

F. H. Eastman

Radio Corporation of American ATS-TP-9

Presented to: ATS Systems Engineers Training Program, G

Avail: Goddard Space Flight Center, Greenbelt, Md.

The primary function of the camera subsystem is to obt obtain continuous cloud cover pictures of the full earth's disc and a selected area of the earth's atmosphere. The video information can be either transmitted directly to the appropriate command and data acquisition station or stored on tape for later transmission. The lecture covers the camera system broken down into its component parts and tabulates the characteristics of the various subsystems. Signal flow within the camera system and the commands from the spacecraft are discussed. The various telemetry signals associated with the camera are tabulated and discussed.
(31 pages, 13 illustrations, 7 tables)

c14, c20 080300 01

W66-014

OMEGA POSITION LOCATION EQUIPMENT (OPLE)

C. R. Laughlin, G. Hilton, R. Lavigne

GSFC

ATS-TP-8

Presented to: ATS Systems Engineer Training Program, GSFC, August 26, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The Omega Position Location Equipment (OPLE) system makes use of the Omega navigation system to provide a means of global collection of meteorological data and position location, applicable to any moving meteorological platform, including balloons. The objective of the OPLE experiment is to demonstrate the feasibility of interrogating, and collecting data from a large number of balloons on a global or semi-global basis, and to locate the position of these balloons. This article describes the overall OPLE concept, the center ground processing equipment emphasizing format of the signal transmission, the platform or balloon package and the link up and the pertinent equipment of the ATS satellite.
(9 pages, 5 illustrations)

c20 080401 01

W66-015

THE IMAGE ORTHICON CAMERA

B. B. Shaw

Hazeltine Electronics Company

ATS-TP-11

Presented to: ATS Systems Engineers Training Program, GSFC, August 26, 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

This lecture covers the image orthicon day-night camera system which is to be flown on the ATS-D spacecraft. The objectives of this experiment are to determine if it is feasible to operate from a synchronous orbit a day-night system with steerable options which can cover the entire earth disc and to determine whether an operational system can be made for meteorological purposes to get real-time full earth coverage. The optical characteristics of the system are discussed along with the characteristics of the camera system. The command sequence to the camera system is explained and the transmission of pictures to the ground is discussed.
(32 pages, 22 illustrations)

c14, c20 080601 01

W66-016

ENVIRONMENTAL MEASUREMENTS EXPERIMENT ON THE APPLICATIONS TECHNOLOGY SATELLITE (MISSIONS ATS-A AND ATS-B)

Westinghouse Electric Corp.
6224A

29 August 1966

This report contains operating and descriptive information concerning the environmental measurements experiments (EME) for the Applications Technology Satellite Mission ATS-A and ATS-B. The EME scientific satellite experiment package consisting of the following is discussed.

- Solar Cell Radiation Damage Experiment
- Thermal Watt Experiment
- Electron Spectrometer
- Suprathermal Ion Detector
- Particle Detector
- Magnetometer
- Omnidirectional Particle Detector
- Electron-Proton Experiment
- Selected Telemetry Formats
- Experiment Signals
- Encoder
- Command Interface Control

(134 pages, 26 illustrations, 14 tables)

c29 110000 10

W66-017

THE VHF EXPERIMENT

J. P. Corrigan

GSFC

ATS-TP-6A

Presented to: ATS Systems Engineers Training Program GSFC, 31 August 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

This lecture describes early work on VHF repeater experiments for ATS-B and ATS-C. The VHF repeater experiment is an active frequency-translation repeater using an eight-element electronically despun phased-array antenna. Objectives of this experiment are: to demonstrate the feasibility of providing a continuous voice-communications link between the ground-control station and aircraft, to demonstrate the feasibility of operating a meteorological network in which data are collected and disseminated, to evaluate the feasibility of VHF navigational systems using satellites, to evaluate the airborne and ground stations required, and to demonstrate the feasibility of providing a continuous communications link between a control station and ships at sea. The experiment package consists of eight phased-array antennas, each with its own transmitter and receiver. Output power of each transmitter is approximately 5 watts; antenna gain is about 9 dB. The transmitter frequency is centered at 135.6 MHz, and the received frequency is centered at 149.22 MHz. General repeater

characteristics are presented, along with rational for certain design details. Schematics for transmitter and receiver are included.
(24 pages, 5 illustrations)

c07 070200 03

W66-018

REVIEW OF GRAVITY-GRADIENT TECHNOLOGY

Howard Foulke

General Electric Company

ATS-TP-16B

Presented to: ATS Systems Engineer Training Program, GSFC, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

This lecture deals with a review of gravity-gradient technology. First an example in a parallel-gravity field is presented and then the discussion progresses to the radial field. Eueler's equations of motion are combined with the developed gravity-gradient equations and are linearized to develop the small-angle equations for a gravity-gradient spacecraft. Several gravity-gradient spacecraft prior to the ATS are discussed. Then the discussion turns to the optimization of the various parameters associated with the ATS, namely pitch, roll, yaw and damper moments of inertia, damping and spring constants and angle of damper boom.
(22 pages, 14 illustrations)

c31 090000 29

W66-019

THE APPLICATIONS TECHNOLOGY SATELLITE GRAVITY GRADIENT MISSION

Robert E. Clayton

General Electric Company

ATS-TP-16C

Presented to: ATS Systems Engineers Training Program, GSFC, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The ATS program is designed, in part, to improve the technology of two leading contenders for long-life spacecraft stabilization: Spin stabilization and gravity-gradient stabilization. This lecture covers gravity-gradient stabilization by discussing the gravity-gradient mission objectives, namely; operation feasibility, mission compatibility and design performance evaluation. Operational feasibility is divided into initial capture, transient damping, steady-state performance, pitch inversion and yaw inversion. Mission comptability is broken down into system response to impulse functions, operational tests by ATS experimenters and life test. The evaluation of the basic ATS design with regards to the boom systems is covered.
(11 pages)

c31 090000 30

W66-020

ATS PERFORMANCE PREDICATIONS

Howard F. Foulke

General Electric Company

ATS-TP-16D

Presented to: ATS Systems Engineers Training Program, GSFC, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

After the optimization of a configuration, it is necessary to establish how well the vehicle will do. Optimizations are usually based on nominal characteristics, some assumptions and a perfect vehicle. This lecture points up the fact that the vehicle is not perfect due to a variety of factors. Errors from individual causes, as well as they are known, are tabulated in an error budget for both the ATS-A and ATS-D. One of the advantages of the error budget is that a quick re-evaluation of the performance is possible as more information becomes available. There is a discussion about basic differences in the ATS-A and ATS-D and their effect on the predictions.
(10 pages, 2 illustrations, 4 tables)

c30 090000 31

W66-021

ATS GRAVITY-GRADIENT HARDWARE

Edward M. Mazur

General Electric Company

ATS-TP-16E

Presented to: ATS Systems Engineers Training Program, GSFC, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

This paper describes the mechanical hardware used on the ATS gravity-gradient spacecraft. The basic attitude-control system, consisting of the X-boom, primary boom system, and the damper boom is described. The difference between ATS-A and ATS-D with regards to the attitude control system are tabulated. Specifications on the various damper systems are tabulated and a general discussion on the damper system is presented. The electronics and detectors used to determine attitude are discussed along with information about the power control unit which takes power from the basic spacecraft system and converts it into requirements of the gravity-gradient systems.
(18 pages, 19 illustrations)

c31 090000 32

W66-022

ATS GRAVITY-GRADIENT DATA SYSTEMS

Tiemann N. Horn

General Electric Company

ATS-TP-16F

Presented to: ATS Systems Engineers Training Program, Greenbelt, Maryland, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The actual performance of gravity-gradient experiments on the Applications Technology Satellite may be broken down into three sections: Data systems, Attitude Determination, and Flight Analysis. This lecture first covers the various data systems by which information is transferred from the satellite to the evaluator. Then attitude determination is defined relative to this program and a description of the actual calculations and measurements needed to accomplish this task. Flight analysis is broken into two phases:

1. System Performance and Capability - Evaluation of Attitude Data.
2. Hardware Performance - Evaluation of the Actual Operation of the Various Hardware Components of the Gravity-Gradient and Gravity-Gradient Related Systems.

(37 pages, 38 illustrations)

c31 090000 33

W66-023

ORBIT OPERATIONS PLAN

Frank Kraus

General Electric Company

ATS-TP-16H

Presented to: ATS Systems Engineers Training Program, GSFC, September 1, 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

The purpose of the Orbit Operations Plan is to provide detailed operational procedures required for on-orbit gravity-gradient experimentation. The secondary function is to provide contingency operational sequences necessary in the event of major catastrophes. This lecture explains from the operational procedures for 13 proposed gravity-gradient experiments in block diagram. The 45 commands allocated to the gravity-gradient experiment are gone over in some detail. It is explained that the finished orbit operation plan will provide the specifics of command implementation and command constraints and will describe the information that will be available for applicable to the gravity-gradient experiments.
(29 pages, 14 illustrations)

c30 090000 34

W66-024

TELEMETRY HANDBOOK ATS-F (F-1)

Space Systems Division, Hughes Aircraft Company

SSD60400R, September 1966

This handbook provides a description of the telemetry portion of the telemetry and command subsystem of the ATS-B spacecraft, including the location of the telemetry sensors, and the details concerning the characteristics of these sensors.
(116 pages, 49 illustrations, 5 tables)

c07 060000 05

W66-025

MULTIPLE ACCESS FREQUENCY CONTROL SYSTEMS

E. Osborne

Westinghouse Electric Corporation

Report No. DSC-5549, September 1966

This paper presented at NASA-ATS school at Goddard Space Flight Center, 26 September 1966

Fundamental concepts for the remote control of frequency received at orbiting satellite communications transponders are described for the ATS multiple access experiment. The ATS system uses FDM of up to 1200 voice channels with SSB and PM forms of modulation on the ground-to-satellite and satellite-to-ground links. "Open" and "Closed" loop AFC methods are used. This type of multiple access requires accurate frequency control by each ground station.
(25 pages, 9 illustrations)

c07 070100 06

W66-027

MOTION OF A SPINNING SPACECRAFT HAVING A ROTATING PART

Lynn H. Grasshoff

Hughes Aircraft Company

Contract: NAS 5-3823

October 10, 1966

Presented to: AIAA Guidance, Control and Flight Dynamics Conference, Huntsville, Alabama, August 1967

Published in: Proceedings of the Meeting

In the course of assessing the effect of motion of a spin scan cloud camera on spin-stabilized spacecraft nutation, it has been determined that there is a unique configuration of a rotating part that results in no spacecraft nutation, regardless of the manner in which the part is rotated (subject to certain parametric constraints). The unique configuration cannot be a body of revolution about its axis of rotation, but must be related to the moment-of-inertia ratio of the spacecraft. Through mathematical analysis, this paper develops equations which are carried to the point where substitution of the rotating body's moments-of-inertia will yield the effects of the particular type of motion being experienced by the body.
(15 pages, 3 illustrations)

c32 020000 01

W66-029

MISSION PLAN FOR THE APPLICATIONS TECHNOLOGY SATELLITE PROJECT FLIGHT MISSION NO. 1 ATS-B

NASA, GSFC

S2-0001

November 1966 (Revision)

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The objective of the Applications Technology Satellite Program is to conduct research and development, and the flight testing of promising technology that is a common rerquirement of any number of satellite applications. The purpose of this document is to outline and define the operational and data requirements for the ATS-B program. A vast amount of information and data is compiled which describes the total system including spacecraft, launch vehicle, test stations, ground stations and the control, communication and computation arrangements. There are detailed sections on prelaunch, launch and postlaunch operations. A section of the document describes the various schedules and reports to be used in connection with the mission. Data acquisition, evaluation and distribution are discussed in detail including examples of message format. Approximately half of the document consists of various appendicies. These include detailed countdown and countup to apogee motor firing, an extensive section on communication procedures and format and failure modes and emergency procedures.
(213 pages, 28 illustrations)

c34 010000 06

W66-030

MISSION PLAN FOR THE APPLICATIONS TECHNOLOGY SATELLITE PROJECT FLIGHT MISSION NO. 3 ATS-C

GSFC

S2-0003

November 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The objective of the Applications Technology Satellite Program is to conduct research and development, and the flight testing of promised technology that is a common requirement of any number of satellite applications. The purpose of this document is to outline and define the operational and data requirements for the ATS-C program. A vast amount of information and data is compiled which describes the total system including spacecraft, launch vehicle, test stations, ground stations and the control, communication and computation arrangements. There are detailed sections on prelaunch, launch and postlaunch operations. A section of the document describes the various schedules and reports to be used in connection with the mission. Data acquisition, evaluation and distribution are discussed in detail including examples of message format. Approximately half of the document consists of various appendicies. These include detailed countdown and countup to apogee motor firing, an extensive section on communication procedures and station report format.
(194 pages, 21 illustrations)

c34 010000 33

W66-031

RESULTS OF THE QUALIFICATION TEST OF EIGHT JPL-SR-28-3 ROCKET MOTORS AT SIMULATED ALTITUDE

A. A. Cimino, C. W. Stevenson (Report No. AEDC-TR-66-221)

Arnold Engineering Development Center

USAF Contract AF 40(600)-1200

Distribution: Defense Documentation Center. No foreign distribution without approval of NASA Goddard Space Flight Center, Greenbelt, Md. Accession No. AD-802 218.

November 1966

Eight Jet Propulsion Laboratory JPL-SR-28-3 solid-propellant rocket motors were test fired under the combined effects of rotational spin at 100 rpm, temperature conditioning at 100 F (4 motors) and 40 F (4 motors), and an average pressure altitude in excess of 100,000 ft. as the Qualification Test Phase of the Applications Technology Satellite Apogee Motor Program. The primary objective of the program was to determine motor performance during simulated flight conditions. Secondary objectives were to measure motor case and nozzle temperatures for 300 sec after ignition and to evaluate the motor case and nozzle structural integrity. Motor performance is presented and compared with data from earlier AEDC test firings of the same type of motor.

c28 020202 01

W66-032

NASA-GSFC, OPERATIONS PLAN 13-66, APPLICATIONS TECHNOLOGY SATELLITE (ATS-B)

Project Operations Support Division, Tracking and Data Systems Directorate, NASA-GSFC

X-513-66-535; OPPLAN 13-66; November, 1966

Avail: Goddard Space Flight Center, Greenbelt, Maryland (For Official Use Only)

This Operations Plan provides planning information for activities concerned with ATS-B, and is to serve as a guide during operations. Contents include:

- Mission
- Responsibilities
- Organization
- Project Implementation
- STADAN Operations and Control
- STADAN Operations
- ATS Field Operations
- External Agency Support
- Manned Space Flight Network Operations
- Data Systems Division
- Information Processing
- NASA Communications Center Operations
- Operational Computing Plan
- ATS-B Sequence of Events
- Spacecraft Telemetry Measurements and Command Assignments
- Signal Strength Calculations
- Potential RF Conflicts

(310 pages, 30 illustrations)

c34 040000 01

W66-003

APPLICATIONS TECHNOLOGY SATELLITE EXPERIMENTAL COMMUNICATIONS SYSTEM DESCRIPTION AND REQUIREMENTS

GSFC-SII-012 (Rev. C) November 1966

ATS Project Officer, Goddard Space Flight Center

This document is concerned only with the ATS communications experiments are defined. The emphasis of this paper is to define the multiple access communication operations providing signal characteristics and requirements. Communication system performance requirements, the characteristics of the spacecraft communications repeater, and a description of the ground station equipment are included.
(65 pages, 11 illustrations, 15 tables)

c07 070100 02

W66-034

THE MILLIMETER WAVE PROPAGATION EXPERIMENT FOR THE ATS-E SPACECRAFT

G. B. Nichols, Nov. 1966

NASA, Goddard Space Flight Center, Greenbelt, Maryland

NASA-TM-X-63026; X-733-66-532

Avail: NASA/GSFC, Greenbelt, Maryland

NOTICE: This Abstract from C-STAR, Accession No. X68-10502, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

The millimeter wave propagation experiment planned for spaceflight on the ATS-3 spacecraft is described. A description of the spacecraft and ground equipment is included so interested rediotelescope stations can determine what equipment modifications must be made for participating as ground terminals for this experiment
(30 pages, with refs.)

c07 070300 02

W66-035

PRESENT STATUS OF KASHIMA GROUND STATION FOR ATS

Radio Research Laboratories Ministry of Posts and Telecommunications (Japan)

1966

This report describes the ground station for space communications experiments which the Radio Research Laboratories of Japan maintains at Hirai, Kashima-machi, Tbarki Prefecture, approximately 90 km east-north-east of Tokyo. The facility, which is used in Applications Technology Satellite (ATS) communications and tracking experiments, is 42.20 meters above sea level and employs an azimuth-elevation type of parabolic antenna 30 meters in diameter. The report describes the following elements of the Kashima ground station: antenna and feeding system, servo control system, tracking equipment, transmitting equipment, receiving equipment, collimation tower equipment, and control line.
(36 pages, 14 figures)

c11 060400 01

W66-036

OPERATION MANUAL FOR ADVANCED TECHNOLOGICAL SATELLITE TRANSPORTABLE STATION TELEMETRY AND COMMAND SYSTEM

Goddard Space Flight Center, Greenbelt, Maryland

Report No.: OM-533-5

This manual covers the description, design, operation, and testing of the Applications Technology Satellite (ATS) transportable station telemetry and command systems, trailers, and van subsystems.

Included in the manual are discussions concerning structures, power distribution, antenna systems, consoles, data handling equipment, and test procedures including block diagrams.

ATS program objectives and mission definitions are contained in the manual Introduction, Section.
(198 pages, 6 tables, 36 figures)

c08 060000 03

W66-037

VERY HIGH-FREQUENCY GROUND-TO-AIRCRAFT COM MUNICATIONS TESTS FOR AIR TRAFFIC CONTROL WITH FEDERAL AVIATION AGENCY PARTICIPATION

O. J. DeZoute, W. Smith, R. Baker

Federal Aviation Agency

T. Barton

National Avaiation Facilities Experimental Center, Atlantic City

ATS-TP-6B

Presented to: ATS Systems Engineers Training Program, GSFC, September 23, 1966

Avail: Goddard Space Flight Center, Greenbelt, Md.

Plans are being made and equipment is being procured for an FAA flight test program to demonstrate satellite-supported ATC communications under selected conditions of long line propagation and remote-control center configuration. The tests are planned to begin in May 1967, involving equipment aboard a C135 aircraft flying over the Pacific, ATS-B, the NASA ground station at Mojave, and an FAA receiving installation at Elmendorf (Anchorage) Alaska. The discussions, with questions and answers, cover preliminary plans for the test links and transmission schedules; the design concept and anticipated capabilities of the aircraft antenna, and plans for digital-data circuit quality tests at 600, 1200, and 2400 bits/s.
(25 pages, 5 illustrations)

c07 070203 05

W66-038

APPLICATIONS TECHNOLOGY SATELLITE 6Gc - 4 Gc FM TRANSLATOR INSTRUCTION MANUAL

G. C. Patterson, L. W. Nicholson, April 1966

NASA, Goddard Space Flight Center, Greenbelt, Maryland

This manual describes the theory of operation, installation, operation, and parts for the Applications Technology Satellite (ATS) FM Translator (6Gc - 4Gc). The purpose of this translator is to convert the transmitted 6Gc spectrum to a 4Gc spectrum within the ATS Ground Stations. This provides an RF closed loop for purposes of station back-to-back loop testing and range/range rate calibration.
(10 pages, 4 figures)

c11 060000 14

W66-039

TELEMETRY DATE PROCESSING PLAN FOR THE APPLICATIONS TECHNOLOGY SPACECRAFT (ATS-B)

J. B. Bourne

NASA/GSFC, Greenbelt, Maryland

Report No.: X-564-66-594

Avail: NASA/GSFC

This plan describes the procedures and techniques for the reduction of experiment telemetry data from the ATS-B satellite.

The heart of the data processing plan is the computer programming of the PCM (Pulse code modulation) and PFM (Pulse frequency modulation) data. After a PFM buffer tape passes a format review, the reduction system provides a one-pass programming of time-corrected decommutated experimenter tapes. For PCM, the reduction system is a two-pass programming arrangement designed to produce individually formatted decommutated experimenter tapes.

Included in the plan is a discussion of the spacecraft, scientific and technological experiments, and NASA ground complexes.

c08 040000 08

W66-040

ANALYSIS OF NON-LINEAR NOISE IN FDM TELEPHONY TRANSMISSION OVER AN SSB-PM SATELLITE COMMUNICATION SYSTEM

P. J. Heffernan

NASA/GSFC, Greenbelt, Maryland

Report No.: NASA TND-2365

Avail: Scientific and Technical Information Division
NASA, Washington, D. C. 20546

This report analyzes the noise produced by dynamic non-linearity in elements of the SSB uplink, spacecraft phase modulator, and ground receiver demodulator. Under high received signal conditions, voice channel quality in FDM telephony over an SSB-PM satellite communication system is limited by dynamic non-linearity and downlink differential group delay. Worst-case channel signal-to-non-linear-noise power ratios are developed in terms of coefficients of a power series expressing the non-linear characteristic. In appendices are discussed the calculation of the autocorrelation function, the evaluation of spectral convolutions, power series coefficients determination, and CCIR terminology and multichannel loading procedures for FDM telephony.

c07 070100 01

W66-041

OMNIDIRECTIONAL TRAPPED PROTON AND ELECTRON DETECTOR EXPERIMENT FOR ATS-A

C. E. McIlwain, R. W. Fillius, J. Valerio, G. Kendrick

University of California, San Diego; LaJolla Calif.

NASA Contract NAS 5-9536, Grant NsG-538

This experiment consists of three scintillation detectors aboard the Applications Technology Satellite (ATS-1) which will measure omnidirectional fluxes of protons with energies greater than 12 and 20 MeV, and electrons with energies greater than 0.5 to 2.0 MeV. Two of the detectors have identical proton thresholds of 12 MeV and geometric crossections which differ by a factor of three. Two detectors are required because one principal objective is to measure short period fluctuations and it is not possible to achieve complete discrimination against electrons with a single detector or of geometric factor large enough to obtain satisfactory statistics. The third detector with a proton threshold of 20 MeV will be used to obtain a parameter of the proton energy spectrum necessary for physical interpretation of the data. It will also be used with the other detectors in measuring time variations. Being omnidirectional, the detectors will obtain high counting rates and be insensitive to orientation required to obtain measurements which can be compared from orbit to orbit with high accuracy.

In addition to a discriminator set at 4 MeV to measure protons, each of the three detectors has four discriminators which are subcommuted and require only one additional accumulator. Besides measuring electron fluxes, the two lower discrimination levels indicate whether or not the maximum expected electron intensities are being exceeded which could cause contamination of the proton measurements.

c29 110200 01

W66-042

DESCRIPTION OF EXPERIMENTAL OMEGA POSITION LOCATION EQUIPMENT (OPLE)

G. Hilton, R. Hollenbaugh, C. Laughlin, R. Lavigne

NASA/GSFC, Greenbelt, Maryland

Report No.: X-731-66-20

The purpose of the Omega Position Location Equipment (OPLE) Experiment is to demonstrate the feasibility of using the Omega Navigational System in conjunction with the synchronous satellites to establish a global location and data collection system. The OPLE concept can be applied to various platform user requirements such as oceanographic buoys, commercial aircraft, ocean vessels, animal migration studies, etc. However, the platform which presents the most stringent packaging requirements and, which is of primary concern in the OPLE Experiment, is the meteorological balloon. An operational balloon system with the capability of providing synoptic global weather information suitable for fast and accurate weather prediction would require thousands of balloons. Such a system would be required to determine the location of each balloon and provide a communications link over which meteorological data could be transmitted and yet not exceed the payload packaging requirements imposed on such balloons. A brief summary of packaging requirements includes: (1) low density to prevent damage to aircraft in case of a collision, (2) light weight (less than five pounds) to meet the carrying capacity of the balloon, (3) low average power consumption consistent with balloon battery/solar cell systems (4) reliability sufficient to assure six months operation (5) ability to withstand the temperature extremes of the balloon environment, (6) low cost to insure the economic practicality of the system.

c20, c21 080401 03

W67-001

ATS-1 FAA EXPERIMENTATION, INTERIM REPORT NO. 1 (10 Dec. 1966-31 Jan. 1967)

System Research and Development Service, Federal Aviation Agency

The FAA efforts during the subject period ending 31 January 1967 evolved from a general interest in preliminary testing, demonstration, observation, and evaluation of satellite-supported communications with aircraft and the effects and conditions of satellite VHF propagation. Flight and ground tests were made to obtain preliminary information on voice transmission capability, potential of VHF interference and to establish criteria and procedures for later experimentation. A review of the effort including results, conclusions and recommendations are presented.
(14 pages, 2 illustrations)

c07 070203 01

W67-002

MISSION PLAN FOR THE APPLICATIONS TECHNOLOGY PROJECT FLIGHT MISSION NO. 2 ATS-A, MEDIUM GRAVITY GRADIENT STABILIZED

GSFC

S2002

February 1967

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The objective of the Applications Satellite Program is to conduct research and development, and the flight testing of promising technology that is a common requirement of any number of satellite applications. The purpose of this document is to outline and define the operational and data requirements for the ATS-A program. A vast amount of information and data is compiled which describes the total system, including spacecraft, launch vehicle, test stations, ground stations and the control, communication and computation arrangements. A Section of the document describes the various schedules and reports to be used in connection with the mission. Data acquisition, evaluation and distribution are discussed in detail and there are examples of message formats. Approximately half of the document consists of various appendixes. These include detailed countdown and countup to apogee motor firing, an extensive section on communication procedures, and station report format.
(209 pages, 29 illustrations, 2 tables)

c34 010000 28

W67-004

REPORT ON THE CLOSED LOOP AUTOMATIC FREQUENCY CONTROL (AFC) SYSTEM OF THE SINGLE SIDEBAND (SSB) TRANSMITTER AT THE TRANSPORTABLE GROUND STATION COOBY CREEK, AUSTRALIA

D. V. Harris

Commonwealth of Australia

March 1967

This report discusses the recognition and resolution of a deficiency in the operation of the closed loop AFC of the SSB transmitter at Cooby Creek. This deficiency precluded compliance of the multiplex channel frequency stability with the specification of the CCITT when the SSB transmitter was utilized in the Multiple Access (MA) experiments of the Applications Technology Satellite Program.

It was found that successful operation in the MA mode was not feasible, even after achieving lock up of the pilot tones on 20 December 1966. This was due to instability of the closed loop AFC as a result of its frequency discriminator being sensitive to the amplitude variation of signals from ATS-1. The open loop AFC was found to be incapable of accommodating the ATS-1 master oscillator offset effect.

The immediate problem was isolated, a solution proposed and interim procedures established such that they enabled successful completion of a number of MA-AT-1.1 tests.

Further work has been done on the circuit analysis, loop analysis and measurement methods for the AFC closed loop system.

The latest measurements have indicated stable loop operation but extremely short term frequency variations in excess of the CCITT specifications of ± 2Hz. These errors were masked in the measurement methods used previously because of the smoothing of the Data.

Further test are being carried out to isolate the sources of this jitter which is evident in Collimation Tower tests also though on a reduced scale.

Work is also proposed with a view to improving or correcting the frequency variations as far as possible.

c11 060300 02

W67-005

NASA-GSFC, OPERATIONS PLAN 7-67, APPLICATIONS TECHNOLOGY SATELLITE (ATS-A)

Project Operations Support Division, Tracking and Data Systems Directorate, NASA-GSFC

X-513-67-99; OPPLAN 7-67; March 1967

Avail: Goddard Space Flight Center, Greenbelt, Maryland (For Official Use Only)

This Operations Plan provides planning information for activities concerned with ATS-A, and is to serve as a guide during operations. Contents include:

- Mission
- Responsibilities
- Organization
- Project Implementation
- STADAN Operations and Control
- STADAN Operations
- ATS Operations
- External Agency Support
- Manned Space Flight Network Operations
- Operational Computing Plan
- Satellite Scheduling Program
- Information Processing Division
- NASA - GSFC Communications Center Operations
- ATS-A Sequence of Events
- Spacecraft Telemetry Measurements and Command Assignments
- ATS Ephemeris Tape Description
- ATS-A Gravity Gradient Experiment List
- Spacecraft Specifications, Spacecraft/STADAN Performance Predictions, and Potential Frequency Conflicts

(344 pages, 56 illustrations)

c34 040000 02

W67-006

APPLICATIONS TECHNOLOGY SATELLITE
ATS-A AGENA VEHICLE 6152
FLIGHT PERFORMANCE EVALUATION AND ANALYSIS REPORT

Lockheed Missiles & Space Company

Contract: NAS 3-7413

LMSC-A876003 April 1967

The Applications Technology Satellite A (MAGGE) space vehicle consisted of Atlas SLV-3 5102, Agena D 6152 and spacecraft ATS-A, was launched 6 April 1967 at 03:23:01.90 GMT from launch complex 12, Air Force Eastern Test Range. This report is limited to the flight performance of Agena 6152 and the flight performance of the Atlas 5102 upon the final trajectory. Atlas performance was good and separation

occurred as planned. Agena first burn performance was satisfactory, but second burn failed to occur as the result of a malfunction in the propellant isolation valve. Final orbit was 100 nautical mile perigee and 6000 nautical mile apogee, thereby exceeding the three-sigma limit.
(41 pages, 10 illustrations, 8 tables)

c30 030200 01

W67-007

FREQUENCY MODULATION AND SINGLE SIDEBAND TRANSMITTER SUBSYSTEM INTEGRATION REPORT MOJAVE GROUND STATION

Westinghouse Electric Corp., Baltimore, Md.

NAS 5-9675

April 1967

This report covers the testing activities of Westinghouse Electric Corporation as the Communications Integration Contractor for the Application Technology Satellite (ATS) Program at the Mojave data acquisition facility at Barstow, California, during implementation of the Raytheon FM/SSB transmitter equipment as part of the ATS ground station system. Integration testing was conducted by Westinghouse under NASA contract NAS 5-9675 during July and August, 1966. The transmitter subsystem was installed and interfaced with associated ATS subsystems. Tests included the CTEC, multiplex and video subsystems as part of the test environment. At the completion of testing it was concluded that the FM/SSB transmitter subsystem was operating satisfactorily to support the ATS communications experiment program.
(163 pages, 77 figures, 11 tables)

c07 060200 02

W67-008

MULTICOLOR SPIN-SCAN CLOUD COVER EXPERIMENT (MSSCC) GROUND STATION STUDY REPORT

Westinghouse Electric Corp., Baltimore, Md.

May 8, 1967

This study report contains a description of the ground equipment required to support the multicolor spin-scan cloud cover (MSSCC) experiment aboard the ATS-C satellite. The body of the report defines a system which is designed to work independently of the existing SSCC equipment.
(54 pages, 8 figures, 1 table)

c11, c14 060000 08

W67-009

VHF SATELLITES FOR MARITIME MOBILE COMMUNICATIONS

R. A. Boucher

Space Systems Division, Hughes Aircraft Co.

Presented to: RTCM Assembly, May 16-17-18, 1967, Washington, D. C.

Published in: Symposium Papers, RTCM Assembly Meeting, Volume V, Maritime Satellite Communication, Paper 43-67/DO-37, page 1 ff.

Avail: Radio Technical Commission for Marine Services. Washington, D. C.

The ATS-1 satellite has proved the feasibility of using synchronous satellites for maritime mobile communications. The rapid growth of satellite technology promises to bring economical satellite service to mobile users in the near future. This paper discusses the reasons that make VHF satellite communication attractive, the test programs which resulted in ATS-1, and its design.

The ATS-1 VHF experiment is an active frequency-translation limiting (class C) repeater receiving at 149 MHz and transmitting at 135 MHz. It receives and transmits through an eight-element phased-array antenna of full-wave dipoles that spin out to an 86-inch diameter circle at separation from the Agena.

The VHF repeater has been successfully used for voice and data communications among NASA ground stations, simplex airground communications with commercial and government aircraft, and simplex and duplex communications with a shipboard terminal. Predicted difficulties with scintillation fades and sea water multipath did not materialize. Future configurations are postulated from which costs as low as $1400 per VHF watt, or $1.00 for the space segment of a 3-minute, 6,000-mile call are postulated.
(12 pages, 5 illustrations)

c07 070200 09

W67-010

MARITIME SATELLITE SERVICE: POSSIBLE APPLICATIONS

M. W. Cardullo

Communications Satellite Corporation, Washington, D. C.

Presented to: RCTM Assembly, May 16-17-18, 1967 Washington, D. C.

Published in: Symposium Papers, RTCM Assembly Meeting, Volume V, Maritime Satellite Communication, Paper 43-67/DO 37, page 13 ff.

Avail: Radio Technical Commission for Marine Services Washington, D. C.

This paper outlines possible applications of communications satellites to the needs of the maritime industry. Applications are suggested in categories of safety, operational/commercial, and specialized requirements, and statistics are presented to support message traffic forecasts. Capabilities of launch vehicles (Delta and Atlas/Agena) and UHF satellites are briefly reviewed, possible problem areas are mentioned, and it is concluded that a maritime satellite service for safety needs offers the best prospects for near-future implementation.
(11 pages, 16 illustrations, 20 references)

c34 070200 10

W67-011

VHF SATELLITE FOR MARINE COMMUNICATION

A. E. Paredes

Communications Company Inc.
Coral Gables, Fla.

Presented to: RTCM Assembly, May 16-17-18, 1967 Washington, D. C.

Published in: Symposium Papers, RTCM Assembly Meeting, Volume V, Maritime Satellite Communication, Paper 43-67/DO 37, page 51 ff.

Avail: Radio Technical Commission for Marine Services Washington, D. C.

After citing advantages of VHF over HF transmission (better quality and reliability, smaller antennas), and how a satellite relay can overcome the line-of-sight range limitations, this paper reviews successful transmissions using ATS-1 and COMCO VHF-FM equipment on aircraft, vessels, and ground during 1966 and early 1967. Calculations of transmission circuit losses show a system margin of 13.9 dB, or 95% reliability. Signal processing considerations lead to a recommendation that the higher frequencies be amplified before clipping and eliminated after clipping for voice satellite communication. The author sees satellite communication as a reality for the small user, pending government provision and regulation of the media.
(10 pages, 5 illustrations)

c07 070200 11

W67-012

PRELIMINARY REPORT OF THE VHF-FM SATELLITE COMMUNICATION TEST CONDUCTED ABOARD THE U.S. COAST GUARD CUTTER KLAMATH

Capt. G. F. Hempton, LCDR R. F. Goward, LTJG J.O. Alexander

U. S. Coast Guard

Presented to: RTCM Assembly, May 16-17-18, 1967 Washington, D. C.

Published in: Symposium Papers, RTCM Assembly meeting, Volume V, Maritime Satellite Communication, Paper 43-67/DO 37, page 13 ff.

Avail: Radio Technical Commission for Marine Services Washington, D. C.

The Klamath (WHEC 66), a 255-foot, a 2000-ton vessel, was fitted by Hughes Aircraft Co. with a COMCO model 648/640 standard VHF/FM equipment driving a linear amplifier rated at 1 kilowatt input power. Two omnidirectional circularly polarized antennas (one high angle, and one low angle) were used. Test with ATS-1 were carried out in the spring of 1967 in the environment of this small ship having numerous other electromagnetic emissions. The extensive test area included Seattle, Ocean Station November (30 N 140 W), Alaska, the Pribilof Islands, and Attu. Results to date indicate that reliable voice communications can be conducted using uncomplicated equipment at 600 watts power to simple antennas, that digital communications in the form of a 75 band tone RATT are easily conducted and superior to high frequency RATT, that 400 and 1000-Hz tones are transmitted with greater clarity than higher frequency tones, sea conditions affect signal strength but do not disrupt communications, and shipboard RFI problems are correctable with filters and antenna location. Additional experiments and continual development are urged.
(9 pages, 5 illustrations)

c07 070206 01

W67-013

SYMPOSIUM PAPERS; RTCM ASSEMBLY MEETING; MAY 16-17-18, 1967; WASHINGTON, D. C.; VOLUME V, MARITIME SATELLITE COMMUNICATION

Radio Technical Commission for Marine Services
Paper: 43-67/DO-37

Avail: Radio Technical Commission for Marine Services Washington, D. C.

This volume contains the following papers:

VHF SATELLITES FOR MARITIME MOBILE COMMUNICATIONS
R. A. Boucher

MARITIME SATELLITE SERVICE: POSSIBLE APPLICATIONS
M. W. Cardullo

PRELIMINARY REPORT OF VHF-FM SATELLITE COMMUNICATION TESTS CONDUCTED ABOARD THE U. S. COAST GUARD CUTTER KLAMATH
Captain G. F. Hempton, Lt. Commander R. F. Goward, and LTJG J. O. Alexander

VHF SATELLITE FOR MARINE COMMUNICATION
A. E. Paredes
(68 pages)

c07 070200 08

W67-015

ADVANCED TECHNIQUES FOR ANALYZING AND IMPROVING GRAVITY GRADIENT SATELLITE POINTING ACCURACIES AT HIGH ORBITAL ALTITUDES - Final Report, Volume I, Analysis; Volume II, Appendices

J. L. Palmer, H. S. Blackiston, R. L. Farrenkopf (Report No. 06517-6005-T000)

TRW Systems

USAF Contract AF 33(615)-5252

Distribution: Defense Documentation Center. No foreign distribution without approval of Air Force Flight Dynamics Lab., Attn: FDCL, Wright-Patterson AFB, Ohio

Accession No.: AD-817 336, AD-817 346

June 1967

This study is directed toward the investigation of the problems, and possible solutions, associated with high pointing accuracies for gravity gradient systems at high orbital altitudes. Two major areas of investigation are considered. In the area of system response, consideration is given to determining the configuration parameters and design techniques which provide the greatest tolerance to disturbance torques. In the area of disturbances, the parameters and design techniques which minimize the amplitudes of the disturbance torques are considered. Specific objectives were to present fundamental gravity gradient characteristics and show methods of analysis. The problem areas are defined by presenting the detailed basic characteristics of a simple single body system and noting its deficiencies. A series of candidate designs are obtained by augmenting the single body system with design techniques which tend to remove its deficiencies. The analytical approach consists of studying the relationship of the system singularities with respect to harmonics of orbit rate. It is shown that for a system with properly located singularities, the influencing parameters in determining ultimate state response are the proper pole and zero locations and damping has a minor effect. The analysis is presented in Volume I and the derivation of dynamic equations, disturbance expressions, and station keeping parameters is contained in Volume II. (Author)

c31 090000 40

W67-017

ANALYSIS OF ISLAND EFFECTS FROM ATS DATA
L. F. Hubert

NESC-ESSA Washington, D. C.

Presented in: Proceedings of the Symposium on Mountain Meteorology, 26 June 1967, Fort Collins, Colorado, Atmospheric Science Paper No. 122

Pictures taken at 23-minute intervals from an earth-synchronous satellite (ATS-1) over the central Pacific are examined to evaluate the cloud-producing efficiency of tropical islands. Can the numerous small islands induce deep convection as significant as, for example, the New Guinea-Borneo-Sumatra group?

Some island effects are easily seen by time-lapse presentation* but it appears that direct small-island effects are insignificant as a mechanism is producing moisture and heat flux to the high troposphere.
(8 pages, 4 illustrations)

*Author's Note: Cloud motions and cirrus development are easily seen when viewed repetitively on a closed-loop time-lapse movie. Figures 2 and 3 are individual pictures from that sequence which are reproduced here to illustrate the general character of the region under discussion. The figures are, however, completely inadequate to illustrate the points made in this paper; the movie must be seen to appreciate the ATS-1 data.

c14, c20 080900 02

W67-018

ATS COMMUNICATION INTEGRATION MOJAVE GROUND STATION, FINAL REPORT

Westinghouse Defense and Space Center, June 1967

Contract NAS 5-9675

The objective of this effort was the integration of the communication subsystems in the Mojave ATS ground station and to insure the readiness of that station to fulfill its mission as an ATS data acquisition facility. This final report summarizes the Westinghouse program effort including the installation design, the supervision of the installation work, the integration and testing of the communications subsystems, and the performance of the communication system tests required to establish the readiness of the Mojave station to conduct prescribed ATS communications operations and experiments.
(129 pages, illustrations, 12 tables)

c11 060200 03

W67-019

APPLICATIONS TECHNOLOGY SATELLITE THERMAL DESIGN

R. J. Wensley, G. A. Kane

Space Systems Division, Hughes Aircraft Co.

NASA Contract NAS 5-3823

Presented to: Thermal Control Working Group Meeting; Dayton, Ohio; 16-17 August 1967

Avail: Space Systems Division, Hughes Aircraft Co., El Segundo, Calif.

Notice: This Abstract in part from C-STAR, Accession No. X69-15882, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

Thermal requirements, analysis, design, and test procedures for both spin-stabilized and gravity - gradient stabilized ATS spacecraft are described.

The spin-stabilized ATS-B and -C were designed to limit temperature of mounting surfaces to 30° F to 100° F ($\pm 30^{\circ}$ F for survival through apogee motor burn and eclipse, respectively) for variations in internal power dissipation of 50 to 180 watts. Passive temperature control is achieved, taking advantage of vehicle spin rate, and maintenance of sun line. Among special problems encountered, spacecraft survival from heat soak back from burned out apogee motor is handled by thermal shielding; thermal control of apogee motor in transfer orbit depends upon thermal mass of the motor and restriction of launch window to constrain the transfer orbit sun angle; and survival of the VHF antenna exposed to the apogee motor plume is accomplished by using beryllium antenna rods and sublimating Teflon sleeving.

The medium altitude gravity - gradient vehicle (ATS-A) thermal design goal was 40° F to 100° F environmental temperature over 30 to 100 watts power dissipation. Among design techniques used was active thermal control using a thermal shutter, rotated by a temperature sensor activator, exposing either more or less of a high-emissivity surface at each end of the spacecraft. Additional problems and their solutions relating to the apogee motor on ATS-B are discussed.

Data from flight tests of ATS-A and ATS-B, and prototype tests on ATS-A are included, as is a review of properties of thermal control finish materials.
(46 pages, 37 illustrations)

c31 021003 01

W67-020

IMAGE DISSECTOR CAMERA SYSTEM
G. A. Branchflower

GSFC

ATS-TP-10

Originally Presented at: ATS Systems Engineers Training Program, GSFC, August 26, 1966

Revised August 1967

Avail: Goddard Space Flight Center, Greenbelt, Md.

The objective of the image dissector camera (IDC) experiment is to transmit back to earth, on a real-time basis, daylingt cloud cover information from the major portion of the full earth's disk. This lecture discusses the parameters of the system, the camera system operating modes, the image dissector camera command list, camera system operation and the image dissector sensor. The associated ground support equipment is discussed with particular attention being given to the video demodulator-sync generator.
(13 pages, 9 illustrations)

c14 080500 01

W67-021

NASA-GSFC, OPERATIONS PLAN 1967, APPLICATIONS TECHNOLOGY SATELLITE (ATS-C)

Project Operations Support Division, Tracking and Data Systems Directorate, NASA-GSFC X-513-67-457; OPPLAN 13-66, September 1967

Avail: Goddard Space Flight Center, Greenbelt, Maryland (For Official Use Only)

This Operations Plan provides planning information for activities concerned with ATS-C, and is to serve as a guide during operations. Contents include:

- Mission
- Responsibilities
- Organization
- Project Implementation
- STADAN Operations and Control
- STADAN Operations
- ATS Operations
- External Agency Support
- Manned Space Flight Network Operations (to be supplied)
- Orbital and Support Computing Plan
- Satellite Scheduling Program
- Information Processing Division
- NASA-GSFC Communications Operations
- ATS-C Signal Strength Calculations
- ATS-C Potential RF Conflicts
- Description of the ATS Ephemeris Tape
- Sequence of Events
- Spacecraft Telemetry Measurements and Command Assignments

(362 pages, 42 illustrations, 23 tables)

c34 040000 04

W67-022

SATELLITE COMMUNICATIONS EXPERIMENTATION, FAA VHF EXPERIMENT

Data Rept. No. 1, Project 221-160-02X

T. H. Barton

NA531, Test and Evaluation Division, Communications Branch, FAA

This data report provides preliminary information on the results of the FAA VHF satellite communication test measurements made with NASA Applications Technology Satellite, ATS-1, in May 1967. The results reported are only a cursory investigation of approximately 30 hours of data recordings. Included in the report is a summary of the test procedure, including flight paths, aircraft antenna patterns, test conditions and preliminary results.

Preliminary results indicated that although the received signal levels on board the aircraft were within expected levels,

it became obvious that additional system tain is required to overcome the multipath propagation, poor antenna patterns and the degradation caused by less than ideal equipment.
(14 pages, 4 illustrations)

c07 070203 02

W67-023

RADIO PROPAGATION STUDIES OF THE IONOSPHERE
(Monthly Progress Report No. 15)

Stanford University

September 1967

NAS 5-10102

This report describes a method of using transmissions from a synchronous satellite (ATS-1) to four ground stations in measuring the columnar electron content of the ionosphere as a technique to study the motions of traveling ionospheric disturbances. The ground stations are at Stanford University and San Diego, California; Ely, Nevada; and Flagstaff, Arizona. Cross-correlation of the fluctuations in the columnar electron content observed at the four ground stations provides precise measurements of both the magnitude and direction of velocities of traveling ionospheric disturbances and to permit relatively inexpensive uninterrupted surveillance of the ionosphere.
(16 pages, 9 illustrations)

c13 100502 01

W67-024

PRESS KIT APPLICATIONS TECHNOLOGY SATELLITE-C

NASA, Washington, D. C.

Release No. 67-276

October 31, 1967

The following general categories of information on the ATS-C are covered in this NASA/Washington press release:

- General Background Information
- ATS Program Up To ATS-C Launch
- The Spacecraft Structure and it Major Subsystems
- ATS Ground Stations & Tracking
- ATS-C Experiments
  - Meteorological
  - Communications
  - Technological
- Sequence of Events
  - Countdown
  - Launch Vehicle
  - Flight Events
- The ATS-C Team

(41 pages, 4 illustrations)

c34 010000 34

W67-025

HELICOPTER COMMUNICATIONS TEST PROGRAM PART I. VHF COMMUNICATIONS VIA ATS-1 SATELLITE RELAY

J. W. Falter, J. W. Uhrig, October 1967

Air Force Avionics Lab, Wright-Patterson AFB, Ohio

Project AF-4164, Task 416401

AD-823957; FLD 17/2-1, 1/3, 22/2; AFAL-TR-67-195-PT-1

NOTICE: No Foreign Distribution Without Approval of Air Force Avionics Laboratory: AVWL, Wright-Patterson AFB, Ohio 45433

Descriptors: (Helicoptors, Communications Satellites (Active)), (Voice Communication Systems, Radio Communication Systems), Feasibility Studies, Advanced Planning, Transport Planes, Very High Frequency, Frequency Modulation, Radio Frequency, Interference, Performance (Engineering), Aircraft Antennas, Antenna Arrays, Airborne, Spaceborne.

(55 pages)

c07 070205 01

W67-026

ATS-C METEOROLOGICAL DATA UTILIZATION PLAN

Abraham L. Ruiz, Leon Goldshlak

9 G45-9 October 1967

Tech Rept. #2 Contract NAS 5-10343

A Meteorological Data Utilization Plan is presented which describes the capability for processing, cataloging, reproducing and storing ATS-C meteorological photographic data at a non-real time rate. This plan utilizes fully the capability and existence of a previously conceived Meteorological Data Utilization Center uniquely oriented toward the processing of satellite meteorological data for the NIMBUS and ATS satellite series (NADUC). A description of the meteorological experiments of ATS-C is included.
(29 pages, 7 illustrations)

c20 080000 03

W67-027

VHF REPEATER EXPERIMENT FOR ATS/C, FINAL REPORT

Res. and Development Div., Hughes Aircraft Company

Rept. No. P67-177, HAC Reference No. B1868-001, 5 Nov. 1967

NASA Contract No. NAS 5-10290

This final report summarizes the Hughes effort of development, design, fabrication, and testing of the ATS/C linear VHF Repeater equipment. This report will serve as a reference document for the remainder of this VHF Repeater Experiment Program for ATS/C. Included in this report are a system summary, a discussion of the system acceptance testing, a discussion of the third harmonic generator, the VHF repeater simulator operation and test and a description of Hughes special test equipments.
(152 pages, 78 illustrations)

c07 070200 13

W67-028

NASA ATLAS/AGENA LAUNCH OPERATIONS WORKING GROUP APPLICATIONS TECHNOLOGY SATELLITE 3 LAUNCH REPORT

Lockheed Missiles & Space Company

Contract: FO4695-67-C-0075

LMSC-274518 16 November 1967

Limited Access

The Applications Technology Satellite 3 flight vehicle, consisting of Atlas SLV-3 5103, Agena-D 6153 and spacecraft ATS-C, was launched on the third attempt on 5 November 1967 at 1837:00.257 EST from launch complex 12, Air Force Eastern Test Range. The range test number was 2800.

A significant amount of data is presented covering flight analysis, Atlas performance, Agena performance, range data coverage and prelaunch operations. A large amount of descriptive data is included in appendicies, tables and figures.

All launch vehicle systems performed satisfactorily and spacecraft ATS-C was injected into the proper transfer eclipse.
(78 pages, 13 illustrations, 22 tables)

c30 030300 01

W67-029

THE APPLICATIONS OF CATALYTICALLY DECOMPOSED HYDRAZINE FOR SPINNING SYNCHRONOUS SATELLITE AND STATION KEEPING

M. E. Ellion, H. DiCristine, and D. A. Mahaffy

Hughes Aircraft Company

Contract: NAS 5-3823

Presented to: Hydrazine Mono Propellant Symposium, Silver Spring, Maryland 11/22/67

Published in: Proceedings of the Symposium, 11/28/67

With the development of Shell 405 catalyst, anhydrous hydrazine now has become adaptable as a mono-propellant in satellite reaction control systems where multiple restart steady-state and pulse mode operations are required for extended periods in space. In order to accumulate actual flight data, the ATS-C spacecraft was modified by converting one of the two reaction control systems over to the use of hydrazine as a propellant. Systems design, modification techniques, development tests and ground support equipment are discussed in some detail with reference to the conversion set-up. A short discussion on hydrazine requirements for future satellite is presented with the accent on performance, reliability and cost.
(11 pages)

c27 021100 01

W67-030

ATS VHF PERFORMANCE

Space Systems Division, Hughes Aircraft Company

SSD70514R December 1967

This report gives a summary of ATS VHF performance as applied to ATS-1 and ATS-3. A brief description of each satellite, including positioning, launch data, and repeater characteristics is given. Performance curves derived from certain modulation and receive characteristics are shown. The primary emphasis of the report is placed on the signal strength variations as measured by Hughes in recent flight tests through November 1967.
(21 pages, 18 illustrations, 3 tables)

c07 070200 16

W67-031

FINAL REPORT FOR ELECTRON SPECTROMETER FOR ATS-1 AND 2 (MARCH, 1965 - DECEMBER 1967)

University of Minnesota

Contract NAS 5-9542

December 1967

This report summarizes a measurement at synchronous orbit of energetic electrons detected by a magnetic deflection spectrometer at energies between 40 keV and 1 meV for the purpose of investigating the origin of these energetic electrons in the trapped radiation. The report includes a brief introduction covering the ATS-1 mission, the data tapes received and some pertinent facts about the operation. A brief discussion of the trapped radiation is given and the specific objectives of the experiment namely, to investigate the acceleration mechanisms during magnetic storms and to perform exploratory measurements in the outer zone, are outlined. The advantages of the geostationary orbit for these purposes are described. A rather detailed description of the construction and operation of experiments follows, including the reduction of data and the determination of electron fluxes in space. Different types of data plots and outputs and the problem of noise filtering are described. A list of titles and abstracts of key published papers is given, followed by a detailed summary of the principal results, their meaning, and theoretical interpretation. This latter section includes comparisons with the OGO electron spectrometer, which permits simultaneous measurements at several places in the magnetosphere. The magnetospheric substorm is identified as a primary mode of injection of electrons into the outer radiation belts.
(48 pages, 17 illustrations)

c13 110400 03

W67-032

REPORT ON FREQUENCY STABILITY OF VHF EXPERIMENTS ON ATS-3

T. M. Stores

ATSOCC SYSTEMS ENGINEER, NASA
NASA, GSFC, 1967

This report summarizes the results of a series of tests conducted on the ATS-3 spacecraft for the purpose of measuring the frequency stability of the downlink carrier from the VHF transponder. The tests were conducted 10-13 Nov. 1967. The report is oriented toward test results and not on speculation on causes of problems detected during test.
(34 pages; 37 illustrations, 4 tables)

c07 070102 01

W67-033

A PHOTOGRAMMETRIC TECHNIQUE FOR FINDING WINDS FROM SATELLITE PHOTOS

M. H. Johnson

Department of Meteorology, University of Wisconsin,
ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1967 (080100 57, N69-17232)

Avail: University of Wisconsin, Madison, Wisconsin

This development introduces a stereoscopic method of measureing cloud displacements from a sequence of ATS photos, and a means to convert these measurements into velocities relative to the earth. Comparisons are made between cloud velocities calculated in this fashion and corresponding rawinsonde wind measurements, with a standard deviation of 21 degrees for direction difference between calculated and measured values, and a standard deviation of 2.7 meters per second for velocity difference.
(18 pages, 8 illustration)

c14 080100 13

W67-034

CLOUD MOTION AND OTHER PARAMETERS FROM ATS-1 DIGITAL DATA

K. J. Hanson, T. H. Vonder Haar

Department of Meteorology, University of Wisconsin

ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1967 (080100 57, N69-17232)

Avail: University of Wisconsin, Madison, Wisconsin

The ATS-1 digital data recording system provides maximum quantitative brightness information from the cloud camera by storing cloud brightness data in a matrix of 2018 scan lines by 8196 picture elements with brightness data digitized at each element on a scale from 0 to 255. To show how this information may be applied to discriminate cloud motion and to parameterize cloud features, three examples of familar clouds are treated:

(1) For low level cumulus embedded in the tropical easterlies, boundaries are discriminated while cloud velocity divergence field are divergence field are determined from a picture pair.

(2) Cloud ensembles made up of deep tropical convection can be parameterized by examining the horizontal brightness gradient and integration of cloud area.
(3) Typhoon Sarah in the mid-Pacific on September 11, 1967, is illustrated; and the band structure is evident.

(16 pages, 14 illustrations, 8 references)

c20 080100 14

W67-035

PHENOMENOLOGY OF CONVECTIVE RING CLOUDS IN THE TROPICS DERIVED FROM GEOSYNCHRONOUS SATELLITE OBSERVATIONS

T. Vonder Haar, K. Hanson, V. Suomi, U. Shafrir

University of Wisconsin

ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1967 (080100 57, N69-17232)

Presented at: International Conference on Cloud Physics, Toronto, 1968

Avail: University of Wisconsin, Madison, Wisconsin

This paper is a preliminary study of the spatial and temporal variations of the ring-like patterns formed by convective cloud, using digitized samples of the video signal from the spin-scan camera on ATS-1. Frequently observed within the tropical convergence zone, those rings are composed of individual convective clouds and surround clear regions whose diameters vary from 30 to 90 kilometers when well-developed. Based on six samples studied, a typical estimated life cycle is 14 to 16 hours. Results demonstrate the usefulness of very high resolution satellite data in such studies.

(7 pages, 4 illustrations, 2 references)

c14, c20 080100 15

W67-036

ON THE DOUBLE STRUCTURE OF CLOUD DISTRIBUTION IN THE EQUATORIAL PACIFIC

J. Kornfield, K. Hanson

Department of Meteorology, University of Wisconsin

ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1967, (080100 57, N69-17232)

Avail: University of Wisconsin, Madison, Wisconsin

This study has employed a photographic and manual technique to analyze ATS-1 cloud information. An equatorial cloud doublet is observed in the East Central Pacific region. It is best developed in March and April. The cloud bands have a preferred location between 5 and 10 degrees North and South of the Equator, and the northern band extends across nearly the entire Pacific Ocean. There is only minor latitudinal displacement of the northern band west of 120^{o} West longitude. East of the meridian there is a seasonal displacement. The intensity, longitudinal position, and extent of the southern band varies with season. The doublet may be closely associated with warmer surface waters in the eastern Pacific in the early spring.

(9 pages, 5 illustrations, 15 references)

c14, c20 080100 16

W67-037

THE INSPACE, ABSOLUTE CALIBRATION OF ATS-1 CLOUD CAMERA

K. J. Hanson, V. E. Suomi

Department of Meteorology, University of Wisconsin

ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1967, (080100 57, N69-17232)

Avail: University of Wisconsin, Madison, Wisc.

The ATS-1 cloud camera was calibrated by observing the moon on September 19, 1967. This paper presents both theory and data for that calibration. In that case the moon served simply as a passive brightness source with which to determine the ATS-1 cloud camera response to reflected sunlignt. The moon's bidirectional reflectance was found by comparing its brightness to a secondary-standard reflectance surface (Kodak white paper), which had been calibrated by comparison with a MgO_2 reflectance surface.

In addition, the paper discusses the use of equations, based on ATS-1 calibration, for determining the radiance of earth and atmosphere, and for determining the bidirectional reflectance within the field of view of the camera.

(25 pages, 4 illustrations, 12 references)

c14, c20 080100 19

W67-038

THE LINE ISLAND EXPERIMENT AND ATS-1 DATA GUIDE

T. L. Yonker

Department of Meteorology, University of Wisconsin

ESSA Grant: WBG-27

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report-1967, (080100 57, N69-17232)

Avail: University of Wisconsin, Madison, Wisc.

The Line Island Experiment provided an opportunity to correlate surface, ship, aircraft, and satellite observations of the Intertropical Convergence Zone. This guide includes ATS-1 cloud photographs of the area of observation (10^{o} S to 20^{o}N, 140^{o}W to 130^{o}W) for each day from February 13 through May 19, 1967. A second set of illustrations consists of a data grid that shows, for local time on each day of the experiment, the type of instrument observations that were made from ATS-1 and ESSA-II and -V satellites, as well as from aircraft, ship, and ground.

(41 pages)

c14, c20 080700 03

W67-039

RADIO PROPAGATION STUDIES OF THE IONOSPHERE FINAL REPORT OF INSTALLATION PHASE

Stanford Project 3304, 1967
Radioscience Laboratory, Stanford University

Contract NAS 5-10102

This final report is a summary of the Stanford University effort on the first portion of a two-phase project on Radio Propagation Studies of the Ionosphere using the ATS satellites. The report includes discussion of the nature and objectives of the experiment and its relationship to other satellite work at Stanford. The history of the project is discussed. The equipment that Stanford developed and installed for the reception of the VHF and UHF signals from ATS-B/C is defined. Features included in this equipment for these studies include the capability to measure the Faraday rotation angle and the differential Doppler beat. Data obtained from the ATS-B/C propagation experiment will be used in at least the following areas of scientific investigation:

A. Temporal Variations of the Protonsphere
B. Electron Content, Production, and Loss Rates in the Ionosphere
C. Motions of Irregularities in the Ionosphere
D. Study of the Diurnal Behavior of the Columnar Electron Content Curve

Included in this report is a mathematical development of the measurement of the satellite spin axis orientation.

The second portion of the contract includes the operations of the data collection stations and the data analysis and interpretations.
(32 pages, 12 illustrations)

c13 100502 02

W67-040

DATA ACQUISITION, REDUCTION AND ANALYSIS FOR THE APPLICATIONS TECHNOLOGY SATELLITE COMMUNICATION SYSTEM

G. E. Dehm

Westinghouse Electric Corporation

Submitted to Johns Hopkins University as a requirement for MS degree in Engineering, 1967

This paper has an excellent summary of the communication satellite program up to 1967. The communication experiments of the ATS program are described in detail and this sets the stage for the description of the communication data reduction and analysis plan.
(89 pages, 10 illustrations)

c07 060000 06

W67-041

SMALL USER USE OF THE ATS MULTIPLE ACCESS SHF TRANSPONDER

Westinghouse Defense and Space Center, Baltimore, Maryland

Contract No.: NAS 5-3980, May 1967

Prepared for: NASA/GSFC, Greenbelt, Maryland

This report describes the feasibility under certain conditions of small users operating through the Applications Technology Satellite (ATS-B) transponder, simultaneously with the normal users of the SSB/PM mode. Due to carrier suppression, and the continuous nature of the PM spectrum, operation is only feasible with the small user carrier inside the regular baseband under certain conditions. With 1200 channels modulation, the usefulness of the mode is very restricted. In the 240 channel case however, the small users can very easily be placed outside the regular baseband, and the mode becomes much more attractive.

In the event a transponder with greater antenna gain (proposed for ATS-C, D, and E) and with more gain ahead of the SSB/PM converter were to be put into orbit, it would be possible to operate from four to eight small users simultaneously with the regular 1200 channel signals, to operate with quite reasonable powers at small user locations, and to communicate directly back and forth between small users.

Equipment needed for tests of the small user mode of operation has been suggested, to the block diagram level, and an experimental program has been outlined.
(80 pages, 11 figures)

c07 070100 07

W67-042

USE OF ELECTRONIC COMPUTERS TO AID IN THE DESIGN OF SATELLITE - BORNE EXPERIMENTS

S. E. DeForest, R. J. Walker

University of California at San Diego, Dept. of Physics, LaJolla, California

Contract No.: NAS 5-10364 Grant No.: NsG-538

Report No.: UCSD-SP-67-3, June, 1967

Avail.: Univ. of Calif. at San Diego, Dept. of Physics, LaJolla, California

In January 1967 the Space Sciences Laboratory of the University of California at San Diego was requested to propose an experiment to study low-energy protons and electrons associated with optical aurora from aboard the Applications Technology Satellite (ATS-E). The relatively short time between initial concept of the experiment and the launch meant little time to optimize the design of the experiment to take full advantage of the ATS-E orbit, within the allowed telemetry and other physical constraints. Therefore, extensive use has been made of computer simulation techniques to design and continually review the experiment.

Since the satellite will be anchored above a given location on earth, rapid time variation in the density and spectra of electrons and protons can be separated from the spatial variation with much more ease than normally possible with a satellite which makes a rapid pass through the auroral zone on the low end of an elliptical orbit.
(31 pages, 12 figures)

c08 111400 01

W67-043

PRELIMINARY ELECTRON DATA FROM SYNCHRONOUS SATELLITE ATS-1

J. B. Blake, S. C. Freden, S. S. Imamoto, G. A. Paulikas

Aerospace Corporation, Space Physics Lab, El Segundo, Calif.

The omnidirectional spectrometer aboard the Applications Technology Satellite (ATS-1) is described together with analysis of preliminary data obtained during December 1966. Fluxes and spectra of energetic electrons are found to be in general agreement with results obtained in this region of space by earlier spacecraft. Fluctuations in electron fluxes of several varieties are detected.

c29 110100 01

W67-044

THE FIRST COLOR MOVIE OF THE PLANET EARTH, ATS-III

16 MM Movie

University of Chicago

1967

Using the color pictures obtained from ATS-III on 18 November 1967 a 400-ft. 16-mm film was made showing cloud cover and cloud systems over approximately one third of the globe. Close-up shots of a number of areas are made to show specific features in the area.

c14 081000 01

W67-045

DESIGN TECHNIQUES FOR AN ATS-4 POWER SYSTEM

E. G. Moses

NASA/GSFC, Greenbelt, Maryland

Report No.: X-716-67-59

Avail: NASA/GSFC

This report concerns environmental and performance parameters considered in the design of the Applications Technology Satellite (ATS-4) power system. The system provides a 28-volt regulated bus from energy derived from solar cells and batteries during daylight and from batteries during night.

The system described easily supplies the 200-watt daytime load and 100-watt nighttime load when the sum is at an extreme angle and after two years of radiation damage. Even under worst case conditions, the design described will fulfill the satellite operational requirements.

c03 020200 05

W67-046

DRAFT OF MINUTES - TENTH GROUND STATION COMMITTEE MEETING

NASA/GSFC, Greenbelt, Maryland

Report No.: X-460-67-247

Avail: NASA/GSFC

A summary report on the Application Technology Satellite (ATS-1) by R. J. Darcey, ATS Project Manager, concerning the spacecraft and experiments is referenced in this draft. Also cited are the "ATS Technical Data Report", dated March 3, 1967 and the "ATS Communications System Description", dated November 1966.

Plans for ATS missions A, C, D, and E are also briefly discussed including references to launch, transfer orbit and spacecraft maneuvers, antenna polarization, tracking, SHF and VHF communication, nutation sensor, and spin-scan cloud camera experiments.

c34 010000 30

W68-001

A COLOR VIEW OF THE PLANET EARTH

V. E. Suomi, R. J. Parent

Department of Meteorology, University of Wisconsin

ESSA Grant: WBG-27

Published in: Bulletin of the Amer. Meteor-Soc., Vol. 49, No. 2, Feb. 1968, pp. 74-83

A photograph of the earth taken from the multicolor spin-scan camera on ATS-3 is reproduced on the cover. This satellite, orbiting over the mouth of the Amazon River, provides pictures of convective activity over the continental tropics of Central and South America. Color capability helps to estimate the altitudes of the cloud tops, since Rayleigh scattering over long light paths causes a change in the ratio of the energy in the blue and red portions of the spectrum. This camera has a sufficiently wide view angle to include the whole earth disk, making accurate navigation easier.

Accompanying articles (W. Sunderlin, Dr. G. Warnecke) describe the details of the camera and its operation, and show some results.
(10 pages

c14, c20 080100 18

W68-002

SINGLE SIDEBAND COMMUNICATIONS WITH ATS SATELLITE

R. J. Darcey

NASA, Goddard Space Flight Center, Greenbelt, Md.

Presented to: IEEE International Convention, New York, N. Y., 18-21 March 1968

Published in: New York: Institute of Electrical and Electronics Engineers 1968, page 209

The Applications Technology Satellite Program is attempting to evaluate problems associated with various modulation techniques applied to satellite communications. The systems being evaluated are: frequency modulation, single sideband modulation, and PCM. The latter system is in process of fabrication and test data will not be available for approximately six months. The primary parameters being evaluated are system efficiency, operational effictiveness, and multiple access.

c07 070100 08

W68-003

FINAL REPORT ATS COMMUNICATIONS INTEGRATION CONTRACT ROSMAN GROUND STATION

Westinghouse Electric Corp., Baltimore, Md.

NAS 5-3980

March 1968

This final report covers the activities which were provided under the Communications Integration Contract (CIC) for the Applications Technology Satellite Program at the Rosman, North Carolina, ground station. The report involves work performed during the period ending with the completion of the on-site integration effort. The Field Engineering and Support Department of the Westinghouse Electric Corporation was awarded the contract by the National Aeronautics and Space Administration, Goddard Space Flight Center and was responsible for the system integration and site readiness of the Communications Experiment Network.

The initial task required the installation and integration of the communications subsystems. This task included the definition of interfaces, fabrication of cabling, wiring, and providing other material required to interconnect the subsystems. In addition, Westinghouse designed, fabricated and installed the Communications Test and Evaluation Console (CTEC) and the Master Control Console (MCC).

After completing the installation, a series of tests was performed, which included both subsystem and system integration tests. Basically, these integration tests utilized back-to-back loops, which provided a means of evaluating the communications system performance of the ground station prior to launch of the spacecraft. As an additional effort Westinghouse wrote the SHF and VHF experimental test plans. These plans served as a source from which the integration tests were developed. Westinghouse also fabricated and installed two other Communications Test and Evaluation Consoles (CTEC) for the Mojave and Transportable Ground Stations.

Throughout the entire period, documentation was provided in the form of reports, drawings and test plans. The initial installation phase started in July 1965 and the station was ready for experimentation in October 1966, prior to the December launching of the ATS-1 satellite.
(112 pages, 31 figures, 2 tables)

c07, c11 060100 03

W68-004

A PRELIMINARY REPORT ON THE MARITIME MOBILE SATELLITE COMMUNICATIONS TESTS ABOARD THE S. S. SANTA LUCIA

E. J. Mueller*, and C. G. Kurz**, March 1968

*Westinghouse Electric Corp., Baltimore, Md.
**U. S. Maritime Administration, Washington, D. C.

The VHF Satellite Communication Test Project, undertaken by the Office of Research and Development of the Maritime Administration, resulted in a test voyage aboard the S. S. Santa Lucia commencing from Port Newark, N. J., through the Panama Canal to Valparaiso, Chile, and return. Tests of voice, data, time synchronization, ranging, interference and propagation were conducted during the 36-day voyage by ARA and Westinghouse personnel, with cooperation of NASA.

The large amount of data gathered during the tests which terminated on March 7, 1968, is still being reduced and analyzed; however, a preliminary review of this data shows some significant observations worthy of reporting at this time. The feasibility of simplex voice communications reported on other programs has been reaffirmed with very good performance observed using an effective radiated power of 1.5 kilowatts aboard the ship. A manually oriented high-gain antenna system was successfully employed at sea, with difficulty arising only when changing course in harbors and rivers. An omnidirectional antenna, employed on five occasions, provided good voice reception at all times. Fading was observed at times, but was not as severe as anticipated.

Pseudorandom test patterns of digital data at 600 and 1200 bits per second were transmitted from shore to ship and back. The complete round-trip error rate was not quite as low as might be expected, but it is felt that difficulties experienced in synchronizing in the error counting process might be related to the errors. The one-way data from the ground station to the ship is not yet analyzed.

The ability to lock up and slave a time display aboard ship from time signals from a ground station through the VHF satellite transponder was demonstrated.

Analysis of three periods of ranging the ship through the satellite is still in progress. A cursory review of this data appears to be inconclusive at this time.

c07 070208 02

W68-005

SATELLITE COMMUNICATIONS EXPERIMENTATION; INVESTIGATION OF AIRBORNE VOR RECEIVER INTERFERENCE CAUSED BY SATCOM TRANSMISSIONS ABOARD THE AIRCRAFT

Test and Evaluation Division, Communications Branch, FAA

Data Report No. 2 Project 221-160-02X April 1968

This data report provides conditions and results of tests performed to provide data pertinent to VOR receiver interference caused by high power satellite communications transmissions on board aircraft.
(20 pages, 10 illustrations, 3 tables)

c07 070203 03

W68-006

PRECISE TIME TRANSFERS TO REMOTE LOCATIONS VIA VHF SATELLITE TRANSPONDER

P. F. MacDoran

USESSA, Satellite Triangulation Division, Coast and Geodetic Survey

April 1968

Avail: Chief, Satellite Triangulation Division, National Oceanic and Atmospheric Admin., Rockville, Md.

The requirement of precise timing for geodetic data acquisition at a remote satellite triangulation station on Pitcairn Island, South Pacific, has prompted the development of a VHF satellite transponder timing system using ATS-1 and 3. This system has been shown capable of achieving accuracies of better than ± 2 microseconds.

In order to analyze the satellite timing system, an algebra is proposed for systematically dealing with system variables and the general active system with channel reciprocity is solved. In order to meet the assumptions in deriving the system equations, a noncatering time encoding technique is introduced.

Passive (one-way transmission) satellite time transfers are considered using a simple earth-satellite analytical model which provides accuracies of better than ± 100 microseconds. Also discussed are timing experiments to a ship at sea, and a South Atlantic island using ATS-3.
(9 illustrations, 65 pages, 6 references)

c21 070207 02

W68-007

THE ATS-E MILLIMETER WAVE PROPAGATION EXPERIMENT

W. O. Binkley, L. J. Ippolito, J. L. King, and R. B. Ratliff

April 1968

NASA, Goddard Space Flight Center, Greenbelt, Maryland

NASA-TM-X-63240; X-733-68-196

Avail: NASA/GSFC, Greenbelt, Maryland

NOTICE: This Abstract from C-STAR, Accession No. X68-17182, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

A review is presented of the ATS-E millimeter wave experiment for defining atmospheric propagation effects at Ku and Ka band, and for evaluating the usefulness of these bands for communication and data link applications. The experiments is designed to determine the propagation characteristics of the earth spacecraft channel in the atmospheric windows centered at frequencies of 15.3 GHz and 31.65 GHz. Several sites will be utilized for experiment ground stations. Extensive meteorological data will be accumulated at each site including radar return, radiometer temperature, rain rate, wind velocity and direction, ambient temperature, and pressure. Two areas of data analysis are planned for the experiment. The first includes an extensive statistical analysis of signal effects versus meteorological variables. The second area is a study of channel characterization by two dimensional (time-frequency) correlation measurements on the signal amplitude data.
(115 pages, with refs)

c07 070300 03

W-68-008

COMPUTER PROCESSING OF SATELLITE CLOUD PICTURES

C. L. Bristor

ESSA National Environmental Satellite Center

Technical Memorandum NESCTM-3, April 1968

Avail: Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce

This paper describes the computer processing of cloud pictures from the ESSA series of satellites in sun-synchronous orbit. Logic diagrams and generalized flow descriptions are given for input data processing, earth location, and picture mapping as performed in April 1968. Usages of the product are listed, including distribution of image sectors through the WEFAX facilities of ATS-1.
(11 pages, 3 illustrations)

c08, c14, c20 080900 03

W68-009

TRAPPED ELECTRONS AT 6.6 R_E DURING THE JANUARY 13-14, 1967 MAGNETIC STORM

L. J. Lanzerotti, W. L. Brown, C. S. Roberts, C. G. Maclennan

Bell Telephone Lab, Inc., Murray Hill, N.J.

Presented to: Amer. Geo. Union

Published in: Trans. Amer. Geo. Union, April 1968 p 229

The sudden abnormal dayside decreases in the energetic ($E \sim 400 \sim 2000$ kev) trapped-electron fluxes observed by ATS-1 at synchronous altitude ($\sim 6.6\ R_E$) about twelve hours after the 1202 hours January 13, 1967, UT, sudden commencement geomagnetic storm are investigated. The electron fluxes during the storm are correlated with the magnetometer data from ATS-1 and with ground-based magnetometers at College, Honolulu, and Nurmijarvi. Particular emphasis is placed on understanding the sudden (within ~ 1.5 min.) flux wipe out that occurred about a minute prior to a sudden reversal in the horizontal magnetic field direction at the satellite at 2:03 PM satellite local time. The electron spectrum after this dayside, trapped-electron wipe out was observed to become very hard during two separate 10-minute periods. A sharp electron flux decrease prior to this wipe out, occurring near 1:20 PM satellite local time, is also described. This decrease occurred simultaneously with a sharp (within 12 sec.) 23-γ decrease in the horizontal field intensity at the satellite.

c29 110300 05

W68-010

OBSERVATIONS OF THE MAGNETOPAUSE AND MAGNETO SHEATH AT 6.6 R_E

W.C. Cummings, A.W. Harris, P.J. Coleman, Jr.

University of California, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1968

Published in: Trans. Amer. Geo. Union, 1968, p. 229

During the main-phase decrease of the geomagnetic storm that began on January 13, 1967, the magnetopause was detected at synchronous altitude (6.6 R_E geocentric range) with the Applications Technology Satellite (ATS-1). Several traversals of the boundary occurred during a 1 hr. interval. The magnetic fields measured during this interval have been examined. The magnetospheric field was 200γ at the boundary. The quiet-day magnitude of the geomagnetic field at this location is typically about 120 γ. The magnetosheath field was roughly 140γ and at nearly 180^{o} to the direction of the magnetospheric field. Power spectra levels were computed about ten times greater in the magnetosheath than in the geomagnetic field. Boundary normals have been computed for each traversal, under the assumption that the normal component of the field is zero. The normals are roughly radial from the earth. Normals have also been computed from amplitude distributions of the vector field components. The results from the two methods have been compared. When the boundary crossings are examined in detail, they are seen to be quite complicated, with rotations occurring in the meridional plane as well as in the plane perpendicular to the radial from the earth. Pure rotations of the field with no change in field strength cannot adequately describe the boundary. In fact, a short interval of very weak field was recorded during each boundary encounter.

c13 110800 10

W68-011

LOCAL TIME DEPENDENCE OF MAGNETOSPHERIC SUBSTORMS AS OBSERVED AT SYNCHRONOUS EQUATORIAL ORBIT

W. D. Cummings, J. N. Barfield, P. J. Coleman, Jr.

University of California, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1968

Published in: Trans. Amer. Geo. Union, 1968, p. 230

Whenever substorms are in progress, a depression in the field (typically 40γ) is observed as the satellite progresses through the evening sector toward the midnight meridian. Usually near midnight a sudden recovery of the field at 6.6 R_E marks the onset of a substorm. A continuation of the depression through the midnight meridian is rarely if ever observed. Further, large depressions in the field are not observed to accompany substorms in the morning sector. The local-time dependence in the signature of the storms suggests that the driving mechanism is symmetrical about the midnight meridian. The time constant for the recovery of the field at synchronous orbit also seems to have a local dependence. Abrupt recoveries, with a time count of the order of 10 min., occur near the midnight meridian, and more gradual recoveries occur from midnight in the evening sector.

c13 110800 11

W68-012

DETECTION OF THE MAGNETOSHEATH PLASMA AT THE SYNCHRONOUS ORBIT, JANUARY 14, 1967

J. W. Freeman, Jr., J. J. Maguire, C. S. Warren

Rice University, Dept. of Space Science, Houston, Texas

Presented to: American Geophysical Union Spring Meeting, April 1968

Published in: Trans. Amer. Geo Union, 1968, p. 229

On January 13 and 14, 1967, an intense magnetic storm occurred. Within three hours after the beginning of the main phase, a positive impulse was observed at low-latitude stations. Coincident with this impulse, anamalously high anisotropic particle fluxes were observed by the low-energy ion detector aboard the synchronous Applications Technology Satellite, ATS-1. At that time the spacecraft was located at approximately 1430 local time. The direction of flow and energy of these particles are consistent with the interpretation that the magnetopause was pushed inward to at least 6-5 R_E during this event. Further, the satellite encountered the magnetopause several times during the ensuing hour. The interesting directional changes in plasma flow at each crossing of the boundary are described.

c13 110700 12

W68-013

THE STORM TIME MAGNETIC FIELD AT 6.6 R_E

W. D. Cummings[1], G. L. Wengrow[1, 2], P. J. Coleman, Jr.[2]

University of California, Los Angeles[1]

North American Rockwell Corp., Downey, California[2]

Presented to: American Geophysical Union Spring Meeting, April 1968

Published in: Trans. Amer. Geo. Union, 1968, p. 230

Applications Technology Satellite (ATS-1) magnetic field data covering several geomagnetic storms occurring between December 1966 and June 1967, are presented and discussed. Comparison of ground and satellite magnetograms indicated strong local-time dependence in the development of field distortions during storms, with the greatest distortion occurring in the afternoon-to-midnight sector. The storm-time observations at the synchronous, equatorial orbit thus show the same local-time effect that is observed at low-latitude surface magnetic stations. We observe large amplitude quasi-sinusoidal oscillations during the main and recovery phases of the storm. The oscillations in H range in amplitude to 30γ with periods ranging from a few minutes to an hour. The oscillations also exhibit a local time dependence occurring in the afternoon-to-midnight sector. The signature of the storm at the satellite is compared with magnetograms from several low latitude ground stations in an attempt to disentangle and identify the various possible sources of the distortion, e.g., the tail current, ring current, and Chapman-Ferraro current.

c13 110800 12

W68-014

THE LONGITUDINAL BUNCHING OF HIGH-ENERGY OUTER-BELT ELECTRONS

W. L. Brown[1], H. Brewer[1], M. Schulz[1], C. S. Roberts[1], L. Lanzerotti[1], J. Roederer[2]

Bell Telephone Lab., Inc., Murray Hill, N.J.[1]

Univ. of Denver, Colorado[2]

Presented to: American Geophysical Union Spring Meeting, April 1968

Published in: Trans. Amer. Geo. Union, Vol. 49, p 228

The energy-dependent longitudinal drift of electrons with energy between 0.4 and 1.9 MeV has been observed at 6.6 R_E on the Applications Technology Satellite (ATS-1). The drift is measurable as a result of a longitudinal bunching of particles. The drift period of the bunches is explained by the calculated drift in the distorted field of the magnetosphere at 6.6 R_E. The electron bunching need not be due to injection of particles but may be produced by disturbances of the magnetic field that violate the third adiabatic invariant and introduce a longitudinal anisotropy in the existing particle distribution. Disturbances that are represented as due to a sudden shift of the stand-off distance of the boundary by a fraction of an earth radius are sufficient to account for the observed effects.

c13 110900 01

W68-015

VHF SHIPBOARD TESTS ON U.S. COAST GUARD CUTTER GLACIER, FINAL REPORT

Joe N. Ware

Electronics Engineering Laboratory, U. S. Coast Guard, Washington Radio Station, Alexandria, Va.

29 May 1968

This report is a summary of results obtained from the VHF satellite tests conducted on board the USCGC Glacier

during the period from 15 October 1967 - 27 April 1968. The Glacier was operating in the region extending from Los Angeles, California, Port Lyttleton, New Zealand, and the Weddell Sea (Antarctica).
(31 pages, 19 illustrations, 12 tables, 5 appendices)

c07 070206 02

W68-016

CONTINUOUS OBSERVATION OF WEATHER MOTION

V. E. Suomi

Director, Space Science and Engineering Center, University of Wisconsin

Presented to: UN Conference on Exploration and Peaceful Uses of Outer Space, 20 June 1968 for Thermatic Session II

The United States Applications Technology Satellite (ATS-1) and others in this series are geostationary space platforms which make it possible to view the weather directly over more than one third of the earth. The motions of major storm systems in high and low latitudes can be tracked accurately. They can be seen as they form and dissipate. Smaller systems, such as hurricanes and typhoons, can be seen from birth to death. Even individual thunderstorms and severe convective storms are observable. The motions of cloud systems can be measured accurately from pciture to picture, and certain features of their structure can be inferred. Examples of these views will be shown using movies.

ATS-1 pictures are being made available on an experimental basis to APT (Automatic Picture Transmission) stations within the ATS-1 coverage area. These stations oridinarily receive local cloud cover pictures from the ESSA and Nimbus satellites, but can also receive ATS-1 pictures retransmitted from NASA experimental ground stations over the VHF channel in ATS-1

Complete nighttime coverage could be made available in the future by using IR sensors.

If experimental geostationary observation satellites are to lead to an operational capability, interested Governments would need to bring satellites into being, provide the ground equipment necessary, and train people to operate it and interpret what is seen. Finally, such nations should develop communications systems for providing timely warnings to people in the paths of destructive storms.
(9 pages)

c14, c20 080100 07

W68-017

NASA-GSFC OPERATIONS PLAN 10-68, APPLICATIONS TECHNOLOGY SATELLITE (ATS-D)

Project Operations Support Division, Tracking and Data Systems Directorate, NASA-GSFC

X-513-68-223; OPPLAN 10-68; June, 1968

Avail: Goddard Space Flight Center, Greenbelt, Maryland (For Official Use Only)

This Operations Plan provides planning information for activities concerned with ATS-D, and is to serve as a guide during operations. Contents include:

- Mission
- Responsibilities
- Organization
- Project Implementation
- STADAN Operations and Control
- STADAN Operations
- ATS Operations
- External Agency Support
- Manned Space Flight Network Operations
- Orbital and Support Computing Plan
- Information Processing Division
- NASA-GSFC Communications Operations
- ATS-D Signal Strength Information
- ATS-D Potential RF Conflicts
- ATS Ephemeris Tape Description
- Sequence of Events
- Spacecraft Telemetry Measurements and Command List

(312 pages, 30 illustrations)

c34 040000 05

W68-018

RADIO PROPAGATION STUDIES OF THE IONOSPHERE, QUARTERLY PROGRESS REPORT #2 (1 April through 30 June 1968)

1 July 1968

Stanford University, Stanford, California

Contract No. NAS 5-10102, Stanford Univ., Proj. 3304

This report defines Stanford progress on the data collection and reduction program using the Faraday rotation angle technique to measure the columnar electron content using VHF signals from a geostationary satellite. Columnar content data from ATS-3 is being recorded at seven stations for reduction and analysis at Stanford. The ATS-3 differential Doppler frequency experiment defined in the first quarterly progress report is compared with the Faraday rotation angle technique.
(4 pages)

c13 100507 01

W68-019

APPLICATIONS TECHNOLOGY SATELLITE ATS-D EXPERIMENTAL COMMUNICATIONS SYSTEM DESCRIPTION

ATS Project Office, GSFC

GSFC-S11-036; July 16, 1968

Avail: Goddard Space Flight Center, Greenbelt, Maryland

Following an introductory outline of the ATS program, mission, and ATS-D launch sequence, this report supplies a system description of the multiple access (SSB-PM) and frequency translation modes of operation to be used for the communications experiments with ATS-D. Baseband and IF signal characteristics and link requirements are specified: system parameter values and performance calculations for communications capabilities in both modes are presented. A block diagram description is given of the spacecraft communications repeater, including planar array and omnidirectional antennas and two independent transponders. The ground station equipment including antenna systems, SSB and FM exciters, power amplifier, receiver, console, range and range rate systems, tracking, and polarization auto-track system, are described. The organization for a typical Communications Test Plan is outlined, together with an explanation of the test plan category grouping and identification system.
(82 pages, 22 tables, 19 illustrations)

c07 070100 09

W68-020

MULTIPLE ACCESS COMMUNICATIONS USING SMALL APERTURE GROUND TERMINAL

General Electric Missile and Space Division, Valley Forge Space Technology Center, Philadelphia, Pennsylvania

Brochure 7/68-500

Avail: General Electric Space Systems

The small Terminal Multiple Access System was demonstrated in center-city Philadelphia at the June, 1968 IEEE Communications Conference. A brief description is given of the experiment in which a single voice (duplex) transmission was successfully fun between the small aperture ground terminal and ATS-3. The concept and operating modes of the ground station are documented.
(3 pages, 6 illustrations)

c07 060600 01

W68-021

PRELIMINARY ATS THERMAL COATING EXPERIMENT FLIGHT DATA

P. Reichard, J. Triolo

NASA, Goddard Space Flight Center, Greenbelt, Maryland

AD-841387; AFML-TR-68-198

Published in: AFSC Proc. of the Joint Air Force - NASA Thermal Control Working Group, Aug. 1968

Presented to: Proceedings of the Joint Air Force - NASA Thermal Control Working Group, 16, 17 August 1967

NOTICE: This Abstract from C-STAR, Accession No. X69-15898, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

Preliminary data of the performance of the thermal control coating for the Applications Technology Satellites are presented in graph form. The samples were mounted so as to be thermally isolated from the spacecraft. Solar absorptance/emittance ratios were calculated from the measured temperatures. The graphs show the ratio plotted as a function of days in orbit and as a function of equivalent sun hours.
(23 pages, with references)

c33 110600 03

W68-022

THE BARBADOS OCEANOGRAPHIC AND METEOROLOGICAL EXPERIMENT

B. Davidson

Bomex Project Office (National Acad. of Sciences

Published in: Bulletin, American Meteorological Society, Vol. 49, No. 9 Sept. 1968, P. 928

A description of this national interagency oceanographic and meteorologic experiment to be conducted 1 May - 31 July 1969 in the ocean area north and east of the island of Barbados is reported. The specific scientific objectives relate to the measurements of the energy input into the atmosphere at the interface of the atmosphere and the ocean using a large displaced array of sensors located on ships, buoys, aircraft and satellites. The data will be analyzed in an attempt to relate the small scale energy input and dissipations with feasible synoptic measurements in the weather and oceanographic systems of the future.
(5 pages, 3 illustrations, 1 table)

c13, c20 080800 01

W68-023

DETERMINATION OF THE COLUMNAR ELECTRON CONTENT AND THE LAYER SHAPE FACTOR OF THE PLASMASPHERE UP TO THE PLASMAPAUSE

O. G. Almeida, O. K. Garriott, and A. V. daRosa

Stanford University, Stanford, Calif.

NAS 5-10102

Presented to: 1969 USNC - URSI Spring Meeting, Washington, D. C., April 22, 1969

Published in: Stanford University, Project 3304, Quarterly Progress Report, October 1, 1968

Measurements of total columnar electron content of the plasmasphere up to the plasmapause have been made using the beacon transmitters aboard the geostationary Applications Technology Satellite, ATS-3. The technique employed is a combination of the differential Doppler frequency and the Faraday rotation angle methods. Such a combination permits the determination of the integration constant necessary to convert differential Doppler data into information about the absolute value of the columnar content. A "layer shape factor" defined as the ratio between the columnar content and the Faraday rotation angle is also determined. The diurnal behavior of this factor can yield information on the ionosphere-protonosphere exchange of ionization. This paper describes the analysis used to obtain both the absolute value of content and the shape factor.
(13 pages, 3 illustrations)

c13 100509 02

W68-024

SIGNIFICANT OBSERVATIONS AND RESULTS DURING SATCOM TESTS WITH TRANS WORLD AIRLINES - OCTOBER, 1968

Aeronautical Radio, Inc.

ARINC/Airlines SATCOM Program

Results are given of two-way VHF Air-Ground Voice and Data Communications Tests (AR-1) conducted in October, 1968, utilizing the ATS-3 satellite and a Trans World Airlines Boeing 707 equipped with a Bendix low-profile quasicircularly polarized antenna and Bendix Satcom radio equipment. Tests were made while the aircraft was over the Atlantic Ocean, and during a period of extensive geomagnetic and solar flare activity. The data demonstrate the VHF satellite communications are possible under extremely disturbed conditions. Observations are presented and discussed for ground/satellite/ground, aircraft/satellite/ground, and ground/satellite/aircraft signal paths.
(54 pages, 37 illustrations)

c07 070204 03

W68-025

OPERATIONAL UTILIZATION OF UPPER TROSPHERIC WIND ESTIMATES BASED ON METEOROLOGICAL SATELLITE PHOTOGRAPHS

G. Jager, W. A. Follansbee, and V. J. Oliver

National Environmental Satellite Center, Washington, D. C.

ESSA TM NESCTM8, October 1968

A technique of estimating upper tropospheric winds over the tropics and subtropics utilizing the appearance of cirriform clouds in meteorological satellite photographs is described. Specifically, the appearance of cirrus cumulonimbogenitus, cirrus spissatus, and the edges of cirrostratus shields is used to furnish clues to the wind direction and speed in their immediate proximity. Known relationships are used to estimate large-scale wind flow at the 200 and 300 millibar levels of the atmosphere. The National Meteorological Center now routinely incorporates such wind estimates into operational numerical map analyses. The data are also transmitted in both analog and digital form to a number of weather centers for use in both conventional and numberical analyses. An objective method for verifying these wind estimates is described, and the results of a six-month test of the data are given.
(23 pages, 13 illustrations)

c14, c20 080900 07

W68-026

VHF SHIPBOARD TESTS FROM OCEAN STATION BRAVO

M. R. Johnson, LCDR, USCG, Commandant (OC)

Joe N. Ware, Electronics Engineering Laboratory, U. S. C. G. Washington Radio Station, Alexandria, Va.

Final Report

Project 1669-A

30 October 1968

This report is a summary of the results obtained from the VHF tests conducted on board the USCGC Casco during the period from 12 August - 13 September 1968. The ATS-3 satellite was used to relay signals from the Cutter Casco while on Ocean Station Bravo to the Coast Guard Laboratory in

Alexandria, Virginia. (via Rosman ATS, Rosman, North Carolina).
(43 pages, 7 figures, 9 tables)

c07 070206 03

W68-027

CHANNEL CORRELATION ANALYSIS FOR THE ATS-E MILLIMETER WAVE EXPERIMENT

Louis J. Ippolito, NASA/GSFC, Greenbelt, Maryland

X-733-68-339, August 1968

This report describes the Channel Correlation Analysis portion of the Applications Technology Satellite (ATS-E) Millimeter Wave Propagation Experiment. The Channel Correlation program, one of two general areas of data analysis planned for the ATS-E Millimeter Wave Experiment, includes a study of channel characterization utilizing two-dimensional (time-frequency) correlation techniques under defined meteorological conditions.

The channel functions to be measured are presented and the development of worst case bounds of coherence bandwidth, time spread, fading bandwidth and coherence time, from the measured channel functions is described.

Included in this report is a discussion of implementation of the correlation analysis, including the utilization of special purpose data processing equipment for the generation of the channel functions.

c07 070300 04

W68-028

OBJECTIVE AND DYNAMIC ANALYSES OF TROPICAL WEATHER,SEMIANNUAL REPORT, 18 Mar. - 18 Sept. 1968

R. L. Mancuso, R. M. Endlich, Nov. 1968

Stanford Research Inst., Menlo Park, California

Contract DAAB07-68-C-0192

AD-845265L; SRI-7124; ECOM-0192-1; SAR-1

Avail: Stanford Research Inst., Menlo Park, Calif.

NOTICE: This Abstract from C-STAR, Accession No. X69-12540, is Unclassified and Available to U.S. Government Agencies and Their Contractors Only.

Preliminary results from a study on determining atmospheric motions from ATS-3 Satellite cloud photographs are presented. Using recently developed methods for measuring cloud displacements from two or more photographs, it has been possible to obtain cloud-motion data that give a relatively dense and continuous spatial coverage of the Caribbean. Thus, the ATS type photographs should provide significant amounts of tropical data for incorporation into objective analysis and prediction schemes. A numerical method has been developed for estimating the wind-speed field given only the streamline field (deduced from satellite data) and actual wind-speed values at the boundaries. The method has been tested using actual wind-vector fields and has been found to provide wind-speed distributions that are reasonably similar to the actual speed distributions. A brief description is given of a number of computer forecasting techniques that are to be tested on tropical wind analysis.
(38 pages, with references)

c07, c20 080900 08

W68-029

A HINGED MODEL OF THE CURRENT SYSTEM IN THE MAGNETOSPHERIC TAIL

W. P. Olson, W. D. Cummings*

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*University of California, Dept. of Planetary and Space Sciences, Los Angeles

Presented to: American Geophysical Union Fall Meeting, Nov. 1968

Published in: Trans. Amer. Geo. Union, Vol. 49, p 742

A model of the tail current system is presented in which the position of the neutral sheet is controlled by the orientation of the earth's dipole relative to the solar wind. The tail currents flow across a neutral sheet and return on an approximately cylindrical boundary. The neutral sheet is hinged to the geomagnetic equatorial plane and oriented so that it is perpendicular to the plane containing the solar wind vector and the dipole axis. The magnetic field produced by this current system is computed and added to the magnetic field produced by the currents flowing on the magnetopause as calculated previously by one of the authors (W. P. O.). Since the magnetic fields from both current systems depend on the orientation of the dipole relative to the solar wind, seasonal as well as diurnal variations are predicted by the model. These predictions are compared with observations of the geomagnetic field as recorded by magnetometers on board the geosynchronous Applications Technology Satellite (ATS-1).

c13 110800 22

W68-030

THE QUIET-DAY MAGNETIC FIELD AT ATS-1

W. D. Cummings, P. J. Coleman, Jr.

University of Calif., Los Angeles

Presented to: American Geophysical Union Fall Meeting, Nov. 1968

Published in: Trans. Amer. Geo. Union, Vol. 49., p. 743

To illustrate the diurnal and seasonal variations in the magnetic field at the synchronous orbit, daily magnetograms from the ATS-1 satellite for the quite days during the six month period January-June 1967 are presented. The magnitude of the diurnal variation in D, the eastward component of the field, increased about 7γ in January to about 23γ in June. Throughout most of the six-month period, the diurnal variation showed a well defined peak near dawn and a broad minimum centered about dusk. The magnitude of the diurnal variation in V, the radial component of the field, increased from about 5γ in January to about 20γ in June. The diurnal variation in V was best defined for June, when it showed a minimum near 0100 LT and a maximum near 1000 LT. The magnitude and form of the diurnal variation in H, the northward component, remained about the same during the six-month interval, namely a maximum near local noon, and a minimum near midnight, with a total excursion of $30\text{-}35\gamma$.

c31 110800 23

W68-031

TAIL-LIKE MAGNETIC FIELDS AT THE SYNCHRONOUS ORBIT

W. D. Cummings, P. J. Coleman, Jr.

University of Calif., Los Angeles

Presented to: Amer. Geo. Union Fall Meeting, Nov. 1968

Published in: Trans. Amer. Geo. Union, Vol. 49, p. 743

On quiet days the magnetic field near midnight at ATS-1 is only slightly distorted from that of a dipole. The H component (positive north) is $\sim 100\gamma$, the V component (positive outward) is $\sim -10\gamma$, and the D component (positive eastward) is $\sim 20\gamma$. However, during main phases of magnetic storms, tail-like magnetic fields frequently appear near the midnight meridian. During these events, the H component is weak ($\sim$50), while the V component is strong ($\sim 150\gamma$). A strong ($\sim 100\gamma$) eastward component of the field is also observed during some events. The field often remains in this tail-like configuration for several hours, but intermittent, and sometimes abrupt, changes in the direction and strength of the magnetic field have been observed. During winter, the V component of the tail-like field is positive, and during summer it is negative. These observations suggest that the near edge of the neutral sheet frequently is inside the synchronous altitude during the main phase of magnetic storms.

c13 110800 24

W68-032

GEOMAGNETIC STORMS AT 6.6 EARTH RADII

P. J. Coleman, Jr., W. D. Cummings

University of Calif., Los Angeles

Presented to: American Geophysical Union Fall Meeting, Nov. 1968

Published in: Trans. Amer. Geo. Union, Vol. 49, p. 743

Our study of geomagnetic storms at 6.6 earth radii in the equatorial plane now covers the first six months of 1967, during which there were nine storms. The characteristics of sudden commencements differ with local time. Near local noon, the dominant effect is an abrupt increase in the strength of the field with little change in its orientation. Near local midnight, the compression is accompanied by a simultaneous enhancement of the tail current. The magnetosphere often remains compressed after the start of the main phase. On two occasions during the early main phase, the magnetopause moved inside the synchronous orbit near local noon. During the main phase of a storm, the leading edge of the sheet current in the tail was sometimes apparently well inside the satellite orbit. At such times the field was oriented predominantly in the antisolar direction and had about twice the normal field strength. The symmetrical ring current apparently moves inward as it decays.

c13 110800 25

W68-033

SIMULTANEOUS MEASUREMENTS OF THE MAGNETIC FIELD AT ATS-1 AND EXPLORER 33 DURING MAGNETOSPHERIC SUBSTORMS

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NASA, Ames Research Center[2]

Presented to: American Geophysical Union Fall Meeting, Nov. 1968

Published in: Trans. Amer. Geo Union, Vol. 49, p 743

Some simultaneous vector measurements of the magnetic field at ATS-1 and Explorer 33 are reported. These measurements were made when the synchronous ATS-1 was near the midnight meridian and Explorer 33 was within the magnetic tail. The measurements during auroral substorms are of particular interest. At the onset of the substorm, the magnitude of the field is observed to increase at ATS-1 and simultaneously to decrease at Explorer 33. These observations indicate that at the onset of a polar substorm magnetic flux is removed from the tail and restored to the inner magnetosphere.

c13 110800 26

W68-034

OSCILLATIONS OF THE MAGNETIC FIELD OBSERVED AT A SYNCHRONOUS, EQUATORIAL ORBIT DURING MAGNETOSPHERIC SUBSTORMS

R. McPherron, W. Cummings, P. Coleman, Jr.

University of California, Los Angeles

Presented to: American Geophysical Union Fall Meeting, Nov., 1968

Published in: Trans. Amer. Geo. Union, Vol. 49, p. 744

Irregular oscillations of the earth's magnetic field have been observed on the ATS-1 satellite in the equatorial plane at 6.6 R_E during magnetospheric substorms. These waves have periods in the Pi2 band and amplitudes as large as 20 gamma peak to peak. Significant fluctuations are seen in all three components of the H, V, D coordinate system. The waves appear to begin at the time of the sudden recovery of the H component at the satellite, i.e., at the beginning of the expansion phase of the substorm. The waves persist for over an hour, decaying slowly in amplitude. Events with the sharpest onset occur close to midnight. Characteristics of these waves, including amplitude envelope, waveform, power spectral matrix, dynamic spectra, local time of occurrence and association with other phenomena, will be described.

c13 110800 27

W68-035

THE MAGNETOSPHERE SUBSTORM: THE FUNDAMENTAL MODE OF PRODUCTION OF ENERGETIC TRAPPED ELECTRONS IN THE MAGNETOSPHERE

G. K. Parks, T. W. Lezniak, J. R. Winckler

University of Minnesota, Minneapolis, 55455

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, 1968, p. 28

The megnetospheric substorm is defined as the time during which certain mechanisms operate in the magnetosphere, giving rise to many correlated effects, for example: energetic electron precipitation, emissions of magnetic micropulsations, magnetic bays, auroral breakups, electric islands, and proton increases in the tail of the magnetosphere. The Applications Technology Satellite, ATS-1, measures electrons of nominal pitch angles 60^{o} to 85^{o} and energies between 50 and 150 keV crossing the 6.6 RE equatorial plane in closed magnetic field regions. The electrons are part of the trapped radiation but show remarkable temporal variations as follows: (1) large increases of intensity persisting for 30 - 90 minutes with greatest intensity in the midnight to dawn sector, (2) periodic events observed are correlated with large energetic-electron fluxes and emissions of high frequency magnetic micropulsations measured at the conjugate region by balloons and ground equipment, (3) temporal analysis of the periodic events shows pulsating structures ranging from a few seconds to several minutes, such as those observed in auroras and precipitated energetic electrons. The conclusion reached is that we are observing freshly produced energetic electrons having trajectories in the trapping region and the acceleration processes have the magnetospheric substorm as their fundamental mode.

c13 110400 04

W68-036

EVIDENCE FOR A PHYSICAL MOTION OF THE MAGNETOSPHERIC BOUNDARY ASSOCIATED WITH THE MAGNETOSPHERIC SUBSTORM

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University of Minnesota, School of Physics and Astronomy, Minneapolis

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, 1968

It has been shown previously that large 2-3 hr periodic fluctuations in the 50-150 keV electron flux at synchronous altitude are manifestations of the magnetospheric substorm. There is considerable evidence these periodic fluctuations are coincident with a contraction - expansion mode of oscillation of the magnetopause on the front (solar) side of the magnetosphere, and thus the oscillation is also coincident with the general phenomenon known as the magnetospheric substorm. On several occassions when the Applications Technology Satellite (ATS-1) was on the front side of the magnetosphere during a strong magnetic storm, the magnetopause was observed to pass inside and then back outside of the synchronous orbit; on each occasion this occurred just after a substorm had subsided and before another began. It is believed that the magnetopause on the front side expands as a substorm develops and contracts as it subsides and the period of this recurring oscillation (surface wave motion) is approximately 2 hours.

c13 110400 05

W68-037

DETERMINATION OF MAGNETOSPHERIC PARAMETERS FROM MAGNETIC FIELD MEASUREMENTS AT SYNCHRONOUS ALTITUDES

J. G. Roederer[1], P. J. Coleman, Jr.[2], W. D. Cummings[2], M. F. Robbins[3]

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University of California, Dept. of Space and Planetary Sciences, Los Angeles[2]
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Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, 1968, Paper P23

Applications Technology Satellite (ATS-1) magnetic field measurements during relatively quite periods have been compared with predictions of the Williams-Mead model of the magnetosphere. In this model four parameters determine the distorted field: the standoff distance of the magnetospheric boundary, the current in the neutral sheet, and the distance of the near and far edges of the sheet. The model treats only the case of the Earth's magnetic dipole perpendicular to the solar wind, and therefore no prediction of the seasonal variation of the field can be made. The absolute value of the field, however, should be relatively insensitive to the tilt of the dipole. With appropriate choice of the parameters of the model, the local time variation of the absolute value of magnetic field on ATS-1 can be well accounted for on quite days. A relationship has been established between the field measured at two instants in time and the average values of two of the parameters the standoff distance and the neutral-sheet current, during that interval of time. This procedure permits a monitoring of the parameters of the magnetosphere on an almost continuous basis during relatively quiet times and thus can provide a useful index for correlations with many other experiments.

c13 110800 09

W68-038

PLASMA FLOW AT THE MAGNETOPAUSE

C. S. Warren* and J. W. Freeman**

NASA-MSC, Houston, Texas*
Rice University, Houston Texas**

Presented at: Trans. Amer. Geophysical Union Fall Meeting 1968

The Rice suprathermal ion detector on board the ATS-1 geostationary satellite detected large anisotropic fluxes during the January 13-14, 1967, geomagnetic storm when the magnetopause was pushed within the ATS-1 orbit. Analysis of the data has enabled the following picture of plasma flow near the magnetopause to be constructed: low-energy ions ($E < 50$ eV) drift sunward under the influence of a crosstail electric field; as they approach the magnetopause, the ions are turned back to flow tailward along a narrow region inside the magnetopause; at the same time the ions are accelerated to the point that some 70% have $E > 50$ eV. Although the plasma flowing tailward inside the magnetopause is in the same general direction as the flowing magnetosheath plasma, the two plasmas have different temperatures.

c13 110700 16

W68-039

HIGHLY DIRECTIONAL FLUXES OF LOW-ENERGY IONS AT THE SYNCHRONOUS ALTITUDE, 1, THE OBSERVATIONS

J. W. Freeman, Jr., D. T. Young

Rice University, Dept. of Space Science, Houston, Texas

Published in: Trans. Amer. Geo. Union, Vol. 49, p. 227, 1968

The Rice University ion detector aboard the ATS-1 satellite has provided measurements of a highly directional flux of positive ions moving with a bulk flow velocity of 30 km/sec. On one occasion, the flux was sufficiently intense that both the proton and α particle peaks were visible on the energy per unit charge differential flux spectrum. An α-to-proton density ratio of approximately 3% was thus obtained. Further, the proton temperature was determined by both the angular distribution and the energy spectrum and found to be of the order of $kT = 1$ eV. The proton density was found to be 6 protons per cm^3 during this unusual event.

c13 110700 07

W68-040

HIGHLY DIRECTIONAL FLUXES OF LOW-ENERGY IONS AT THE SYNCHRONOUS ALTITUDE, 2, IMPLICATIONS FOR MAGNETOSPHERIC CONVECTION THEORY AND THE ENERGETIC TRAPPED RADIATION

J. W. Freeman, A. Chen, L. D. Kavanagh, Jr.

Rice University, Dept. of Space Science, Houston, Texas

Published in: Trans. Amer. Geo. Union, Vol. 49, p. 228 1968

The observation of highly directional plasma flow in the magnetosphere, described in the preceding paper, has established the existence of convective motion of the magnetospheric thermal ions. The flow direction and magnitude observed are generally consistent with current theories of magnetospheric convection. The electric field required to have established the flow velocity is 5 mV/m, and the direction is across the magnetosphere from the dawn to dusk side. A gross pattern of magnetospheric convection that is consistent with this as well as with previously reported ATS-1 data is presented. Implications of the requisite electric field for the energetic trapped radiation in the outer portion of the outer Van Allen zone are briefly discussed. It is shown that these particles must be highly transitory.

c13 110700 08

W68-041

CALIBRATION OF A SEMICONDUCTOR DETECTOR TELESCOPE FOR SPACE EXPERIMENTS

L. J. Lanzerotti

Bell Labs, Murray Hill, N.J.

Published in: Nuclear Instruments and Methods, Vol. 61, (1968) pages 99-107

A description of the procedures and results of the electron and proton calibrations of the two satellite experiments ATS-1 and ATS-2 are reported. Each experiment consists of a six-element solid-state detector telescope designed to investigate the particle flux and population in the earth's magnetosphere.

c13 110300 04

W68-042

LOW FREQUENCY MAGNETIC-FIELD OSCILLATIONS AT SYNCHRONOUS EQUATORIAL ORBIT

W. D. Cummings, R. J. Sullivan, N. E. Cline, P. J. Coleman

University of California, Los Angeles

Presented to: Amer. Geo. Union

Published in: Trans. Amer. Geo. Union, 1968, Paper P22

Nearly monochromatic frequency fluctuations in the magnetic field have been detected at positions of the synchronous equatorial Applications Technology Satellite (ATS-1). These fluctuations are reverse to the mean field and very nearly sinusoidal. Fluctuations with periods ranging from 50 to 300 sec have been examined. They have been observed to continue for intervals up to two hours in length. Amplitudes in excess of 20 γ peak-to-peak have been recorded. The fluctuations are usually nearly polarized. The polarization vector is sometimes observed to rotate slowly about the mean field, and the waves are sometimes amplitude modulated. The waves are usually observed at quiet times and in the daylight hemisphere. The local-time and field-strength dependencies of their amplitudes, frequencies, and polarization directions are shown. Possible sources of such waves are also discussed.

c13 110800 08

W68-043

SEASONAL AND DIURNAL VARIATIONS IN THE QUIET-DAY GEOMAGNETIC FIELD STRENGTH SYNCHRONOUS, EQUATORIAL ORBIT

W. D. Cummings, J. N. Barfield, P. J. Coleman, Jr.

University of California, Los Angeles

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, 1968, Paper P21

The quiet-day geomagnetic field at 6.6 R_E has been studied using data from the ATS-1 magnetometer for the period September 1966 to June 1967. In particular, available ATS-1 data for the ten quietest days of each month, as determined from the ΣKp index, have been employed. From the measurements, the relative effects of the Chapman-Ferraro current, and the quiet-day ring current on the diurnal and seasonal variation of the geomagnetic field components have been estimated. There is an increase of 10-20 γ in the noontime vertical component from January to June. This is attributed to predominance of the ring current over the Chapman-Ferraro current. The field of the quiet-day tail current system has also been estimated. The effect on the horizontal field component at local midnight is typically a decrease of 20 γ below the undisputed dipole value.

c13 110800 13

W68-044

MESOSTRUCTURE OF SUBTROPICAL JETSTREAM

Tetsuya T. Fujita

University of Chicago

Presented to: World Meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 28

It has been known that an extensive jetstream cirrus is imbedded on the equatorial side of a jetstream axis. When the fine structure of the cirrus is examined carefully, we often see in satellite pictures a large number of transverse bands. Studied in this session are the nature of these bands called cloud trails and the fields of divergence closely related to the pattern of the jetstream cirrus clouds.
(5 illustrations)

c20 081000 09

W68-045

GROWTH OF ANVIL CLOUDS

Tetsuya T. Fujita

University of Chicago

Presented to: World Meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 29

An anvil is defined in this session as a cloud trial extending from a convective cell. The velocity of the convective cell and the anvil-level wind velocity are required for the computation of the stretching velocity of the anvil.
(4 illustrations)

c20 081000 10

W68-046

MODIFICATION OF JETSTREAM BY LARGE CONVECTIVE STORMS

Tetsuya T. Fujita

University of Chicago

Presented to: World Meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 30

In an attempt to determine the influences of large convective clouds upon the jetstream inside which these clouds are imbedded, a series of ATS-3 pictures, taken at 14-minute intervals, are analyzed in detail. Results indicated that clouds acting as barriers to the flow transport large amounts of low-level atmosphere to the anvil level. The increase in the horizontal mass flux at the anvil level was estimated to be over 35%.
(8 illustrations)

c20 081000 11

W68-047

OUTFLOW FROM A LARGE TROPICAL CLOUD MASS

Tetsuya T. Fujita

University of Chicago

Presented to: World Meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbroune, Australia, 1968 Session 31

In order to reveal the field of outflow from the top of a large cloud mass in the tropics, a series of high-resolution ATS-1 pictures over Fiji-Samoa area were analyzed in detail. Results show that the computed cloud velocities of fuzzy clouds represent 250-mb winds very well. The field of upper divergence was established from cloud velocities thus computed. Streamlines indicate that the outflowing air spirals out, accelerating from practically zero speed to over 80 kt while decreasing its geopotential height.
(7 illustrations)

c20 081000 07

W68-048

KINEMATIC ANALYSIS OF HURRICAN BRENDA

Tetsuya T. Fujita, University of Chicago, and Kazuo Watanabe, Meteorological Research Institute, Tokyo

Presented to: World Meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 32

Hurricane Brenda of 21 June 1968 was studied in detail by using a loop movie filmed from a series of digitized ATS pictures. Due to relatively strong westerlies at the storm top, most of the high and moddle clouds were blown off toward the northeast, thus exposing the western half of the circulating low clouds. Results of the surface, the 500-mb and the 250-mb flow, were discussed in detail.
(6 illustrations - for Textual Material See Authors)

c14, c20 081200 01

W68-049

INTERACTION BETWEEN A JETSTREAM AND OUTFLOWS FROM HURRICANE AND LARGE RAIN AREAS

Tetsuya T. Fujita

University of Chicago

Presented to: World Meteorological Organization, Regional Seminar on the Interpretion of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 33

Presented in this session is a process of jetstream blocking by outflowing masses from tops of large convective systems. Such outflowing masses, which enter the southern

portion of a jetstream, are accelerated gradually from very low outflow speed at the source as they flow in while dropping the geopotential height. During this subgradient flow, inflow masses block the main jetstream flow thus reducing its kinetic energy. When the inflow masses reach their supergradient speed, being accelerated from the height of convective cloud tops downward, they act as the sources of kinetic energy added to the jetstream. The latter addition of the kinetic energy to the jetstream seems to be in excess of the loss caused by the initial blocking action
(5 illustrations for Textual Material See Authors)

c20 081200 02

W68-050

DIVERGENCE AND VORTICITY AT THE JETSTREAM LEVEL

Tetsuya T. Fujita and Gisela Baralt

University of Chicago

Presented to: World meteorological Organization, Regional Seminar on the Interpretation of Meteorological Satellite Data of Melbourne, Australia, 1968 Session 34

Both large-scale and mesoscale fields of divergence and vorticity are analyzed. The first example covers the case of Session 33 and the second, that of Session 28.
(8 illustrations for Textual Material See Authors)

C20 081000 08

W68-051

AN OBJECTIVE TECHNIQUE OF EVALUATING MESOSCALE CONVECTIVE HEAT TRANSPORT IN THE TROPICS FROM GEOSYNCHRONOUS SATELLITE CLOUD PHOTOGRAPHS

D. Sikdar, V. Suomi

Space Science and Engineering Center, University of Wisconsin

ESSA Grant: E-230-68

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1968, (080100 58, N71-13174)

Avail: University of Wisconsin, Madison, Wisc.

This paper aims at developing an objective technique for estimating the mass and energy exchange in convection systems corresponding to congestus and cumulonimbus intensities. This technique involves measuring the area change of the cirrus outflow on a sequence of satellite cloud photographs obtained at geostationary altitude. The data clearly show that: (1) The technique is able to isolate vigorous and moderate convection regimes on the ATS-1 and ATS-3 satellite cloud photographs; and (2) Our model estimates of mass and energy are consistent with ground-based measurements such as those of Braham (1952) and Brown (1967). Thus it is concluded that the geostationary satellite cloud photographs can be used to estimate convective mass and heat transport over the tropics
(35 pages, 16 illustrations, 18 references)

c14, c20 080100 30

W68-052

A CENSUS OF CLOUD SYSTEMS OVER THE TROPICAL PACIFIC

D. Martin, O. Karst

Space Science and Engineering Center, University of Wisconsin

ESSA Grant: E-230-68

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1968, (080100 58, N71-13174)

Avail: University of Wisconsin, Madison, Wisc.

ATS-1 and ESSA-III satellite photographs were used to prepare a census of cloud systems over the tropical Pacific from March 1967 through February 1968. Most of the cloud systems which appeared could be classified as ovals, lines, waves, or vortices. Distribution, characteristics, and changes exhibited symmetry across the equator in some respects. Frequencies which were near zero at the equator increased north and south to maxima at 5 to 10 degrees. The maximum size of the largest systems decreased toward the equator. Other observations are included as to movement, persistency, and frequency. Analysis is continuing.
(14 pages, 6 illustrations)

c14, c20 080100 31

W68-053

METEOROLOGICAL APPLICATIONS OF REFLECTED RADIANCE MEASUREMENTS FROM ATS-1 AND ATS-3

T. Vonder Haar

Space Science and Engineering Center, University of Wisconsin

ESSA Grant: E-230-68

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1968, (080100 58, N71-13174)

Presented at: 49th Ann. Meet., Am. Meteor Soc., New York, January 20-23, 1969

Avail: University of Wisconsin, Madison, Wisc.

The spin-scan camera experiments on ATS satellies offer a wide range of meteorological applications using relative and absolute reflected radiance data. Radiance analyses can complement the normal photographic products and add a quantitative value to studies using ATS measurements. The nearly continuous time coverage can be exploited to advantage. ATS-3 multispectral radiance data can yield cloud height or surface pressure inferrence. Radiance measurements can be used in objective techniques for inferring winds from cloud motions. Examples of applications are shown, and a mathematical expression for the effective reflected radiance is presented.
(10 pages, 6 illustrations, 9 references)

c14, c20 080100 32

W68-054

PROTOTYPE ALIGNMENT JIG FOR USE IN REGISTERING ATS PICTURES

T. Schwalenberg

Space Science and Engineering Center, University of Wisconsin

ESSA Grant: E-230-68

Published in: Studies in Atmospheric Energetics Based on Aerospace Probings, Annual Report - 1968, (080100 58, N71-13174)

Avail: University of Wisconsin, Madison, Wisconsin

A prototype has been constructed of an alignment jig for registering ATS-1 and ATS-3 cloud cover pictures when comparative measurement from one picture to another is required. The jig consists of a moveable platform with lateral and rotational motions for the picture to be registered, a reference picture mount, two alternately flashing xenon light sources, and a partially silvered mirror to superimpose the two images. Viewing optics for magnification or projection may be added.

The flashing light sources produce alternate images of the picture to be registered and of the reference picture, allowing the operator to use his sensitive perceptions of the apparent motion to determine both the magnitude and direction of correction necessary to align the two pictures.
(5 pages, 3 illustrations)

c14, c20 080100 33

W68-055

EXPLORING SPACE WITH A CAMERA

Edgar M. Cortright (Editor and Compiler)

National Aeronautics and Space Administration

1968

Available from Government Printing Office

The "collection of the best photographs taken from space during the first decade of (American) space exploration" contains color and black-and-white photographs, mostly of the Earth and the Moon, taken from spacecraft along with explanatory comments on some of the finer points of the photographs. The photographs included were taken from the Applications Technology Satellites and ten other classes of American spacecraft. Techniques used in preparing composite photographs are explained and the report describes the use of the photographs in meteorology, cartography, astronomy, mineralogy oceanography, and in the selection of sites for manned spacecraft activities.
(214 pages)

c14, c20 080000 10

W68-056

WORLD WEATHER WATCH

V. E. Lally, 1971

National Center for Atmospheric Research, Boulder, Colorado

Only in the last hundred years has man come to recognize that weather systems move and to forecast them he must predict their movement and their chances of becoming more or less intense. To make a forecast for a period even as short as a day, observations must be made beyond any one nation's boundaries. To provide a collaborative means for collecting and analyzing weather data among nations, the International Meteorological Organization was created in 1873; in 1951 it became the World Meteorological Organization (WMO), a specialized United Nations agency with 125 nation members.

In its first report WMO recommended the creation of a World Weather Watch, combining weather satellite information with an expanded network of conventional observations, to bring better weather services to all nations of the world.

With the advent of high-speed computers and sophisticated physical models of the atmosphere, it became theoretically possible to make weather predictions for periods of many days. However, within a week or two, a disturbance in the troposphere can circumnavigate the globe. Thus, if useful weather predictions are to be obtained for a period of a week or more, weather observations must be conducted on a global basis.
(7 pages, 7 figures, 1 table)

c20 080900 05

W68-057

A DESCRIPTION OF THE ATS-C FARADAY ROTATION EXPERIMENT QUALITY CHECK PROGRAM

T. Southerland

NASA/GSFC Greenbelt, Maryland

Report No: X-564-68-295, July 1968

Avail: NASA/GSFC

This report describes the Faraday Rotation Experiment on board the Applications Technology Satellite (ATS-C) and the procedures used in performing the quality analysis of the acquired data. The analysis was required because it is imperative to know the quality of experimental data if conclusive and meaningful answers are to be arrived at when experimental values are compared with values obtained from the mathematical model.

Experimenters are concerned with finite values relative to a specific time interval, whereas quality control is mainly concerned with the efficiency of the analog/digital processing and assuring experimenters that they have good, processable tapes.

Computer Program inputs were BCD digital buffer tapes previously produced on the analog/digital lines. Outputs were summary analyses printed on a file by file basis, plus a buffer file card for each file of data processed.

The report includes a detailed description of the inputs and outputs processed for this experiment.

c08 040000 09

W68-058

RESULTS OF OPLE EXPERIMENTS FOR THE PERIOD FEBRUARY 15, 1968 THROUGH APRIL 22, 1968

H. Horiuchi, G. Hilton
NASA/GSFC Greenbelt, Maryland

June 15, 1968

The results of Omega Position Location Equipment (OPLE) system operational tests conducted during the period February 15, 1968 through April 22, 1968 are presented. These tests used the OPLE Control Center (OCC), the ATS-III satellite, platform electronic packages (PEP) placed at fixed locations, a mobile platform, and an aircraft platform. The objective of these tests was to provide experimental data on the location accuracies of the system. Test results showed that fixed, mobile and aircraft platforms could be located with reasonable accuracy. This accuracy is presently limited by the skywave corrections which are used to compensate for seasonal and diurnal variations in the VLF propagation paths of the Omega Navigational network.

c21 080402 01

W68-059

RESULTS OF OPLE EXPERIMENTS FOR THE PERIOD JUNE 13, 1968 THROUGH JUNE 28, 1968

H. Horiuchi, G. Hilton
NASA/GSFC Greenbelt, Maryland

June 15, 1968

Examination of data taken during the shipboard experiment indicates that a position fix can be made on a vessel with relatively good accuracy. In comparing the OPLE-derived position fixes with fixes determined by the vessel, the differences were found to range from less than 1 nautical mile to 6 nautical miles. The difference in position fixes varied, depending on the technique used by the navigator. Dead Reckoning, Loran, Visual, Radar, and Omega were used. The Omega measurements made by the navigator differed from the OPLE-derived fixes by less than 1 nautical mile to 4 nautical miles. The OPLE estimates differed from the more reliable radar fixes by less than 1 nautical mile to slightly greater than 2 nautical miles. The latter illustrates relatively good correlation between the true position of the vessel and OPLE-derived position fixes.

c21 080402 02

W68-060

A NOTE ON THE AMPLITUDE DISTRIBUTION OF RADIO WAVES PASSING THROUGH THE IONOSPHERE

X-520-68-371

A. D. Poularikas, T. S. Golden
NASA/GSFC Greenbelt, Maryland

September 1968

The study of radio wave scintillation records of a single wave passing through the ionosphere shows that the amplitude distribution does not always follow Rayleigh's statistical law. This phenomenon was observed with good correlation for both right-and left-handed circularly polarized waves. In addition, the "after-effect" function shows that the phenomena responsible for the statistical behavior of the scintillations contain a rapidly decaying, periodic component.

c13 100500 15

W68-061

FARADAY ROTATION MEASUREMENTS OF THE EQUATORIAL IONOSPHERE

Jurgen Peter Schodel
Max-Planck-Institut Fur Aeronomi Abteilung Fur Weltraumpnysiki, West Germany

November 1968

Faraday rotation measurements by means of the ATS-3 spacecraft were carried out on board the German research ship "Meteor" during May and June 1968. The latitude dependence of the Faraday rotation is shown. An attempt is made to define the mean ionospheric height for geostationary satellites. Transport effects in the nighttime ionosphere were recorded and their amount and direction is estimated. An outlook on future measurements is emphasized.

c13 100512 01

W68-062

METEOROLOGICAL SATELLITE

L. F. Hubert

Published in: McGraw Hill Yearbook of Science and Technology Labs, 1968. Pg. 253-255

Cloud photography from space platforms is now providing daily observations to weather services around the world. Pictures of remote areas are tape recorded for playback on command to Fairbanks, Alaska, and to Wallops Island, Virginia. These data are relayed directly to the National Environmental Satellite Center (NESC) near Washington, D. C., where they are integrated into the analysis of the World Weather Center. A second satellite system broadcasts pictures in a form that can be received on simple equipment anyplace on Earth.

December 9, 1966, saw the debut of a dramatic new device: the spin-scan "camera" carried by the synchronous Applications Technology Satellite (ATS-1). The camera produces exceptionally detailed pictures of nearly one-third of the Earth's surface, is fixed above the central Pacific, and views an area from Sidney, Australia, to Chicago, Illinois. The ATS-1 is considered the greatest advance in meteorological observations since Tiros I in 1960.

c20 080900 06

W68-063

DETERMINATION OF MASS OUTFLOW FROM A THUNDERSTORM COMPLEX USING ATS III PICTURES

T. T. Fujita, D. L. Bradbury
University of Chicago

Grant USESSA E-22-45-68 (G)
Grant NGR 14-001-008
Grant ESSA E-198-68 (G)

Presented to: Sixth Conference Severe Local Storms, Chicago, Ill., 1968

Published in: Conference Proceedings, p. 38-43

Presented in this paper are some preliminary results of the Tornado Watch Experiment, 1968. Two excellent cases of tornado outbreaks over the Midwest were photographed at 14-min intervals by ATS III. One of the cases occurred on April 19 and was studied together with aerological and surface data, radar pictures, and cloud displacement computation from ATS pictures. It was found that there was little evidence of mesoscale divergence of high-cloud velocities prior to the storm formation. As the storm grew rapidly, a significant divergence at the anvil level modified the field of jetstream-cloud velocities. This preliminary study resulted in a number of new questions to be answered in the future rather than solving previously unanswered questions. It is expected that the 1969 experiment to be conducted again by NASA and ESSA will include acquisition of radar and synoptic data so that our effort can be expanded toward the solution of complicated phenomena of severe-storm formation over the Midwest.

c20 081100 05

W68-064

THE TORNADO SITUATION OF 19 APRIL 1968

16 MM Movie

University of Chicago

1968

Using the ATS-III picture sequence of a 290-ft 16-mm time lapse color movie was made showing a severe storm situation for which tornadic activity had been forecast. This was part of the Tornado Watch Experiment for 1968 which was conducted during April and May.

c20 081100 02

W68-065

THE TORNADO SITUATION OF 23 APRIL 1968

16 MM Movie

University of Chicago

1968

The ATS-III picture sequences for 23 April were used to make a 372-ft 16-mm time lapse movie showing the severe convective activity which had been forecast for this day. This flim was part of the Tornado Watch Experiment of 1968

c20 081100 03

W68-066

CLOSE-UPS FROM HURRICANE WATCH 1968

16 MM Movie

University of Chicago

1968

This is a 226-ft film showing enlargements of specific local views of cloud formations from the Hurricane Watch 1968 movie. The cloud formations include hurricane outflow, cumulus dissipation, sea breeze frontal clouds over Yucatan, anvil growth near the shear line, cloud hand over the Bahamas, and cumnionimous growth over Cuba and Puerto Rico.

c20 081200 03

W68-067

HURRICANE WATCH EXPERIMENT OF 1968

116 MM Movie

University of Chicago

1968

During June 1968 three hurricanes occurred over the western North Atlantic. A 409-ft 16-mm time lapse color movie was made using ATS-III pictures taken during different stages of the three hurricanes. For Hurricane Abby the period covered in the film was June 3, 4, 5 and 6: for Hurricane Brenda only one day was included in the film, namely, June 21: and for Hurricane Candy the period included June 22 and 23.

c20 081200 04

W68-068

HORIZON STUDIES OF ATS-1 BEACON SIGNALS

T. J. Elkins

Air Force Cambridge Research Laboratories, Bedford, Massachusetts

NASA/GSFC, Greenbelt, Maryland

ATS-1 has been used mainly for propagation studies at very low elevation, where fading of both tropospheric and ionospheric origins is observed. When ATS-1 is below the geometric horizon at Sagamore Hill, the received signal strength shows a clear diurnal pattern, varying from approximately the free space level near noon to below the galactic noise level at night. After making all necessary corrections, the remaining difference in ionospheric refraction from day to night was 0. 2 degrees. This figure was verified by numerical ray tracing for typical ionospheric electron density profiles.

A highly variable component of refraction has also been observed. Ionospheric irregularities have been shown to produce signal fading with quasi-periods in the range from several seconds to several hundred seconds. The probability distribution of the fading amplitude is often non-symmetrical, or highly skewed, suggesting the presence of pronounced spectral features in the power spectrum of the fading amplitude. This has been substantiated by numerical Fourier analysis, in selected cases. In addition to the amplitude measurements, for certain periods, the angular component of the fading has been measured, using an interferometer with minimum angular resolution of approximately 0. 5 arc minutes. A combination of amplitude and angular measurements has sometimes shown the presence, in the ionosphere, of large lens-like or prism-like structures, during the periods of intense fading.

The results of observations, like those described above, are being compiled statistically, for use in practical communication circuit design. As an example of information available, for the particular geographic location at Sagamore Hill, rms amplitude fading, at zero elevation and 137 MHz, on a space to earth link, exceeds 5% for 60% of the time, and exceeds 20% for 5% of the time.

ATS-1 has also been used in conjunction with other available geostationary and near stationary satellites, to provide information on the following:

1. Geographic distribution and motion of patches of ionospheric irregularities.
2. Diurnal and seasonal variations in fading activity.
3. Effect of solar disturbances and magnetic activity on fading characteristics.
4. Irregularities in tropospheric refractive index, in particular, those having very large scale size (several kilometers).

c07 100504 01

W68-069

BEACON STUDIES OF ATS-3 IN NORTH AND SOUTH AMERICA

J. Aarons

Air Force Cambridge Research Laboratories, Bedford, Massachusetts

NASA/GSFC, Greenbelt, Maryland

To measure scintillations of signal as a function of latitude and total electron content (at one middle latitude station), a long range series of measurements are being started under the coordination of the Radio Astronomy Branch of the Air Force Cambridge Research Laboratories. Continuous observations are being taken at the magnetic equator at Huancayo, Peru, in the Panama Canal Zone, and at Sagamore Hill Radio Observatory, Massachusetts. The Danish Meteorological Institute site at Narssarssuaq, Greenland will be added to the group of stations when the Applications Technology Satellite (ATS-3) moves over the Atlantic. Studies of similar nature with COMSAT satellites have shown the fluctuation in signal to be heavy from the Greenland site for a percentage of the time, and have shown nightly maxima over both the equatorial station and over Sagamore Hill. A synoptic study will be performed with ATS-3. Studies of the variations in total electron content are being performed at Sagamore Hill using a polarimeter on a 150 foot antenna and a rotating yagi to detect the signals.

When the ATS-3 is moved to a position over the Atlantic, it is expected that more stations in Europe will join in the studies. Stations from the Scandanavian countries to observatories in Africa have indicated their interest in observation of the 136-137 MHz signals from ATS-3.

c07 100505 01

W68-070

LOW FREQUENCY MAGNETIC-FIELD OSCILLATIONS AT SYNCHRONOUS EQUATORIAL ORBIT

W. D. Cummings, R. J. Sullivan, N. E. Cline, P. J. Coleman

University of California, Los Angeles, Calif.

Published in: Trans. Amer. Geophysical Union, 1968

Nearly monochromatic, low frequency fluctuations in the magnetic field have been detected at positions of the synchronous, equatorial Applications Technology Satellite (ATS-1). These fluctuations are transverse to the mean field and very nearly sinusoidal. Fluctuations with periods ranging from 50-300 sec. have been examined. They have been observed to continue for intervals up to two hours in length. Amplitudes in excess of 20γ peak-to-peak have been recorded. The fluctuations are usually poorly polarized. The polarization vector is sometimes observed to rotate slowly about the mean field, and the waves are sometimes amplitude modulated. The waves are usually observed at quiet times and in the daylight hemisphere. The local-time and field-strength dependences of their amplitudes, frequencies, and polarization directions are shown. Possible sources of such waves are discussed.

c29 110800 14

W68-071

BALLOON FLIGHT SUMMARY

National Center for Atmospheric Research, Boulder, Col.

National Science Foundation

Flight No. 425-P, Aug. 26, 1968

Presented to: NASA/GSFC, Greenbelt, Maryland and NCAR, Boulder, Colorado.

Avail: NCAR, Boulder, Colorado

This summary describes one (1) balloon flight from the NCAR Scientific Balloon Flight Station at Palestine, Texas for Mr. Gay Hilton of Goddard Flight Center at Greenbelt, Maryland, and Mr. Alvin Morris of the National Center for Atmospheric Research at Boulder, Colorado.

The object of the flight was an electronic test of the Omega position and location experiment (OPLE) in conjunction with the Applications Technology Satellite (ATS-III) in synchronous orbit above Brazil.

The flight requirements were: Normal launch and ascent to approximately 70, 000 feet, float at altitude approximately ten (10) hours, termination, parachute descent, and recovery.

The scientific electronic requirement was six (6) tone commands. The payload to balloon coupling was to be a single point-nonmetallic suspension (a 5, 000 pound test webbing was provided.) The instrument was to be placed in upright position as soon as possible after impact.

A Raven 360, 000 cubic foot balloon constructed of 1. 5 mil polyethylene was selected to meet the load and altitude requirements.

Time was scheduled on ATS-III for the 26th of August 1968. The balloon was launched at 0711 CDT. The surface winds were southeast at four (4) knots and the temperature was +22° C with clear skies. The system ascended at 847 feet per minute to a float altitude of 69,400 feet.

Positions were obtained during flight by radar, GMD, theodolite, down camera on the balloon, and tracking aircraft. The gondola was safely parachuted and impacted at 1809 CDT, nine (9) miles southwest of Coleman, Texas. Instruments were returned to Palestine, Texas the following day, 27 August 1968.

c21 080400 09

W68-072

ATS-B THERMAL COATINGS EXPERIMENT FIRST QUARTERLY PROGRESS REPORT (MARCH 68)

J. Triolo

NASA/GSFC, Greenbelt, Maryland

Published in: Technical Data Report, Section 11

The two objectives of this experiment were (1) to measure the solar absorptance over thermal hemispherical emittance ratio, A_s/E, and of eight selected coatings in space environment as a comparison with laboratory measurements, and (2) to monitor the A_s/E which will establish the stability of these coatings in the space environment.

While total coverage has been more than adequate, there was no coverage of the first fifty hours after launch. Since the largest rates of change in solar absorptance occur during this time for most coatings, it is not expected the experiment will provide much information for evaluating the validity of techniques employed in laboratory measurements.

Data shown in curves represent manually corrected and reduced values, therefore, only a sampling of actual data is presented. The present superficial analysis indicates only that the experiment package is qualitatively performing as expected. A detailed analysis of the report data will be supplied in the next quarter report.

c33 110602 01

W68-073

VHF TRANS-IONOSPHERIC PROPAGATION MEASUREMENTS

Ministry of Technology Radio Department, Royal Aircraft Establishment, Farnborough, Hants, England

Interim Report No. 1

Published in: Technical Data Report, Section 10

Continuous wave transmissions directed towards the Applications Technology Satellite (ATS-3) from the USA at 149.22 MHz are transponded by the satellite, the retransmission being at 135.60 MHz. The transponded signals are received and strength recorded at Cove Radio Station and at Losbam Satellite Tracking Station. All times quoted are GMT.

A total of four VHF transmissions from ATS-3 have been monitored at the two separated sites. The transmission times were such that sunset would be affecting the ionosphere; its height and activity would be changing during the time of the transmissions.

On one occasion, violent variations of signal strength were recorded which were far in excess of that anticipated based on previous experience.

Of the remaining three occasions, only minor variations (about 3 dB) were recorded. These variations were not similar to scintillation effects recorded in earlier experiments.

Difference in signal level (in dBm) recorded on the different transmissions is not necessarily indicative of a difference in downlink signal power on different days.

c07 100508 01

W68-074

ATS-B THERMAL COATINGS EXPERIMENT SECOND QUARTERLY PROGRESS REPORT (JUNE 1968)

J. Triolo

NASA/GSFC, Greenbelt, Maryland

Published in: Technical Data Report, Section 11

This report provides information concerning 2198 hours of recorded data beginning the third day of Application Technology Satellite (ATS-B) orbiting through April 30, 1967. Should the high quality of the data continue, present telemetry coverage is more than sufficient to monitor and measure the A / ϵ degradation as a function of time. However, complete coverage of the short periods of eclipse will be necessary to obtain ϵ measurements.

The following observations are based on a limited quantity of band reduced data:

1. Variation of A/ϵ during a twenty-four hour period (Figure 12). This is thought to be caused by variation of the albedo input during the satellite day. The variation is not large (0.5 to 0.8% overall).

2. Two (2) coatings have degraded out of temperature range of their thermistor networks.

   a. T_iO_2/MS - 150% change in A/ϵ

   b. S_iO_x/Al - 20% change in A/ϵ

3. Flight A/A values from first few days in orbit are larger than laboratory values. This data is questionable, and will remain so if not reprocessed.

4. Some eclipse data received has not been reduced due to delays in developing a temperature-time program and time required to plot the data by band.

5. Altitude changes during the first few days in orbit are another possible source of error in early data. The addition to the difficulty in assigning a solar aspect angle to the data, the attitude changes affected the quality of the telemetry data (large signal-to-noise ratios).

ATS Progress Report (5 May 1967, page VI-C1-30a) discusses difficulties encountered in determining spacecraft attitude.

c33 110602 02

W68-075

NOTES ON LOWER ATMOSPHERE SCINTILLATIONS

J. Aarons

Radio Astronomy Branch Ionospheric Physics Laboratory Air Force Cambridge Research Laboratories, Bedford, Massachusetts

Presented To: NATO Advanced Study Institute on "Satellite Signal Propagation in the Ionosphere," Viareggio, Italy

Edited By: Centro Microonde Del C.N.R., Florence, Italy (Notes for students)

June 10 - 22, 1968

This paper briefly discusses the following subjects:

Sunrise Observations

Synchronous Satellite Rises and Sets at 401 MHz

Synchronous Satellites at Low Altitides Over Long Periods of Time

c07, c13 100500 12

W68-076

ROSMAN GROUND STATION

NASA/GSFC, Greenbelt, Maryland

Published in: Technical Data Report Section 6

Avail: NASA/GSFC Greenbelt, Maryland

Date: June 6, 1968

The Rosman ground station is located in western North Carolina, near the town of Brevard. The prime function of this station is to perform communication experiments in conjunction with the Applications Technology Satellites (ATS).

The instrumentation building houses the communications, telemetry, and command subsystems as well as offices, supply and maintenance areas.

The 85-foot parabolic communications antenna, located adjacent to the instrumentation building, has a cassegrain type feed system and utilizes monopulse tracking techniques to automatically track the ATS spacecraft. Polarization tracking is also provided as part of this system. Preamplification of the received signal is accomplished by a low noise parametric amplifier followed by a traveling wavetube (TWT) amplifier. Communications signals are transmitted, received, and processed as required by the various ATS experiments.

Spacecraft commands are encoded, transmitted and verified by the telemetry and command (T & C) system. Spacecraft housekeeping telemetry (PCM) and discrete real time functions (FM) are also received, processed, recorded and displayed by the telemetry subsystem. The combined telemetry/receive and command/transmit antenna consists of an array of crossed dipoles. The antenna is maintained on the spacecraft by use of monopulse tracking techniques.

Station power is provided by 10 diesel engine generators. Six are a small type D393; each has an output of 250 KVA. The other four are a larger type D398; each provides a 500 KVA output. All generators are three-phase synchronous types.

Communication with ATSOCC is normally accomplished by a Switching Conference and Monitoring Arrangement (SCAMA) voice circuit one full duplex TTY circuit and one transmit only TTY circuit.

c11 060100 04

W69-001

RADIO PROPAGATION STUDIES OF THE IONOSPHERE

Contract NAS 5-10102 (Project 3304, Stanford University)

Quarterly Report No. 4

January 1969

An airplane navigation system based on the measurement, at VHF, of the range between the aircraft and a geostationary satellite is under development by NASA. In this paper, an examination is made of the errors resulting from the unknown propagation characteristics of the signal through the ionosphere.

These errors are found to be a function of the distance between sub-aircraft and sub-satellite points. At short distances, unfavorable geometry causes small ranging errors to be translated into large position errors. As the distance increases, the errors become smaller until a minimum is reached at some 5000 km. At even larger distances the errors again increase due to the greater path length of the signal in the ionosphere.

Completely disregarding ionospheric effects leads to position errors of some 5 km at 5000 km distance, during the midday period near the solar cycle maximum. By using good predictions of the ionospheric electron content, it may be possible to reduce such errors to 1 km on a representative day.

Since the errors are proportional to the columnar electron content, they become correspondingly smaller at night and decrease by, roughly, a factor of 3 during the sunspot minimum period.
(27 pages, 8 figures)

c29, c21, c07 100510 01

W69-002

STANDING ALFVEN WAVES IN THE MAGNETOSPHERE

P. J. Coleman, Jr.

University of California, Los Angeles

Published in: Journal of Geophysical Research, Space Physics, Vol. 74, p. 778,1 February 1969

Transverse, low-frequency oscillations in the magnetic field have been recorded in the equatorial plane at 6.6 R_E (earth radii) with the UCLA magnetometer on board the Applications Technology Satellite (ATS-1). The oscillations have peak-to-peak amplitudes of 2 to 20γ and have been observed predominantly on geomagnetically quiet days in the morning and noon quadrants. The fluctuations are very nearly monochromatic, and those with periods ranging from 50 to 300 sec. have been studied. This paper reports on observations made during January 1967, when 25 separate events were recorded with durations ranging from 10 to 400 min. The oscillations could be grouped into two period ranges, one centered about T = 190 sec. and the other about T = 102 sec. The oscillations were confined to a plane that was approximately perpendicular to the main magnetic field vector. They were generally elliptically polarized in this plane, with the major axis of the polarization ellipse typically inclined eastward at an angle of $\simeq 30^o$ to the radially outward direction. An MHD analysis is given for an idealized model in which the earth is considered a perfect conductor, the background magnetic field is that of a dipole, and the plasma density varies as a power law. For the case of a standing Alfvén wave poloidal and toroidal wave equations uncouple. These equations are solved numerically, and the eigenfrequencies appropriate to the synchronous orbit are tabulated for the first six harmonics for seven density models. From the results of the analysis it is argued that the observed transverse oscillations are the second harmonic of a standing Alfven wave. Under this interpretation the data are consistent with the hypothesis that the plasmapause is beyond 6.6 R_E only during very quiet periods.

c29 110800 29

W69-003

VHF SHIPBOARD TESTS FROM OCEAN STATION DELTA

Final Report

Joe E. Ware

U. S. Coast Guard Electronics Engineering Laboratory

U. S. Coast Guard Washington Radio Station, Alexandria, Virginia

21 January 1969

This report is a summary of the results obtained from the VHF tests conducted on board the USCGC CASCO during the period from 7 October - 7 November 1968. The ATS-3 satellite was used to relay signals from the Cutter CASCO while on Ocean Station Delta to the Coast Guard Laboratory in Alexandria, Va. (via Rosman ATS, Rosman, N. C.).
(35 pages, 8 illustrations, 6 tables)

c07 070206 04

W69-004

SYMPOSIUM PAPERS; RTCM ASSEMBLY MEETING; APRIL 21-22-23, 1969; CLEVELAND, OHIO; VOLUME 2 COMMUNICATIONS VIA SATELLITE RADIO TECHNICAL COMMISSION FOR MARINE SERVICES PAPER; 95-69/DO-46

Avail: Radio Technical Commission for Marine Services, Washington, D. C.

This volume contains the following papers:

Basic Considerations for a Planning Study Dealing with a Satellite System for Radiocommunication and Radiodetermination in the Maritime Mobile Services
Dipl. -Ing. W. E. Steidle
President, Comite International Radio Maritime (CIRM)
General Consultant, DEBEG
Hamburg, Federal Republic of Germany

Results of the Maritime VHF Satellite Communication Tests on the S. S. Santa Lucia
D. R. Rau, Engineer, Systems Integration Programs
Westinghouse Defense and Space Center, Baltimore, Maryland

C. G. Kurz
U. S. Maritime Administration, Washington, D. C.

The Status of Satellite Communications for the Maritime Mobile Services
E. J. Mueller, Systems Integration Programs
Westinghouse Defense and Space Center, Baltimore, Maryland

Communication Planning for National Data Buoy Systems
LCDR.M. E. Gilbert, USCG
U. S. Coast Guard Headquarters, Washington, D. C.

Economic Benefits of Ownership of Shipboard Satellite Navigation Equipment
Joseph Chernof, Director, Space Navigation and Tracking
Aerospace Laboratories, San Fernando, California

International Efforts in Maritime Space Communications
Capt. Charles Dorian, USCG
Assistant Director, Office of Telecommunications
Department of Transportation, Washington, D. C.

MEDIVISION - MEDIcal aid by satellite and teleVISION
Howard L. Peterson
Washington, D. C.
(81 pages)

c07 070208 04

W69-005

IRREVERSIBLE EFFECT OF THE MAY 1967 MAGNETIC STORM ON ENERGETIC TRAPPED PROTONS

R. W. Fillius

University of California at San Diego, La Jolla, California

Presented to: Amer. Geo. Union Spring Meeting, Washington, D. C., April 1969

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 285

The magnetic storm of May 25-30, 1967, caused a large irreversible decrease in the flux of energetic (> 12 MeV) trapped protons at L values of 2.2 and greater. The event is the largest since September, 1963, and is similar to the previous event in many features. The region of non-adiabatic loss penetrated down to a rather sharply defined L shell (L = 2.2); the particles with high equatorial pitch angles were affected more; and the change occurred within a very short interval - during the main phase of an intense magnetic storm. It is possible to study this event with three proton energy channels on ATS-2 from 10 to 20 MeV and with one channel on Relay II at 40 MeV. There is no major difference in the features of the event as seen by any of these four detectors.

c29 110200 05

W69-006

LONGITUDINAL DRIFT ECHOES IN INNER-ZONE PROTON FLUXES

C. E. McIlwain

University of California at San Diego, La Jolla, California

Presented to: Amer. Geo. Union Spring Meeting, Washington, D. C., April 1969

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 282

The data obtained by the three omnidirectional scintillation detectors on the ATS-2 satellite have been searched for periodicities in the fluxes of protons greater than 11 and 20 MeV in the region L = 1.5 to 3.0 earth radii. In the frequency range 0.3 to 6.0 cycles per minute, it has been found that fluctuations greater than (1000/J) 1/2 percent are rare where J is the omnidirectional flux. On three occasions, however, clear periodic fluctuations were found. In one case, the fluctuations began within one minute of a large sudden commencement and the other two cases occurred during magnetic storms. In each instance the period of the fluctuations was within 30 percent of the longitudinal drift period computed for protons in the energy range appropriate for each detector.

c29 110200 04

W69-007

ATS-2 OBSERVATION OF GREATER THAN .5 MeV ELECTRONS DURING THE MAY 25, 1967 STORM

C. J. Rindfleisch, Jr.

University of California at San Diego, La Jolla, California

Presented to: Amer. Geo. Union Spring Meeting, Washington, D. C., April 1969

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 282

Data was acquired by three scintillation detectors on the Applications Technology Satellite, ATS-2, during the May 25, 1967, storm. An L region of 1.2 to 3.4, and energy range of .5 MeV to 2.0 MeV were covered. The time dependence of the observed electron acceleration and subsequent diffusion are presented.

c29 .110200 03

W69-008

EFFECTS OF TRANSIENT ELECTRIC FIELDS UPON PARTICLE DISTRIBUTIONS IN THE MAGNETOSPHERE

E. W. Hones, Jr. *, J. G. Roederer**

University of California at Los Alamos, Los Alamos, N. Mex. *
University of Denver, Denver, Colo. **

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, April 1969, p. 286

Although transient electric fields clearly exist within the magnetosphere during substorms, their distribution, intensity, direction and duration remain subject to great uncertainties. From calculated trajectories for equatorially mirroring particles in a part of the magnetosphere we have determined the temporal variations in particle spectra that would be caused at the synchronous orbit (6.6 R_E) by proposed substorm electric fields.. The character of the variation is dependent upon local time as well as features of the electric field. Comparison of these calculations with particle measurements made with the ATS satellite may permit differentiation between several magnetospheric electric field models.

c29 110300 09

W69-009

THE MAGNETOSPHERE SUBSTORM OF AUGUST 25-26, 1967, PART 2: RELATIVISTIC ELECTRON ACCELERATIONS AT SYNCHRONOUS ALTITUDES

L. J. Lanzerotti, C. G. Maclennan

Bell Telephone Labs, Murray Hill, N. J.

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union April 1969, p.287

Approximately eight minutes after the onset of the magnetospheric substorm an abrupt spike (fullwidth ~ 6 minutes) of relativistic electron fluxes was observed by the Bell Laboratories experiment on ATS-1. The sudden non-adiabatic increase of relativistic electrons was observed in the E_e > 400, > 600, > 500, and > 1100 KeV channels. The width of the spike and the velocity dispersions in the time of occurrence of the spike (as compared to acceleration events observed at different local times) suggest a source region spread in longitude around the midnight-early morning sector of the magnetosphere. A second non-adiabatic electron increase, partially attributable to the longitudinal drift of the electrons in the initial spike, was also seen. The initial electron increases were observed after a decrease in the low energy magnetotail electron fluxes and just prior to the onset of auroral zone X-ray enhancements near the ATS-1 conjugate point. Two small, sharp, adiabatic increases in the ATS-1 equatorial electrons observed during a subsequent period of intense, pulsating auroral zone X-rays suggest that during this time the dayside magnetosphere at synchronous altitude was moderately disturbed.

c29 110300 10

W69-010

AN EXPERIMENTAL STUDY OF ELECTRON DRIFT SHELLS IN THE DISTORTED MAGNETOSPHERE

K. A. Pfitzer, J. R. Winckler

University of Minnesota, School of Physics and Astronomy, Minneapolis

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 281

Electron fluxes between 50 keV and 1 MeV on drift shells computed from the Mead model (without tail field) have been compared by the satellites ATS-I and OGO-III far apart in local time. Two measurements at -50° and -10° local time (0° equals local midnight) tend to suggest that drift shells in the evening sector lie closer to earth than predicted by the Mead model but move out to the predicted position just after local midnight. This drift shell displacement is consistent with the large asymmetry around local midnight revealed by the ATS-I measurements, especially during disturbed times, consisting of sudden increases in energetic electron flux and magnetic field strength at synchronous orbit just after local midnight. Correlated rapid changes in outer zone electron intensity have been observed at widely separated points in local time on a time scale short compared to the drift time, indicating that the process controlling the intensity is of a large scale.

c29 110400 18

W69-011

PERIODIC MODULATIONS OBSERVED IN ENERGETIC ELECTRONS AND THE MAGNETIC FIELD AT THE ATS-1 DURING A MAGNETOSPHERIC SUBSTORM

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University of California, Los Angeles[2]

Bell Telephone Labs., Murray Hill, New Jersey[3]

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 284

On June 26, 1967 during a magnetospheric substorm, 4-minute periodic modulations were observed in both the energetic electrons and the local magnetic field at the synchronous orbit. The electrons and the magnetic field were varying in phase, with the field fluctuating as much as 30 γ in the H-component. The waves were linearly polarized with the axis of polarization contained in the magnetic meridional plane. The electron modulations were observed simultaneously in the 50-150, 150-500 and >1100 keV energy channels, suggesting that the modulations as well as in the time owing to the growing amplitude modulations in high energy electrons while those in low energy electrons remained relatively constant. Although the electrons and the magnetic field are well correlated in phase, the amplitudes of the two modulations are not correlated. Consequently, the electron intensity and spectrum variations observed cannot be entirely due to adiabatic effects, such as the betatron-type mechanism. Instead, the modulations in both electrons and the magnetic field are caused by non-adiabatic process, intimately related to processes responsible for the magnetospheric substorm.

c29 110400 14

W69-012

PARTICLE SUBSTORMS OBSERVED AT THE GEOSTATIONARY ORBIT

R. L. Arnoldy, K. W. Chan

University of New Hampshire, Durham

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 285

Particle substorms observed at 6.6 R_E by a spectrometer measuring electrons in 3 energy windows between 50 keV and 1 MeV aboard the ATS-B geostationary satellite have been extensively correlated with ground-based magnetometers. A study of the occurence of the flux increases in the various energy windows as a function of local time and in time correlation with the local midnight magnetic bay suggests that in many of the cases the particles observed originate at local midnight and apparently drift to the satellite location. There are, however, cases of particle events at local noon or afternoon where there is no indication of velocity dispersion. For these events the magnetic substorm is more worldwide and appears to be of the DP2 variety which is associated with a convective electric field in the magnetosphere as suggested by A. Nishida. Solar wind ions show no fluctuations that can be associated with the dynamics of a substorm. However, preceding a series of substorms, there is a pressure increase, often abrupt.

c29 110400 15

W69-013

THE LATITUDE DISTRIBUTION OF PRECIPITATION AND ITS RELATION TO SUBSTORM INCREASES TO 50 keV ELECTRONS AT SYNCHRONOUS ORBIT

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ESSA, Boulder, Colorado[2]

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 286

Comparisons of electron precipitation events at 7 riometer stations in Alaska (L=3.9 - L=8.0) with increases of trapped electron fluxes at the ATS-1 synchronous orbit give the following results: (1) There is nearly a one to one correspondence between the trapped electron (50-150 keV) increases and auroral zone precipitation events occurring during magnetospheric substorms. (2) The 100 riometer events studied give evidence for an apparent motion (progression of the source region across L, 25% of the events) and also for a stationary pattern (intensity variations occurring simultaneously within one minute over at least several values of L, 42% of events). During the apparent motion, the ATS-1 increases correlate best with precipitation nearest the field lines connecting the ATS-1 and the auroral zone. This observation suggests that the apparent motion is also in the equatorial plane. (3) Precipitation is most often seen at L-5 or 6, but only 1/5 as often at L-3.9, and 1/2 as often as L=8. Since the ATS-1 field line and those within synchronous orbit are closed for these events, it is certain that substorm-correlated acceleration may take place on closed field lines and frequently occurs simultaneously over a large depth in the magnetosphere.

c29 110400 16

W69-014

THE RELATION OF ACCELERATION AND PRECIPITATION IN THE AURORAL ENERGETIC ELECTRONS

G. K. Parks[1], R. L. McPherron[2]

University of Minnesota, School of Physics and Astronomy, Minneapolis[1]

University of California, Los Angeles[2]

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 293

The pitch-angle distribution of electron increases (50-150 keV) observed at the ATS-1 orbit has been obtained for a substorm event that occurred on April 21, 1967. Simultaneous observation of precipitation for this event comes from measurement of X-rays (from precipitated energetic electrons) detected from a region conjugate to the ATS-1 satellite in the auroral zone. The pitch-angle distribution in the interval 60° - 90° at the equatorial plane for this event shows that the distribution peaked near 90° from the onset to the end of the substorm. However, the anisotropy factor A, defined as $J(90^\circ)-J(60^\circ)/J(90^\circ)$, changes with time. The factor A subsequently decreases as the electron flux decreases, finally reaching the pre-substorm figure of about 28% as the substorm terminates. This behavior of pitch-angle distribution argues against pitch-angle diffusion mechanism by which electrons are precipitated. Instead, it is concluded that the energetic electron precipitation during substorms represents a direct measure of freshly accelerated particles in the loss cone.

c29 110400 17

W69-015

EVIDENCE FOR FIELD ALIGNED CURRENTS AT THE SYNCHRONOUS ORBIT DURING MAGNETOSPHERIC SUB-STORMS

W. D. Cummings, R. R. Lewis, P. J. Coleman, Jr.

University of California, Dept. of Planetary and Space Science, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, 1969, p. 280

Magnetometer data from the Applications Technology Satellite (ATS-1) are examined for several magnetospheric substorms. As previously reported, onsets of the expansive phase of a polar substorm is coincident with a sudden increase of 30-50 γ in the magnetic field strength at the synchronous orbit near midnight. In addition to the field strength change, which represents a return from a depressed value to the normal value, there is sometimes a temporary change in field direction. The direction change is in the east-west direction and occurs at the beginning of the recovery in field strength. This suggests that the direction change is caused by field-aligned current flows on two L shells, parallel to B on one shell and antiparallel on the other, then the east-west magnetic field would only be observed when the satellite is between the two shells. According to this interpretation, the near edge of the plasma sheet must have been inside the synchronous orbit prior to the onset of the expansive phase, and it must have moved outward across the synchronous orbit during onset.

c29 110800 30

W69-016

RESULTS OF THE MARITIME VHF SATELLITE COMMUNICATIONS TESTS ON THE SS SANTA LUCIA

D. R. Rau (Westinghouse Electric Corporation),
C. G. Kurz (U. S. Maritime Administration)

Radio Technical Commission for Marine Services, Symposium Papers, Volume 2, Communications via Satellite, April 21 - 23, 1969

This report describes the results and evaluates the performance of a VHF satellite communications system aboard the S. S. Santa Lucia on two voyages in 1968 from Port Newark, N.J., to Valparaiso, Chile, and Charleston, S. C. Communications were transmitted to the Santa Lucia from the NASA ground station at Mojave, California, via the ATS-1 and ATS-3 spacecraft. The report is particularly concerned with tests of voice quality, data error rate, time synchronization, ranging, frequency sharing, and propagation and antenna evaluation. The system configuration is described, measurements and results are presented and recommendations for improved performance are proposed. (16 pages, 1 figure, 4 tables)

c07 070208 05

W69-017

THE STATUS OF SATELLITE COMMUNICATIONS FOR THE MARITIME MOBILE SERVICES

E. J. Mueller, April 1969

Westinghouse Electric Corporation, Baltimore, Md.

Presented to: Radio Technical Commission for Maritime Services (RTCM)

Published in: Vol. 2 Communications Via Satellite

Avail: RTCM, Washington, D. C.

This paper presents the current status of Maritime Mobile Satellite Communications and traces an orderly sequential development of a Maritime Mobile Satellite System. Four areas are outlined which may benefit shipping: (1) Improved safety for ships at sea; (2) Expansion of current functions to meet growing capacity requirements; (3) Improved reliability for existing operational requirements and (4) Improved reliability required to serve new applications from recent technology, such as computer data, facsimile, etc.

A satellite system can provide improvements in these areas since it is capable of high quality "line-of-sight" performance between stations separated as much as 10,000 miles. Recent developments have made it possible to accomplish this with lowcost, off-the-shelf equipment aboard ship, as well as in space system equivalents of coast stations.
(12 pages, 3 illustrations)

c07 070208 06

W69-018

NIMBUS/ATS DATA UTILIZATION CENTER
SUMMARY REPORT (March 7, 1967 to March 7, 1969)
Donald R. Jones

Allied Research Associates, Inc.

9 G45-37
Contract #NAS5-10343

Avail: NASA/GSFC, Greenbelt, Md.

Major activities of the Nimbus/ATS Data Utilization Center (NADUC) are summarized for the two-year period ending 7 March 1969. The description defines how NADUC's meteorological and photgraphic data handling system provides the geophysical community with optimum utilization and availability of NASA weather satellite data. The meteorological data sensor characteristics of the associated satellites are summarized. NADUC support of the WEFAX experiment is defined. Illustrations of the excellent meteorological and photographic data received are included. An overview of the operation problems arising from the new and unique satellite sensor systems is presented.
(51 pages, 14 illustrations)

c20 040200 01

W69-019

ATS SSB-FDMA/PhM MULTIPLE ACCESS EXPERIMENT

E. J. Mueller, R. J. Martel, L. W. Nicholson, and B. R. Perkins

Westinghouse Defense and Space Center, NASA Goddard, and Australian Post Office

Presented at IEE International Conference on Communications, Boulder, Colorado.

9 June 1969

The SSB-FDMA/PhM technique appears to be a promising candidate for an operational satellite system since it achieves an effective trade-off between efficient use of the spectrum, channel capacity, and satellite power available within the current and perhaps foreseeable state-of-the-art. In addition this technique has the advantage of directly handling conventional SSB-FM multiplex traffic presently flowing over terristrial communications systems. The experimental system has been tested on two geostationary, spin-stabilized satellites as a part of the ATS program. This paper discusses the system, the SSB-FDMA/PhM technique, system performance and channel signal-to-noise.

Recommendations are included for future systems design using this technique.
(21 pages, 12 illustrations)

c07 070100 14

W69-020

OBJECTIVE AND DYNAMIC ANALYSES OF TROPICAL WEATHER Semiannual Report, 18 Sept. 1968 - 18 Mar. 1969

R. C. Mancuso, R. M. Endlich, June 1969

Stanford Research Inst., Menlo Park, California

Contract DAABO7-68-C-0192

AD-854893; SRI-7124; ECOM-0192-2; SAR-2

Avail: Stanford Research Inst., Menlo Park, Calif.

NOTICE: This Abstract from C-STAR, Accession No. X69-18448, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only

Various approaches were tested for deriving wind information from satellite cloud photographs made by the ATS-3 satellite. Approaches tested included: estimating a wind-vector field from cloud-motion measurements; altering the kinematic properties (divergence and vorticity) to fit cloud distributions; and estimating wind speeds from satellite-derived wind direction. All these schemes gave wind fields that were in reasonable agreement with the available station winds and provided excellent background fields for analyzing the station data. A multilayer baroclinic model was developed for the purpose of making shortrange tropical forecasts. The model is based primarily on the vorticity equation and is designed to operate on the actual wind fields rather than the pressure and temperature fields. At present, testing of the model has been restricted to considerations of internal consistency and to comparisons with barotropic forecasts. Preliminary objective analyses were performed using available rawinsonde data over Southeast Asia in order to test the applicability of objective analyses and forecasting techniques in this area.
(52 pages, with refs)

c20 080900 10

W69-021

COMMENTS ON "THE EASTERN PACIFIC HURRICANE SEASON OF 1968"

L. F. Hubert

National Environmental Satellite Center, ESSA, Washington, D. C.

Published in: Monthly Weather Review, Vol. 97, No. 7, July 1969, pp. 521-522

This correspondence relates to an earlier paper bv W. J. Denney(1). After observing how well Mr. Denney's paper demonstrates that routine satellite coverage can provide information to fill previous deficiencies in storm climatology, Mr. Hubert points out that part of Mr. Denney's deductions of cloud level inflow were incorrect. By using wind estimates from cloud motions revealed by geostationary satellite time-lapse movies, he concludes that spiral bands cannot be accepted as direct evidence of cool inflow; cloud band orientation and wind direction can be quite different. ATS-1 photos of tropical storms Diana (24 July 1968) and Fernanda (9 August 1968), with derived cloud motion superimposed, illustrate the critical importance of geostationary satellite data.

In a concurrently printed reply, Mr. Denney essentially concurs with Mr. Hubert's conclusions.

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(1) "The Eastern Pacific Hurricane Season of 1968, "Monthly Weather Review, Vol. 97, No. 3, March 1969, pp. 207-224, W. J. Denney, Weather Bureau Forecast Office, ESSA, San Franscisco, Calif.

c20 081200 06

W69-022

SYNCHRONOUS SATELLITE SIGNALS AT 137 MHz AS OBSERVED FROM THULE, GREENLAND

J. Aarons, J. Mullen, L. Zuckerman

Air Force Cambridge Research Laboratories, Radio Astronomy Branch, Ionospheric

Physics Laboratory, Bedford, Mass.

Published in: Report of Air Force Cambridge Research Laboratories, July 1969

This report concerns the ionospheric effect known as "scintillation" or "amplitude fluctuation" observed at Thule, Greenland, at the AFCRL Geopole Station. The propagation characteristics of the Applications Technology Satellite, ATS-3, transmitted at 137 MHz are studied for the measurement periods October - November 1968 and May 1969. Thule located at a latitude of 76.6°N and longitude of 69°W is near the geomagnetic pole, at a geomagnetic latitude of 88°. It observes synchronous satellites of very low inclination at longitudes of 19°W and 118°W on its horizon; satellite elevation rises to 1° when the satellite station longitude is 113°W or 25°W. At 90°W the satellite can be observed at 4° of elevation with highest elevation approximately 4.9° at the station longitude of 69°W.

The auroral oval is a region a few degrees wide where the maximum flux of low energy precipitated particles (>40 KeV) is noted. Its mean position is taken to be approximately $\pm 2°$ of 75° at noon and $\pm 4°$ of 68° at night during moderately quiet conditions. The propagation patch from Thule to ATS-3 went through the auroral zone at night and through the lower latitude edge at noon.
(13 pages, 6 illustrations)

c29 100515 01

W69-023

NASA-GSFC OPERATIONS PLAN 11-69, APPLICATIONS TECHNOLOGY SATELLITE (ATS-E)

Project Operations Support Division, Tracking and Data Systems Directorate, NASA-GSFC

X-513-69-273, OPPLAN 11-69, July, 1969

Avail: Goddard Space Flight Center, Greenbelt, Md. (For Official Use Only)

This Operations Plan provides planning information for activities concerned with ATS-E, and is to serve as a guide during operations. Contents include:

- Mission
- Responsibilities
- Organization
- Project Implementation
- STADAN Operations and Control
- STADAN Operations
- ATS Operations
- External Agency Support
- Manned Space Flight Network Support
- Orbital and Support Computing Plan
- Information Processing Division
- NASA-GSFC Communications Operations
- ATS-E Signal Strength Information
- ATS-E Potential RF Conflicts
- ATS Ephemeris Tape Description
- Sequence of Events
- Spacecraft Telemetry Measurements and Command List

(321 pages, 49 illustrations)

c11, c34 040000 07

W69-024

APPLICATION TECHNOLOGY SATELLITE ATS-E SYSTEM DESCRIPTION

GSFC

GSFC-S11-037

August 1969

Avail: Goddard Space Flight Center, Greenbelt, Maryland

The objective of the Applications Technology Satellite Program is to carry out research and development in scientific and technology areas by conducting experiments on satellites. This document covers the ATS-E satellite and is divided into the following major areas.

General Information
Modes of Operation
Signal Characteristics and Requirements
Communication System Performance
Spacecraft Communication Repeater
Ground Station Equipment Description
Communication Test Plan
Experiment Summaries

Additionally, there is a quantity of data presented in tables and illustrations.
(113 pages, 24 tables, 15 illustrations)

c11 020100 02

W69-025

SUMMARIES OF PAPERS: SYMPOSIUM ON THE APPLICATION OF ATMOSPHERIC STUDIES TO SATELLITE TRANSMISSIONS,SEPTEMBER 3, 4 AND 5, 1969; BOSTON, MASSACHUSETTS

Sponsored by the Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

This volume contains papers of the following categories: propagation problems, millimeter wave propagation studies, scintillation, winds and heights, total electron content, and latitudinal patterns.

The following papers are related to the Applications Technology Satellites.

VHF Propagation Effects on Range Measurements from Satellites
Roy E. Anderson, General Electric Co.

A Millimeter Wave Propagation Experiment from the ATS-E Spacecraft
J. W. Dees
Martin Marietta Corp.

Equatorial Scintillation
John R. Koster
University of Ghana

High Latitude Scintillations during the Oct. 30-Nov. 4 Magnetic Storm
Jules Aarons, Herbert Whitney
AFCRL, Bedford Massachusetts

Effect of Magnetic Storms on the Low Latitude Ionosphere
T. H. Roelofs and P. C. Yuen
University of Hawaii

Mid-Latitude Ionospheric Variations during Magnetic Storms
M. Mendillo and M. D. Papagiannis
Boston University, Boston Massachusetts
J. A. Klobuchar, AFCRL, Boston, Massachusetts

c07, c13, c29 070200 22

W69-026

VHF PROPAGATION EFFECTS ON RANGE MEASUREMENTS FROM SATELLITES

R. E. Anderson

General Electric Co., Schenectady, New York

NAS 5-11634

Presented to: Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Sept. 3-5, 1969, Boston, Mass.

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

Applications Technology Satellites ATS-1 and ATS-3 are being used by the General Electric Company in a ranging and position fixing experiment to determine the usefulness of VHF for position surveillance of vehicles over large earth regions. Results of the experiment indicate that while ionospheric delay variations and sea reflection multipath affect range measurements from satellites at VHF, position fixes better than ±5 nautical miles, one sigma, are achievable.
(4 pages, 7 illustrations)

c07, c21 070211 05

W69-027

HIGH LATITUDE SCINTILLATIONS DURING THE OCT. 30-NOV. 4 MAGNETIC STORM

J. Aarons, H. Whitney

AFCRL, Bedford, Massachusetts

Presented to: Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Sept. 3-5, 1969, Boston, Mass.

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

This report examines the boundary concept for highly disturbed conditions to determine the diurnal control and localized, temporal effects. Using similar methods of data reduction, amplitude records of four stations: Thule, Greenland; Narssarssuaq, Greenland; Rude Skov, Denmark; and Sagamore Hill, Hamilton, Massachusetts were compared simultaneously, observing 137 MHz transmissions from the Applications Technology Satellite, ATS-3.

Considerations of the polar characteristics of scintillations are probably produced directly or indirectly by precipitation of energetic particles of a few hundred electron volts. From the local time control during the magnetic storm it appears that normal magnetospheric control of the boundary is maintained. However, during short periods within small areas, precipitation proceeds from higher values to lower values and then back to higher latitudes.
(4 pages, 3 illustrations)

c13, c29 100500 49

W69-028

A MILLIMETER WAVE PROPAGATION EXPERIMENT FROM THE ATS-E SPACECRAFT

J. W. Dees

Martin Marietta Corp., Orlando, Florida

Presented to: Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Sept. 3-5, 1969, Boston, Mass.

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

Instrumentation aboard an Applications Technology Satellite (ATS-E) is described for a millimeter wave propagation experiment which will continue over a period to include seasonal changes. The objective is to determine propagation parameters important in characterizing wideband earthspace communication or data links at K_u and K_a bands. The satellite is transmitting wideband signals at 15.3 GHz and receiving signals at 31.65 GHz utilizing various earth terminals.

Correlating propagation effects with weather conditions will permit performance predictions of future links under various weather conditions.
(4 pages, 5 illustrations)

c07 070300 07

W69-029

MID-LATITUDE IONOSPHERIC VARIATIONS DURING MAGNETIC STORMS

M. Mendillo*, M. D. Papagiannis*, J. A. Klobuchar**

Boston University, Boston Mass. *
AFCRL, Bedford, Mass. **

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

Observations by the authors of magnetic fields and electron content measured in April and July of 1968, and February and March of 1969 at various local times, indicate that in instances of large magnetic storms the increase of total electron content during the pre-sunset hours coincides with an increase of the total magnetic field. The enhancement in total content typically has the form of a surge in the ionization lasting for three to six hours which is super-imposed on the diurnal variation of a quiet day. It is noted that cause and effect relations between enhancements of the magnetic field and of the total content is not entirely clear. Doppler sensitive backscatter measurements of the electron density are suggested to provide further information on vertical motions of ionization.
(3 pages, 2 illustrations)

c13, c29 100500 45

W69-030

EFFECT OF MAGNETIC STORMS ON THE LOW LATITUDE IONOSPHERE

T. H. Roelofs, P. C. Yuen

University of Hawaii, Honolulu, Hawaii

Presented to: Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Sept. 3-5, 1969, Boston, Mass.

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

Since December 1966, electron content of magnetic storms has been measured using the geostationary Application Technology Satellite, ATS-1. Information gained indicates good examples of the response of the ionosphere to magnetic storms. Both electron content and peak density are abnormally high during the day and night following sudden commencement.
(2 pages, 2 illustrations)

c29 100500 46

W69-031

EQUATORIAL SCINTILLATION

J. Koster

University of Ghana

Presented to: Symposium on the Application of Atmospheric Studies to Satellite Transmissions, Sept. 3-5, 1969, Boston, Mass.

Published in: Summaries of Papers

Sponsored by: The Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

Characteristics of equatorial scintillation, ionospheric irregularities, and daytime scintillation are covered by the author. Earlier reports of equinoctial enhancement of scintillation have been borne out by results from the synchronous satellites Canary Bird, Applications Technology Satellite (ATS-C), and Early Bird. Diurnal variation of equatorial scintillation is well established. The main feature to be noted is that scintillation of moderate amplitude is centered on midnight, with the most violent occurrences around 22 hours. Daytime scintillation is rare, occurring only seven times between mid May and the end of June 1969. Solar cycle dependence and latitudinal distribution are included in experiments covered.
(6 pages, 6 illustrations)

c29 100500 47

W69-032

MEASUREMENT OF EARTH MAGNETIC FIELD OSCILLATIONS AT SYNCHRONOUS SATELLITE ALTITUDES

W. E. Radford, R. L. Hickerson

Presented to: INTERMAG, International Conference on Magnetics, Amsterdam, Netherlands, 15-18 April 1969

Published in: IEEE Trans. Magnetics, Vol. Mag-5, No. 3, p. 607, Sept. 1969

Each satellite is equipped with a three axis vector magnetometer to measure the components of the earth's magnetic field relative to the satellite body axes. With attitude sensor data, the magnetometer readings can be transformed into geocentric coordinate axes. The orbit of DODGE passes approximately 1200 nautical miles below that of ATS-1 every eleven days. The slow relative motion of these satellites makes it possible to take simultaneous data from the ATS-1 position and DODGE positions at all longitudes and at latitudes from 7°S to 7°N. Therefore, spatial characteristics of magnetic waves may be measured. The magnetometer data from these satellites and data from ground magnetic measurements are used to determine the complete characteristics of the quasisinusoidal geomagnetic micropulsations.

c13, c29 110800 36

W69-033

APPLICATION OF THE MINIMUM VARIANCE PREDICTION & SMOOTHING TECHNIQUES TO ATS VHF RANGING DATA

H. S. Fitzhugh

Westinghouse Electric Corporation, Baltimore, Maryland

Presented to: IEEE Computers and Communications Conference Record, 30 Sep - 2 Oct 1969, Rome N.Y.

Published in: IEEE Record of Conference, p. 155-74

Avail: IEEE New York, Abstract 35570

This paper describes a digital filtering process which has been applied to ranging data obtained from the Applications Technology Satellites (ATS). Ranging data was obtained by the Multiple Side-Tone Ranging Technique whereby an HF carrier-frequency is phase modulated by a number of tone frequencies. Phase measurements are obtained between transmitted and received modulating tone-frequencies, and differences sampled and converted to discrete digital phase measurements. Corrections for ionospheric propagation effects such as change in velocity of propagation and path bending have been included. Spectral analysis of contaminated data was performed in an attempt to identify additive noise.
(20 pages)

c07 070210 02

W69-034

A MULTIPLE USER SATELLITE SYSTEM FOR NAVIGATION AND TRAFFIC CONTROL

L. M. Keane

NASA Electronics Research Center, Cambridge, Massachusetts

Presented to: Electronic and Aerospace Systems Convention, Washington, D. C.

27-29 Oct. 1969

Published in: New York: IEEE Record of Convention 1969, p. 190-7

A promising system approach is described which can support aircraft and marine surveillance, communication, and navigation needs. The results of studies of ranging modulation techniques are described and an experiment plan identified which will use ATS-E to evaluate some of the critical parameters of the satellite system in a field environment.
(8 pages, with ref's)

c07, c21 070200 21

W69-035

RADIO PROPAGATIONS STUDIES OF THE IONOSPHERE, QUARTERLY PROGRESS REPORT NO. 7
(1 July - 30 Sept. 1969)

O. G. Almeida, A. V. DaRosa, Oct. 1, 1969

Stanford University, Radioscience Lab.

NAS 5-10102, Stanford Univ., Project 3304

This report summarizes the analysis at Stanford of about 29 hours of continuous phase path difference data from the VHF/UHF transmissions of the Applications Technology Satellite (ATS-5). Compared to the ATS-3 signal, that of ATS-5 is much more favorable as the spin modulation has a smaller effect in spreading available energy over the spectrum and the ERP is substantially larger.

The studies indicate that the Faraday rotation angle follows the electron content in nearly parallel manner during the daytime period. The Faraday angle decreases more rapidly than the electron content in the afternoon, and for the sunrise period the observed angle of polarization increases faster than the electron content causing the rise of the layer shape factor to its final daytime constant value. Results also show that the position of ATS-5 at 108°W is much more favorable for layer shape studies from Stanford than at 73°W.
(17 pages, 5 figures)

c29 100514 01

W69-036

RANGING AND POSITION FIXING FROM SATELLITES AT VHF

R. E. Anderson

General Electric Company

Paper in NEREM Record 1969; Presented at NEREM Session on Satellite Communications 6 November 1969

Contract No. NAS 5-11634 and N00014-68-C-0467

This paper defines the VHF ranging and position fixing experiments with ATS-1 and ATS-3 satellites. The method of conducting the rough measurements is described. The results of recent tests with the land vehicles, aircraft and a Coast Guard vessel are sited. Results obtained indicate that prior estimates may have been conservative and that a practical system using simple equipment compatible with present communications equipment and procedures can be achieved.
(2 pages, 4 illustrations)

c07, c21 070211 07

W69-037

ENERGETIC ELECTRONS AT THE SYNCHRONOUS ALTITUDE: A COMPILATION OF DATA, Rept. for Jan 68-Jun 69

G. Paulikas, J. Blake, J. Palmer, November 12, 1969

Aerospace Corp., Space Physics Lab., El Segundo, California

Contract F04701-69-C-0066

TR-0066(5260-20)-4; SAMSO TR-69-413

NOTICE: This Abstract from the Technical Abstract Bulletin, Accession No. AD-864 417 Fld. 4/1, 22/2, is Unclassified. Foreign Distribution Requires Approval of Commander, SAMSO (SMSDI-STINFO) Los Angeles Air Force Station, Calif. 90045

Energetic electron data from the omnidirectional spectrometer on the synchronous ATS-1 satellite have been compiled for the period December 1966 to March 1968. Omnidirectional fluxes of electrons $>$ 300 keV, $>$450 keV, $>$ 1.05 MeV, and $>$ 1.9 MeV were analyzed in terms of the probability of observing an integral flux greater than F sub x above these thresholds.
(36 pages)

c29 110100 15

W69-038

FINAL PROJECT REPORT FOR LOCKHEED LOW-ENERGY ELECTRON AND PROTON SURVEY EXPERIMENT (HARDWARE PHASE)

R. D. Sharp

Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304

NAS 5-10392

Report No. LMSC/N-35-69-1,

Nov. 1969

A compact channel-multiplier instrument has been designed and developed for the spectral analysis of low-energy (0.5 - 800 keV) electrons and protons at synchronous altitude on the ATS-E satellite. The instrument is contained in a single package which weighs 1.3 kg and occupies a volume of 790 cm^3. It consists of eleven individual sensors, five electron sensors spanning the energy region from approximately 0.5 keV to 100 keV and six proton sensors spanning the energy region from approximately 1 keV to 800 keV. This instrument features a completely automatic in-flight calibration system which periodically tests the efficiency of the detectors and their pulse-height distributions, as well as calibrating the electronics associated with each sensor.

In connection with the development and testing of this spectrometer, we have performed extensive long-term gain stability tests of the channel-electron-multipliers which are employed as particle detectors in all sensors. We have established a screening process which makes it possible to select channel-multipliers which have a high probability of long-term gain stability without producing significant fatigue in the selected units. This procedure is described in detail together with the verification of the selection process and the statistical results of tests performed on a total of 70 channel-multipliers of the type used in the spectrometer. Further tests on the effects of various environments on the long-term gain stability of channel-multipliers are recommended.

c29 111302 01

W69-039

ATS-B TO BEGIN METEOROLOGY, COMMUNICATIONS, CONTROL TESTS

Technology Week

December 5, 1969

This magazine article, which was published before

the launching of ATS-B and its redesignation as ATS-1, describes the spacecraft and the program of experiments planned. These experiments include taking the first cloud-cover photographs from synchronous orbit, providing the first radio communications between a satellite and an airplane in flight, making the first test of a new electronically despun antenna, and evaluating the use of a resistojet for spin control and orbital maneuvers. Also cited are the use of radio signals from the spacecraft to help determine the ion content of the atmosphere, and the capability of transmitting both wideband (black and white and color TV) and narrowband (voice) signals between stations in North America, Asia, and Australia.
(1 page, 1 illustration)

c34 010000 19

W69-040

SOLAR PROTON OBSERVATIONS AT SYNCHRONOUS ALTITUDE DURING 1968

G. Paulikas, J. Blake, Dec. 12, 1969

Aerospace Corp., Space Physics Lab., El Segundo, Calif.

Contract F04701-69-C-0066

TR-0066 (5260-20)-13; SAMSO TR-70-28

NOTICE: This Abstract from Technical Abstract Bulletin, Accession No. AD-865 658 Fld. 4/1, is Unclassified. Foreign Distribution Required Approval of Commander, SAMSO (SMSDI-STINFO) Los Angeles Air Force Station, Calif. 90045.

Measuremente of solar protons in the 5- to 70-MeV energy interval obtained at synchronous altitude during 1968 are presented. The major contributors to the integrated flux were the events of June 9 and November 18.
(28 pages)

c29 110100 16

W69-041

ATS-E SPACECRAFT MAGNETIC TEST

J. C. Boyle, Dec. 1969

NASA, Goddard Space Flight Center, Greenbelt, Maryland

NASA-TM-X-63833; X-325-69-536

Avail: NASA/GSFC, Greenbelt, Maryland

Notice: This Abstract from C-STAR, Accession No. X70-13126, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only

The ATS-E Spacecraft was tested in the GSFC Attitude Control Test Facility. By deperm treatment and magnet compensation it was possible to reduce the perm bias at the flight magnetometer probe to less than 10 gammas on each axis. Simultaneously, the perm moment of the spacecraft was reduced from an initial value of 8440 pole centimeters to a value of 366 pole centimeters. This resulted, however, in an unacceptably high field level in the vicinity of the EME experiment package. It was necessary to remove two of the compensating magnets and to reverse a third. The final compensated value of perm moment was 2884 pole centimeters. The spacecraft flight magnetometer was calibrated up to approximately + or - 20 gammas in its sensitive range and up to approximately + or - 500 gammas in its insensitive range along all three axes. In addition, corrections were established for perm and stray field bias. The spacecraft magnetic torquing coils were calibrated through the full range of 32 steps on all three axes. The maximum moments produced were 102,300 pole centimeters from the X set of torquers; 100,000 pole centimeters from the Y set of torquers; and 108,500 pole centimeters from the Z set of torquers.
(31 pages, with refs.)

c11 020000 21

W69-042

SATELLITE/BUOY READOUT PROGRAM

L. A. Chwney et. al.

General Electric Re-Entry & Environmental Systems Division

Office of Naval Research Contract: N00014-68-C-0467

Document No. 69 SD 2130 A, 15 December 1969

Avail: Chief of Naval Research, Arlington, Va.

This report describes the hardware and the first test carried out under the buoy satellite readout program from May 15, 1968 to December 15, 1969. The object was to record sufficient data to enable concept selection and design of data readout and position fixing systems for buoys. Three experiments are recounted:

(1) The ATS experiment to determine usefulness of VHF for locating platforms, and to test a tone-code ranging technique, by using ATS-3 to interrogate a buoy at various locations.

(2) The Omega Position Location Equipment (OPLE) experiment to demonstrate the feasibility of using the Omega navigation system in conjunction with synchronous satellites to establish a global location and data collection system.

(3) The HF experiment to determine the extent to which the ionosphere will support HF transmission, using the Sea Robin buoy near Bermuda transmitting directly to a receiving site near Syracuse, N. Y.

Analysis of the data collected is presented.
(157 pages, 66 illustrations, plus appendices)

c07 070215 02

W69-043

ATS-V POST LAUNCH REPORT (PRELIMINARY)

GSFC

Avail: Goddard Space Flight Center, Greenbelt, Md.

December 1969

In August 1969 the ATS-V spacecraft was launched into synchronous orbit from launch pad 36A at the John F. Kennedy Space Flight Center, Merritt Island, Florida. The ATS was launched from an Atlas Centaur combination. This report presents a significant amount of data dealing with the post launch period and the attendant problems caused by the spacecraft being in an improper orientation. Sections of the text deal with the summary of flight events, assessment of recovery problems, analysis of recovery procedures, critical assessment of recovery procedures, and evaluation of energy dissipation. Several appendicies of detailed background material and calculations backup each of the various sections. On the basis of the quantity of data and the various calculations, conclusions dealing with the orientation problem are reached and recommendations are put forth.
(275 pages, 95 illustrations, 17 tables)

c11, c34 030500 01

W69-044

THE UCSD PLASMA DETECTOR ON ATS-5

C. E. McIlwain, S. D. DeForest

University of California, S. D., LaJolla

Presented to: American Geophysical Union Winter Meeting, Dec 1969, San Francisco

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 660

The Applications Technology Satellite (ATS-5) is presently in synchronous orbit at 107°. It spins at approximately 70 rpm with the spin axis parallel to the earth axis.

The UCSD low-energy particle experiment contains four detectors arranged in two sets of electron-protron pairs which look along the spin axis and perpendicular to it. These detectors are channel electron multipliers with curved electrostatic analyzer plates to select energies. The energy range of 50 eV to 50 keV is covered in 62 discrete steps spaced 12% apart. Two additional steps are set at zero energy for background. The analyzing voltage can be stepped in a continuous scan, or it can be controlled by a servo-loop which seeks and locks onto a peak in the counting rate. The fraction of time spent in either mode can be regulated by ground commands. Initial studies show a background of less than .5 ct/sec. Electrons typically peak at a few thousand ct/sec, while protons peak at a few hundred ct/sec. Spectra can be flat, singly, or multiply peaked for both electrons and protons.

c29 111401 01

W69-045

INITIAL RESULTS OF ATS-5 PLASMA EXPERIMENT

S. E. DeForest

University of California, S. D., LaJolla

Presented to: American Geophysical Union Winter Meeting, Dec. 1969, San Francisco

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 660

The Applications Technology Satellite (ATS-5) was launched into synchronous orbit on 12 August 1969. The UCSD low-energy experiment covers the range from 50 eV to 50 KeV with 12% resolution for both electrons and protons in two orthogonal directions. Initially, the spacecraft was oriented spinning at about 100 rpm with the spin axis perpendicular to B. One set of detectors were parallel to the spin axis, and the other set swept out all pitch angles with approximately 180° per readout. Some data from this period have been reduced and displayed in various formats. Conclusions based on these early data are that the day-to-day variation is as large as diurnal effects. On at least one day, ATS-5 penetrated a high-density region of particles with energies less than 100 eV. At times an anisotropy of 2-3 is seen in pitch angle distribution which persists for hours. Multiple peaks are common in both electron and proton spectra. One example shows a spectrum with four distinct peaks.

c29 111400 02

W69-046

MAGNETOSPHERIC SUBSTORM OBSERVATIONS AT SYNCHRONOUS ALTITUDE

R. D. Sharp[1], L. F. Smith[1], G. Paschmann[2]

Lockheed Palo Alto Research Lab., Palo Alto, Calif. [1]

Max-Planck Institute for Extraterrestrische Physik, Munich, Germany[2]

Published in: EOS Trans. Amer. Geo. Union, Vol. 50, p. 663, 1969

Some of the impulsive events reported in the previous paper will be described in more detail. The more intense events had peak electron fluxes of the order of a few ergs/cm^2 - sec-sr, comparable to the flux required for a Class II aurora. The spectra were variable, but generally similar to those often observed at comparable L values by similar instruments on the low-altitude polar satellite OV1-18. In the one instance for which a magnetogram is presently available from a ground station located near the foot of the field line, the impulsive event at synchronous altitude was coincident with the onset of a negative bay, indicating that at least this one event was temporal in character rather than a spatial variation, and probably represented an inward motion of the inner boundary of the plasma sheet occurring during a magnetospheric substorm.

c29 111300 03

W69-047

CONFERENCE ON THE PHYSICS AND APPLICATION OF LITHIUM DIFFUSED SILICON

M. H. Moore, P. H. Fang, Dec. 1969

NASA, Goddard Space Flight Center, Greenbelt, Maryland

Sponsored by: NASA, GSFC - Conference at Greenbelt, Apr. 25, 1968

NASA-TM-X-63821, X-711-69-366

Avail: NASA, GSFC, Greenbelt, Maryland

NOTICE: This Abstract from C-STAR, Accession No. X70-12600, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

This conference was directed towards the solution of a particular problem in space applications, damage to semiconductor devices by energetic particle radiation. The theme centered around the technology of silicon p-on-n solar cells in which lithium is used as the donor impurity. Much work remains to fully understand the role of lithium in silicon. To this end, the purpose of the conference was to discuss: (1) the role of lithium in silicon on the introduction of defects and their annealing; and (2) the applicabilities of silicon (lithium) to solar cells and to other electronic devices.
(185 pages, with refs)

c11, c29 110500 03

W69-048

SUMMARY OF SOLAR CELL RADIATION DAMAGE ON ATS-I AND ATS-II

R. C. Waddel

NASA, Goddard Space Flight Center, Greenbelt, Maryland

NASA-TM-X-63821; X-711-69-366

Avail: NASA/GSFC, Greenbelt, Maryland

Presented to: Conference on the Physics and Application of Lithium Diffused Silicon

Dec. 1969

Various types of solar cells were monitored aboard the orbiting synchronous Applications Technology Satellites, ATS-1 and ATS-II. According to the remaining percentages of initial maximum power available, several qualified conclusions were drawn: (1) degradation was greater than expected; (2) optimum base resistivity was 10 ohm-cm; (3) optimum shield thickness was 6 mils; (4) sapphire and silica shields were comparable; (5) silica shields were superior to glass; (6) aluminum and boron doping were comparable; and (7) it was necessary to presume some radiation damage, a drop in illumination, and a development of series resistance to account for the results.
(22 pages, 14 refs)

c29 110500 04

W69-049

CHARACTERISTICS OF LOW-ENERGY PARTICLE FLUXES OBSERVED AT SYNCHRONOUS ALTITUDE

E. G. Shelley, R. G. Johnson

Lockheed Palo Alto Research Laboratory, Palo Alto, California 94304

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 663, 1969

The Lockheed experiment on ATS-5 measures proton and electron fluxes in eleven individual particle detectors covering the energy region from about 0.6 keV to 800 keV. On the basis of a preliminary analysis of the presently available data (approximately one week) some gross

characteristics of the particle populations at synchronous altitude have been determined. The electron fluxes were generally low and relatively constant during the day and evening hours (local time). Impulsive flux increases generally occurred between midnight and dawn and lasted for a few hours or less. The protons were more stable in character than the electrons and were seen at all local times. The lower energy (a few keV) protons showed only small variations during the impulsive electron events. The more energetic protons (> 38 keV) were substantially depressed during the electron events and in several instances exhibited rapid fluctuations near the peaks of the events.

c29 111300 02

W69-050

MAGNETOSPHERIC PLASMA FLOW AT 6.6 R_E DURING MAGNETIC DISTURBANCES

D. T. Young

Rice University, Houston, Texas

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 280, 1969

At approximately 2150 U. T. on February 7 and 2350 U. T. on February 15, 1967 the Rice University suprathermal ion detector on the ATS-1 satellite detected large, highly anisotropic fluxes of low energy (E < 50 eV) ions. Near noon Local Time on February 7 the detector encountered ion fluxes which show a strong tendency toward alignment with the equatorial component of the earth's field measured by the onboard magnetometer. Ion flow on February 15 at 2 P. M. Local Time (2350 U. T.) is coincident with the sudden commencement of a geomagnetic storm and appears to be in part associated with the inward motion of the magnetopause boundary. These ion flow events have patterns unlike those reported previously by Freeman and associated with storm main phases.

c29 110700 19

W69-051

EVIDENCE FOR VISCOUS INTERACTION AT THE MAGNETOSPHERIC BOUNDARY

C. S. Warren[1], J. W. Freeman[2]

NASA-MSC Houston, Texas[1]

Rice University, Houston, Texas[2]

Published in: Trans. Amer. Geo. Union, Vol. 50, p. 661, 1969

Observations of convected magnetospheric plasma near the magnetopause during the magnetic storm of January 13-14, 1967, show that some type of interaction with the magnetosheath plasma causes the convected plasma to be turned toward the flanks of the magnetosphere. The turned plasma had flow parameters of $n = 9\ cm^{-3}$, $v = 25$ km/sec, and $T = 300°K$ which were similar to flow parameters of the plasma toward the front of the magnetosphere. This cool plasma evidently flows tailward inside the boundary layer of streaming magnetosheath plasma.

c29 110700 23

W69-052

BAND LIMITED MICROPULSATIONS AT 6 TO 8 EARTH RADII IN THE EQUATORIAL PLANE

R. L. McPherron, P. J. Coleman, Jr.

University of California, Dept. of Planetary & Space Science Los Angeles

Presented to: American Geophysical Union, 1969

Published in: EOS, Vol. 50 p. 663

Ground observations of magnetic micropulsations in the auroral zone have identified a phenomenon called band limited pulsations which occurs in the early morning hours during the recovery phase of magnetospheric substorms. The association of these micropulsations with modulated electron precipitation suggests these waves originate in the equatorial plane at distrances of 7 earth radii. A preliminary search for these pulsations has been made with magnetometers on the ATS-1 and OGO-5 spacecraft. These waves have been found at the expected time and location. The two wave events presently under study are quasi-monochromatic with periods about 20 seconds and amplitude of 1 gamma. The waves are transverse to the DC magnetic field and tend to be linearly polarized. During the ATS-1 event, simultaneous modulation of both trapped and precipitating electrons was observed.

c29 110800 37

W69-053

SIMULTANEOUS OBSERVATIONS OF 10-30 SECOND PERIOD AURORAL ZONE X-RAY PULSATIONS AND MAGNETIC FIELD VARIATIONS OBSERVED AT SYNCHRONOUS ORBIT

J. D. Pierson[1], W. D. Cummings[2]

NASA, Manned Spacecraft Center, Houston, Texas[1]

Grambling College, Physics Dept., Grambling, Louisiana[2]

Presented to: American Geophysical Union, 1969

Published in: EOS, Vol. 50, p. 663

Auroral zone x-ray pulsations in the 10-30 second period range, observed at Ft. Yukon, Alaska on August 18-19, 1967 and magnetic field variations with similar periods measured at synchronous orbit are described. These observations indicate that these fluctuations do not have a unique period but do have a most probable interval between pulsations of 10-30 seconds. These combined data suggest that the x-ray pulsations are not caused by electrons executing any fundamental periodic motion in the geomagnetic field but rather are caused by some large scale wave-particle interaction.

c29 110800 38

W69-054

ESTIMATES OF EFFECTS OF POLAR CAP ABSORPTION ON VHF SIGNALS RECEIVED AT HIGH LATITUDE STATIONS

H. E. Whitney, 1969

Air Force Cambridge Research Laboratories, Bedford, Mass.

This paper discusses an analysis of the polar cap absorption (PCA) effect on VHF signals from ATS-3 during two periods of known strong PCA events; 29 October-2 November 1968 and 11-14 April 1969, From the analysis performed, there was no discernible absorption during the two PCA events, however, during portions of these events there were accompanying magnetic storms which produced rapid and deep fading which at times reached the receiver noise level.
(4 pages, 5 illustrations)

c29 100500 64

W69-055

TRANSMISSIONS TO EUROPE FROM THE OLYMPIC GAMES IN MEXICO

A. Riccomi

EBU Rev. A (Internat.) No. 113, p2-12 (Feb. 1969)

Published in: IEEE Abstracts, Vol. 72, No. 863, P. 1208, Nov. 1969

This paper describes the technical arrangements which made possible the sound and television broadcasting of the XIXth Olympic Games held in Mexico in October 1968. Operations were centralized for European services by means of a joint EBU/OIRT Operational Group which organized the planning and installation of equipment on the basis of a production pool formed by the EBU/OIRT, Telesistema Mexicano, Nippon HOSO Kyokai and the American Broadcasting Company. Transmissions to Europe were relayed by the ATS-3 satellite via Mexican Earth-station at Tulancingo.

c34 010000 45

W69-056

EARTH REFLECTION VIEWED FROM ATS-III

I. Ruff, W. L. Smith

National Environmental Satellite Center, Hillcrest Heights, Md.

Presented to: American Geophysical Union Spring Meeting, April 1969

Published in: Trans. Amer. Geo. Union, p. 175, No. M93

The reflected solar radiation from several different types of earth's surface (e.g., ocean, desert, grassland, etc.) is studied as a function of wavelength region and solar zenith angle, using data from the Applications Technology Satellite (ATS-III) Multicolor Spin-Scan Cloud Camera. The variations of reflectance with solar angle observed with ATS are related to total reflectance patterns obviously obtained (e.g., from aircraft, ground observations, and from theory). The differences in the reflectance patterns for the various surfaces studied are illustrated. Problems of separation of the data, and of obtaining cloudless observations are also discussed.

c20, c14 080100 25

W69-057

QUANTITATIVE AND ANALYTICAL RESULTS OF ATS-1 (ATS-B) TELEMETRY DATA PROCESSING

M. A. Rabyor

Goddard Space Flight Center, Greenbelt, Maryland

Report No.: X-564-69-19, January 1969

This report covers the results of processing telemetry data from PCM (engineering data) and PFM (scientific data) telemetry systems. The data was acquired from the Applications Technology Satellite (ATS-1) during the period December 7, 1966 through July 1967. Information obtained concerned data quality in terms of data recovery and error statistics, including comparisons of data quality between the acquisition stations. For PCM data, Toowoomba, Australia was significantly better (in a statistical sense) than Rosman, North Carolina or Golstone Lake, California.

Variation in quality of PFM data was largely caused by an out-of-range condition of the Minnesota experiment aboard the satellite.

Two main factors were noted concerning the data processing operation:

1. A high percentage (55.1) of PCM tapes were recorded but not processed, because of late arrival.
2. For PFM data, a shake-down period of approximately 5 months was required to establish a smooth line setup, line maintenance, and production handling operation.

(45 pages, 7 tables, 8 figures)

c08 040000 06

W69-058

FIRST QUARTERLY REPORT FOR LOCKHEED EXPERIMENT ON ATS-5 (1 Sep. 1969 - 30 Nov. 1969)

R. D. Sharp

Lockheed Palo Alto Research Laboratory, Palo Alto, Calif.

Contract No.: NAS 5-10392

Prepared for: NASA, Goddard Space Flight Center, Greenbelt, Maryland

This report covers the first quarter of work on the reduction and analysis of the data from the Lockheed low-energy particle experiment on the Applications Technology Satellite (ATS-5). The experiment is highly successful and a large body of extremely valuable data is being obtained. A brief description of the currently developed computer programs and the quantity and quality of the processed data is presented. The status of the experiment is reviewed and the results of a preliminary analysis of the first week of data are given. The gross characteristics of the low-energy particle environment at synchronous altitude are described. Impulsive electron flux increases, generally observed at local times between midnight and dawn, are interpreted as the result of an inward motion of the inner boundary of the plasma sheet accompanying magnetospheric substorms.
(21 pages, 1 table, 6 figures)

c29 111302 02

W69-059

PERFORMANCE TESTING OF THE ATS-III RESISTOJET EXPERIMENT DUPLICATE FLIGHT PACKAGE ON THE GSFC MICROTHRUST BALANCE

T. A. Cygnarowicz, D. C. McHugh

NASA, Goddard Space Flight Center, Greenbelt, Maryland

X-734-69-407, March 1969

Avail: NASA/GSFC, Greenbelt, Maryland

A laboratory test program was performed using the Applications Technology Satellite (ATS-III) Resistojet duplicate flight package on a single-axis thrust balance in a 4' diameter, 5' long vacuum chamber. The objective of the program was to attempt to duplicate some of the resistojet flight phenomena and to evaluate the microthrust measuring capabilities of the single-axis thrust balance.

The resistojet tests were run for two specific purposes. The first was to try to duplicate the flight unit exponential thrust decay on the No. 2 thruster (from 256 micropounds to a steady value of 127 micropounds during the last 2 days of operation). The second purpose was to obtain a plenum pressure vs. time relationship for the final system depletion for comparison to flight data.

No exponential decay in thrust was observed, but the thrust did drop from approximately 185 to 140 micropounds when the primary regulation valve stuck closed and the plenum pressure dropped to the level which the secondary regulation valve-pressure switch was set to maintain. The valve sticking probelm suggests that a sticking thruster valve may have been the cause for the exponential thrust decay on the flight system. This and other failure possibilities are discussed in Section I.

The operation of the thrust balance is described in Section II. Satisfactory measurements were obtained for thruster pulses of long duration with a fairly constant thrust. Transient thrust measurements could not be made. The nulling of the balance, moreover, is a tedious and time consuming process which caused considerable test delay.
(18 pages, 6 figures)

c31 020000 18

W69-060

FINAL REPORT: ATS-E DUAL SWEPT RADIOMETER SYSTEM

Sanders Associates, Inc.

Contract NAS-5-10468, September 1969

Prepared by: Sanders Associates, Inc., Geospace Electronics Div., Plainview, New York

Sanders Associates, Inc. under NASA Contract NAS-5-10468 constructed and delivered two flight models and one prototype of the Applications Technology Satellite (ATS-E) Dual Swept Radiometer, as well as the associated ground support equipment.

The units will be used during the coming solar maximum for extensive radio astronomy observations of the radio emission from the sun. The observable spectrum will be extended into the long wavelength region. By utilizing the existing space on the scheduled ATS-E, observations will be made over the spectrum from about 50 kHz to 4 MHz from a synchronous (36,000 kilometer) orbit. A dual swept radiometer, of which one unit can function as a fixed frequency radiometer, upon ground command, will be flown. In addition, this contains its own power converter and internal calibrating noise source and programmer. The spacecraft is equipped with four 132-foot gravity gradient booms, and these will be used as the antennas.

This report discusses the system, ground support, and calibration in detail.

c14 111000 09

W69-061

AN ANALYTICAL REVIEW OF THE ATS-1 SOLAR CELL EXPERIMENT: FINAL REPORT

R.H. Stroud, M.J. Barrett

Exotech Incorporated, Systems Research Div., Washington, D.C. 20024

Contract No.: NAS 5-11663

Report No.: TRSR-70-05, November 20, 1969

The environment in which satellites in synchronous orbit operate has a significant effect on their performance. An important portion of this effect is evidenced by the degradation of the power supplies aboard the spacecraft. In general, the loss can be traced to the silocon solar cells which convert sunlight to electricity. Study of these cells is of major importance since they will continue to be the preferred power sources for unmanned spacecraft.

The importance of the silicon solar cell experiment aboard the Applications Technology Satellite (ATS-1) follows from these observations. Flown in December, 1966, this experiment provided observations of the degradation process for over 400 days in space. This report reviews the results of the experiment and offers tentative conclusions regarding the nature of the effects observed.

The effort to relate environment and solar cell degradation was handicapped by the failure of the onboard data storage device after only 417 days in orbit. This essentially "finishes" the experiment and makes a future effort necessary if the trends that appear in the solar cell experiment are to be verified.

The report describes (1) the experimental program, (2) the synchronous orbit environment, and (3) analysis of the observations.
(87 pages, 35 figures, 9 tables)

c03 110500 10

W69-062

ATS-E PFM REAL TIME SUPPORT

F. A. Wulff

NASA/GSFC, Greenbelt, Maryland

Report No: X-564-69-182, May 1969

Avail: NASA/GSFC

This report explains the on-line data processing systems to be used during support periods. PCM telemetry (194 bits per second) from the Applications Technology Satellite (ATS-E) is viewed from the PFM experimenters operational area. Data reduction of both PCM and PFM telemetry simultaneously allows cross comparisons of all experiments carried on the satellite.

The PFM telemetry is routed by the Data Processing Control Center (DPCC) to the C-8 processing area. The filtered PFM is routed to the Westinghouse PFM Data Handling Equipment (DHE) and the PCM encoded version of the PFM is then routed to an adjacent PCM DHE.

The PCM DHE is used to monitor experiments parameters which are best displayed as an analog wave form versus time plotted on a stripchart. The PCM DHE cannot assemble nonadjacent telemetry words onto one stripchart channel, therefore only one PFM channel, representing only four bits of a counter, can be displayed on one stripchart channel.

This report also describes the format printer, displays, converters and various other experiments used for real time signal processing.

c07 040000 10

W69-063

OPLE EXPERIMENTATION SUMMARY

Computer Sciences Corporation, Falls Church, Va.

Contract No.: NAS-5-11672

Report No.: 4031-19

Avail: NASA/Goddard Space Flight Center

This report presents a digest of the program development, implementation, and results for the Omega Position Location Equipment (OPLE) experiment.

A description of the equipment, work accomplished, and the performance achieved during the course of the experiment is presented. It covers the OPLE System concept the experiment objectives, analysis and implementation of the equipment, and a performance review of the experiment results.

The concept of using the Omega Navigation System for the location of remote meteorological platforms was first considered in January 1965. It led to the OPLE System concept and the experiment to prove its feasibility. The experimental phase was completed in September 1969.

c21 080402 03

W69-064

ATS-I FLIGHT EXPERIMENTS, THERMAL COATINGS

NASA/GSFC, Greenbelt, Maryland

Quarterly Progress Report

Published in: Research and Advanced Technological Development Activities, June 1969, Vol. 5 p.p. 141-142

The increase in several coatings on this experiment resulted in equilibrium temperatures out of the range of the temperature sensors for five coatings. To obtain information on coatings behavior, the transient temperature data from the periods the satellite was in eclipse was analyzed.

Applications Technology Satellite (ATS-II) data was examined and questionable data eliminated. Data for 170 days in orbit for five coatings have been salvaged from this experiment. Data for ATS-I and II show remarkable agreement for "identical" samples.

c33 110600 04

W69-065

BALLOON FLIGHT SUMMARY

National Center for Atmospheric Research, Boulder, Col.

National Science Foundation

Flight No. 449-P, Feb. 19, 1969

Presented to: NASA/GSFC, Greenbelt, Maryland and NCAR, Boulder, Colorado

Avail: NCAR, Boulder, Col.

This summary will describe one (1) balloon flight from the NCAR Scientific Balloon Flight Station at Palestine, Texas for Mr. Gay Hilton of Goddard Space Flight Center at Greenbelt, Maryland and Mr. Alvin Morris of the National Center for Atmospheric Research at Boulder, Colorado.

This flight was the second in a series of flights designed to test the ability of the NASA OPLE (OMEGA Position and Location Experiment) system to determine the position of a balloon system in flight.

The flight requirements were: Normal launch and ascent to approximately 100,000 feet, float at altitude approximately eight (8) hours, termination, parachute descent and recover.

The scientific electronic requirement was six (6) tone commands. The payload to parachute suspension was to be a single point nonmetalic suspension (a 3,000 pound test nylon webbing was provided.)

In order to meet load and altitude requirements, a Winzen 2.90 million cubic foot balloon, constructed of 1.5 mil polyethylene, was selected.

After an eight (8) day delay due to weather, the balloon was readied for flight. Time was scheduled on the Applications Technology Satellite (ATS III) an integral part of the OPLE system, and the balloon readied for launch on the morning of 19 February 1969 at 0536 CST. The surface winds were east at eight (8) knots and the temperature was +4° C. The system ascended at a rate of 847 feet per minute to a float altitude of 130,000 feet.

During the flight, balloon positions were obtained by radar, GMD, theodolite, down camera on the balloon, and the tracking aircraft. The flight was terminated from the aircraft after eight (8) hours and forty-eight (48) minutes. After a parachute descent of forty-two (42) minutes, the gondola impacted at 1657 CST, eleven (11) miles east of Montgomery, Alabama. The balloon was recovered the following morning 20 February 1969, from Maxwell Air Force Base golf course.

c21 080400 10

W69-066

MAGNETOSPHERIC PLASMA PHENOMENA AT THE GEOSTATIONARY ORBIT

J. W. Freeman, Jr., D. T. Young

Rice University, Department of Space Science, Houston, Texas

NASA Contract NAS 5-9561

Presented to: European Space Research Organization Colliquium on the ESRO Geostationary Magnetospheric Satellite, Copenhagen, 15-17 October, 1969

This paper reviews the principal phenomena detected by the low-energy plasma detector aboard the Applications Technology Satellite (ATS-1). Designed primarily for positive ions in the energy range of 0 to 50 cV, the detector covered this energy range with 19 differential energy steps and 2 integral energy steps. Through its integral character the instrument was sensitive to positive ions of higher energy and electrons of energy greater than 3 keV. The detector was mounted radially on the satellite equator, and the spin axis was normal to the orbital plane.

Principal plasma phenomena detected may be classes as follows:

1. Directed flow of cool magnetospheric plasma
2. Magnetopause plasma flow
3. Plasma sheet dynamics
4. Hydromagnetic wave induced plasma motion

c29 110700 22

W69-067

SUMMARY OF ATS-III CLOUD ANALYSIS

16 MM Movie

University of Chicago

1969

A selected series of ATS-III cloud pictures that had been taken during the period from 18 November 1967 through hurricane Camille of August 1969 were used to make a 142-ft 16-mm film to show the various types of cloud analyses that can be made from such satellite pictures. Included in the series is the snowstorm over northeast United States on 3 March 1969, the tornado situtations of 19 and 23 March 1968, jet stream cirrus clouds, cloud formations from Hurricane Candy in June 1968 and from Hurricane Camille in August 1969.

c20 081000 14

W69-068

APPLICATION OF ENHANCED ATS PICTURES FOR HURRICANE RESEARCH OR PRELIMINARY FILM OF ENHANCED CAMILLE

16 MM Movie

University of Chicago

1969

This is a 16-mm film of approximately 100-ft. in length which shows the cloud circulation around Hurricane Camille on 17 August 1969 just prior to landing on the Mississippi coast. By enchancing the brightest portion of the scan line the overshooting comulonimbus tops can be observed. These are associated with the areas of most intense convection in the wall clouds surrounding the eye and in the radical cloud lines surrounding the center. It was found that these enhanced clouds coincide with radar echoes from ground based and aircraft radar and their motion may be used to determine the circulation around such storms.

c20 081200 05

W69-069

OBJECTIVE AND DYNAMIC ANALYSES OF TROPICAL WEATHER

R. L. Mancuso, R. M. Endlich

Stanford Research Institute, Menlo Park, Calif.

Contract DAAB07-68-C-0192

Semiannual Report No. 2, 18 Sept. 68 - 18 Mar. 69

NOTICE: Foreign distribution requires approval of Commanding General, Army Electronics Command, ATTN: AMSEL-BL-AP, Fort Monmouth, N.J. 07703

Various approaches were tested for deriving wind information from satellite cloud photographs made by the ATS-3 satellite. Approaches tested included: estimating a wind-vector field from cloud-motion measurements; altering the kinematic properties (divergence and vorticity) to fit cloud distributions; and estimating wind speeds from satellite-derived wind direction. All these schemes gave wind fields that were in reasonable agreement with the available station winds and provided excellent background fields for analyzing the station data. A multilayer baroclinic model was developed for the purpose of making shortrange tropical forecasts. The model is based primarily on the vorticity equation and is designed to operate on the actual wind fields rather than the pressure and temperature fields. At present, testing of the model has been restricted to considerations of internal consistency and to comparisons with barotropic forecasts. Preliminary objective analyses were performed using available rawinsonde data over Southeast Asia in order to test the applicability of objective analyses and forecasting techniques in this area. (Author)

c20 080900 21

C-5

W69-070

FINAL REPORT FOR OMEGA POSITION LOCATION EQUIPMENT CONTROL CENTER DEVELOPMENT AND EXPERIMENT DATA ANALYSIS (29 June 66 - 31 Jan 69)

Texas Instruments Incorporated.

Contract No.: NAS5-10248

Report No.: U-25-815800-F

Avail: NASA/GSFC, Greenbelt, Maryland

After receipt of the OPLE contract in June 1966, Texas Instruments performed a three-month OPLE Control Center (OCC) Design Study followed by a five-month OCC System Design Phase. After completion of the Design Phase, the OCC hardware was manufactured and the system software design was implemented and checked out.

During August and September of 1967, the Experimental OPLE System was integrated and preliminary tests were performed in Dallas using the Applications Technology Satellite (ATS-1). Tests with ATS-1 demonstrated the integrity of the OPLE system and provided preliminary engineering data for use in the OPLE Experiment.

The OCC was then installed at GSFC and preliminary testing with the ATS-3 satellity was performed. The actual OPLE Experiment was initiated on 19 February 1968, with the primary objective being to obtain a statistical performance analysis of the OPLE system. The results of the OPLE Experiment clearly demonstrated the feasibility of using the OPLE concept in a global position and data collection system. The following are significant performance characteristics observed during the experiment:

Absolute platform position location accuracy

Daytime - 1 to 2 nautical miles

Nighttime - 2 to 4 nautical miles

Differential platform position location accuracy

Daytime - 0.2 to 0.5 nautical mile

Nighttime - 0.2 to 0.5 nautical mile

Probability of correct platform position - Approximately 0.8 ambiguity resolution

Platform sensor data word error rate - Approximately 1.3×10^{-2}

Probability of correct platform response - Approximately 0.6 to interrogations

Additional experimentation is continuing through mid-1969, and an addendum to this report will be published covering the results.

c21 080400 11

W69-072

HIGH ACCURACY GRAVITY GRADIENT STABILIZATION

H. Foulke

General Electric Company, Space Systems Organization, Philadelphia, Pa.

This paper presents a study of a low altitude semi-passive attitude control system capable of achieving pointing accuracies of one degree, or better, in all axes. The system consists of a two-axis gravity gradient subsystem for pitch and roll control, and a momentum wheel for yaw control and roll assist. Two modes of operation of the momentum wheel are discussed, a "fixed speed" mode (momentum wheel turning at constant speed) and a modulated mode wherein the wheel speed has a nominal bias, but is modulated over a finite range of speed. To improve pitch performance, the momentum wheel speed is modulated as a function of a pitch attitude error signal.

Principles of operation of the system are presented with particular emphasis on optimizing the performance in all axes. A preliminary design, developed from available hardware, is also presented, with steady state attitude performance estimates for the design included. Comparisons are made between the semi-passive system (with the two momentum wheel modes of operation), and the performance of other spacecraft.

A growth version of the semi-passive concept, to include synchronous altitude and larger spacecraft, is presented. Refinements permitting better pointing accuracy, more rapid damping time, and a more flexible mode of operation are also discussed.

c31 090000 54

W70-001

ATS-5 MILLIMETER WAVE EXPERIMENT DATA REPORT, OCT. - DEC. 1969

L. J. Ippolito

Applications Experiments Branch, GSFC

X-733-70-123, March 1970

Presented to: Ground Station Committee Meeting, London England, April 21, 22, 23, 1970.

Avail: NASA, Washington, D. C.

The Millimeter Wave Propagation Experiment was successfully launched on board the ATS-5 (Applications Technology Satellite) in August, 1969 and is providing initial information on the propagation characteristics of the earth's atmosphere in the K_u (12.5 to 18 GHz) and Ka (26.5 to 40 GHz) frequency bands.

In spite of an unexpected spin condition induced on the satellite early in the launch phase, seven-millimeter wave receiving stations began data acquisition operations early in October and a large portion of the data analysis program conceived before launch has been modified to accept the spin-modulated data.

Amplitude and phase measurements on two independent test links at 15.3 GHz (downlink) and 31.65 GHz (uplink) will provide propagation characteristics of the earth's atmosphere during measured weather conditions.

The experiment objectives and equipment configurations are briefly reviewed, post-launch spacecraft and ground systems performance is described, and statistical analyses performed on data acquired during the first three months of operations, and some of the initial results are discussed.
(104 pages, 25 illustrations)

c07 070300 10

W70-002

BASIC PROBLEMS ON CLOUD IDENTIFICATION RELATED TO THE DESIGN OF SMS - GOES SPIN SCAN RADIOMETERS

T. T. Fujita

The University of Chicago

NASA Grant NGR-14-001-008

SMRP Research Paper No. 84, March 1970

Avail: University of Chicago Department of Geophysical Sciences

Meteorological input based upon up-to-date knowledge of cloud systems will be useful to determine design criteria for future geostationary satellites. The subjects discussed in this paper are: horizontal resolution, picture intervals and areas, brightness and radiance enhancement. Recommendations for design parameters of spin scan radiometers are made based upon meteorological evidences obtained as of January 1970.

Cloud photographs (convective, cirrus, and overshooting cloud tops) from ATS-III and Apollo are presented and analyzed to support the conclusions. Recommendations for future research are made.
(33 pages, 27 illustrations)

c20 080100 47

W70-003

THE ROLE OF LOW ENERGY PLASMA IN MAGNETOSPHERIC SUBSTORMS AT THE SYNCHRONOUS ORBIT

D. T. Young

Rice University

Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, March, 1970

Avail: Rice University, Houston, Texas

Reviews and interprets the Suprathermal Ion Detector (SID) experiment and the magnetometer experiment aboard ATS-1, in light of recent theories viewing the magnetic substorm as a relaxation process.

c29 110700 24

W70-004

STORM-RELATED WAVE PHENOMENA: ATS-1

J. N. Barfield, P. N. Colemen, Jr.

University of California, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 391

When a geomagnetic storm is in progress, quasi-sinusoidal oscillations are often observed in the magnetic field of Applications Technology Satellite (ATS-1), most commonly during or after the main phase minimum. The local time distribution of the oscillations is peaked at 1600 LT. The period of the oscillations ranges from 1 to 15 minutes, with 3 to 5 minutes most common. The average fluctuation amplitude is $\sim$ 10 γ, and the parallel component is usually comparable to the transverse. The polarization of the oscillations is nearly linear, and the fluctuations usually lie in the meridional plane. The period and phase characteristics of the observed oscillations are compatible with a drift wave carried by 10-40 keV protons and having a wavelength comparable to the proton gyroradius. This report represents an expansion of previous work based on data from four geomagnetic storms in early 1967. The present results are based on the entire year 1967, during which 23 events were observed. We conclude that these oscillations are a regular feature of the geomagnetic storm and play an important role in the interaction of the geomagnetic field and storm-time ring current.

c29 110800 43

W70-005

INWARD COLLAPSE OF THE MAGNETIC TAIL DURING MAGNETOSPHERIC SUBSTORMS

R. L. McPherron, P. J. Coleman, Jr.

Presented to : American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 402

At 1120 UT on August 7, 1967, the ground magnetogram from College, Alaska, showed the start of the expansion phase of a polar magnetic substorm. At this time both ATS-1 and OGO-5 were aligned on the meridian at 0100 LT, both in the equatorial plane. Their respective geocentric distances were 6.6 and 8.8 earth radii. Data from the OGO-5 magnetometer indicate that at 1118 UT the magnetic field began to rotate from a tail-like orientation towards a dipole-like magnetic field configuration. At 1129:03 UT the field magnitude increased suddenly. A similar increase was observed with the ATS-1 magnetometer, but delayed by 94 seconds. This delay corresponded to an earthward motion of the discontinuity with a velocity of 148 km/sec. These data provide considerable support for the magnetospheric substorm model that is based on the collapse of the magnetic tail.

c29 110800 44

W70-006

THE MAGNETIC FIELD AT SYNCHRONOUS EQUATORIAL DISTANCE

P. J. Coleman, Jr., W. D. Cummings

University of Calif., Dept. Of Planetary and Space Science, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 48, p. 80

Measurements of the magnetic field at the geocentric range 6.5 R_E have been made with the magnetometer on board the first Applications Technology Satellite (ATS). Results of a preliminary analysis of the measurements are described. The satellite was placed in synchronous, equatorial orbit at longitude 155°W. The diurnal variations of the field are described on the basis of data taken during periods of relatively low geomagnetic activity. Measurements taken during both quiet and disturbed times are compared with simultaneous measurements of the surface field at Honolulu (long. 158°W) and College, Alaska (long. 148°W).

c29 110800 45

W70-007

A DUSK EFFECT IN IONOSPHERIC STORMS

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Boston University, Boston, Mass. 02215

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 376

Total electron content (N_T) measurements from Hamilton Mass. using the ATS-3 satellite have been used to monitor the diurnal changes of N_T during 20 geomagnetic storms. Comparison of these data with monthly median values shows that N_T exhibits a very pronounced increase during the dusk hours on the first day of the storm. This effect seems to be independent of the storm commencement time and is usually associated with an enhancement of the total magnetic field. The fact that the contraction of the plasmapause and the equatorward movement of the ionospheric trough are most sensitive to magnetic disturbances near the sunset meridian suggests that the dusk increase in N_T is produced by the dumping of magnetospheric plasma into the topside ionosphere. The squeezing of plasma from the tubes of force is probably the result of the compression of the plasmasphere by enhanced convection from the tail of the magnetosphere. This effect becomes most noticeable at the bulging of the plasmasphere near the dusk meridian.

c13, c29 100500 62

W70-008

ENERGETIC PARTICLE MEASUREMENTS ON THE ATS-5 SYNCHRONOUS SATELLITE

F. S. Mozer, F. H. Bogott

University of California, Berkeley

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 390

The University of California, Berkeley, experiment on the Applications Technology Satellite (ATS-5) consists of two detectors looking approximately parallel and anti-parallel to the magnetic field direction. Each detector is a photomultiplier viewing a two-layered scintillator that allows separation of protons, electrons, and alphas, and that measures electrons four energy ranges from 5 to 200 KeV, protons in three energy ranges from 30 to 300 KeV and alpha particles with energies between 300 and 500 KeV. Variations in the fluxes and spectra of these particles are observed on time scales varying from shorter than the appropriate particle bounce period to as long as several days during quiet times. The pitch angle distributions are generally anisotropic and are peaked toward larger pitch angles, with anisotropies of 20 to 50% over a range of 24° in pitch angle. Variations exceeding an order of magnitude are observed when the detectors sweep through the loss cone near local noon.

c29 111200 01

W70-009

ELECTRON AND PROTON PITCH ANGLE DISTRIBUTIONS MEASURED ON ATS-E

F. H. Bogott, F. S. Mozer

University of California, Berkeley

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 806

For the first several weeks of its orbit, the synchronous Applications Technology Satellite (ATS-5) was spinning in such a way that the University of California (Berkeley) 30-300 keV proton and electron spectrometer observed an unusually wide ($\sim 15^\circ - 90^\circ$) range of pitch angles. Pitch angle distributions for eight days during this period and during several interesting events at later times have been analyzed with the conclusion that the observed anisotropy is a function of both local time and substorm time. The predictions of models based on drift-shell splitting and on strong pitch angle diffusion are compared with these ATS-5 results. Several examples of pitch angle distribution variations are discussed as a function of time during large flux increases.

c29 111200 03

W70-010

MAGNETOPAUSE PROPERTIES INFERRED FROM ENERGETIC PARTICLE MEASUREMENTS ON ATS-5

F. H. Bogott

University of California, Berkely

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 390

A compression of the magnetosphere during a magnetic storm permitted measurements near the magnetopause of 5-200 KeV electron fluxes and 30-300 KeV proton fluxes from 1730 to 2000 U.T. on September 29, 1969. The data of interest consists of nine intervals, each of approximately one minute duration, during which the electron fluxes decreased by factors $\gtrsim 10$ and the proton intensities decreased by factors $\lesssim 2$. During the first of these decreases the magnetic field observations indicated that the satellite had crossed the magnetopause boundary. The particle data on this crossing and the eight passes within $\sim$ 1 gyroradius of the boundary are interpreted in terms of the structure of the magnetopause which is found to be complex and probably associated with electric fields.

c29 111200 02

W70-011

RADIATION EXPERIMENT IN THE VICINITY OF BARBADOS - FINAL REPORT

Kirby J. Hanson, Stephen Cox, Verner E. Suomi and Thomas H. Vonder Haar

University of Wisconsin

April, 1970

Grant: NSF Grant GA. 12603

From the low-resolution radiometer on the first generation satellites, it has been learned that more solar energy is absorbed by the earth's atmosphere system in the tropics than was previously thought.

These measurements give no indications of whether this additional energy is absorbed primarily in the ocean or in the atmosphere. It is important to know where this absorption occurs because it has been generally thought that solar energy by the atmosphere is a relatively small term among the other atmospheric energy terms. A field program was carried out on Barbados from May 1 - July 31, 1969. This report describes the operational results and the instrumentation of this program. The scientific results are not included due to the fact that this data had just begun to be processed. (100 pages, 15 illustrations)

c13 080800 05

W70-012

MAGNETIC EVENTS OBSERVED BY THE ATS-5 MAGNETOMETER DURING THE MAGNETIC STORM OF SEPTEMBER 27-30, 1969

T. L. Skillman, M. Sugiura

NASA, Goddard Space Flight Center, Greenbelt, Maryland

Presented to: Fifty-first Annual AGU Meeting, Washington, D. C., April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, No. 4

Two specific events that occurred during the main phase of this storm are discussed in detail, namely, (a) a rapid field increase of $\sim 100\gamma$ starting from 1732 UT on September 29, immediately followed by a sharp decrease by $\geq 300\gamma$, and (b) a rapid decrease of the field by 50 at 1954 UT on the same day. The magnetic field was already high ($\sim 250\gamma$) at the time the first event took place, being nearly equal to that expected from the Mead model, if the magnetopause was near the ATS orbit at 6.6 R_E. Particle measurements made on the same satellite by other experimenters indicate a sudden drop out of trapped electrons at the time of this event. A preliminary examination of ground magnetic records indicates a worldwide sudden impulse and a possible initiation of pc 5 pulsations at high latitudes. Interpretations of the two events are made on the basis of these observations and on additional magnetic data from ATS-1 and OGO 5.

c29 100600 01

W70-013

COHERENT OSCILLATIONS IN THE MAGNETIC FIELD AND ENERGETIC ELECTRON FLUXES IN THE PC-4 BAND AT ATS-1

J. N. Barfield[1], C. G. Maclennan[2], G. A. Paulikas[3], M. Schulz[3]

University of California, Los Angeles[1]
Bell Telephone Labs., Murray Hill, N. J.[2]
Aerospace Corp., El Segundo, California[3]

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 391

During a quiet time interval (1640 - 1855 UT) on February 14, 1967, the magnetic field at ATS-1 and the energetic electron fluxes in at least four distinct energy channels covering the band 0.3-1.9 MeV exhibited coherent modulations having a frequency of 34 cph (period $\sim$100 sec) and duration of at least 30 oscillations. The electron flux and magnetic field oscillated in phase. The field perturbation reached 10γ (peak to peak) in the direction of the mean geomagnetic field. The transverse component of the field perturbation remained below $\sim 1\gamma$. The characteristics of the observed oscillations are compatible with the passage of a compressional drift wave carried by 30-keV protons and having a wavelength comparable to the proton gyro radius.

c29 110800 42

W70-014

PROPAGATION OF SUBSTORM EFFECTS AWAY FROM MIDNIGHT AS OBSERVED BY THE ATS-1 MAGNETOMETER

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Univ. Of Calif., Dept. Of Planetary and Space Science, Los Angeles, California

Presented to: American Geophysical Union, Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 391

It has been previously reported that the ground magnetometer beneath ATS-1 'tracks' the satellite magnetometer during magnetospheric substorms. A quantitative study of this relationship using regression analysis reveals a nearly linear relation when the satellite and ground magnetometers are close to local midnight. However, this relationship degenerates away from midnight. On the basis of these results we assume that we can use measurements of the surface field at low latitudes and other longitudes to determine the state of the field at these other longitudes along the synchronous equatorial orbit. We then use measurements from a chain of low latitude observatories to estimate substorm 'strengths' at local midnight. Finally ATS magnetometer data are used to measure the magnitude and delay of the substorm effects along the synchronous orbit as functions of local time and strength (at midnight).

c29 110800 41

W70-015

THE DEPENDENCE OF SPECTRAL HARDNESS UPON PITCH-ANGLES DURING MAGNETOSPHERIC SUBSTORMS

G. K. Parks

University of Toulouse, France

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 402

The University of Minnesota ATS-1 experiment measures electrons in the pitch-angle range about 60^o—90^o in three energy ranges: ΔE_1 = 50-150 keV, ΔE_2 = 150—500 keV, and ΔE_3 = 500-1000 keV. Define R, a ratio of electron fluxes in different energy ranges as a function of pitch-angles:

$$R = \frac{J[\Delta E_1; \Delta \alpha\{min\}]/J[\Delta E_2; \Delta \alpha\{min\}]}{J[\Delta E_1; \Delta \alpha\{max\}]/J[\Delta E_2; \Delta \alpha\{max\}]}$$ where $\Delta\alpha\{min\}$ and $\Delta\alpha\{max\}$

represent the minimum and maximum 6^o range of pitch-angles sampled. The function R is a measure of spectral hardness that is pitch-angle dependent. R=1 means that the spectral hardness is pitch-angle independent, while $R > 1$ means $\Delta\alpha$ (min) particles are softer than the $\Delta\alpha\{max\}$ particles, and vice versa. The application of this function to 5 substorm-correlated acceleration events indicates that for these 5 events, $R > 1$. This result together with previous observations that precipitation is strongly coupled to equatorial acceleration events with pitch-angle distributions that are peaked toward 90^o pitches can be consistently interpreted in terms of strong pitch-angle diffusion process that is coupled to inward radial diffusion process.

c29 110400 26

W70-016

CHARACTERISTICS OF MAGNETOSPHERIC SUBSTORMS OBSERVED AT SYNCHRONOUS ALTITUDE

R. D. Sharp, R. G. Johnson, E. G. Shelley, L. F. Smith

Lockheed Palo Alto Research Laboratory

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 389

The Lockheed auroral particle experiment on Applications Technology Satellite (ATS-5) measured electrons and protons in the energy range from about one-half to several hundred keV. The gross characteristics of these particles observed during several relatively quiet days in September 1969 will be discussed with emphasis on their behaviour during magnetospheric substorms. Large increases in the electron fluxes were generally observed at local times between midnight and dawn in association with negative bays observed on ground magnetograms from auroral zone observatories located at a longitude close to that of the satellite. The arrival of the low energy electrons ($\approx$ 1 keV) was typically observed before the onset of the more energetic electrons ($\approx$10 keV). The proton fluxes making up the quiet time ring current were usually relatively constant or showed a broad depression during the period of the substorms. On some occasions, there was a characteristic "signature" observed most clearly in the energetic ($E > 38$ keV) proton fluxes and consisting of an initial decrease followed by a relatively rapid increase. The time scale of this feature was the order of one hour. Preliminary indications are that the average electron energies in the inner plasma sheet during the period of these observations were substantially higher than have been reported deep in the tail.

c29 111300 04

W70-017

PRECIPICES AND CHASMS IN THE MAGNETOSPHERIC PLASMA

S. E. DeForest

University of California, S. D., LaJolla

Presented to: American Geophysical Union Spring Meeting, April 1970, and International Symposium on Solar Terrestrial Physics. (URSI/COSPAR) Leningrad, Russia, 1970

Published in: Trans. Amer. Geo. Union, 1970 (SPM 37)

Data obtained from four spectrometers aboard the synchronous Applications Technology Satellite (ATS-5) show energy spectra of electrons and protons have between zero and six maxima and minima in the range 50 eV to 50 keV. During magnetically quiet periods, these features often slowly move in unison toward lower energies for periods of many hours. At times, fluxes at one or more of the minima become essentially zero while flux at neighboring energies remain large. On one occasion such a "chasm" was observed to develop near 20 keV in the proton spectrum shortly after local midnight and to progress smoothly toward lower energies and reach 1 keV before dusk. Another spectral feature observed is a precipitous increase in flux with increasing energy in electron or proton fluxes directed along the field while perpendicular fluxes exhibit no such "precipice". When a precipice appears in the parallel proton spectrum, an intense sharp peak in both parallel and perpendicular proton spectra always appears at the threshold energy. Preliminary theoretical work indicates that these and other phenomena such as almost monoenergetic electron fluxes found in association with spectra exhibiting "precipices" may be the effect of electric fields resulting from potentials of -5000 to +2000 volts local to the spacecraft.

c29 111400 03

W70-018

EQUATORIAL OBSERVATIONS OF AURORAL PLASMA

C. E. McIlwain

University of California, S. D., LaJolla

Presented to: American Geophysical Union Spring Meeting, April 1970

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 389

A set of four spectrometers aboard the Applications Technology Satellite (ATS-5) are being used to observe the characteristics of the plasma responsible for the production of visible auroras. From their vantage point at 6.6 earth radii and about 105 degrees west, these detectors measure the energy dependence of the electron and proton particle populations over the range of 50 eV to 50 keV with 15% resolution. Pairs of detectors are directed parallel and perpendicular to the spin vector which is oriented parallel to the earth's axis. Energy versus time spectrograms exhibit complex structure in both energy and time. It is expected that many features such as the irregular buildup of the electron energy density during the hours preceding midnight can be directly correlated with the auroral patterns which are being photographed near the point the ATS-5 magnetic field line enters the atmosphere. The perpendicular proton detector sometimes finds an azimuthal asymmetry in the proton velocity distribution produced by the plasma flowing perpendicular to the magnetic field.

c29 111400 04

W70-019

MINUTES, GROUND STATION COMMITTEE MEETING LONDON, ENGLAND, April 21, 22, and 23, 1970

Distributed by: L. Jaffe, (Chairman, Ground Station Commitee) Office of Space Science and Applications National Aeronautics and Space Administrations, Washington, D. C.

Avail: NASA, Washington D. C.

This 12th Ground Station Committee meeting was held as a forum for NASA to present, and to obtain reactions to, its plans for the next few years. Satellite status reports included a summary of spacecraft system operating times, a review of ATS-I, -II, and -III anomalies, a summary of typical usage (ESSA, NASA, Japan, and Austrialia)of ATS-I and -III, and results of C-Band communications (TV and SSB-MA) experiments on ATS-I and -III. The nutation anomaly of ATS-V, believed due to excessive (30 to 40 times predicted) damping from the solar panel heat pipes rendering ineffective the nutation control jet firings, is discussed in some detail. The millimeter wave (Ku- and Ka-Band) experiments on ATS-V are reviewed, as is the L-Band performance. Topics presented briefly include the magnetic field monitor, the solar radiation damage experiment, and the environmental measurements experiments (EME). The remainder of the meeting was devoted primarily to plans for ATS-F and -G, to reports from participating countries (Canada, France, Germany, India, Italy, Japan, UK, and US) on their ground station operations and plans, and to future plans by NASA and others. Detailed information on many of the topics if contained in the following appendices. With the exception of B, C, and D, these appear in a separate binder.

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ATS-E MAGNETIC FIELD MONITOR INSTRUMENTATION, T. L. Skillman, Appendix D, (100600 01, N70-22958)

APPLICATIONS TECHNOLOGY SATELLITE - F EXPERIMENTS Appendix E.

REPORT ON PATTERN AND RECEPTION CHARACTERISTICS RECORDED USING APPLICATIONS TECHNOLOGY SATELLITE ATS-III IN CONJUNCTION WITH AN EXPERIMENTAL EARTH STATION AT CRYSTAL BEACH, OTTAWA, ONTARIO, CANADA Northern Electric Co., Ltd., Appendix F

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SSCC MONOCHROMATIC PICTURE RECEIVING EQUIPMENT AT KASHIMA GROUND STATION, Ministry of Posts and Telecommunications, Japan, Appendix J

CHARACTERISTICS OF 26 Mϕ PARABOLOIDAL ANTENNA AT KASHIMA EARTH STATION, Ministry of Posts and Telecommunications, Japan, Appendix K

SUMMARY OF U. K. EXPERIMENTS CONDUCTED WITH ATS-III, Appendix L

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ATS-V MM WAVE PROPAGATION EXPERIMENT, J. L. Levatich, Appendix N

AN ON-BOARD SWITCHED MULTIPLE-ACCESS SYSTEM FOR MILLIMETER-WAVE SATELLITES, W. G. Schmidt, Appendix O

THE SPADE DEMAND ASSIGNMENT SYSTEM, A. M. Werth, Appendix P

SPADE: A PCM FDMA DEMAND ASSIGNMENT SYSTEM FOR SATELLITE COMMUNICATIONS, A. M. Werth, Appendix Q

TDMA SYSTEM DEVELOPMENT WORK AT COMSAT, W. G. Schmidt, Appendix R

THE FRANCO-GERMAN TELECOMMUNICATION SATELLITE SYMPHONIE, B. R. K. Pfeiffer and P. Viellard, Appendix S

ITALIAN RESEARCH PROJECT ON MILLIMETER WAVE COMMUNICATION EXPERIMENT, Appendix T

EXPERIMENT PROPOSAL FOR A. T. S. PROGRAM (A. T. S. G.), France, Appendix U

EXPERIMENTAL PROPOSAL FOR A. T. S. PROGRAM (A. T. S. G.), France, Appendix V

EXPERIMENTAL SATELLITE TRANSMISSION OF BROADCASTING PROGRAM, Radio Research Laboratories, Japan, Appendix W

TRANSMISSION OF SOUND AND VISION SIGNALS BY TIME-DIVISION MULTIPLEX, NHK, Japan, Appendix X

U. K. VIEWS OF AREAS IN WHICH FURTHER PROPAGATION TESTS WOULD BE DESIRABLE, Appendix Y

U. K. PROPOSALS FOR FURTHER EXPERIMENTS USING ATS-III, Appendix Z

(213 pages, 120 illustrations, plus appendices)

c34 060000 11

W70-020

THE FADING OF V. H. F. SIGNALS FROM A GEOSTATIONARY SATELLITE (ATS-3)

E. M. Bramley, S. M. Cherry

U. K. Radio and Space Research Station

April 14, 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970; Appendix M.

Avail: NASA, Washington D. C.

Recordings of the 136.47 MHz beacon on Satellite ATS-3 made at Winkfield, U. K., on vertically and horizontally polarized receivers over a 4-month period during 1969 have been analyzed for amplitude scintillation, and the results given. A short discussion of the ionospheric and troposheric conditions required to produce the amplitude scintillation, and the results given. A short discussion of the ionospheric and tropospheric conditions required to produce the amplitude scintillations is given: the effect of the troposphere at 136 MHz is not thought to be significant. (5 pages)

c13, c29 100500 63

W70-021

SUMMARY OF U. K. EXPERIMENTS CONDUCTED WITH ATS-3

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970; Appendix L

Avail: NASA, Washington D. C.

Experiments reported include BOAC monitoring of ATS-3 from London (Heathrow) Airport immediately after launch. Significant fades were observed. Royal Aircraft Establishment reported results for a 1200 bits/s, chirp modulation, 40 kHz frequency sweep data link; as well as results of VHF propagation tests with ATS-3 in 1969, with scintillation of varying duration and severity.
(3 pages)

c07, c21 070224 01

W70-022

ATS-5 MM WAVE PROPAGATION EXPERIMENT

J. L. Levatich

COMSAT Laboratories

April 14, 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970; Appendix N

Under INTELSAT sponsorship, COMSAT Labs in Clarksburg, Md. is participating in data collection on 15-GHz atmospheric attenuation and coherence bandwidth, using the 15.3 GHz phase-modulated signal from ATS. The Cassegrain type, fully steerable, antenna has a 16-foot diameter metalized fiberglass reflector. The receiver has tunnel diode front end and a down-converter to 1.05 GHz. Meterological instrumentation includes 15 GHz and 5.4 GHz weather radars and rain gauges. Limited results by the time of the meeting showed good rough correlation between radar data, rain intensity, and attenuation.
(4 pages, 1 illustration)

c07, c20 070300 13

W70-023

CHARACTERISTICS OF 26 MΦ PARABOLOIDAL ANTENNA AT KASHIMA EARTH STATION

Ministry of Posts and Telecommunications, Japan

April, 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970 Appendix K.

Avail: NASA, Washington D. C.

The antenna for the SHF communications experiments at Kashima earth station is a steerable Cassegrain antenna near field shaped-dish type having a capability of operating on frequencies of 6212 MHz for transmission, 6301 MHz for transmission, 4119 MHz and 4178 MHz for reception and tracking, and 4135 MHz and 4195 MHz for beacon tracking.

For transmission and reception of SHF waves, the antenna and feeding system are used in common. The primary feeding horn is a conical horn reflector of 2-meter diameter. The axis of the conical horn is coincident with the elevation axis.

The transmitting and receiving waves are both linearly polarized and are orthogonal. These waves are fed at the diplexer orthogonally but the polarization angle of the transmitting wave can be changed to be parallel to that of the receiving wave by using a 90-degree twist wave guide.

Details of system parameters and performance are listed.
(6 pages, 4 illustrations)

c11 060400 03

W70-024

SSCC MONOCHROMATIC PICTURE RECEIVING EQUIPMENT AT KASHIMA GROUND STATION

Ministry of Posts and Telecommunications, Japan

April, 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970 Appendix J.

Avail: NASA, Washington, D. C.

The spin scan cloudcover camera (SSCC) picture receiving equipment was installed at Kashima Ground Station in the latter part of 1969 and pictures are being received from ATS-1.

The SHF signal of 4178 MHz, transmitted from the ATS-1 satellite, is received with the 26 meter antenna. The signal is preamplified by a parametric amplifier operating at room temperature and FM-demodulated after converting to IF, 70 MHz.

The SSCC signal is processed by a processing console and takes pictures displayed on a kinescope with a camera using Polaroid sheet film. Mercator pictures, processed from the globular pictures, are then used for meterological analysis. Optimum adjustment of the circuitry is not complete but fairly good pictures are being taken.

When tape recorded signals are used, the picture quality deteriorates because of the recorded flutter. This problem is alleviated with the use of digital tape equipment. Two tape recorders running simultaneously are desirable because of the 2-minute retrace time of the telescope which is not enough to allow rewind and replacement of the tape reel at receiving sites.

The evaluation of the complete SSCC system is still underway.
(17 pages, 12 illustrations)

c11, c20 060400 04

W70-025

SSB-PM MULTIPLE ACCESS COMMUNICATION EXPERIMENTS VIA ATS-I AT KASHIMA EARTH STATION

Ministry of Posts and Telecommunications, Japan

April 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970 Appendix I

Avail: NASA, Washington, D. C.

March 1969 marked the completion of installation work on the communication terminal equipment. Single station loop configurations via ATS-I were conducted for phase 1 and 2 from May 20, 1969 to February 5, 1970. These tests were conducted using the new 26-meter dish paraboloidal antenna. Pattern gain, noise temperature, and other characteristics were improved. Prior to the satellite communications tests, the equipment was tested by the manufacturing company and the Kashima earth sataion. Brief descriptions are given of the SSB-PM terminal equipment, their performance characteristics, and test results in categories of radio frequency parameters (MA-RF), baseband parameters (MA-BB), multiplex channel parameters (MA-MX), and special tests for various control loop performance (MA-SP).

The first phase of the experimental stage brought forth some modifications to the SSB transmitter exciter. The ATS project office suggested changing the carrier frequency from 6301.050 MHz to 6212.094 MHz because only transponder No. 1 would be available for future SHF communications experiments.

The data obtained in the second stage of the experiment are now under analysis.
(39 pages, 17 illustrations)

c07, c11 070400 11

W70-026

EVIDENCE OF PERIODIC PULSATIONS IN TROPICAL CONVECTION ACTIVITY

D. N. Sikdar and V. E. Suomi

Space Science and Engineering Center, University of Wisconsin

Paper presented to American Geophysical Union meeting held in Washington, D. C., 20-24 April 1970. Abstract in Transactions of American Geophysical Union 1970

An analysis of geostationary satellite photographs over the Pacific in April 1967 reveals that in the tropics convection on the scale of cloud clusters pulsate with a periodicity of about 5 days. It appears that large scale tropical distrubance fields having a wavelength of 75° longitude and a westward motion of 15° longitude per day control the release of convection.
(22 pages, 13 illustrations)

c20 080100 43

W70-027

REPORT ON TELECOMMUNICATIONS IN FRANCE

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970 Appendix G

Avail: NASA, Washington, D. C.

Brief reports are included on operations at Pleumeur Bodou with INTELSAT III, the French Meterological Office participation in the WEFAX experiment with ATS-I and -III, a proposal from the University of Paris to use recently acquired 136-138 MHz receiving equipment to study ionospheric perturbations and structure, and planned

experiments simulating radio links between aircraft-satellite-ground, the satellite being simulated by a stratospheric balloon.
(5 pages)

c20, c11 080200 05

W70-028

APPLICATIONS TECHNOLOGY SATELLITE 1 (ATS-1) SUPRATHERMAL ION DETECTOR (SID) EXPERIMENT, FINAL REPORT FOR (DECEMBER 6, 1966-MARCH 30, 1970)

J. W. Freeman, Jr., and D. T. Young

Dept. of Space Science, Rice University

Contract No. NAS 5-9561

Avail: NASA, GSFC, Greenbelt, Md.

The Rice University Suprathermal Ion Detector Experiment (SID) on the ATS-1 began operation on December 10, 1966 and sent back useful data through February 16, 1967 when degradation of the Channeltron Electron Multiplier caused a significant loss of sensitivity of incident charged particles. During the more than 2 months of nearly continuous operation the SID returned data on low energy ($<$ 50 eV) plasma flows during magnetically distributed times which has in turn contributed to our knowledge of the magnetospheric electric field. A fortuitous crossing of the magnetopause boundary at 6.6 R_E has enabled a detailed study of low energy plasma flow at the boundary. Very low frequency plasma waves have been detected on a few occasions during magnetically distributed times. Lastly, during magnetospheric and polar substorms the tail plasma sheet is found to penetrate to 6.6 R_E and is a highly recurrent feature of these phenomena.

The final report includes a bibliography of papers based on ATS SID Data as well as a short summary of the conclusions reached as a result of this experiment.
(30 pages, 7 illustrations)

c29 110700 25

W70-029

SYMPOSIUM PAPERS; RTCM ASSEMBLY MEETING; APRIL 29-30 AND MAY 1, 1970; SAN FRANCISCO, CALIFORNIA: VOLUME 4 SPACE COMMUNICATIONS

Radio Technical Commission for Marine Services Paper: 87-70/DO-55

Avail: Radio Technical Commission for Marine Services, Washington, D. C.

This volume contains the following papers:

CCIR - What's the Action
Captain Charles Dorian, USCG, Asst. Director, Office of Telecommunications
Department of Transportation, Washington, D. C.

Maritime Services Satellites: How Do We Get One! (Cost, Benefit and Implementation Considerations.)
Barry A. Mendoza, Director, Satellite Communication Systems
Automated Marine International, Newport Beach, California

Rocks and Shoals: The Way to a VHF Maritime Satellite System
CDR Harry A. Feigleson, USCG
LT Richard E. Shrum, USCG
U.S. Coast Guard, Washington, D. C.

A Way of Getting VHF Space Communication Channels
Colonel J. D. Parker, Secretary-General
Comite' International Radio-Maritime, London, England

Beacon + Satellite = Rescue
LCDR M. R. Johnson, USCG
LCDR P. D. Russell, USCG
U. S. Coast Guard, Washington, D. C.

Results of Marine Position Fixing Experiments Using ATS Satellites
Roy E. Anderson, Consulting Engineer
General Electric Company, Schenectady, N. Y.

Communications and Navigation Experiments At L-Band Using ATS-5
J. D. Barnla, Director, Systems Engineering
D. L. Kratzer
Applied Information Industries, Moorestown, N. J.

(79 pages)

c07, c21 070200 25

W70-030

ROCKS AND SHOALS (The Way to VHF Maritime Satellite System)

CDR Harry A. Feigleson, USCG, Lt. Richard E. Shrum, USCG

Radio Technical Commission for Marine Services, Symposium Papers, Volume 4, Space Communications, April 29 - May 1, 1970

Avail: RTCMS, Washington, D. C.

Noting the success of the NASA Applications Technology Satellites, the authors analyze the potential contributions of maritime satellites in the areas of improving environmental information dissemination and data collection, improving navigation and ship location systems; search and rescue, distress, and safety; and improved communication systems. The authors also cite frequency considerations, potential technical difficulties, the need for international agreements to establish such maritime satellites and the economics of installations aboard individual vessels.
(15 pages, 2 illustrations)

c20, c07 070206 06

W70-031

RESULTS OF MARINE POSITION FIXING EXPERIMENTS USING ATS SATELLITES

Roy E. Anderson (General Electric Company)

Symposium Papers, Radio Technical Commission for Marine Services, Volume 4, Space Communications, April 29- May 1, 1970

NASA Contract NAS 5-11634

A series of VHF position fixing experiments using Applications Technology Satellites ATS-1 and ATS-3 demonstrates a capability of locating ships and buoys in the mid-latitude regions with an accuracy of approximately one nautical mile. The experiments also showed that aircraft could be located with an accuracy of approximately one nautical mile if automatic reference repeaters are positioned at fixed geophysical locations to permit real-time measurements of the ionosphere and to correct for small uncertainties as to the location of the satellite(s).

Facilities and equipment used in the tests, in addition to the spacecraft, consisted of General Electric's Radio Optical Observatory near Schenectady, N. Y., a Coast Guard cutter in the Gulf of Mexico, a buoy moored near Bermuda, two aircraft over the continental United States, and a panel truck.

To locate a vehicle, a short tone-code ranging interrogation containing the individual address of the vehicle was transmitted from the Schenectady observatory to one of the spacecraft, usually ATS-3. The spacecraft transmitted the signal back to the ground station as well as to all user craft. The vehicle that was addressed repeated the response. If both satellites were within line-of-sight of the vehicle, both repeated it and the user responses relayed by the satellites were received separately by directional antennas at the ground terminal. The times from the initial transmission of the interrogation to the response from the interrogating satellite and to the responses from the user as

relayed back through both satellites were measured at the terminal. The distances between each satellite and the user craft were calculated from these measurements. Two spheres of position are thus defined. The spheres are centered at the satellites and have radii equal to the measured distances. A third sphere centered at the Earth's center and having a radius equal to the Earth's radius plus the altitude of the craft intersects the other two spheres at two points - one in the northern hemisphere and one in the southern. Prior knowledge permits the choice of the correct point as the vehicle location.
(14 pages, 16 figures)

c20, c07 070211 09

W70-032

COMMUNICATIONS AND NAVIGATION EXPERIMENTS AT L-BAND USING ATS-5

J. D. Barnla, D. L. Kratzer

Applied Information Industries, Moorestown, New Jersey

Presented to: Radio Technical Commission for Aeronautics Assembly Meeting (RTCM), Apr 29-30, May 1, 1970

On February 10, 1970, modulated signal's from the Applications Technology Satellite (ATS-5) were received for the first time at L-band (1540 - 1660 MHz). Included was ranging information and data communications originated at Mojave, California.

A comprehensive analysis was conducted to review the dynamic characteristics of the ATS-5 in orbit and to access the ability of AII receiver instruments to operate with periodic illumination obtained from the spinning ATS-5 satellite. The results of tests and experiments demonstrated the technological feasibility of obtaining meaningful data which would represent a significant step to advance the date at which the benefits of synchronous satellite technology will be available to meet the spectra of marine needs.
(12 pages, 9 figures)

c07, c20 070704 01

W70-033

REPORT ON PATTERN AND RECEPTION CHARACTERISTICS RECORDED USING APPLICATIONS TECHNOLOGY SATELLITE ATS-III IN CONJUNCTION WITH AN EXPERIMENTAL EARTH STATION AT CRYSTAL BEACH, OTTAWA, ONTARIO, CANADA

Northern Electric Co. Ltd.

May, 1970

Published in: Minutes, Ground Station Committee Meeting; London, England; April 21, 22, 23, 1970 Appendix F

Avail: NASA, Washington, D. C.

This report describes a series of tests on the performance of an experimental earth station at Crystal Beach, Ottawa, designed for use as a television receive-only (TVRO) terminal at remote Northern townsites (with the Canadian Domestic satellite ANIK 1). The entire test series was run using ATS-3.

The station's antenna has a 25-foot in diameter, shaped main reflector in a Gregorian configuration. The antenna specification forms Appendix A to this report.

Antenna pattern measurement was conducted with ATS-3 in the multiple access (MA) mode on Feb. 27th, 1970.

For the video transmission testing, scheduled for 2 and 3 March 1970, ATS-3 was switched to the frequency translation (FT) mode. Video test transmissions were generated at Mill Village 1 Earth Station, Nova Scotia, Canada.

An accompanying paper, "An Experimental Earth Station for Domestic Television Reception," P. Parkinson, AIAA Paper No. 70-432, describes the design of the antenna, feed system, amplification, and demodulation equipment.
(108 pages, 43 illustrations)

c11, c07 070104 01

W70-034

POSSIBILITIES FOR SOUNDING THE ATMOSPHERE FROM A GEOSYNCHRONOUS SPACECRAFT

V. Suomi, T. Vonder Haar, R. Krauss, A. Stamm

University of Wisconsin, Madison, Wisconsin

Contribution to: Symposium on Remote Sounding of the Atmosphere, XIIIth meeting of COSPAR, Leningrad, USSR, 20-29 May 1970

This paper demonstrates that vertical temperature sounding of the atmosphere from geostationary altitude is feasible. It treats the meteorological and instrumental options which must be considered to obtain soundings from this great distance with the required accuracy in a reasonable period time. Measurements from the geosynchronous ATS satellites are used to examine cloud conditions. Observations from experiments on NIMBUS-III are used to specify radiance levels to be measured. For a spin-scan system, like that planned for the SMS, an instantaneous field-of-view of 0.3-0.4 mrad (11-14 km) is recommended for the tropospheric sounding channels of 20 cm^{-1} bandwidth near the 15 um region. Results indicate that it will be possible to sound the atmosphere to the earth's surface through openings in a 95% cloud cover in less than one hour.
(12 pages, 4 illustrations)

c20 080100 44

W70-035

THE EARTH LOCATION OF GEOSTATIONARY SATELLITE IMAGERY

C. L. Bristor, May 11, 1970

National Environmental Satellite Center, ESSA, Washington, D. C.

Published in: Pattern Recognition, 1970, Vol. 2, pp. 269-277

Spin scan cloud pictures from NASA's Applications Technology Satellites are being computer processed as an operational experiment. Details of this near-real-time image manipulating activity are described. Processing involves the treatment of horizon and landmark features in support of the photogrammetric aspects and the subsequent transformation of images onto standard map projections.
(9 pages, 7 figures)

c20 080900 23

W70-036

RANGING AND POSITION FIXING EXPERIMENTS USING SATELLITES: 24-HOUR RANGING TEST, MARCH 13-14, 1970

R. E. Anderson

Research and Development Center General Electric Co., Schenectady, New York

Report No. 70-C-198

June 1970

The Radio-Optical Observatory of General Electric recently conducted a twenty-four hour ranging and propagation experiment by interrogating a ground reference transponder at Gander, Newfoundland through the NASA ATS-3 satellite. The ground reference transponder used in the experiment is an automatic receiver-transmitter tone-code ranging responder that can be activated by interrogation through the ATS-3 satellite.

The tone-code ranging technique, developed at General Electric, provided a large quantity of data for analyses of accuracy, communications reliability, and ionospheric propagation.

In addition to the ranging tests, voice communications were conducted between a Pan American 747 aircraft enroute to Puerto Rico from New York City and return, Aeronautical Radio, Inc., at Annapolis, NASA terminals in Miami and Los Angeles, and the G. E. Laboratory. Ranging measurements were successfully made through the satellite while these voice communications were in progress. Other ranging measurements were made from Schenectady to the satellite simultaneously on the same channel with voice transmissions.

c07, c21 070211 10

W70-037

TECHNICAL NOTE ON THE CONVERSION OF STATISTICS ON OCCURRENCE OF SCINTILLATION INDICES TO CUMULATIVE DISTRIBUTION OF SIGNAL AMPLITUDES

H. E. Whitney

Radio Astronomy Branch, Ionospheric Physics Laboratory, AFCRL

AFCRL Report, July 1970

The intent of this note is to describe a method developed to convert statistics on scintillation indices to amplitide distribution and to report results for several sets of data as set forth in a series of several tables. Amplitude distributions were chosen based on the performance of the Applications Technology Satellites, ATS-1 and ATS-3; Canary Bird; and COMSAT. Information was plotted at various degrees of elevation over extended periods of time at various geographic locations.
(16 pages, 10 figures)

c29, c13 100518 01

W70-038

ANNUAL REPORT FOR THE REFLECTOMETER EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE PHASE II

(1 January 1969 - 1 January 1970)

Electro-Optical Systems; Pasedena, California

Contract No: NAS 5-9669

7003-AR

This report contains a brief description of the reflectometer instrument; the measurement techniques involved in determining the sample degradation, and reduced flight data obtained during the first two years of operation. Reflection surface degradation data gathered from 18 test samples flown on the Applications Technology Satellite (ATS-3) are presented. The reflectometer instrument measures specular sample reflectivity in four spectral bands plus one broadband. The measurements cover a spectral range of 0.3 to 3 microns. The primary objective of this instrument is to test, in actual space environment, the durability of selected specularly reflective surface materials in order to obtain directly applicable data for use in equipment design. A secondary aim of the experiment is to obtain data of scientific value relating to the degradation process.
(66 pages, 36 illustrations)

c14 100300 03

W70-039

MULTIPATH/RANGING L-BAND EXPERIMENTAL PROGRAM USING ATS-5

Boeing Commercial Airplane Group

Contract No. DOT FA69WA-2109

July 1970

A plan is described for a proposed L-band multipath/ranging experiment using a one-way L-band transmission from an aircraft to the National Aviation Facilities Experimental Center (NAFEC) via ATS-5.

The plan for the multipath experiment calls for sea-reflected and composite (combined sea-reflected and direct) signals for various elevation angles, sea states, and signal polarizations, and analyzing the data to determine the amplitude statistics and selective fading characteristics of sea-reflected and composite signals. It is planned to use these results to derive a model for predicting multipath-induced fade depths as a function of satellite elevation angle, sea state, and polarization. Bandwidth criteria for operation in a multipath environment would be based on selective fading characteristics.

Plans for the ranging experiment call for the transmission of ranging tones over a single one-way link from the aircraft to NAFEC via ATS-5. A single link would not permit full position determination but would provide the capability of measuring the range between an aircraft and a ground station via an L-band satellite.

A comparison of measured range values with the true values that should be observed is planned to check the accuracy of the ranging system. Computation of true range values would be based on a knowledgh of aircraft and satellite positions. The plan also includes a provision for studying the effects of multipath on ranging accuracy by comparing the ranging error statistics for direct and composite signals for various elevation angles and sea states.
(45 pages, 17 figures)

c07, c21, c13 070704 03

W70-040

L-BAND MARINE NAVIGATION AND COMMUNICATIONS EXPERIMENT

U. S. CCIR Study Group IVD/XIII (Draft Report)

July 21, 1970

This report describes a series of L-band communications and navigation experiments conducted on the ice-breaker tanker U. S. Manhattan through ATS-5 with wide variations in latitude, longitude, elevation angle, and weather conditions to evaluate the feasibility of navigation and traffic control services via synchronous satellites and to correlate quantitative data with theoretical expectations.

L-band signals, transmitted from NASA's STADAN station at Mojave, California, and relayed by the ATS-5 spacecraft to a station aboard the S. S. Manhattan and a stationary receiver in New Jersey, demonstrated the feasibility of line of position fixing by making range measurements between a fixed ground station, a satellite in a known position, and a moving platform on the surface of the Earth. The experiments also demonstrated the simultaneous transmission and reception of data communications on the ranging signal.

The experiments were conducted during the S. S. Manhattan's 1970 spring Arctic voyage, starting March 31, 1970, when the icebreaker was docked at Newport News, Virginia (37°N, 76.5°W), and ending April 24, 1970, when the vessel was at 73.5°N and 60°W.
(8 pages, 2 figures)

c07, c21 070704 04

W70-041

FIRST RESULT FROM 15.3 GHz EARTH-SPACE PROPAGATION STUDY

A. A. Penzias, February 27, 1970

Bell Telephone Laboratories

Published in: Bell System Technical Journal, July-August 1970

This experiment was designed to check further the validity of radiometer results by a direct comparison of the data obtained from a 16 GHz radiometer with the attenuation measured by transmission from a satellite at a nearby frequency. This experiment was made possible by the inclusion by NASA of two 200 MW, 15.3 GHz transmitters aboard the Applications Technology Satellite (ATS-5).

Data were taken for all rainstorms occurring during the time the satellite was transmitting in the three-month period following the initial ATS-5 transmitter turn-on October 4, 1969. In only one storm (Nov. 19 and 20, 1969) did attenuation exceed 3 dB. In addition to this storm data, attenuation due to rain in excess of 1 dB was noted on the radiometer record for a number of other occasions. Correspondence of recorded data was obtained, indicating clearly that the radiometer data is a reliable measure of attenuation over the range of storm intensities measured.
(4 pages, 1 figure)

c07 070300 09

W70-042

THE BETA/BETA DOT COMPUTER PROGRAMS TO ADJUST GROUND EQUIPMENT FOR SPIN-SCAN CLOUD CAMERA (SSCC) EXPERIMENTS ON ATS-1 AND ATS-3

Compiled by Document Branch, Technical Information Division GSFC on basis of work performed by Westinghouse Electric Corp. under contract NAS 5-10217

X-460-70-370, August 1970

Avail: NASA, GSFC

This document summarizes the support functions and defines the mathematical development of the computer programs required to generate distrotion free pictures from ATS-1 and ATS-3.
(33 pages, 8 illustrations)

c11, c20 080100 49

W70-043

THE LUBBOCK TORNADOES: A STUDY OF SUCTION SPOTS

T. T. Fujita

University of Chicago

Article Published in "Weatherwise", Vol. 23, No. 4

August 1970

Research Supported by NASA Grant NGR 14-001-008 and ESSA Grant E-198-68

This article is a scientific meteorological analysis of the 11 May 1970 tornadoes that struck Lubbock, Texas. As a matter of coincidence, 11 May 1970 was a day scheduled for the "Tornado Watch Experiment" which was being conducted jointly by NASA and ESSA during the 1970 tornado seasons, thus ATS-3 was programmed to take cloud pictures at 11 minute intervals during the daylight hours. ATS-3 cloud pictures, Air Force and Weather Bureau radar data and meteorological reports were used in this analysis. The article includes tentative conclusions and recommendations for those interested in this area of research.
(13 pages, 17 illustrations)

c20 081100 11

W70-045

SUMMARY OF TEST RESULTS FOR THE OPLE EXPERIMENT (FEBRUARY 1968 - SEPTEMBER 1969)

H. M. Young

Computer Sciences Corporation

Report #4031-17, September 1970

Contract: NAS 5-11672

Avail: NASA, Goddard Space Flight Center

This report summarizes the results of a series of tests that comprise the Omega Position Location Equipment (OPLE) experiment. OPLE, as configured for the experiment, is a limited version of a real time global location and data gathering system. It uses the Omega navigation system and consists of platform electronic packages, a synchronous satellite communications repeater, and a control center that interrogates platforms and processed data. The tests first demonstrated the feasibility of single and simultaneous multiple position determinations; long term system performance evaluation was conducted with a number of fixed site platforms. The possible applications of OPLE were demonstrated with a successful tests involving: a station wagon, a ship, single aircraft location, separation of two aircraft, moored and drifting buoys, and drifting high altitude balloons. Performance of the OPLE system was comparable to that of the Omega system. A technique called differential OPLE was investigated, and location accuracy of the system was improved significantly. Application to location of high speed (2000-knot) aircraft was demonstrated by a simulation test. A test involving use of landlines demonstrated the the system's ability to use ground receiving stations remote from the data processing station.
(169 pages, 61 illustrations)

c21 080401 02

W70-046

PSEUDO NOISE RANGING WITH ATS SATELLITES

D. Barbiere, R. Martel, and J. DiPietro

Westinghouse Electric Corporation, Defense and Space Center, Baltimore, Md.

WATSTM No. 12; Sept. 22, 1970

Avail: Westinghouse Electric Corporation, Box 1693, Baltimore, Md. 21203

This technical memorandum defines the pseudorandom or pseudonoise (PN) ranging (spread spectrum) experiment for providing random multiple access communications and higher resolution slant range measurements to ATS satellites. The possibility exists that simultaneous ranging with the pseudonoise (PN) ranging code co-channel with a TV signal could be performed without degradation of the TV signal. This simultaneous feature was given a qualitative evaluation in January 1970 and extensive testing during August 1970. Experimental results using ATS-3 and ATS-5 supported the theory of the Pseudo-Noise (PN) ranging simultaneously with ITV on an operational basis. Recommendations are provided for use of this technique with ATS-F. The properties of the PN sequences applicable to ranging is defined. A discussion of the range errors and ambiguities and techniques to cope with these problems is included. There is a PN test plan defining the possible test areas. The appendix provides a description of the spread spectrum systems at the Rosman and Mojave ground stations.
(35 pages, 7 illustrations)

c07 070800 01

W70-047

STUDIES ON TECHNIQUES FOR SATELLITE SURVEILLANCE OF GLOBAL ATMOSPHERIC POLLUTION

M. McClintock, T. A. Hariharan, A. McLellan IV

The Space Science and Engineering Center, University of Wisconsin

National Air Pollution Control Administration Contract: CPA 22-69-101 (July 1, 1969 to September 30, 1970)

Avail: National Air Pollution Control Administration, Washington D. C.

This report covers research on the feasibility of using satellites to study air pollution, constituting an initial survey of promising areas. Following a basic discussion of the need for understanding the cause-and-effect relationships that lead to global air pollution problems, a chapter on remote sensing of particulates in the atmosphere stresses the information about aerosols that is obtainable from polarization measurements, including a review of the Mie theory on scattering characteristics. The possibility of "calibrating" the intensity of specularly reflected sunlight and using this optical source to measure the spectral turbidity of the

atmosphere is suggested. The use of ATS-III data to obtain information about atmospheric turbidity over the Los Angeles basin is illustrated. Available and promising spectroscopic methods for remote sensing of gaseous air pollutants from satellites are reviewed. Experimental measurement of atmospheric carbon monoxide with a modified (SMS satellite) infrared spin scan radiometer is outlined. Ways in which lasers have been or are likely to be applied to air pollution studies are reviewed. Beyond the ATS measurements, which have already been taken beyond the concept stage, it is recommended that feasibility studies of measuring turbidity and albedo provide the most direct and precise experimental route to understanding the planetary energy balance.
(88 pages, 22 illustrations, 99 references)

c11, c20, c13 080000 29

W70-048

A TRANSMISSION SYSTEM OF SOUND SIGNALS WITHIN THE COLOR SYNCHRONIZING SIGNAL

T. Fujio, T. Komoto

Nippon Hoso Kyokai (NHK) Technical Research Laboratories, Tokyo

Presented to: 1) ABU, Istanbul, September, 1970
2) EBU Technical Committee, London, March 29 - April 2, 1971

Avail: Kashima Branch, Radio Research Laboratories, Ministry of Posts and Telecommunications, Kashima-Machi, Ibaraki-Ken, Japan

This report describes a multiplex transmission system in which pulse coded TV sound signals, together with color burst signals, are superimposed on the video base band signal for joint reception in satellite broadcasting. The design of the processing unit is described, and results are reported of tests between Kashima earth station and ATS-1. It is concluded that the projected system is practicable.
(11 pages, 2 illustrations)
(Content essentially similar to 070400 14)

c07, c14 070400 12

W70-049

GLOBAL MORPHOLOGY OF IONOSPHERIC SCINTILLATIONS

J. Aarons, H. E. Whitney, R. S. Allen, Sept. 1970

Air Force Cambridge Research Laboratories, Bedford, Massachusetts

Amplitude fluctuations produced by small irregularities in electron density in the F-layer of the ionosphere can be a problem to communication and navigation systems in the VHF-UHF range. Recent measurements are shown with emphasis on high and equatorial latitude observations. At high latitudes an irregularity region exists whose lower boundary reaches 57° invariant latitude near midnight. During magnetic storms the boundary descends to lower latitudes and the fading becomes deeper. Over the polar cap, scintillations are somewhat diminished. Observing synchronous satellites through the irregularity region, deep fading is seen frequently with fade rates to one per second.

Irregularities produce deep scintillations in the VHF range ±15° from the geomagnetic equator. In equatorial regions maximum occurrence of high level scintillations takes place between 2100 and 2400 during the equinoxes; a minimum occurrence is observed in the solstices. The data for various latitudes has been placed in statistical form i. e. distribution of amplitudes for 15 minute samples as well as for periods of one year and longer. To minimize the effect of this phenomenon on satellite transmissions, the system designer can utilize the amplitude distributions, fading rates, and depths in designing his modulation.

c13, c29 100500 81

W70-050

A NOTE ON EQUATORIAL IONOSPHERIC SCINTILLATION AT 136 MHz AND 1550 MHz

T. S. Golden, Oct. 1970

NASA, Goddard Space Flight Center, Greenbelt, Maryland

NASA-TM-65402; X-520-70-397

Avail: NASA/GSFC, Greenbelt, Maryland

NOTICE: This Abstract from C-STAR, Accession No. X71-10129, is Unclassified and Available to U. S. Government Agencies and Their Contractors Only.

The ATS-5 satellite was launched into synchronous orbit with several experiments onboard to determine, among other things, the effects of propagation parameters on operation at 1550 MHz and 35 GHz. Because ATS-5 was erroneously orbited with a reverse spin direction the antennas are no longer despinnable as was planned. The antenna patterns remain fixed to the spacecraft and the signals observed on the ground are modulated by these spinning patterns. For this reason some of the tests originally planned for ATS-5 were not carried out.
(10 pages, with refs)

c07, c13 100500 82

W70-051

SCINTILLATION OBSERVED DURING THE ATS VHF TEST OF 11-12 NOV 1969

J. P. Mullen, Nov. 1970

Air Force Cambridge Research Laboratories, Bedford, Massachusetts

An intensive effort has been made to understand the global morphology of scintillations imposed on transionospheric VHF signals. In this instance VHF signals from synchronous satellites were observed by a network of STADAN stations and ionospheric observatories for several intensive periods. Data from the STADAN sites was examined but because of their more specialized instrumentation, results are not shown. The observatories used circular polarized yagi antennas, VHF converters and communications receivers. The converters were either transistor or nuvistor types having noise figures on the order of 3 dB, and the receivers were R-390A/URR's.

Scintillations on the order of 11 to 20 decibels peak to peak were found on recordings of ATS-1 and ATS-3; in low, mid, and high latitudes. Generally, low latitude scintillation is found only at night, mid latitude scintillation mostly at night, and high latitude scintillation day and night. The frequency sensitivity of the scintillation phenomenon is briefly mentioned; during periods of weak scintillation, an inverse square law seems to follow a scaling near 1/f. Equatorial scintillation appears anti-correlated with magnetic activity. High and midlatitude scintillation have been found positively correlated with magnetic activity. High and low latitude scintillation phenomena are believed to result from different causes.
(25 pages, 15 figures)

c07, c13, c29 100519 01

W70-052

PROPAGATION STATISTICS FOR 15 AND 32 GHz EARTH-SPACE TRANSMISSIONS FROM THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-5)

L. J. Ippolito

NASA/GSFC, Greenbelt, Maryland

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, GSFC

The Applications Technology Satellite (ATS-5) Millimeter Wave Propagation Experiment is the first flight experiment in the NASA Goddard Millimeter Wave Measurements Program for the determination of long and short term attenuation statistics of operational millimeter wavelength earth-space links as a function of defined meteorological conditions. The ATS-5 Experiment, launched August 12, 1969 is providing the first propagation data from an orbiting geosynchronous spacecraft in the 15 GHz (downlink) and 32 GHz (uplink) frequency bands.

The spacecraft transmitter is an all solid state phase modulated unit that provides up to 250 MW of CW power at 15.3 GHz. The 31.65 GHz uplink signal is derived from a frequency stabilized klystron, varactor upconverter, and 1000 watt traveling wave tube amplifier. A multi-level computer processing program generates propagation statistics for attenuation as a function of rainfall rate, sky temperature, radar backscatter, and other variables.

Downlink measurements made at the NASA Rosman, North Carolina Station typically show attenuations of 1 to 3 dB in light rains or dense fog; 3 to 7 dB in continuous rains (5 to 50 mm/hr.), and a number of fades exceeding 12 dB in heavy thunderstorms. Uplink fades of up to 18 dB in heavy rains have been observed.

Correlation of measured attenuation with sky temperature recorded on a small aperture radiometer was very good for most storms. Valid predictions of attenuation from 16 GHz sky temperature measurements were observed for up to 15 dB of measured attenuation.

The uplink to downlink attenuation ratio varied with each precipitation event and often varied during a single storm. The ratio has ranged from 2:1 to 4:1 during heavy precipitation periods.
(56 pages, 36 figures, 2 tables)

c07, c20, c13 070300 19

W70-053

MILLIMETER WAVE PROPAGATION MEASUREMENTS WITH ATS-5 AT COMSAT LABS

A. Buige, H. D. Craft, Jr., J. Levatich, E. Robertson

Communications Satellite Corporation, COMSAT Labs, Clarksburg, Maryland

Sponsored by: International Telecommunications Satellite Consortium (INTELSAT)

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

The intent of this experiment was to gather data on atmospheric attenuation and coherence bandwidth utilizing the Applications Technology Satellite (ATS-5) radiating a phase-modulated signal, consisting of a carrier at 15.3 GHz and sidebands at $\pm$100 kHz, $\pm$1 MHz, $\pm$10 MHz or $\pm$50 MHz, with respect to the carrier.

Due to a launch malfunction resulting in ATS-5 being spin-stabilized rather than gravity gradient-stabilized, and due to a subsequent 9-dB degradation in the satellite transmitter power, it was not possible to obtain the coherence bandwidth measurement.

As a result of equipment malfunction in the non-redundant meteorological instrumentation, data gathered were not sufficient to provide meaningful comparisons between the attenuation and meteorological measurements. Useful data was obtained concerning the attenuation due to atmospheric hydrometers.
(11 pages, 6 illustrations)

c07 070300 22

W70-054

MILLIMETER-WAVE PROPAGATION EXPERIMENTS UTILIZING THE ATS-5 SATELLITE

X-751-70-428

Presented to: The Fall (November 1970) Meeting of the URSI (International Scientific Radio Union), Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

This volume contains papers of the following categories: propagation statistics, attenuation, millimeter wave propagation, and effects of rain on an earth-satellite path.

The following papers are related to the Applications Technology Satellites.

PROPAGATION STATISTICS FOR 15 AND 32 GHz EARTH-SPACE TRANSMISSIONS FROM THE APPLICATIONS TECHNOLOGY SATELLITE (ATS-5)
L. J. Ippolito, NASA, GSFC

ATTENUATION, EMISSION AND BACKSCATTER BY PRECIPITATION
J. I. Strickland, Communications Research Centre, Dept. of Comm.

PROPAGATION DATA FROM CRAWFORD HILL
A. A. Penzias, Bell Telephone Laboratories, Inc.

MILLIMETER WAVE PROPAGATION MEASUREMENTS WITH ATS-5 AT COMSAT LABS
A. Buige, H. Craft, Jr., L. Levatich, E. Robertson, Communications Satellite Corp., COMSAT Labs

A MILLIMETER WAVE DIVERSITY PROPAGATION EXPERIMENT
P. Bohley, D. B. Hodge, Ohio State University

EFFECTS OF RAIN ON AN EARTH-SATELLITE PATH AT 15 GHz
B. M. Fannin, A. W. Straiton, D. N. Pate, University of Texas, Austin

c07, c20 070300 18

W70-055

PROPAGATION DATA FROM CRAWFORD HILL

A. A. Penzias

Bell Telephone Laboratories, Inc., Holmdel, New Jersey

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

The principal aim of this experiment was to check the validity of radiometer results by comparing attenuation deduced from 16 GHZ radiometer data with attenuation measured directly by transmission from the 15.3 GHz transmitter aboard the Applications Technology Satellite (ATS-5).

The correlation of all rainstorm signal attenuation data plotted against attenuation computed from radiometer data was quite satisfactory.
(7 pages, 3 illustrations)

c07 070300 21

W70-056

A MILLIMETER WAVE DIVERSITY PROPAGATION EXPERIMENT

P. Bohley, D. B. Hodge

Ohio State University, Columbus, Ohio

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

This paper describes a 15.3 GHz diversity propagation experiment utilizing a transmitter on board the Applications Technology Satellite (ATS-5) synchronous satellite. Two complete receiving terminals, one fixed and the other transportable formed the ground-based facility. The following meteorological parameters were recorded in addition to the received signal amplitudes and radiometer temperatures: local wind speed, wind direction, temperature, rain rate, and relative humidity.

Initial results of the analysis of data collected from the two terminals are presented for a site separation of four kilometers. These data are useful in characterizing the nature of the propagation path for a satellite-to-ground millimeter wave communication link and, assessing the effect of thunderstorm cell size and structure on two separated receiving terminals. Data relating signal attenuation and radiometric temperature are also presented.
(17 pages, 11 illustrations)

c07, c20 070300 23

W70-057

EFFECTS OF RAIN ON AN EARTH-SATELLITE PATH AT 15 GHz

B. M. Fannin, A. W. Straiton, D. N. Pate

University of Texas, Austin, Texas

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

This experiment using the 15 GHz signal of the Applications Technology Satellite (ATS-5) reenforced conclusions drawn by other experimenters. Specifically, the 15 GHz signal becomes severely attenuated (in excess of 12 dB) by rain storms possessing isolated cells of unusually intense rain, these attenuations being observed even when the signal path passes through the storm cell at heights to 4 or 5 kilometers. Rains relatively uniform over wide areas do not extend to such extreme heights and generally do not result in attenuations in excess of 3 dB.

During May 14 and August 4, 1970 rain storms, the low-level, line-of-sight, 15 GHz link was not in operation, therefore, no comparison of attenuation along this path and that from the satellite is possible. However, occasional pronounced fades are observed on the nearly horizontal path due to anomalous refractive-index structure when there is no hint of rain in the vicinity. Thus, to obtain statistics on expected earth-satellite attenuation by analyzing the ground-to-ground link data, the information for the no-rain periods should be discarded.
(8 pages, 5 illustrations)

c07, c20 070300 24

W70-058

ATTENUATION, EMISSION AND BACKSCATTER BY PRECIPITATION

J. I. Strickland

Communications Research Centre, Ottawa, Ontario, Canada

X-751-70-428 (Part of)

Presented to: The Fall (November 1970) Meeting of the URSI, Columbus, Ohio

Avail: NASA, Goddard Space Flight Center, Greenbelt, Maryland

Since September 1969, the Applications Technology Satellite (ATS-5) has provided an appropriate source of coherent radiation at 15.3 GHz. The attenuations measured using ATS-5 are compared with those calculated from the radar data. Also, path attenuations can be predicted from measurements of sky temperature in the direction of the satellite. Results indicate that during periods of light to moderate rain, attenuations up to 5 dB have been observed. On a few occasions, heavier precipitation has caused attenuation exceeding 10 dB.

Path attenuations at 15.3 GHz have been calculated for slant paths of 30 degrees elevation from simultaneous measurements of sky temperature at 15.3 GHz and radar backscatter measurements at 2.86 GHz. These predicted attenuations have been compared with path attenuations measured directly from the ATS-5 beacons at 15.3 GHz. Generally, good agreement between measured and predicted attenuations was evident.
(18 pages, 10 illustrations)

c07 070300 20

W70-059

A METHOD FOR ESTIMATING CYCLONE VERTICAL MOTIONS FROM SATELLITE CLOUD PHOTOGRAPHS

Francis Hilaire Nicholson

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

The cyclone is treated from the point of view of a symmetrical three-dimensional model, occupying that portion of the atmosphere below the level of non-divergence. A tangential and radial wind field is postulated, which allows both the trajectories and cloud patterns to be logarithmic spirals. From the interaction of these two spirals, using the hypothetical wind field, a vertical velocity field is established by means of considerations of conservation of mass. A physical analogue is generated in the laboratory which gives similar results to the model. The properties of the cyclone model are examined, particularly with regard to pressure gradient, vorticity patterns and the relative packing of isotherms along the fronts within the cyclone.
(28 pages, 10 illustrations)

c20 080100 62

W70-060

SEVERE LOCAL STORM RESEARCH

Brian A. Auvine and Dr. Charles E. Anderson

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

The advent of satellite technology has made possible a more comprehensive examination of squall lines and associated severe local weather. A particular well defined outbreak of severe weather in the Ohio River Valley occurred on April 23, 1968. Using ATS-III satellite photographs as source data, radar observations from the Cincinnati radar were transposed onto an accurately gridded brightness contour analysis of the satellite photo. Convergent analysis was performed for various times at and around the storm time. A conclusion was reached, namely: that surface convergence or upper air divergence is a good objective indicator of severe weather. The theory that in a situation of conditional instability, convergence will produce intense convection and cause the formation of a squall line is discussed.
(5 pages, 5 illustrations)

c20 080100 63

W70-061

THREE-DIMENSIONAL, TIME DEPENDENT NUMERICAL EXPERIMENTS WITH DRY AND MOIST, SHALLOW AND DEEP CONVECTION MODELS

Uri Shafrir, Shmuel Kaniel and Boris Shkoller

Goddard Institute for Space Studies

Grant: ESSA Grand E-230-68-G

Published In: Studies of the Atmosphere using Aerospace Probings, November 1970

The Boussinesq and anelastic systems of equations for shallow and deep atmospheric convection, respectively, are solved numerically, both for dry and moist situations. Numerical techniques are discussed in some detail, and the returns of several experiments are exhibited. It is concluded that it is now possible to experiment numerically with three-dimensional convective flows, characterized by the set on anelastic equations, and taking full account of the interplay between dynamic and thermodynamic variables, caused by the release of latent heat of condensation. With the advent of a new generation of computers, this type of analysis will become more and more practical.
(51 pages, 28 illustrations)

c11, c20 080100 64

W70-062

A NOTE ON INERTIAL INSTABILITY

David D. Houghton and John A. Young

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

Blumen and Washington (1969) suggest that pure centrifugal instability should be a rare phenomenon in the atmosphere. This note was written to discuss certain limitations of this analysis and to offer a simple model which provides a more general understanding of inertial instability as it might occur in the atmosphere. The mathematical analysis shown is an attempt to provide a link between the results of the analysis of Blumen and Washington (where the response of the pressure field to the disturbance motion is very special) and other results where the response is lessened or even eliminated by the use of particle dynamics.
(5 pages)

c11, c20 080100 65

W70-063

THE INFLUENCE OF LATITUDINAL WIND SHEAR UPON LARGE-SCALE WAVE PROPAGATION INTO THE TROPICS

John R. Bennett and John A. Young

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

The effects of horizontal shear of the mean zonal wind on the lateral propagation of disturbances through the tropics is studied by the use of a one-layer model. The governing equations are reduced to a second order differential equation for V, the northward component of velocity. The equation is analyzed as an eigenvalue problem and solved numerically for the free modes of the tropics for the case with zero mean flow. These solutions are compared with solutions which are forced at a boundary situated in mid-latitudes for cases with and without a mean zonal flow. At "critical latitudes" the basic equation has a singularity (where the phase speed of a wave forced at the boundary is equal to the mean flow). The case for forced motions is investigated in more detail by numerically studying the evolution of disturbances as an initial value problem for the case of non-divergent flow. The horizontal shear is shown to significantly alter the types of mid-latitude motions which can affect tropical motions. In particular, disturbances with large eastward phase propagation are shown to have negligible effect. Disturbances that have phase speeds which are somewhat equal to the mean flow are shown to be absorbed at the critical latitude. Disturbances with phase speeds more westward than the mean flow may be free to propagate into the tropics, providing their wave lengths are not too short.
(30 pages, 14 illustrations)

c11, c20 080100 66

W70-064

A NUMERICAL STUDY OF THE THREE-DIMENSIONAL STRUCTURE AND ENERGETICS OF UNSTABLE DISTURBANCES IN ZONAL CURRENTS

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

The multiple modes of dynamic instability, their structure and energy conversions for various zonal currents (pure baroclinic, pure barotropic, and mixed jet type) are investigated through use of a linear quasi-geostrophic model. Numerical results are obtained from the complete set of complex eigenvalues and eigenvectors of the finite difference version of the governing equations.

Numerical results are obtained for pure baroclinic and pure barotropic zonal currents and are compared with the well-known theoretical results. Their accuracy is examined by varying the number of subdivisions. It is found that the numerical method gives sufficiently accurate results in describing the structure and behavior of the primary unstable disturbances of cyclone scale. New results include information on the relation between the growth energetics, amounts of available energy, and disturbance wavelengths.

For jet type zonal currents containing absolute vorticity extrema at various latitudes, there exist two primary modes of instability, each corresponding to a unique category of available zonal energy sources. The first is mainly characterized by baroclinic processed (modified by horizontal shear) and the other by barotropic mechanisms (modified by vertical shear). The baroclinic mode dominates for shorter waves, while the barotropic mode dominates for longer waves. The baroclinic mode increases the kinetic

energy of the zonal current; conversely, the barotropic mode decreases the zonal kinetic energy. The presence of both energy sources tends to reduce individual rates of energy conversion. However, the baroclinic instability mechanism dominates in the lower layer, while the barotropic instability is most pronounced near the tropopause, particularly for longer waves.

Zonal currents which are similar but contain no active barotropic instability mechanism are found to possess only one strongly unstable mode which withdraws potential energy from the zonal flow, yet feeds kinectic energy into the jet.
(86 pages, 38 illustrations)

c20 080100 67

W70-065

MASS CONVERGENCE IN A BAROCLINIC EKMAN LAYER

John A. Young

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

An expression for the vertical mass outflow above a balanced Ekman boundary layer is derived for flow states possessing low level fields of baroclinity. It is found that the presence of horizontal temperature gradients may significantly alter the outflow from that expected when the pressure field is invariant throughout the boundary layer. The extent of this modification is greatest when the geostrophic wind varies substanitally over the depth of the boundary layer, as in lower latitudes or over sloping terrain with thermal stratification near the surface.

The contribution of the baroclinic effect to the outflow produces upward motion over cold centers and downward motion over warm centers relative to that associated with the surface pressure field. Over sloping terrain with temperature lapse (increase) with height this corresponds to sinking (rising) motion in valleys and rising (sinking) motion over tropographical maxima. The pressure work done by the boundary layer vertical motion usually drains energy from the free atmosphere above, but in sufficiently warm surface lows (or cold highs) this energy flux may actually be directed oppositely.
(13 pages, 3 illustrations)

c13, c20 080100 68

W70-066

REAL TIME ATS DATA PROCESSING USING WIDE BANDWIDTH VIDEO STORAGE AND DISPLAY

Robert Krauss

University of Wisconsin

Grant: ESSA Grant E-230-68-G

Published in: Studies of the Atmosphere using Aerospace Probings, November 1970

This report presents the results of a brief study of the advantages of a wide bandwidth video storage and display system for processing ATS picture data. The system can provide great speed advantages in obtaining winds and quality eye pleasing motion pictures, as well as serving to monitor ATS camera operation in real time. Its main disadvantages are its limited resolution elements per picture and lack of photometric fidelity and range. Compensation for the disadvantages is attainable with other components of the SSEC data processing system. Set-up cost will be high, although operating costs could be justified by output, given high system use. Thus, the major decision is whether the potential utility of such an addition to SSEC justifies the initial cost.

c14, c20 080100 69

W70-067

TIME SERIES ANALYSIS OF ATS-1 ELECTRON FLUX MEASUREMENTS

G. R. Andersen*, R. H. Hilberg**

Bellcomm, Inc., Washington, D. C. *

NASA, Goddard Space Flight Center, Greenbelt, Maryland**

Presented to: American Geophysical Union Fall Meeting, November 1970

Published in: Trans. Amer. Geo. Union, 805

Measurements of equatorial mirroring particles taken on ATS-1 during the first five months of 1967 have been analyzed to give information on the shape of the outer trapped electron zone. Data were separated into twenty-four 150 day series of hourly averages, one for each hour of the day. Results show that the diurnal variation of the .4 Mev electrons is quite different from that of the 2.0 Mev electron fluxes. The 150 day average of the .4 Mev flux varies, with local time, in amplitude by a factor of 2.5 less than the average of the 2.0 Mev flux. The variance of the lower energy flux is large for times near local 2200 and small for other local times, while that for the higher energy electrons is larger and relatively constant for all local times. Further, the lines of approximate symmetry for the .4 and 2.0 Mev electron distributions with respect to local time occur at about 1000 and 1200 hours, respectively. Because of the symmetry of the variance of the higher energy fluxes with respect to local time, we conclude that the trapping region for higher energy electrons ends at a smaller radial distance than for lower energy electrons.

c29 100500 92

W70-068

OGO-5 OBSERVATIONS OF MAGNETIC VARIATIONS IN THE NEAR GEOMAGNETIC TAIL

C. T. Russell, R. L. McPherron, P. J. Coleman, Jr.

Univ. Of Calif., Inst. of Geophysics and Planetary Physics, Los Angeles, Calif.

Presented to: American Geophysical Union Fall Meeting, November 1970

Published in: Trans. Amer. Geo. Union, 1970, p. 810

The magnetic signature of a substorm at the synchronous orbit of ATS-1 is an increase in the magnitude of the field from a depressed state accompanied by a return to a more dipole-like field. In the region from 25 to 33 R_E behind the earth, auroral zone activity as observed on IMP-4 is accompanied near the neutral sheet by gradual increases and sudden decreases of the field. Simultaneous with this decrease the field becomes more dipolar. OGO-5 observations show that this far tail behavior extends as close as 10 R_E but as the satellite enters the region of depressed field in the nightside magnetosphere proper, the signature of auroral zone activity changes to that observed on ATS-1. Magnetic fluctuations (0.1 to 1.0 hz) with rms amplitudes of 2 gammas are common at the time of these changes in field configuration. Another feature observed in the tail are changes in declination similar to the "D spikes" observed on ATS-1. The declination changes are not closely correlated with field magnitude changes.

c29 110800 51

W70-069

COORDINATED AURORAL-ELECTRON OBSERVATIONS FROM A SYNCHRONOUS AND A POLAR SATELLITE

D. L. Carr, R. G. Johnson, R. D. Sharp, E. G. Shelley

Lockheed Palo Alto Research Laboratory

Presented to: American Geophysical Union Fall Meeting, November, 1970
Published in: Journal of Geophysical Research Nov. 1, 1971. Vol. 76, No. 31

The Applications Technology Satellite (ATS-5) was launched on August 12, 1969, into a nearly synchronous orbit and has been maintained in the vicinity of 105° west longitude. The OV1-18 satellite was launched on March 18, 1969, into a 99° inclination orbit with apogee at 590 km and perigee at 469 km. Similar experiments on both spacecraft consist of auroral particle spectrometers using channel-multiplier sensors and either magnetic analysis or foil-threshold techniques to measure specific energy groups of protons and electrons. Primary emphasis was placed on the energy range between about one-half and 50 keV which contains most of the auroral particles. During selected intervals in 1969, an effort was made to program the OV1-18 satellite such that it would acquire data in the vicinity of the northern hemisphere conjugate point to ATS-5. Preliminary results from two cases indicate that the number fluxes of electrons are quite comparable at the two locations; that is there is no evidence for equatorial angular distributions highly peaked in the loss cone. Significant spectral differences, however, are observed.

c29 111300 07

W70-071

HIGH LATITUDE PERFORMANCE OF MILITARY SATELLITE COMMUNICATION SYSTEMS

L. A. Maynard

Communications Research Centre, Ottawa, Canada

Presented to: NATO Defense Research Group Seminar on Space Communications, 1970

Avail: Communications Research Centre, Ottawa, Canada

The problem of long range reliable communications into the Artic regions has been of concern to the Canadian Armed Forces for some time. Relatively new means provided by satellites such as the Applications Technology Satellite (ATS-3) and LES-6 offer potential solutions. Discussed are some problems employing geostationary satellites with communications terminals located at high latitudes. The author describes atmospheric effects on propagation, tropospheric and ionospheric effects, signal fading measurements above and below 1500 MHz, and required system margins. Although most future satellite systems intended for fixed or strategic purposes will operate at frequencies above 4000 MHz, the VHF/UHF frequency range shows promise of solving certain problems.

Some advantages exist for systems operating at lower frequency ranges and include the fact that simple, broadbeam, even omnidirectional antenna systems may be employed on ground-based terminals. Fully mobile communication systems become feasible, allowing land, sea, and air capability. The VHF and UHF ranges, however, suffer from spectral crowding in some geographical locations and it is anticipated that these bands will be restricted to applications not easily satisfied by SHF techniques. It appears that systems in both the UHF and SHF regions may be required for military use.

For 99.9% propagation reliability in the lower VHF range, fairly large margins (12-16 decibels) are required. This margin drops rapidly in the 400-1500 MHz range. Visual aurora activity has negligible additional effects on signal fading in the VHF/UHF range. SHF frequencies need relatively small margins in a broad range of frequencies from 1000-10,000 MHz for all latitudes except extreme limits of the coverage zone from 75-80 degrees of latitude. (11 pages, 13 illustrations)

c07, c13 070200 31

W70-072

INFLUENCE OF THE SOLAR ACTIVITY ON THE IONOSPHERIC ELECTRON CONTENT

A. V. daRosa and H. Waldman (Stanford University) and O. K. Garriott, (Manned Spacecraft Center, Houston, Texas).

1970

The SYNCOM-3 and Applications Technology Satellites were used to investigate the long term and day-to-day influence of solar activity on the ionospheric electron content. Generally, the columnar electron content of the ionosphere is influenced by the behavior of the F2 layer which, in turn, depends largely on the intensity of the extreme ultra violet (EUV) flux from the sun. Earlier studies had shown a fair correlation between EUV and the 2.8-GHz solar radio flux. To determine the best index of solar activity, correlation coefficients were calculated between the solar parameters and the various ionospheric quantities. These coefficients led to the adoption of the 183-day mean of the solar radio flux at 2.8 GHz as the index of solar activity and either the 31-day mean electron content on the 30-day mean value of daily (24-hour) average electron content as the index of electron content. Tables show that the correlation of electron content with solar radio flux is considerably higher than a similar correlation of electron count with sunspot number.
(17 pages, 14 illustrations)

c29 100500 89

W70-073

QUASI-PERIODIC MODULATIONS OF AURORAL PARTICLES OBSERVED ON ATS-5

E. G. Shelley, R. D. Sharp, D. L. Carr

Lockheed Palo Alto Research Laboratory, Palo Alto, Calif.

Published in: EOS Trans. Amer. Geo. Union, Vol. 51, p. 389, 1970

Several examples of quasi-periodic modulations of protons and electrons with energies between one-half and several hundred KeV have been observed in the first few weeks' data from the Lockheed auroral particle experiment on ATS-5. Wave trains of about a half dozen consecutive oscillations with periods of the order of one minute are most commonly seen. They are generally most prominent in the lower energy electrons ($\approx$ one-half to 20 keV) and cases with flux modulations of the order of $\pm 50\%$ for specific energy groups will be described. Examples are shown of associated electron and proton flux oscillations which are roughly out of phase.

c29 111300 05

W70-074

QUASI-PERIODIC FLUX MODULATIONS AT SYNCHRONOUS ALTITUDE CORRELATED WITH MICROPULSATIONS

E. G. Shelley, S. K. Lew, R. G. Johnson, R. D. Sharp, L. F. Smith

Lockheed Palo Alto Research Lab., Palo Alto, Calif.

Published in: EOS Trans. Amer. Geo. Union, Vol. 51, p. 808, 1970

The Applications Technology Satellite (ATS-1) was launched into a nearly synchronous orbit on August 12, 1969. The Lockheed Palo Alto Research Laboratory''s experiment was designed to perform a survey of charged particle fluxes in the auroral energy range. It was previously reported that quasi-periodic flux modulations are frequently observed with periods in the range of one-half to several minutes. Several of these events have recently been analyzed for power spectra. Examples of the power spectral densities for these events will be shown together with similar power spectral densities for micropulsations of the Pc-4, 5 type observed near the foot of the ATS-5 field line. The correlation between the satellite and ground-based measurements will be discussed.

c29 111300 06

W70-075

POTENTIALS ON THE ATS-5 SATELLITE AND THEIR USE IN PLASMA STUDIES

S. E. DeForest

University of California, San Diego

Transactions American Geophysical Union (SPM76)

1970

The Applications Technology Satellite (ATS-5) charges to several thousand volts negative when the satellite passes into the earth's shadow and is simultaneously outside the plasmasphere. The potential on the spacecraft is determined by the incoming flux of particles and the outgoing secondary flux. The incoming flux is measured by the UCSD plasma detector, and the secondary flux can be found by solving the equations for zero net current to ATS-5 before and during an eclipse. Solutions for several different eclipses in both fall and spring agree sufficiently well that the secondary currents (photo-electric, back-scatter, and true secondary particle currents) calculated can be used to predict the potential on the satellite at almost anytime. Spacecraft charging during an eclipse allows one to extend the lower limit of the energy range of the detector from 50 ev down to 0 ev. Results of this study are not complete, but for the cases examined, if a Maxwellian distribution with $kT \ll 50$ ev is assumed, in addition to the normally measured distribution, then a typical density of these "cold" protons outside of the plasmasphere near midnight is $n\left(\frac{\text{part}}{\text{cm3}}\right) = .01\,(kT)^{1/2}$ where kT is in ev.

c29 111400 09

W70-076

LOW-ENERGY PLASMA AT ATS-1 DURING MAGNETOSPHERIC SUBSTORMS

D. T. Young

Rice University, Houston, Texas

Published in: Trans. Amer. Geo. Union, Vol. 51, p. 811, 1970

A survey has been made of 72 substorm events recorded by the Rice Univ. Suprathermal Ion Detector (SID) between 12/14/66 and 2/16/67. An event is defined as an abrupt($<$1/2 hr.) increase in SID integral ($W_i > 50$ eV, $W_e > 3.2$ keV) counting rates followed by a slower ($\sim$ 3 hr.) decay. The events occur within $\pm$ hours of local midnight and are associated with polar substorms as small as 75γ. The smaller substorms often are not identifiable with indicators of magnetospheric substorms at ATS-1 viz. production of $>$ 50 keV electrons and substorm-related magnetic variations as described by other ATS-1 experimenters. SID events occur on either side of midnight in contrast to the behavior of $>$50 keV electrons reported by Winckler et. al. The distribution of electron energies at the inner edge of the plasma sheet published by Shield and Frank has been used with SID data to infer an electric field of 0.35×10^{-3} volts/m during 8 weak-to-moderate intensity substorms (K_p = 0 + to 30).

c29 110700 26

W70-077

DIURNAL VARIATIONS IN EQUATORIAL AND PRECIPITATING SOLAR PROTON FLUXES

L. J. Lanzerotti

Bell Telephone Labs., Murray Hill, N. J.

Presented to: American Geophysical Union

Published in: Trans. Amer. Geo. Union, 1970, p. 389

The near-90° pitch angle solar proton fluxes measured at synchronous altitude frequently exhibit diurnal variations which resemble the mid-day recoveries of PCA events. These diurnal effects are due to the distortion of the earth's dipole field. While the latitude dependence of precipitating proton fluxes can sometimes be accounted for by trajectory cut-off calculations in realistic field geometries, the equatorial fluxes are not predicted by these calculations. The synchronous altitude solar proton fluxes from the January 28, 1967, solar event exhibited diurnal variations in the lower energy fluxes. These diurnal variations bear a strong resemblance to the diurnal variations observed in the precipitating proton-produced nuclear rays measured by Barcus (1969) at Byrd Station during the event. Calculations of the ray intensities that would be produced by proton spectra such as those measured at synchronous altitude give reasonable agreement with Barcus' measurements. It is suggested that other mechanisms in addition to direct access are important for solar particle access to high latitude field lines.

c29 110300 29

W70-078

OGO-5 OBSERVATIONS OF THE MAGNETIC SIGNATURES OF SUBSTORMS ON AUGUST 15, 1968

R. McPherron, C. Russel, M. Aubry

University of California, Inst. of Geophysics & Planetary Physics, Los Angeles

Presented to: American Geophysical Union, 1970

Published in: EOS, Vol. 51, p. 810

The magnetospheric substorm is known to be related to large, rapid changes in the configuration of the geomagnetic tail. These changes are most pronounced between 5 and 15 R_E on the midnight meridian. On August 15, 1968, OGO-5 spacecraft was inbound through this region just above the magnetic equatorial plane as a sequence of substorms took place. The magnetic signature of these substorms included a relatively slow growth phase during which the field at OGO-5 became more tail-like with B_T and B_X (GSM) increasing while B_Z (GSM) decreased. This phase was terminated by a rapid expansion during which the field rotated back to a dipolar configuration. The rotation was accompanied by large amplitude, short period (T $<$ 15 seconds) magnetic fluctutations. The relative timing of different aspects of these events has been determined both from ground magnetograms and from simultaneous observations of the field at the synchronous orbit of ATS-1. It is possible to interpret these results in terms of a model in which the plasma sheet thins slowly during the growth phase and expands rapidly in the expansion phase.

c29 110800 52

W70-079

CHANGES IN THE SOLAR WIND MAGNETIC FIELD ORIENTATION AS A MAJOR SOURCE OF PERTURBATIONS IN THE MAGNETIC TAIL

M. P. Aubry, R. L. McPherron

University of California, Inst. of Geophysics & Planetary Physics, Los Angeles

Presented to: American Geophysical Union, 1970

Published in: EOS, Vol. 51, p. 813

We compared solar wind data from Explorer 33 and 35, magnetospheric data from ATS-1 and OGO-5 as well as ground magnetograms, with published data on the tail magnetic field at about 30 R_E behind the earth (Fairfield and Ness 1970). In the main lobe of the tail the field increases slowly either when the inter-planetary field turns southward or horizontal with fluctuations. A sub-storm can cause a slow decrease: the spatial or temporal character of such variations if discussed. The plasma sheet field changes indicate a rapid thinning when the interplanetary field turns southward and a rapid expansion when it turns northward. A substorm can cause a temporary rapid expansion. These results imply that any study of the tail signature of the magnetospheric substorm requires a precise knowledge of the simultaneous behavior of the solar wind.

c29 110800 53

W70-080

BROADCASTING SATELLITE SERVICE (TELEVISION) FOR COMMUNITY RECEPTION, A TIME DIVISION MULTIPLEX TRANSMISSION SYSTEM OF TELEVISION SOUND USING COLOUR SYNC SIGNAL IN COMMON

Kashima Branch, Radio Research Laboratories, Ministry of Posts and Telecommunications, Japan

Study Program 5-1 D/11

Document 11/J-5, October, 1970

Presented to: CCIR Special Joint Study Group Meeting, (SG 11), WARC, February, 1971

Avail: Director, Kashima Branch, Radio Research Laboratories, Ministry of Posts and Telecommunications, Kashima-Machi, Ibaraki-Ken, Japan

This report describes a system of television sound multiplex transmission whereby the sound signal, pulse code modulated, is multiplexed in the line blanking interval of the video signal. The system permits transmission of two channels of 15 kHz bandwidth, 9 bits/sample quantized sound signals. The system is briefly described, together with results of indoor transmission tests, and tests with ATS-1 at Kashima earth station from June 22 through July 4, 1970. It is concluded that the system can be used in practical transmission without any basic problem.
(7 pages, 1 illustration)

c07 070400 13

W70-081

FIRST QUARTERLY REPORT FOR THE UCSD PLASMA DETECTOR ON BOARD ATS-5
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University of California, San Diego, Physics Dept., LaJolla California

Contract No.: NAS 5-10364

Prepared for: NASA, Goddard Space Flight Center, Greenbelt, Maryland

November 4, 1970

Data reduction and analysis of the output of the UCSD plasma detector (code name 3 DLE) on board the Applications Technology Satellite (ATS-5) has been highly successful to date. The failure of the spacecraft to orient properly has been used to advantage to actually increase the value of this data. Phase one and two data reductions are now routine operations, and more time is being spent on scientific analysis. Since launch, a total of four papers have been presented at the American Geophysical Union meetings on this data, and two papers were presented at the International Symposium on Solar-Terrestrial Physics in Leningrad. A paper has been accepted for publication in the Review of Scientific Instruments and the referee for an article submitted to the Journal of Geophysical Research recommended publication after minor changes.

Close contact has been maintained with other experimenters on ATS-5, and recently attempts have been made to correlate the ATS-5 data with both other spacecraft (notably the Vela) and ground based measurements. This work is continuing.
(5 pages, 1 illustration)

111402 01

W70-082

UNITED KINGDOM MARITIME SATELLITE COMMUNICATION TESTS (August to December 1970)

Prepared for: The Ad Hoc United Kingdom Maritime Satellite Tests Committee

Prepared by: The Post Office
The University College of Swansea
The Marconi Company

This Report summarizes the results of tests of Speech, Teleprinter, Facsimile and Selective Calling transmissions that were carried out via the Applications Technology Satellite (ATS-3) between the container vessel Atlantic Causeway and the Post Office Coast Radio Station at Burnham-on-Sea, England.

Statistical results of the signal-to-noise ratios and speech quality achieved with FM are given for different conditions of modulation and speech processing. The results of a limited series of tests using a Double Sideband Suppressed Carrier (DSBSC) system are also included.

The results are in broad accord with theoretical considerations, but practical problems of equipment compatibility and installation restricted the amount of data that could be collected.
(51 pages, 22 figures, 9 tables)

c07 070227 01

W70-083

NEUTRAL WINDS IMPLIED BY ELECTRON CONTENT OBSERVATIONS DURING THE 7 MARCH 1970 SOLAR ECLIPSE

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Stanford University, Radioscience Laboratory, Stanford, Calif.

Published in: Journal of Atmospheric and Terrestrial Physics, 1970

Measurements of columnar electron content using geostationary satellite signals were made at several Stanford observatories throughout the United States, during the 7 March 1970 solar eclipse. The ionospheric response to the eclipse was simulated in a computer. Discrepancies between observed and simulated electron content behaviours can be greatly reduced by assuming the existence of plausible neutral winds originated by the eclipse in the F-region heights.

c29 100509 05

W70-084

THE DETERMINATION OF CLOUD PATTERN MOTIONS FROM GEOSYNCHRONOUS SATELLITE IMAGE DATA

John A. Leese, Charles S. Novak, and V. Ray Taylor
National Environmental Satellite Center, Washington, D. C. USA

February 1970

Cloud motion can be determined from sequential pictures obtained from the geosynchronous Applications Technology Satellites, ATS-I and ATS-III. Experiments have been conducted using two automated techniques for computing the cloud motions over the time interval between two digitized pictures. One technique is a direct application of cross-correlation using the fast Fourier Transform (FT), In the other, a relatively simple matching technique is used in the computer to recognize binary images of cloud fields on each member of a picture pair. Results obtained from the two techniques are similar. The computed directions are in good agreement with those determined by manual methods with indications that computed speeds are more accurately resolved than those determined manually.

c20 080900 27

W70-085

ATS-1 THERMAL COATINGS EXPERIMENT AND BOEING TESTS

NASA/GSFC, Greenbelt, Maryland

Quarterly Progress Report

Published in: Research and Advanced Technological Development Activities, March 1970, Vol. 5 p.p. B-II-11, 12

The results of the Thermal Coatings Experiment on the Applications Technology Satellite (ATS-1) and the Boeing tests have been examined and compared. Synergistic effects have not been taken into account since lab data for simultaneous exposures of UV and electrons of these coatings have not been performed. Exposure rates differ for the ATS-1 coatings and the Boeing samples and there is Boeing data to suggest that over the range of flux rates, electron damage is independent of the exposure rate.

In plotting the data, it was assumed that all electrons from 10 to 100 Kev produce the same damage in a given coating. This is not true for all coatings. The ATS-1 coatings were exposed to protons in the energy range $0 < E < 50$ Kev at a rate on the order of 3.95×10^{13} protons/cm^2 day. Boeing tests on other white paints indicate a threshold for proton damage of about 10^{14} protons/cm^2.

In view of the above comments, it is surprising how well the ATS-1 experiment data agrees with that of Boeing. To determine this agreement is not by chance, future lab tests should include exposure of the ATS-1 coatings to protons and "simultaneous" UV + electron + proton environments.

c33 110600 05

W70-086

FURTHER COMPARISON OF CLOUD MOTION VECTORS WITH RAWINSONDE OBSERVATIONS

S. M. Serebreny, E. J. Wiegman, R. E. Hadfield
Stanford Research Institute, Menlo Park, California

Contract E-210-60 (N)

SRI Project 7930

August 21, 1970

The displacement of clouds judged to be of cirrus genera from their appearance in ATS photographs was measured through the use of the SRI/NASA Electronic Display Console and processed into vectors using the MSL ATSWIND computer program. Of a total of 301 cloud measurements, only those cases (170) within 120 nmi of a rawinsonde station were used for comparison with hodographs at the nearest rawinsonde station.

Levels of best-fit between cloud motion and balloon wind ranged from 10,000 ft. to 53,000 ft. with 78 percent of the same (132 cases) having "best-fit" heights above 20,000 ft. The mode of the distribution encompassed the layer 26,000-32,000 ft. (350-300 mb).

Magnitudes of vector difference between cloud motion and wind at the level of best-fit did not exceed 11 knots in 80 percent of the cases. The mean magnitude of the vector difference was 5.5 knots. The standard deviation of vector difference (σ_V) was 6.7 knots.

Cloud motions within 60 nmi of a rawinsonde station (69 cases) were compared to the wind at 300 mb and 200 mb. The mean magnitude of the vector difference was 20 knots (σ_V= 22.9 knots) and 27 knots (σ_V = 31.8 knots) respectively. Comparisons of directions and speeds, separately, with the wind at the 300 mb level showed a mean directional difference of 13 degrees and a speed difference of 15.6 knots; at the 200 mb level, the corresponding differences were 10.8 degrees and 23.3 knots respectively.

c20 080900 25

W70-087

SOME EXAMPLES OF THE USE OF SYNCHRONOUS SATELLITE PICTURES FOR STUDYING CHANGES IN TROPICAL CLOUDINESS

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Environmental Science Services Administration, National Environmental Satellite Center, Washington, D. C.

Presented to: Symposium on Tropical Meteorology, Honolulu, Hawaii, Dec. 1970.

In June of 1969, pictures from the synchronous Applications Technology Satellite (ATS-1) became available for daily, real-time monitoring of tropical cloud systems. ATS-1 is positional above the equator at 150° west longitude and provides pictures of the earth at 24-minute intervals. Each day, pictures are received for a six-hour period beginning at 1730 GMT.

In the next year, it will be possible to study cloud surges, easterly waves, and mesoscale cloud formations from both ATS-1 views of the Pacific and daily ATS-3 views of the Atlantic, Pacific, and the Americas. Combined with twice daily IR coverage from the ITOS satellite, a much improved set of data should be available for determining the height to which tropical cloud surges travel and how they change moving from land to sea, or sea to land. The IR data will make possible a more quantitative measurement of these phenomena and much easier processing of data into chimatological arrays needed to answer questions concerning the energetics of these tropical disturbances.

c20 081000 16

W70-088

LOW-ENERGY PARTICLE RADIATION ENVIRONMENT AT SYNCHRONOUS ALTITUDE

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Low-energy charged particles in the space environment are important contributors to the degradation of thermal control surfaces on satellites and may affect thin films such as cover materials used in connection with large flexible solar arrays. These particle-induced degradation effects are of particular importance in planned future satellite projects with projected lifetimes to ten years. The ATS-5 satellite, launched in August 1969, was the first synchronous satellite to include instrumentation for the investigation of the plasma properties of these low-energy charged particles. The Lockheed Palo Alto Research experiment on ATS-5 measured electron and proton fluxes in the energy range from approximately one-half to several hundred keV with primary emphasis on the region below 50 keV which contains most of the plasma energy. A statistical analysis of the data, sampled over the period from September 1969 through December 1969, shows systematic variations in the average low-energy particle radiation environment at synchronous altitude with local time and magnetic activity (K_p). This suggests the possibility of estimating the environment under various conditions of magnetic activity from the present data.

c29 111300 09

W70-089

TOTAL SOLAR ECLIPSE

16 MM Movie

University of Chicago

1970

On 7 March 1970 two whole sky camera stations were set up near Turkey, North Carolina to operate during the total solar eclipse period. In addition a series of telephoto views were taken from an equatorial mount. These were combined with ATS-III pictures to make a 300-ft movie showing the changes taking place during the eclipse.

c14 081000 15

W70-090

COLLISIONLESS DRIFT WAVES OBSERVED BY THE ATS-5 PLASMA EXPERIMENT

R. E. LaQuey

University of California, San Diego; LaJolla, Calif.

Presented to: American Physical Society Meeting, Div. of Plasma Physics, Washington, D.C., Nov. 1970

Published in: American Physical Society Bulletin, Nov. 1970, 7c10, p. 1471

Velocity distribution functions of both the electron and the proton component of the magnetospheric plasma are measured in 62 logarithmically spaced steps from 50 ev to 50 kev by an experiment aboard the Applications Technology Satellite (ATS-5) in circular synchronous orbit (6.6 R_E). This plasma often has $\beta \sim 1$, $n \sim 5/cm^3$, $Te \sim 1$ kev, $Ti \sim 5$ kev and can be used as a natural laboratory for the study of wave-particle interactions. Much oscillatory phenomena thought to be caused by such interactions are found in this data.

One class of oscillations appears to be collisionless drift waves having apparent periods of several minutes or more. Using the measured average distribution function, $\langle F \rangle$, and drift wave theory, one can predict a perturbation distribution function. The functional dependence of the theoretical perturbation distribution function, δF_T, upon particle velocity, can be compared with that of the measured perturbation δF_M. The measured perturbation of δF_M, also considered a function of particle velocity, varies over three orders of magnitude and changes sign. The ratio $\delta F_M/\langle F \rangle$ approaches 1, thus the problem is non-linear in at least part of phase space. Nonetheless, the δF_T determined by using $\langle F \rangle$ and linear wave theory correctly predicts the sign of δF_M, and the relative magnitude of δF_M to within a factor of two over the entire velocity range.

c29 111400 10

W70-091

INTERIM REPORT ON SCINTILLATION ANALYSIS OF ATS-3 DATA FROM SAGAMORE HILL, HUANCAYO, AND NARSSARSSUAQ

H. E. Whitney

Air Force Cambridge Research Laboratories, Bedford, Massachusetts

Applications Technology Satellite (ATS-3) signal strength recordings from Sagamore Hill, Huancayo, and Narssarssuaq have been scaled to give 15 minute scintillation indices. Subsequently the 15 minute indices were averaged to give an hourly index. Time periods covered are summarized as follows:

Sagamore Hill - 16051 - one hour samples - Nov 67 - Aug 69

Narssarssuaq - 3581 - one hour samples - Sep 68 - Aug 69

Huancayo - 4372 - one hour samples - Jan 68 - Feb 69

During the period of time spanned by the data, the ATS-3 moved from 95° W longitude to 45° W longitude. The diurnal variation for five levels of scintillation index is shown for the three sites in figure 2-4. In each case the scintillation peak around midnight. Narssarssuaq shows effects of high geomagnetic latitudes on increasing the occurrence over that experienced at a sub-auroral latitude of Sagamore Hill. Huancayo shows the characteristic of equatorial scintillation of an abrupt increase before local midnight.

The percentage occurrence of scintillation index for the three sites is shown in figure 5. Figure 6 compares cumulative distributions of depth of scintillations for the ATS-3 data from the three sites. Also shown are distributions for Canary Bird and ATS-1 data.

Work is continuing on conversion of scintillation index to signal strength distribution curves. Power spectrum and amplitude distribution analysis will be preformed for sample periods by computer and results compared with those of an analog signal totalizer.

c13, c29 100500 21

W70-092

AN OBJECTIVE METHOD FOR COMPUTING WIND SPEEDS FROM STREAMLINES

R. L. Mancuso

Stanford Research Institute, Menlo Park, California

Presented to: Symposium on Tropical Meteorology, Honolulu, Hawaii, Dec. 1970

An objective method has been developed for computing a wind-speed field from a given wind direction field for which speeds are specified only along boundaries. This method was developed for application over tropical areas where only the wind-direction field within the interior of the region could be specified from satellite cloud photographs. The basic approach consists of stepping downwind along streamlines from known wind speeds at the inflow boundary. A method of determination based on regularly spaced grid points is used. If the horizontal flow in non-divergent or if the actual divergence field is known, then the wind-speed field can be accurately computed.

An analysis of the computational procudure and results achieved, using known wind fields over the United States, has been described.

c20 081000 17

W70-093

THE EQUATORIAL F LAYER IRREGULARITY EXTENT AS OBSERVED FROM HUANCAYO, PERU

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February 1970

Simultaneous observations of propagation paths to two synchronous satellites transmitting at 137 MHz have revealed distinctive characteristics of the equatorial irregularity structure. Data were taken between July

1967 and February 1969. The abrupt onset of scintillations on a particular path within minutes led to the concept that a sharp boundary of about 10 Km exists between quiet non-scintillating regions and regions of irregularities. Once the scintillation has started a region of over 5000 Km in extent east-to-west may contain irregularities. Within that region there is strong localized control of irregularities. Comparison of scintillation onset on two paths spaced one to two hours apart at their sub-ionospheric points reveals that in the mean, scintillation onset is a function of local time.

However, many days show nearly simultaneous onset on two paths one hour apart in local time. Other days show onset of scintillations on the westerly satellite path before the eastern intersection, clearly a negation of the diurnal pattern. Maximum occurrence of scintillation has been observed in September, October and November. A somewhat lower occurrence of high amplitude scintillation is noted in the December-January solstice period. A secondary maximum exists in March, according to other South American data. A very low occurrence of scintillation is observed in May, June and July. The scintillation phenomenon is correlated in the mean with the downward motion of the F layer after 2100 local time at Huancayo. A hypothesis is advanced that after 2100 the westerly F layer maximum is higher in altitude and has a greater electron density than that to the east. This west-east gradient of electron density either through electrodynamic forces of diffusion produces the irregularities which show an apparent eastward drift. The diurnal pattern with its nighttime maximum of scintillation occurrence is a westward motion but the irregularity drifts noted are clearly eastward in the direction of lower electron density profiles.

c13 100500 57

W71-001

EFFICIENCY OF CHANNEL ELECTRON MULTIPLIERS FOR ELECTRONS OF 1-50 KeV

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University of Calif., Physics Dept., San Diego, La Jolla, Calif.

NAS 5-10364 and Grant NGL 05-005-007

Published in: The Review of Scientific Instruments, Vol. 42, No. 1, January 1971

The efficiency of a channel electron multiplier for counting electrons has been measured during the calibration of the University of California, San Diego (UCSD) plasma detector flown on the Applications Technology Satellite (ATS-5). Multipliers used are Bendix type CEM 4013, and results are valid only for this type, but fair agreement with other types is indicated. No efficiencies for energies less than 500 V are found in this study.

Several sets of data by different experimenters have been renormalized to agree with UCSD. The agreement between experimenters for several types of multipliers is very good. In particular, there is excellent agreement between experimenter L. A. Frank and UCSD with both using similar sensors. Over-all agreement between all experimenters, using several types of multipliers, is sufficiently good to indicate that actual efficiency of a given multiplier may depend strongly on the configuration in which it is used.
(3 pages, 4 figures)

c29 111400 11

W71-002

SYSTEM 621B/ATS-5 SIGNAL DEMONSTRATION TEST FINAL TECHNICAL REPORT

J. D. Barnla, D. H. Westwood, O. J. Hanas

Applied Information Industries, Moorestown, New Jersey

Sponsored by: United States Air Force, Space and Missile Systems Organization, Los Angeles, California 90045

Contract F04701-70-C-0281

SAMSO TR 71-35, AII No. 710226, Feb. 26, 1971

NOTICE: Each Transmittal of This Document Outside the Agencies of the U.S. Government Must Have Prior Approval of SAMSO

A test experiment has been accomplished in which L- and C-band range measurements have been made between a fixed ground station at Mojave, California, and the Applications Technology Satellite (ATS-5) on orbit. These tests covered a three-month period from October 1970 to January 1971 and produced comparative data for use in evaluating the ionospheric propagation effects at L-band frequencies. The ATS-5 is spinning and has a reception window of approximately 50 milliseconds with each rotation. The test instrumentation reacquired the satellite signal within a few milliseconds at the beginning of each reception and performed both an L-band and a C-band measurement during the burst.

c07 070705 01

W71-003

SCOMB-1, A SATELLITE COMMUNICATION OCEANOGRAPHIC AND METEOROLOGICAL BUOY

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SIMRAD Company, Oslo, Norway[2]

Chr. Michelsen Institute (CMI), Bergen, Norway[3]

Sponsored by: Royal Norwegian Council for Scientific and Industrial Research (NTNF), Space Activity Div.

SAD-10-T, February 1971

This report concerns a Satellite Communication Oceanographic and Meteorological Buoy (SCOMB-1) developed to evaluate the possibilities of satellite relayed data transmissions from ocean platforms operating at high latitudes. Transmitted data are encoded in PCM format comprising meteorological, buoy attitude, housekeeping, and position information. Transmission is initiated by command signal from a ground station. The SCOMB-1 has been tested with the Applications Technology Satellite, ATS-III, in a 47°W position, and in the waters south of Tromso using a satellite transponder simulator and the Tromso Satellite Telemetry Station. During the last test, SCOMB-1 was located outside Bergen, and the ground station was in Oslo. Knowledge and experience gained from this project should provide valuable background data for the set-up of operational systems.

c07, c13, c20 070223 01

W71-004

EFFECTS OF PRECIPITATION ON 15.3 AND 31.65 GHz EARTH-SPACE TRANSMISSIONS WITH THE ATS-V SATELLITE

L. J. Ippolito

Member IEEE

Published in: Proceedings of the IEEE, Vol. 59, No. 2, February 1971

The Applications Technology Satellite (ATS-V) millimeter wave propagation experiment is the first flight experiment for the determination of long and short-term attenuation statistics of operational millimeter wavelength earth-space links as a function of defined meteorological conditions. Launched August 12, 1969, ATS-V is supplying the first propagation data from a geosynchronous spacecraft in the 15-GHz (downlink) and 32-GHz (uplink) bands.

The spacecraft transmitter is an all solid-state phase modulated unit providing up to 250 MW of CW power at 15.3 GHz. The 31.65 GHz uplink signal is from a frequency stabilizer klystron, varactor upconverter, and 1000 W traveling wave tube amplifier. A multilevel computer processing program generates propagation statistics for attenuation as a function of rainfall rate, sky temperature, radar backscatter, and other variables.

Downlink measurements made at the NASA Rosman, N. C. station show attenuations of 1 to 3 dB in light rains or dense fog; 3 to 7 dB in continuous rains (5 to 50 mm/hr.), and number of fades exceeding 12 dB in heavy thunderstorms. Uplink fades of up to 18 dB in heavy rain have been observed.

Correlation of measured attenuation with sky temperature recorded on a small aperture radiometer was very good for most storms. Valid predictions of attenuation from 16 GHz sky temperature measurements were observed for up to 15 dB of measured attenuation.

The uplink to downlink attenuation ratio varied with each precipitation event and often varied during a single storm. The ratio has ranged from 2:1 to 4:1 during heavy precipitation periods.
(17 pages, 33 illustrations)

c07, c20 070300 25

W71-005

RADIO PROPAGATION STUDIES OF THE IONOSPHERE
(Final Report - Draft)

A. V. da Rosa (Stanford University)

Contract NAS5-10102

February 1971

Avail: Goddard Space Flight Center, Greenbelt, Md.

This report describes several aspects of a four-year experiment to maintain continuous surveillance of the ionospheric electron content over different locations to obtain data for engineering and scientific purposes, and to investigate and develop methods and equipment for the gathering of such data. Much of the data was obtained from the SYNCOM III and ATS-1, ATS-3, and ATS-5 spacecrafts. Sections of the report describe equipment used, electron content data processing, and available data. The appendix section of the report contains eleven scientific papers prepared on work performed during the program: "The Significance of Electron Content Measurements", "Real Time Recording of Electron Content Values from Faraday Rotation Measurements", "An Adaptor for Direct Digital Recording of Ionospheric Information", "A Calibration Procedure for the Stanford Mark II and Mark III Polarimeters", "Processing of Faraday Rotation Data", "Tape Formats and Tape Processing Programs for Electron Content Data", "Electron Content of the Upper Plasmaspher", "Motion of Ionospheric Irregularities", "The Ionospheric Storm of 8 March 1970", "Electron Content Measurement at an Equatorial Site Using Faraday Rotation Measurements from VHF Transmissions of Geostationary Satellites", and "Determination of the Columnar Electron Content and the Layer Shape of the Plasmasphere up to the Plasmapause."
(144 pages, 11 appendixes)

c29 100516 02

W71-006

BIBLIOGRAPHY OF AERONAUTICAL SATELLITE SYSTEM CHARACTERISTICS AND PROPAGATION FACTORS THROUGH 1971

E. J. Mueller

Westinghouse Electric Corporation

NAS X-490-71-91

March 1971

Avail: NASA Goddard Space Flight Center, Greenbelt, Maryland

The documents listed in this bibliography are subdivided into thirteen categories
Air Traffic System Requirements
Communication System Requirements
Surveillance and Navigation System Requirements
Satellite Design
Aircraft Equipment
Earth-Space Propagation: General
Ionospheric Phenomena
VHF Propagation (100-400 MHz) - Ionospheric Absorption
VHF Propagation (100-400 MHz) - Ionospheric Scintillation
VHF Propagation (100-400 MHz) - Multipath and Polarization
L-Band Propagation (1600 MHz) - Ionospheric and Tropospheric Scintillation
L-Band Propagation (1600 MHz) - Multipath
L-Band Propagation (1600 MHz) - Noise

60 pages

c07, c34 070200 32

W71-007

AIRBORNE SATELLITE COMMUNICATIONS DURING AURORAL STUDIES

M. Max Garcia

EG&G, Inc., Albuquerque, N. M. 87106

Sponsored by: Atomic Energy Commission, Los Alamos, N. M.

Contract AT(29-1)-1183

EGG 1183-3011, Apr. 12, 1971

Communications equipment experiments were conducted during a series of auroral study flights in October and November of 1970. These experiments were designed to test the effectiveness of a satellite link in maintaining communications between two aircraft which were flying at high altitude and at conjugate geomagnetic auroral points in opposite hemispheres. Ground tests, flight checks, and actual auroral mission communications indicated that marked improvement in coordination between the aircraft could be obtained by using the Applications Technology Satellite (ATS-1).

c07 070216 01

W71-008

SUBMICROSECOND TIME SYNCHRONIZATION OF GROUND STATIONS VIA THE APPLICATIONS TECHNOLOGY SATELLITES

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X-573-71-115

April 1971

The Applications Technology Satellites (ATS) provide a broadband capability (approximately 30-MHz bandwidth) and a stable line-of-sight propagation path at C-band for time synchronization between ground stations. The synchronization experiments were carried out via ATS-1 and ATS-3 between the ATS ground stations at Rosman, North Carolina, and Mojave, California. Two transponders on each satellite were used in the tests: one for the 1-s epoch pulses transmitted by Rosman to Mojave and the other for those sent in the opposite direction. Each station measured the time interval between its transmitted pulse and the pulse received from the other station via the satellite. The difference in the two time intervals was a measure of the synchronization between clocks at the two stations.

A simple method was used to measure the time intervals. The transmitted pulse started a 10 ns-resolution electronic counter already available in the ATS range and range rate system, and the received pulse stopped the counter. Runs of several minutes duration were taken at 1 pulse per second and the time interval measurements were punched on paper tape. Standard deviations of the runs were about 20 ns. At Rosman and Mojave, delays through the transmitting and receiving systems to the antenna feed were measured. Two portable cesium clocks were transported to the stations to verify the technique. With systematic errors included, the accuracy of the technique was estimated to be 100 ns.

c07, c11 070103 01

W71-010

THE RESPONSE OF THE MID-LATITUDE IONOSPHERE TO GEOMAGNETIC STORMS

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Boston University, Dept. of Astronomy, Boston, Mass.*

Air Force Cambridge Research Laboratories, Bedford, Mass.**

Presented to: American Geophysical Union, April 1971

Published in: Abstracted in AGU Transaction, P. 29

This study of 28 geomagnetic storm periods has permitted the first in-depth storm analysis of three ionospheric parameters at a mid-latitude site. The quantities examined were the ionospheric total electron content, the peak density of the F-region, and the ionospheric slab thickness.

The local time results show that the enhancements are confined to dusk hours on the first day of a storm while the depletions are strongest near 0300 local time on the following days. The slab thickness patterns point out the important influence of season. Daytime values are generally positive in all seasons except winter, while nighttime values are less than or equal to 0 for all seasons except summer.

c29

100500 105

W71-011

A TDMA/PCM EXPERIMENT ON APPLICATIONS TECHNOLOGY SATELLITES

Yukiyasu Suguri, Hiroyuki Doi, and Eric E. Metzger

Published in: IEEE Transactions on Communication Technology Vol. Com-19, No. 2, April 1971, pp. 196-205

In recent years there has been considerable interest in time-division multiple access (TDMA) for communications via satellites. TDMA is free of intermodulation effects, since only one station signal is present in the satellite at a given time. The principal problem which had to be solved for TDM was that of establishing and maintaining time synchronization between the participating earth stations in the communications network.

In a joint communication experiment a new TDMA/pulse-code modulation (TDMA/PCM) system was built in Japan and installed at the Applications Technology Satellites (ATS) stations. The features of the system are 1) that time synchronization is established with a continuous low-level pseudonoise (PN) sequence so that the interference of other stations is negligible and knowledge of satellite range is not required and 2) that the participating earth stations have clock control loops which maintain bit and frame coherency referred to the satellite, that is, the bits as they arrive at the satellite are coherent from one station burst to the next station burst. Some of the results of extensive communication tests through the ATS are discussed.
(10 pages, 8 figures)

c07

070100 17

W71-012

TOTAL ELECTRON COUNT, SLAB THICKNESS, AND AMPLITUDE SCINTILLATIONS OBSERVED AT FORT MONMOUTH DURING THE STORM AND ECLIPSE PERIOD MARCH 6-10, 1970.

P. R. Arendt, F. Gorman, Jr., H. Soicher

USAECOM, Ft. Monmouth, N. J. 07703

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, SA13

Data from measurements of the 137.35 MHz beacon of the ATS-3 satellite are submitted. The total integrated electron content was obtained from polarization measurements with a precision of ± 5.5 degrees. Unusually large content variations were observed on March 8 when geomagnetic activity reached its peak; an enhancement up to 8×10^{13} e/cm^2 was followed by a fast depletion to about 2×10^{13} e/cm^2 within an hour. These content variations and the variations during the eclipse are compared with true height variations of bottomside plasma frequencies from simultaneously taken ionograms. The amplitude scintillations index was obtained by using the AFCRL method. It shows that ionospheric observations during the eclipse period were not greatly affected by magnetic activity. The amplitude scintillations index was large during periods of fast changes of the K_p magnetic index; an effect from the obsolute magnitude of K_p could not be derived.

c29

100500 106

W71-013

PULSATIONS SIMULTANEOUSLY OBSERVED IN ATS-1 ELECTRON FLUXES AND AT GROUND MAGNETIC STATIONS

N. A. Tartaglia

Bell Telephone Labs, Murray Hill, New Jersey

Presented to: Amer. Geo. Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, SM46

The digital dynamic power spectra (240-1536 sec. period) calculated from the rapidrun magnetograms obtained from Great Whale ($L \sim 6.9$), Pt. Barrow ($L \sim 8.0$), College ($L \sim 5.4$), and Sitka ($L \sim 3.9$), were compared with those calculated using the BTL electron data ($E > 0.4$, > 1.1 MeV) observed on the ATS-1 satellite ($L \sim 6.4$). During the period used for analysis (Dec. 19, 1967, 0200-0500 UT) a positive bay was in progress at the stations located in the evening sector, while a negative bay was occurring at Great Whale in the midnight sector. The comparison shows that a pulsation band (640-960 sec.) occurred simultaneously in the spectra of the data from the evening sector stations and at the equator on ATS. It was not observed at Great Whale. No other pulsation bands correlated in this way. The maximum amplitude of the 640-960 sec. pulsation occurred earliest at the higher L-value station (Pt. Barrow), and progressively later in the observations taken at lower L values including ATS-1. This movement ($\sim .2$L/min.) is too slow for Alfven wave propagation. It is speculated that the pulsation may be associated with the inward drifting of plasma which occurs in the evening sector during magnetic polar disturbances.

c29

110300 37

W71-014

CHARACTERISTICS OF LOW-FREQUENCY TRANSVERSE OSCILLATIONS AT ATS-1

W. D. Cummings[1], F. Mason[1], P. J. Coleman, Jr.[2]

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Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, p. 331, 1971

Low frequency transverse oscillations ($T > 50$ seconds) of the magnetic field at ATS-1 have been analyzed for the two year period, December, 1966 through 1968. Oscillations were most frequently observed during the afternoon, with a peak in the occurrence rate between 1400 and 1500 L. T. The seasonal variation in the occurrence frequency showed a prominent maximum near winter solstice. The frequency of the oscillations varied from event to event, with the most often observed period in the range 72-84 seconds. During a given event the amplitude of the transverse oscillation usually varied gradually, increasing to a maximum during several oscillations, and then decreasing in about the same time interval. The average maximum amplitude was 2.8γ. The local time and period distributions of these oscillations are similar to those reported for Pc 4 micropulsations.

c29 110800 63

W71-015

PC4 and PC5 MICROPULSATIONS OBSERVED DURING GEOMAGNETIC STORMS: ATS-1

J. N. Barfield, R. L. McPherron, P. J. Coleman, Jr.

University of Calif., Dept. of Planetary and Space Science, Los Angeles 90024

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, p. 332, 1971

Quasi-sinusoidal fluctuations of relatively large amplitudes are regularly observed at the ATS-1 orbit during geomagnetic storms. During the year 1967, 26 clearly defined events were observed, with periods in the range 2-15 minutes and amplitudes up to 20γ. These oscillations were usually elliptically polarized with the major axis of the polarization ellipse lying in a swept back meridional plane. The events typically occurred during the main phase of the geomagnetic storm, and were generally confined to the afternoon sector. All 26 events were closely correlated with substorm activity in the midnight sector.

c29 110800 62

W71-016

CORRELATIONS BETWEEN MAGNETIC FIELD CHANGES AT ATS-1 AND LOW LATITUDE GROUND STATIONS

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University of Calif., Dept. of Planetary and Space Science, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, 1971

The horizontal components of the magnetic fields measured at the synchronous satellite ATS-1, and at Honolulu and Tucson are often observed to be highly correlated. The highest correlation is present during the onset of magnetospheric substorms occurring within three hours of local midnight, and after periods of little or no disturbance from the quiet day magnetic field. A linear regression of data from Tucson, Honolulu, and Guam versus the satellite shows that the correlation depends upon local time, the magnitude of the field, and the longitudinal distribution of the ground stations. It is suggested that the phenomena responsible for these correlations are spatial and temporal changes in the tail current caused by increased magnetic pressure on the plasma sheet. Other current systems tend to destroy the correlation. The correlation may also be weakened when ATS-1 is engulfed by the tail current. We believe that this phenomenon can be used as an effective tool in studying the tail current in the absence of magnetic storms.

c29 110800 61

W71-017

LOW FREQUENCY WAVES AT ATS-1 AND ITS CONJUGATE POINT DURING SUBSTORMS

R. L. McPherron, P. J. Coleman, Jr.

University of California, Dept. of Planetary and Space Science, Los Angeles

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, p. 323, 1971

A geomagnetic observatory at the calculated conjugate point of the synchronous satellite ATS-1 has been used to digitally record low frequency waves during substorms. Simultaneous observations at ATS-1 reveal whether these waves are present on the field line passing through the satellite. The comparison between the two locations is made quantitative by spectral analysis of the waveform data. When a single wave phenomenon appears to be present at both locations, a transfer function for the field line is determined. Among the ground wave phenomena considered are sweepers, noise bursts, irregular fluctulations, and band limited pulsations. Not all of these are simultaneously observed at both locations indicating either the waves are localized in space with the satellite on a different field line or the waves originate in the ionosphere.

c29 110800 60

W71-018

CHANGES IN THE CUSP OF THE GEOMAGNETIC TAIL DURING MAGNETOSPHERIC SUBSTORMS

M. P. Aubry[1], R. L. McPherron[1], C. T. Russell[1], D. S. Colburn[2]

University of California, Los Angeles[1]

Ames Research Lab, Palo Alto, California[2]

Presented to: Amer. Geo. Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, 1971, paper SM49

The cusp in the geomagnetic tail is a region of depressed field and high energetic electron flux first studied by Anderson and Ness in 1966. It was observed that during the growth phase of magnetospheric substorms it undergoes contraction followed by sudden expansion at the onset of the substorm expansion phase. These observations appear to be of crucial importance to the understanding of the substorm triggering mechanism. Data from a number of sources will be used to describe the changes in this region due to substorms only (i.e., when the solar wind magnetic field is constant). Sources include the UCLA magnetometer and particle spectrometer on OGO-5, the UCLA magnetometer on ATS-1, the Ames magnetometers on Explorers 33 and 35, and ground magnetograms.

c29 110800 59

W71-020

NOISE CHARACTERISTICS OF AN SSB-FDMA/PhM MULTIPLE ACCESS SYSTEM

E. E. Crampton, Jr., and S. J. Andrzejewski

Westinghouse Electric Corporation

May 1971

Contract NAS 5-21598

This report describes the results of a 3.5-year communication experiment to determine the magnitude and spectral characteristics of three basic types of noise in an SSB-FDMA/PhM multiple access system. The types of noise are identified as thermal, intermodulation, and threshold noise. The experiment, part of the NASA Applications Technology Satellite program, employed two spin-stabilized satellites (ATS-1 and ATS-3) and ground stations at Mojave, California; Rosman, North Carolina; and Cooby Creek, Australia. Noise measurements were made in six test loops to investigate the noise characteristics in the three basic subsystems: the single-sideband transmitter, the single-sideband phase modulation spacecraft unit, and the ground receiver. The six test loops were: single station, multistation, collimation tower, RF, SSB transmitter, and ground receiver. Equipment configurations are illustrated, noise levels and components are shown, and the results of the study are summarized.
(52 pages, 16 illustrations)

c07 070100 18

W71-021

A SIMPLE METHOD OF SIGNAL RECEPTION FROM A SATELLITE USING AN OMNIDIRECTIONAL ANTENNA DIVERSITY SYSTEM WHICH ELIMINATES MULTIPATH FADING

Dr. W. Goebel

Institute for Satellite Electronics

From Report DLR FB 71-05 published by Deutsche Forschungs-und Versuchsonstalt fur Luft-und Raumfahrt eV

Presented at the Eleventh European Space Symposium in Berlin, W. Germany, May 1971

The purpose of this paper is to present a reliable and rugged small site antenna diversity system of omnidirectional antennas, which avoids multipath effects and which has been proven in the form of land station receiving of ATS-3 (geostationary) and AZUR (polar orbit) at frequencies of about 136 MHz.

The mathematics of the interference pattern around an omnidirectional antenna is used to show that all elevation angles 0^{o}-90^{o} can be covered by several omnidirectional antennas. If the antennas can be properly combined to form an antenna space diversity system, then this project is feasible. In the system used on this experiment, 5 antennas were mounted in a complex diversity system with output signal levels monitored by an electronic commutator and evaluated by an anxiliary receiver. The antenna with the strongest signal is selected.
(15 pages, 13 illustrations)

c07 070212 10

W71-022

VHF NAVIGATION EXPERIMENT

(Sept. 1969 to Dec. 1971)

Texas Instruments, Dallas, Texas

John F. Dubose, et al

Final Report U9-8324000-F

May 1971

This report documents the results of an experiment to determine the accuracy that could be obtained in locating the position of an aircraft when using sidetone ranging signals relayed by two synchronous satellites, ATS-1 and ATS-3. A real-time display system was developed by Texas Instruments that allowed the aircraft position, as derived by the satellite system, to be compared with that derived from an airport surveillance radar. The experiment demonstrated that the use of differential position location techniques, could provide location accuracy of approximately 3 nautical miles; processing reduced the error to 2 nautical miles. Recommendations are made that would improve the system accuracy of approximately 1 nautical mile

c07, c21 080400 07

W71-023

VHF RANGING AND POSITION FIXING EXPERIMENT USING ATS SATELLITES

General Electric Company, Final Report on Phases 1 and 2

Contract NAS 5-11634, (25 November 1968 - 1 May 1971)

This report describes a 2.5-year testing program with NASA's ATS-1 and ATS-3 spacecraft which demonstrated that geostationary satellites can provide superior communication and position surveillance for mobile craft. The tests indicated that inexpensive modifications of conventional mobile communications equipment can provide reliable, high quality voice and digital communications with distant ground stations as well as automatic surveillance of the positions of all the crafts by a ground facility. FM signals with the narrow audio and frequency bandwidths of terrestrial mobile radio communications were relayed through the VHF transponders of the geostationary satellites and provided voice and digital communications far superior in quality and reliability to long distance mobile communications provided by such other means as medium or high frequency radio. Position fixes by range measurements from the two satellites were accurate to approximately 1 nautical mile, one sigma, except near the equator and the poles.
(332 pages, 202 figures, 21 tables)

c07, c20 070211 16

W71-024

SEVENTH QUARTERLY PROGRESS REPORT FOR LOCKHEED EXPERIMENT ON ATS-5

Lockheed Pale Alto Research Laboratory

7 June 1971

Contract NAS 5-10392

Available: NTIS

This report, which was produced during a continuing Lockheed experiment involving the detailed study of individual isolated magnetospheric substorms, presents illustrations of raw and filtered particle flux data obtained from ATS-5 during a magnetospheric substorm on day 44 of 1971.
(8 pages, 5 illustrations)

c29 111302 08

W71-025

NIMBUS/ATS DATA UTILIZATION CENTER (NADUC) SUMMARY REPORT (7 MARCH 1969 TO 19 MARCH 1971)

A. G. Oakes, 1971

Allied Research Associates, Inc.

Report No. 9G45-79

Contract No. NAS 5-10343

This report summarizes the major activities of the NADUC from March 1969 to March 1971 and is contiguous with the Summary Report (9G45-37) for the period March 1967 to March 1969. One significant event for the ATS effort of NADUC was the transfer of the ATS-1 meteorological experiments to NOAA in April 1969.

As a result of this continuing NADUC effort, though these satellites were designed as meteorological tools many additional applications have been realized such as; the characteristics of the earth's crust and of the ocean's waters are displayed in areal magnitudes, heretofore unattainable, thermal and sediment boundaries can be discerned in water bodies, while large-scale geologic features of the land areas can be recorded in entireties, daily repetitive coverage of the same areas is especially useful in studies of both surface and atmospheric changes, large storms can be observed from their early development through their life cycle, the pulsation of vegetation and snow boundaries can be correlated with the changing seasons for hydrological and argicultural purposes and ice boundaries can be monitored for shipping purposes. Much analysis remains before the fullest advantage of these data can be realized.
(47 pages, 23 illustrations, 3 tables)

c13, c20 040200 02

W71-026

A SIGNALLING SYSTEM FOR DEMAND ASSIGNMENT COMMUNICATION SYSTEM

Radio Research Laboratories, Japanese Ministry of Post and Telecommunications

Paper prepared for submission to CCITT

1971

This paper describes the general characteristics of Demand Assignment Multiple Access (DAMA) satellite communications system as determined by experiments conducted

over a synchronized multiple access communications system (SMAX) through the ATS-1 spacecraft in 1968. The scope of the paper is restricted to the signalling system between earth stations and does not consider the interworking between terrestrial and satellite systems. Characteristics required for a Demand Assignment Satellite Communications system are described. These characteristics include a common channel signalling system, signal processing, channel control signal and station code, error control and signal synchronization. The paper also contains a note describing the affinity between DAMA and PCM-TDMA systems.
(12 pages, 3 illustrations)

c07 070400 15

W71-028

FINAL REPORT ATS-5 RANGING RECEIVER AND L-BAND EXPERIMENT VOL. I

Westinghouse Electric Corp., Defense and Space Center, Baltimore, Maryland, September 1971

NASA/GSFC, Greenbelt, Maryland

NAS 5-21019

This experiment final report contains information describing the L-band ranging receiver and preliminary results obtained from the Mojave station test data. Also supplied is a brief program history and description of the installation and testing phases of the experiment at Mojave.

The ranging receiver was designed to utilize tone ranging techniques, with tones supplied from the station ATS ranging system. The receiver is used in conjunction with the station L-band transmit/receive system.

The majority of the ranging and position location data which was obtained with the receiver will be analyzed and presented in Volume II of this report.
(61 pages, 17 figures, 4 tables)

c07 070701 01

W71-029

THE PROPAGATION OF TROPICAL CLOUD DISTURBANCES AS DEDUCED FROM SATELLITE DATA

J. A. Young, D. N. Sikdar

University of Wisconsin, Dept. of Meteorology & Space Science & Eng., Madison, Wisconsin

Published in: Trans. Amer. Geo. Union, April 1971, No. M84

This paper represents an attempt to delineate more fully the variety of characteristics of large scale cloud systems over the tropical oceans during a transitional season. To accomplish this, the satellite-observed cloud amount data has been separated into distinct frequency bands of intermediate width. The resulting time series are thus capable of exhibiting quasi-periodic motions as well as modulations on a longer time scale.

Longitude-time sections are shown to indicate the existence of both planetary and synoptic-scale transient disturbances. The smaller-scale travelling systems experience continuous fluctuations in wavelength and phase speed. In addition, longer period regimes involving reversed senses of propagation and seasonal changes become apparent.

c20 080100 75

W71-030

VERTICAL TEMPERATURE SOUNDINGS FROM GEOSTATIONARY ALTITUDES

V. E. Suomi

University of Wisconsin, Dept. of Meteorology, Madison, Wisconsin

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, 1971, No. M71

This paper demonstrates that vertical temperature soundings of the atmosphere from geostationary altitude are feasible. It treats the meteorological and instrumental options which must be considered to compensate for the small amount of energy received from this great distance with the required accuracy in a reasonable period of time. Measurements from satellites are used to obtain cloud opening statistics. Results indicate that it will be possible to sound the atmosphere to the earth's surface through openings in a 95% cloud cover in less than one hour.

c20 080100 76

W71-031

TIME-SPECTRAL CHARACTERISTICS OF LARGE-SCALE CLOUD SYSTEMS IN THE TROPICAL PACIFIC

D. N. Sikdar, J. A. Young, V. E. Suomi

University of Wisconsin, Space Science & Eng. Center & Dept. of Meteorology, Madison, Wisconsin

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, 1971, No. M95

Power spectra of time varying cloud amount over the Central Pacific are studied to determine the large-scale variations of tropical disturbance activity for a four-month period in 1967. The fluctuating components are found to be more prevalent in the Southern Hemisphere, with major variations in activity evident between the eastern and western parts. Normalized power spectra show that the transient activity occurring in the equatorial zone is dominated by the shorter periods of about four days, while longer periods are dominant away from the equator. Coherency magnitudes and phases between different locations indicate that propagating cloud systems are most identifiable at the lower frequencies and in the Southern Hemisphere. Wave-length estimates are uncertain for the shorter periods, but activity with periods in excess of five days consists largely of westward propagation on the planetary wave scale.

c20 080100 77

W71-032

THE USE OF SATELLITE CLOUD MOTIONS FOR DERIVING THE MEAN CIRCULATION OVER THE TROPICS

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Dept. of Commerce, National Environmental Satellite Service, NOAA, Washington, D. C.

Presented to: American Geophysical Union Spring Meeting, April 1971

Published in: Trans. Amer. Geo. Union, 1971, No. M96

Mean monthly resultant winds over the Pacific are derived from the Applications Technology Satellite (ATS-1) for the month of November 1969. Since the method uses clouds as tracers, these resultant winds are biased towards cloud-producing circulation features. These biases appear to be smallest in the tropics and consequently the winds here can be very useful for studies of the average circulation at low latitudes. Some of the important features of this circulation over the Pacific, in particular the major tropical convergences and the equatorial dry zone, are clearly revealed.

c20 080100 78

W71-033

SECOND QUARTERLY REPORT FOR UCSD HIGH ENERGY DETECTOR ON BOARD ATS-5

C. J. Rindfleisch, Jr., April 28, 1971

University of California, San Diego, Physics Dept., LaJolla, California

Contract No.: NAS 5-10363

Prepared for: NASA, Goddard Space Flight Center, Greenbelt, Maryland

The UCSD ODHE particle detector on the Applications Technology Satellite (ATS-5) has been functioning for over one year. There have been no failures in any detector, and excellent data have been received. The major effort of the past year has been development of data reduction and analysis computer routines. The reduction routines are completed, with work still progressing on the analysis.

While no papers have yet been published, data have been distributed to other ATS-5 experimenters for reference and comparison. Correlation of data with ATS-1 has been attempted, and effort in this area is being continued.
(8 pages, 4 figures)

c29 110203 01

W71-034

MAGNETOSPHERIC SUBSTORMS ON SEPTEMBER 14, 1968

E. W. Hones, Jr.[1], R. H. Karas[2], L. J. Lanzerotti[3], S. I. Akasofu[4]

University of California, Los Alamos Scientific Lab., New Mexico[1]

University of California, Berkeley[2]

Bell Telephone Labs., Murray Hill, New Jersey[3]

Geophysical Institute, University of Alaska, College[4]

Published in: Journal of Geophysical Research, Oct. 1, 1971 pp. 6765-6780

Several moderate magnetospheric substorms on September 14, 1968, were observed by two satellites (Vela-4A and ATS-1), balloon-borne X-ray detectors, and extensive arrays of ground-based instruments in Alaska. Combined results from those observations and their interpretations are described in detail. Several interesting aspects of magnetospheric substorms are suggested by the analysis. (a) Simultaneous with the brightening of an auroral arc that signals the onset of an auroral substorm, there can occur a sudden enhancement of energetic electron flux in a limited region of the distant magnetotail. The simultaneity of these two phenomena suggests a magnetic link between them. The region evidently contracts rapidly toward the earth. A satellite appropriately situated in the magnetotail (e.g., a Vela satellite at 18 R_E) may be imbedded in the electron flux initially and then, after a short time, find itself outside it as the flux-containing region contracts earthward. This results in a brief impulsive flux of energetic electrons at the satellite starting at substorm onset. (b) The sharp enhancement of electron flux that, in the midnight sector of the geosynchronous orbit ($r = 6.6\ R_E$), characterizes substorm onset and that is generally ascribed to a change of electron drift paths associated with earthward 'collapse' of magnetic field may, in some substorms, be partly due to earthward motion of a nonadiabatic source region. (c) The westward drift motion of auroral patches results from that of a source of scattering region rather than from the drift of the individual precipitated electrons in a strong electric field. The number of substorms that can be studied with such a variety of simultaneous observations is obviously very limited, and thus the generalization of our conclusions must be taken to be tentative.
(16 pages, 10 figures)

c29 110300 32

W71-035

INTERMODULATION NOISE AND SYSTEM ANALYSIS

The Radio Research Laboratories, Ministry of Posts and Telecommunications, Kashima Branch, Kashima-Machi, Ibaraki-Ken, Japan

NASA has proposed the SSB-PM system as one of the Multiple Access Communications Systems and many investigations have been made at the Kashima ground station by conducting satellite communication experiments via ATS-1. The main purpose of this paper is to present the data for designing the SSB-PM communication link in multiple access, and to make some analysis of intermodulation (IM) noise and system performance. In the first part of this paper, the IM noise generation mechanism is discussed with two-tone and noise loading tests in a Kashima-single-station-loop configuration. The useful data for SSB-PM communication link design are given in graphical form. In the second part, effects of IM noise on multiple access performances are discussed with the multi-station test results.
(42 pages, 7 tables, 20 figures)

c07 070400 16

W71-036

NON-ADIABATIC PROCESSES AFFECTING GEOMAGNETICALLY TRAPPED ENERGETIC ELECTRONS

C. J. Rindfleisch, Jr., Ph. D., 1971

University of California, San Diego

Observations of the May 25, 1967 geomagnetic storm were made by the Applications Technology Satellite (ATS-II) and Environmental Research Satellite-18 (ERS-18) for $>$ 500 keV and $>$ 1.25 MeV electrons in the L range 1.2 to 3.5. The observations are corrected for adiabatic effects. Large, rapid, non-adiabatic enhancements are correlated with a substorm which occurred at 2300 UT May 25, some 12 hours after the onset of the geomagnetic storm. For $L<2.2$ for $>$ 500 keV electrons, a slower non-adiabatic increase lasted for 8 days.

The non-adiabatic effects are classified into four categories: 1) rapid loss, 2) rapid increase, 3) radial diffusion, and 4) pitch-angle diffusion. The rapid increase is suggested to be due to the intrusion of the plasma sheet to an L of 2.2 - 2.5. The subsequent decay of the energetic electrons for $2.4 \leq L \leq 3.0$ can be explained by a pitch-angle diffusion for a given L, energy and time period whose diffusion coefficient has the form $D = D_o \sin^n \alpha_o$. D_o and n are constants and α_o is the equatorial pitch angle. The range of D_o is from .015 to .1 day^{-1} and for n, 0 to 2.

c29 110200 06

W71-037

INSTRUMENTATION FOR SOLAR CELL EXPERIMENTS ON RELAY I, II, AND ATS-I, II

R. C. Waddel

NASA/GSFC, Spacecraft Technology Division, Greenbelt, Maryland

On satellites Relay I and Relay II the solar cell radiation damage experiments consisted of exposing 30 solar cells of various compositions and bearing various radiation shields to the trapped radiation environment, and telemetering to ground the voltages developed across individual, permanently connected load resistors of about 3 ohms value. Switching was by solid state devices. Readings were taken sufficiently rapidly with respect to satellite spin rate that the maximum output during spin could later be computer selected. Telemetry was by 9 bit PCM, a digitizing step thus being 1.47 mv, or about 0.49 ma. Sufficient information was obtained to correct for aspect angle, earth-sun distance, temperature, and variations in apparatus zero and gain. The solar cells were loaded to approximately the short-circuit current condition.

Data was taken from Relay I for 1.2 years and from Relay II for 2.5 years. The results showed the superiority of n-on-p construction, of silicon to gallium arsenide, and of 60 mil shields to 30 mil shields, using short-circuit current as a criterion.

The solar cell radiation damage experiments on the Applications Technology Satellites (ATS-I and II) consisted of exposing 30 solar cells of various compositions and bearing various shields to the radiation environment of synchronous orbit, and telemetering to ground the cell responses upon being loaded by resistors of 3, 4.5, 6, 8, 10, 15, 20, and 2000 ohms. The telemetry was by 8 bit PFM, a digitizing step thus being 3.0 mv. The switching was by microminiature mechanical relays. By suitably sequencing the relays the responses of all cells, as loaded successively by the eight load resistors, were entered in a 2,176 bit magnetic memory, upon ground command. Information about time of observation, aspect angle, temperature, and response to zero and mid-scale standard signals were also entered. After filling, the contents of the memory were repeatedly and indefinitely telemetered to ground, until interrupted by a new memory-refill ground command.

The experiment on ATS-I operated excellently for 270 days, when the memory failed. It revived for about a week after 415 days in orbit. The information gained from this experiment has been of great interest. The value of depicting the full voltage-current characteristic of cells during damage in space was demonstrated.

The solar cell experiment on ATS-II apparently functioned perfectly, but incorrect rocket performance left the spacecraft tumbling so rapidly that useful results from the experiment could not be obtained. The ATS solar cell experiment packages, including the memory, consumed about five watts, weighed five pounds and occupied about 32 square inches of spacecraft surface area.

The results from the ATS-I experiment indicate that there is little difference between boron and aluminum doping of silicon n-on-p cells, that a resistivity of about 10 ohm-cm seems optimum, that increasing the thickness of radiation shields protects the short-circuit current from degrading, and that the optimum shield thickness for maintaining maximum power from cells is between 1 and 16 mils of silica.

c03 110500 11

W71-038

PLASMA FLOW IN THE VICINITY OF THE GEOSYNCHRONOUS ORBIT

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Presented to: Summer Advanced Institute
Earth's Particles and Fields
Cortina, Italy, 1971

An analytic function representing the quiet time magnetospheric electric field has been constructed making it possible to compute complete particle trajectories in a fraction of a second. The function was determined by a trial and error procedure that provides reasonable explanations for the characteristics of the plasma observed by the geosynchronous Applications Technology Satellite (ATS-5). It is believed the model field is usefully accurate within the region of 5 to 7 earth radii on the dawn side of the magnetosphere and 5 to 10 earth radii on the dusk side. At a fixed distance of 6.7 earth radii, the model field peaks at a value of 1.2 mv/m near local midnight and is at a minimum of 0.04 mv/m near 19 hours local time.

c29 111400 12

W71-039

AN AUTOMATED TECHNIQUE FOR OBTAINING CLOUD MOTION FROM GEOSYNCHRONOUS SATELLITE DATA USING CROSS CORRELATION

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February 1971

An automated procedure has been developed for determining cloud motion from geosynchronous satellite pictures based on the use of cross correlation. The speed required for use in a real-time operational system is attained by application of the fast Fourier Transform as a computation algorithm in determining the cross-correlation coefficients. The input data consists of a pair of pictures from the Applications Technology Satellite ATS-I taken 24 min. apart and mapped on a Mercator projection. Relative mapping errors are automatically corrected by matching common landmarks on the two pictures.

A sample of 300 vectors determined from low-level clouds was compared with those obtained by manual methods in a non-operational environment. Speeds agree within 10 kt in 82% of the cases and directions within 30° in 72% of the sample. Comparison of 300 vectors with those obtained from a manual operational procedure showed similar results for direction but indicated that the automated procedure was better at resolving differences in speed.

With multiple cloud layers, the ability to determine the individual motions is dependent upon the structure of the pattern in each layer as well as the difference in speed between the layers and the amount and opacity of the upper layer.

Test results to date indicate that a combination of the manual and automated techniques provide the best operational solution to obtaining cloud motion vectors from geosynchronous satellite data.

c20 080900 22

W71-040

THE BEHAVIOR OF LOW-ENERGY PARTICLES DURING SUBSTORMS

R. D. Sharp, R. G. Johnson

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This paper reviews recent results on behavior of low-energy particles near the inner edge of the plasma sheet and the trapping boundary during magnetospheric substorms. Major emphasis is on Applications Technology Satellite (ATS-5) data, and a substorm at 0530 UT on 13 February 1970.

c29 111300 10

W71-041

SECOND QUARTERLY REPORT FOR THE UCSD PLASMA DETECTOR ON BOARD ATS-5

S. E. DeForest
University of California, San Diego

Contract NAS 5-10364

April 26, 1971

Data reduction for the UCSD 3DLE instrument on ATS-5 has now become routine, and is normally handled by the programming staff. During this quarter, the major effort has been on scientific analysis. The first results of this have been the development of a mapping of electric fields in the magnetosphere as inferred from particle motion. This model has been presented in an invited paper given at the American Geophysical Union Meeting in Washington, D. C. These results are also being prepared for publication. Some preliminary studies have been done to evaluate the accuracy of measuring bulk plasma flows with this instrument. These studies have been very encouraging.

Another part of analysis is correlation studies with other experimenters. We are currently exchanging data with Vela experimenters (Dr. E. Hones), rocket probes experimenters (Dr. R. Arnoldy), and ground based observations (Dr. S. Akasofu and Dr. R. Eather). We expect that this exchange of information will lead to much better understanding of magnetospheric phenomena than can be achieved by one group of experimenters.

A paper on spacecraft charging effects is still in the writing process, and should be completed in the next quarter. The same is true of a paper on drift waves.

c29 111402 02

W71-042

ATS-5 MILLIMETER WAVE PROPAGATION EXPERIMENT ATS TECHNICAL DATA REPORT - Final Report

S. J. Andrzejewski, R. J. Brockway, H. S. Fitzhugh, L. K. Harman

Westinghouse Defense and Electronic Systems Center, Baltimore, Maryland.

Contract No.: NAS-5-21598, Final Technical Report

Avail: NASA/GSFC, Greenbelt, Maryland

This report presents the final technical data report on the automated data processing program of the ATS-5 Millimeter Wave Experiment, which provided the first earth-space measurements of propagation effects at frequencies above 10 GHz. Attenuation measurements at 15.3 GHz (downlink) and 31.65 GHz (uplink) from a 20 month period are analyzed and compared with rainfall rate, sky temperature and radar backscatter. Statistical relationships of the above parameters, including density functions, cumulative distributions, and covariance coefficients are presented. Site diversity measurements taken over two base lines are described, and the diversity improvement developed. Methods of predicting path attenuation from sky temperature and rain rate measurements are discussed, and a storm analysis model is developed.

c07, c20 070300 32

W71-043

A COMPARISON OF OCEANIC AND CONTINENTAL SQUALL LINES IN THE TROPICS

E. J. Zipser

National Center for Atmospheric Research, Boulder, Colorado

Presented to: Symposium on Tropical Meteorology, Honolulu, Hawaii, Dec. 1970.

Recent investigations have focussed attention on the existence of cool down drafts in a number of tropical disturbances. H. Riehl analyzed a Carribbean disturbance in which downdraft air dominated the lower level in the eastern half of the system, ascribing the effect to more or less steady production of the downdraft from mid-tropospheric air moving in relative motion through the system from west to east, sinking under the influence of precipitation from a higher level.

The structure of these squall lines is characterized by active cumulonimbus clouds on the leading edge, in which low level air overtaken by the squall rises to the upper troposphere, and a large area of downdraft air, with mid-tropospheric origin, occupying the rain area and forming a microcold front advancing in the direction of propagation of the squall line. The mid-tropospheric air which sinks in the rain area to form the downdraft air is verified to remain highly unsaturated while sinking, with relative humidities as low as 50% in the heavy rain at low levels.

c20 081000 18

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M. Lunc
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Active Nutation Control 020700 01
AN ON BOARD, CLOSED-LOOP, NUTATION CONTROL SYSTEM FOR A SPIN-STABILIZED SPACECRAFT
L. H. Grasshoff
c31 A68-27202

Spacecraft Spin Control 020800 01
SYNCHRONOUS SATELLITE STATION KEEPING
M. J. Neufeld, B. M. Anzel
c31 A66-24771

Spacecraft Spin Control 020800 02
SURVEY OF REACTION CONTROL SYSTEMS FOR SYNCHRONOUS SATELLITES
E. Ellion, H. DiCristina, L. M. Wolf
c31 A67-31972

Spacecraft Spin Control 020800 03
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Spacecraft Spin Control 020800 04
DESPINNING THE ATS SPACECRAFT
J. P. Dallas
c32 N67-36222

Spacecraft Spin Control 020800 05
DESIGN CONSIDERATIONS FOR SPIN AXIS CONTROL OF DUAL-SPIN SPACECRAFT
J. McElvain, W. W. Porter
c31 N68-33538

Spacecraft Spin Control 020800 06
DESPINNING THE ATS SATELLITE
J. P. Dallas
c31 A70-34115

Ion Engine 020900 01
TIMETABLE FOR ION PROPULSION
G. R. Brewer, J. H. Molitor
c28 A67-32435

Ion Engine 020900 02
AN ADVANCED CONTACT ION MICROTHRUSTER SYSTEM
R. Worlock, J. Davis, P. Ramirez, E. James, O. Wood
c31 A68-33752

Ion Engine 020900 03
CONTACT ION ENGINE SYSTEM FOR ATS SATELLITES D AND E ANNUAL PROGRESS REPORT 22 MAR. 1967 - 22 MAR. 1968
R. M. Worlock
c28 N68-28816

Ion Engine 020900 04
REVIEW OF THE NASA PROGRAM IN ELECTRIC PRO-PULSION
J. Lazar
c28 A69-21216

Ion Engine 020900 05
AN ADVANCED CONTRACT ION MICROTHRUSTER SYSTEM
R. Worlock, J. J. Davis, E. James, P. Ramirez, O. Wood
c28 A69-39212

Ion Engine 020900 06
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c28 N70-13850

Ion Engine 020900 07
CONTACT ION ENGINE SYSTEM FOR ATS SATELLITES D AND E ANNUAL PROGRESS REPORT
R. M. Worlock
c31 N69-33841

Ion Engine-Description, ATS-D 020901 01
PACKAGING OF HIGH VOLTAGE POWER SUPPLIES FOR ELECTRIC PROPULSION
A. E. Hatheway, O. P. Wood
c09 A69-39941
c28 A69-39948

Ion-Engine - Description, ATS-D 020901 02
CESIUN CONTACT ION MICROTHRUSTER ABOARD APPLICATIONS TECHNOLOGY SATELLITE (ATS) IV
R. E. Hunter, R. O. Bartlett (NASA/GSFC), R. M. Worlock, E. L. James
(Electro-Optical Systems, Inc., Pasadena, Calif.)
c28 A69-21218

Ion Engine-Description, ATS-D 020901 03
CESIUM CONTACT ION MICROTHRUSTER ABOARD APPLICATIONS TECHNOLOGY SATELLITE (ATS) IV
R. E. Hunter, R. O. Bartlett (NASA/GSFC), R. M. Worlock, E. L. James
c28 A69-43238
c28 A69-21218

Thermal Control System 021000 01
COMPATABILITY EVALUATION OF AN AMMONIA-ALUMINUM-STAINLESS STEEL HEAT PIPE
E. D. Waters, P.P. King
c33 A70-41049

Thermal Control System - Description, ATS-1 021001 01
DEGRADATION OF THERMAL CONTROL COATINGS BY VACUUM ULTRAVIOLET IRRADIATION
J. Donohoe, E. N. Paczkowski
c18 A71-14896

Thermal Control System - Description, ATS-2 021003 01
APPLICATIONS TECHNOLOGY SATELLITE THERMAL DESIGN
R. J. Wensley, G. A. Kane
c31 W67-019

Hydrazine System 021100 01
THE APPLICATION OF CATAYTICALLY DECOMPOSED HYDRAZINE FOR SPINNING SYNCHRONOUS SATELLITE STATION KEEPING
M. E. Ellion, D. A. Mahaffy, H. DiCristine
c27 W67-029

Hydrazine System Performance, ATS-3 021102 01
AN EFFICIENCY EVALUATION OF THE ATS-3 HYDRAZINE ORBIT CONTROL SYSTEM
R. H. Greene, M. S. Russ, A. H. West
c31 A70-25464

Special Spacecraft Tests 021300 01
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ACOUSTICAL QUALIFICATION OF S-1C FIN STRUCTURES
C. J. Beck, Jr., D. R. Kennedy
c32 N68-28000

SECTION 03
LAUNCH VEHICLE

Keywords

Agena	Flight Analysis
Apogee Motor	Flight Performance
Atlas	Ignition
Centour	Motor Development
Delta	Rocket Motor
Exhaust Plume	Solid Propellant

Launch Vehicle 030000 01
ATLAS/AGENA-25 APPLICATIONS TECHNOLOGY SATELLITE C OPERATIONS SUMMARY
NASA TM-X-60905
c31 N68-19111

Launch Vehicle - Atlas Description 030001 01
DETAIL SPECIFICATION FOR ATLAS STANDARD LAUNCH VEHICLE SLV-3 CONVAIR MODEL 69, ADDENDUM XI
J. D. Fitzgearald
c31 W66-002

Launch Vehicle - Agena Description 030002 01
THE DELTA AND THOR/AGENA LAUNCH VEHICLES FOR SCIENTIFIC AND APPLICATIONS SATELLITES
C. R. Gunn
c31 N70-40230

Launch Vehicle - Apogee Motor Description 030004 01
APPLICATIONS TECHNOLOGY SATELLITE (ATS) MOTOR DEVELOPMENT
R. G. Anderson, R. A. Grippi
c31 N67-12119

Launch Vehicle - Apogee Motor Description 030004 02
APPLICATIONS TECHNOLOGY SATELLITE MOTOR DEVELOPMENT
D. R. Frank, R. G. Anderson
c28 N67-15719

Launch Vehicle - Apogee Motor Description 030004 03
DESIGN, FABRICATION AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR CHAMBER
V. F. Lardenoit, B. K. Wada, D. P. Kohorst
c28 N68-24974

Launch Vehicle - Apogee Motor Description 030004 04
IGNITION SYSTEM FOR THE ATS ROCKET MOTOR
T. P. Lee
c28 N68-24000

Launch Vehicle - Apogee Motor Description 030004 05
SOLID PROPELLANT ENGINEERING
Jet Propulsion Lab
c27 N67-23653

Launch Vehicle - Apogee Motor Description 030004 06
SOLID PROPELLANT ENGINEERING
Jet Propulsion Lab
c27 N67-29151

Launch Vehicle - Apogee Motor Description 030004 07
SPACE PROGRAMS SUMMARY 37-44, VOL. IV FOR THE PERIOD FEB. 1, 1967 TO MARCH 31, 1967 SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
Jet Propulsion Lab
c34 N67-29141

Launch Vehicle - Apogee Motor Description 030004 08
SOLID PROPELLANT ENGINEERING
Jet Propulsion Lab
c28 N67-34768

Launch Vehicle - Apogee Motor Description 030004 09
DESIGN, FABRICATION AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR NOZZLE
R. A. Grippi, Jr.
c28 N68-24008

Launch Vehicle - Apogee Motor Description 030004 10
QUALIFICATION PHASE FOR THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE ROCKET MOTOR - TECHNICAL MEMORANDUM, JULY-AUG. 1966
D. R. Frank, R. G. Anderson
c28 N68-24001

Launch Vehicle - Apogee Motor Description 030004 11
SOLID PROPELLANT ENGINEERING
Jet Propulsion Lab
c27 N68-12315

Launch Vehicle - Apogee Motor Description 030004 12
SPACE PROGRAMS SUMMARY NO. 37-47, VOL. 3 FOR THE PERIOD AUGUST 1, 1967 TO SEPTEMBER 30, 1967, SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
Jet Propulsion Lab
c30 N68-12306

Launch Vehicle - Apogee Motor Description 030004 13
SOLID PROPELLANT ENGINEERING
Jet Propulsion Lab
c27 N69-16483

Launch Vehicle - Apogee Motor Description 030004 14
SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT SPACE PROGRAM SUMMARY, VOL. 3
Jet Propulsion Lab
c28 N69-16475

Launch Vehicle - Apogee Motor Description 030004 15
DESIGN AND THEORY OF OPERATION-SAFETY-IGNITION DEVICE FOR APPLICATIONS TECHNOLOGY SATELLITE ROCKET MOTOR
E. N. Freeman
c28 N69-37123

Launch Vehicle - Apogee Motor Description 030004 16
THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE ROCKET MOTOR A SUMMARY REPORT
R. G. Anderson
c28 N70-20772

Launch Vehicle - Apogee Motor Description 030004 17
DESIGN, FABRICATION, AND TESTING OF THE APPLICATIONS TECHNOLOGY SATELLITE APOGEE MOTOR INSULATION
R. A. Grippi, Jr.
c28 N70-40996

ATS-1 Flight Analysis 030100 01
ATLAS TRAJECTORY AND PERFORMANCE ANALYSIS SLV-3/AGENA/ATS PROGRAM
C. J. Bertz
c34 W66-006

ATS-1 Flight Analysis 030100 02
MANNED SPACE FLIGHT NETWORK RADAR ANALYSIS REPORT
NASA/GSFC
c07 N68-10248

ATS-1 Flight Analysis 030100 03
ATLAS AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-1 MISSION
NASA/GSFC
c31 N69-24038

ATS-1 Flight Analysis 030100 04
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ATS-2 Flight Analysis 030200 01
APPLICATIONS TECHNOLOGY SATELLITE (ATS-A) AGENA VEHICLE 6152 FLIGHT PERFORMANCE EVAL. AND ANALYSIS REPORT
Lockheed Missile and Space Co., Sunnyvale, Calif.
c30 W67-006

ATS-2 Flight Analysis 030200 02
ATLAS-AGENA FLIGHT PERFORMANCE FOR THE APPLICATIONS TECHNOLOGY SATELLITE ATS-2 MISSION
NASA Lewis Research Center, Cleveland, Ohio
c31 N69-27260

ATS-3 Flight Analysis 030300 01
APPLICATIONS TECHNOLOGY SATELLITE - 3 LAUNCH REPORT
Launch Report Lockheed Missile & Space Co.
c30 W67-028

ATS-3 Flight Analysis 030300 02
FLIGHT PERFORMANCE OF THE ATLAS-AGENA LAUNCH VEHICLE IN SUPPORT OF THE APPLICATIONS TECHNOLOGY SATELLITE ATS-3
NASA Lewis Research Center, Cleveland, Ohio
c31 N69-37840

ATS-3 Flight Analysis, Apogee Motor Performance 030303 01
EXHAUST PLUME CONVECTIVE HEAT TRANSFER MEASUREMENTS FROM A SPACE FIRING OF THE ATS ROCKET MOTOR
R. W. Fehr, R. J. Wensley
c33 A70-33926

ATS-5 Flight Analysis 030500 01
ATS-V POST LAUNCH REPORT (PRELIMINARY)
NASA/GSFC Greenbelt, Maryland
c11, c34 W69-043

Keywords

Analytical Results
Nimbus/ATS Data Utilization Center (NADUC)
Operations Plan
Performance Evaluation
Quantitative Results

Operations 040000 01
NASA/GSFC OPERATIONS PLAN 13-66 APPLICATIONS TECHNOLOGY SATELLITE (ATS-B)
NASA/GSFC
c34 W66-032

Operations 040000 02
NASA/GSFC OPERATIONS PLAN 7-67 APPLICATIONS TECHNOLOGY SATELLITE (ATS-A)
NASA/GSFC
c34 W67-005

Operations 040000 03
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c08 N67-28765

Operations 040000 04
OPERATIONS PLAN 1967 APPLICATIONS TECHNOLOGY SATELLITE (ATS-C)
NASA/GSFC
c34 W67-021

Operations 040000 05
NASA/GSFC OPERATIONS PLAN 10-68 APPLICATIONS TECHNOLOGY SATELLITE (ATS-D)
NASA/GSFC
c34 W68-017

Operations 040000 06
QUANTITATIVE AND ANALYTICAL RESULTS OF ATS-1 (ATS-B) TELEMETRY DATA PROCESSING
M. A. Rabyor
c08 W69-057

Operations 040000 07
NASA/GSFC OPERATIONS PLAN 11-69 APPLICATIONS TECHNOLOGY SATELLITE (ATS-E)
NASA/GSFC
c11, c34 W69-023

Operations 040000 08
TELEMETRY DATA PROCESSING PLAN FOR ATS-B
J. B. Bourne
c08 W66-039

Operations 040000 09
A DESCRIPTION OF THE ATS-C FARADAY ROTATION EXPERIMENT QUALITY CHECK PROGRAM
T. Southerland
c07 W68-057

Operations 040000 10
ATS-E PFM REAL TIME SUPPORT
F. A. Wulff
c07 W69-062

Nimbus/ATS Data Utilization Center (NADUC) 040200 01
NIMBUS/ATS DATA UTILIZATION CENTER SUMMARY REPORT - MARCH, 1967 TO MARCH, 1969
D. R. Jones
c20 W69-018

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A. G. Oakes
c13, c20 W71-025

SECTION 05
ORBIT PARAMETERS

Keywords

Angle Tracking
Apogee Motor
Optimum Launch
Synchronous Orbit
Trajectories

Orbit Parameters 050000 01
X/Y ANGLE AND POLARIZATION ANGLE TRACKING OF THE ATS-B SPACECRAFT USING THE ROSMAN 85 FOOT ANTENNA NO. 2 AND MOJAVE 40 FOOT ANTENNA
T. Keating
c07 N67-19866

Orbit Parameters 050000 02
EXPLICITY EQUATIONS FOR OAO, ATS AND MARINER
D. H. Flowers
c21 A68-37541

Orbit Parameters 050000 03
ACCELERATIONS ON 24-HOUR SATELLITES AND LOW ORDER LONGITUDE TERMS IN THE GEOPOTENTIAL
C. A. Wagner
c30 N70-12925

ATS-1 050100 01
A SIMPLIFIED APPROACH FOR CORRECTION OF PERTURBATIONS ON A STATIONARY ORBIT
R. E. Balsam, B. M. Anzel
c30 A68-25483
c30 A69-39757

ATS-E 050500 01
OPTIMUM LAUNCH TRAJECTORIES FOR THE ATS-E MISSION
O. F. Spurlock, F. Teren
c30 N70-32027
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ATS-E 050500 02
OPTIMUM TRAJECTORIES TO CIRCULAR SYNCHRONOUS EQUATORIAL ORBIT FOR SMALLER - THAN - OPTIMUM APOGEE MOTORS
F. Spurlock, F. Teren
c30 N70-38570

SECTION 06
GROUND STATIONS

Keywords

Antenna	Maser
Control System	Mojave
Cooby Creek	Range and Range Rate
Data Acquisition	Rosman
FM Transmitters	SSB Transmitters
Ground Equipment	Small Aperture Ground Station
Ground Station	Telemetry and Command System
Japan	Telecommunications

Ground Stations 060000 01
APPLICATIONS TECHNOLOGY SATELLITE RANGE AND RANGE RATE - DESIGN EVALUATION REPORT
General Dynamics
c21 W65-001

Ground Stations 060000 02
FINAL REPORT FOR ATS SSB AND FM TRANSMITTERS
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Raytheon Company
c07 W66-005

Ground Stations 060000 03
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NASA/GSFC
c08 W66-036

Ground Stations 060000 04
OPERATIONAL MANUAL FOR ATS TELEMETRY AND COMMAND SYSTEM (ROSMAN II AND MOJAVE GROUND STATIONS)
NASA/GSFC
c11 W66-008

Ground Stations 060000 05
TELEMETRY HANDBOOK ATS-B (F-1)
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c07 W66-024

Ground Stations 060000 06
DATA ACQUISITION, REDUCTION AND ANALYSIS FOR THE APPLICATIONS TECHNOLOGY SATELLITE COMMUNICATION SYSTEM
G. E. Dehm
c07 W67-040

Ground Stations 060000 07
AUTOMATIC, REAL TIME DATA ACQUISITION AND PROCESSING FOR ATS COMMUNICATIONS EXPERIMENTS
G. E. Dehm, R. W. Donaldson
c07 A67-20669

Ground Stations 060000 08
MULTICOLOR SPIN-SCAN CLOUD COVER EXPERIMENT (MSSCC) GROUND STATION STUDY REPORT
Westinghouse Elec. Corp., Balto., Md.
c11, c14 W67-008

Ground Stations 060000 10
MICROWAVE PUMP REQUIREMENTS FOR FIELD OPERATIONAL BROADBAND RUTILE TRAVELING - WAVE MASERS
L. E. Rouzer
c16 N68-33635

Ground Stations 060000 11
MINUTES, GROUND STATION COMMITTEE MEETING LONDON, ENGLAND
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c34 W70-019

Ground Stations 060000 12
AN AIR TRANSPORTABLE SATELLITE TELECOMMUNICATIONS TERMINAL
H. Salasin, General Electric Co.
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c07

Ground Stations 060000 14
APPLICATIONS TECHNOLOGY SATELLITE 6 Gc - 4 Gc FM TRANSLATOR INSTRUCTION MANUAL
G. C. Patterson, L. W. Nicholson
c11, W66-038

Rosman 060100 01
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Westinghouse Elec. Corp., Baltimore, Md., Report
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Rosman 060100 02
THE MASER EXPERIMENT
C. C. Johnson
c16 A67-36595

Rosman 060100 03
FINAL REPORT ATS COMMUNICATIONS INTEGRATION CONTRACT ROSMAN GROUND STATION
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Rosman 060100 04
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Mojave 060200 02
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c07 W67-007

Mojave 060200 03
FINAL REPORT, ATS COMMUNICATIONS INTEGRATION MOJAVE GROUND STATION
Westinghouse Elec. Corp., Balto., Md., Report
c11 W67-018

Ground Station - Cooby Creek 060300 01
APPLICATIONS TECHNOLOGY SATELLITE TRANSPORTABLE STATION TELEMETRY AND COMMAND SYSTEM OPERATIONS MANUAL (COOBY CREEK, AUSTRALIA)
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c11 W66-004

Ground Station - Cooby Creek 060300 02
REPORT ON THE CLOSED LOOP AUTOMATIC FREQUENCY CONTROL (AFC) SYSTEM OF THE SINGLE SIDE BAND (SSB) TRANSMITTER AT THE TRANSPORTABLE GROUND STATION COOBY CREEK, AUSTRALIA
D. V. Harris
c11 W67-004

Kashima, Japan 060400 01
PRESENT STATUS OF KASHIMA GROUND STATION FOR ATS
Radio Research Labs., Ministry of Posts and Telecommunications, Japan
c11 W66-035

Kashima, Japan 060400 02
ELECTRICAL PERFORMANCE OF THE 30 M CASSEGRAIN ANTENNA AT THE KASHIMA EARTH STATION
M. Kajikawa
c09 A68-32168

Kashima, Japan 060400 03
CHARACTERISTICS OF 26Mϕ DIAMETER PARABOLOIDAL ANTENNA AT KASHIMA EARTH STATION
Ministry of Posts and Telecommunications
c11 W70-023

Kashima, Japan 060400 04
SSCC MONCHROMATIC PICTURE RECEIVING EQUIPMENT AT KASHIMA GROUND STATION
Ministry of Posts and Telecommunications
c11, c20 W70-024

Small Aperature Ground Station 060600 01
MULTIPLE ACCESS COMMUNICATIONS USING SMALL APERATURE GROUND TERMINAL
General Elec. Co., Missile & Space Div., 7/68
c07 W68-020

SECTION 07
COMMUNICATIONS EXPERIMENT

Keywords

AFC
Airline Communications
Airline Safety
Air Traffic Control
Auroral Studies
Austrailian Communications
FDMA
Frequency Stability
Hydrological Communications
India Communications
Interferometer
Japan Communications
L-Band
Maritime Communications
Millimeter Wave
Military Satellite
Multiple Access
Navigation
PCM
Phase Modulation
Postion Fixing
Propagation
Radiometer
Ranging
Satellite-to-Aircraft
Scintillation
SHF
Spread Spectrum
SSB
TDMA
Time Synchronization
Transmission
VHF

SHF Communications Experiment 070100 01
ANALYSIS OF NON-LINEAR NOISE IN FDM TELEPHONY TRANSMISSION OVER AN SSB-PM SATELLITE COMMUNICATION SYSTEM
P. J. Hefferman
NASA Tech Note TN-D-2365
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SHF Communications Experiment 070100 02
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W. C. Bunyea, New Mexico State University, Physical Science Lab
c07

SHF Communications Experiment 070100 04
THE APPLICATIONS TECHNOLOGY SATELLITE
R. H. Pickard
c31 A67-30694
c31 A67-30684
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SHF Communications Experiment 070100 06
MULTIPLE ACCESS FREQUENCY CONTROL SYSTEMS
E. Osborne
c07 W66-025

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SMALL USER OF THE ATS MULTIPLE ACCESS SHF TRANSPONDER
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SHF Communications Experiment 070100 08
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R. J. Darcey
c07 W68-002

SHF Communications Experiment 070100 09
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c07 A69-42500

SHF Communications Experiment 070100 12
SHORT TERM FREQUENCY STABILITY MEASUREMENTS OF ATS-1 MULTIPLE ACCESS COMMUNICATION SYSTEM
G. K. Kuegler, R. Martel
c07 A69-42509

SHF Communications Experiment 070100 13
A TDMA/PCM EXPERIMENT ON APPLICATION TECHNOLOGY SATELLITES
Y. Suguri, H. Doi, E. Metzger
c07 A69-42510

SHF Communications Experiment 070100 14
ATS SSB-FDMA/PH. M MULTIPLE ACCESS EXPERIMENT
E. J. Mueller, R. J. Martel, L. W. Nicholson, B. R. Perkins
c07 W69-019

SHF Communications Experiment 070100 15
DOPPLER FREQUENCY SPREAD CORRECTION DEVICE FOR MULTIPLEX TRANSMISSIONS
David W. Lipke
c07 N69-39978

SHF Communications Experiment 070100 16
FREQUENCY STABILITY CHARACTERISTICS AND STABILIZATION IN AN SSB-FDMA/PH. M MULTIPLE ACCESS SYSTEM
S. J. Andrzejewski
c07 A70-25460

SHF Communications Experiment 070100 17
A TDMA/PCM EXPERIMENT ON APPLICATIONS TECHNOLOGY SATELLITES
Y. Suguri, H. Doi, E. Metzger
c07 W71-011

SHF Communications Experiment 070100 18
NOISE CHARACTERISTICS OF AN SSB-FDMA/PH. M MULTIPLE ACCESS SYSTEM
S. J. Andrzejewski, E. Crampton
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Special Experiments 070102 01
REPORT ON FREQUENCY STABILITY OF VHF EXPERIMENTS ON ATS-3
T. M. Stores
c07 W67-032

SHF Communications Experiment, Other U.S. 070103 01
SUBMICROSECOND TIME SYNCHRONIZATION OF GROUND STATIONS VIA THE APPLICATIONS TECHNOLOGY SATELLITE
W. M. Mazur, Jr., D. Barbiere
c07, c11 W71-008

SHF Communications Experiment, Other U.S. 070103 02
VLBI OBSERVATIONS OF RADIO EMISSIONS FROM GEOSTATIONARY SATELLITES
R. D. Michelini, M. D. Grossi
c07 A71-33845

SHF Communications Experiment, Other U.S. 070103 03
VERY LONG BASELINE INTERFEROMETER (VLBI) EXPERIMENTS USING ATS-3 AND ATS-5 SATELLITES
J. Ramasastry, P. E. Schmid, Jr., B. Rosenbaum
c14 N71-16447

SHF Communications Experiment, TV Tests 070104 01
REPORT ON PATTERN AND RECEPTION CHARACTERISTICS RECORDED USING ATS-III IN CONJUNCTION WITH AN EXPERIMENTAL EARTH STATION AT CRYSTAL BEACH, OTTAWA, ONTARIO, CANADA
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c11,

VHF COMMUNICATIONS EXPERIMENT

VHF Communications Experiment 070200 01
ATS TO AID AIRLINE COMMUNICATIONS TESTS
P. J. Klass
c07, c11

VHF Communications Experiment 070200 02
A SPLIT PERSONALITY VHF COM SYSTEM
B. Spratt
c07 A67-10665

VHF Communications Experiment 070200 03
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J. P. Corrigan
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J. P. Corrigan
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AIRCRAFT, SPACECRAFT SATELLITE AND RADAR OBSERVATIONS OF HURRICANE GLADYS, 1968
T. T. Fujita, R. C. Gentry, R. C. Sheets
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c20 A71-10589

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AIRCRAFT, SPACECRAFT, SATELLITE AND RADAR OBSERVATIONS OF HURRICANE GLADYS, 1968
R. C. Gentry, R. C. Sheets, T. T. Fujita
c20 A71-16662

SECTION 09
GRAVITY GRADIENT EXPERIMENT

Keywords

Attitude Control	Passive Damper
Gravity Gradient	Stabilization

GRAVITY GRADIENT EXPERIMENT

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Gravity Gradient Experiment 090000 03
A SYSTEM FOR PASSIVE ATTITUDE CONTROL OF SATELLITES THROUGH THE VISCOUS COUPLING OF GRAVITY GRADIENT AND MAGNETIC FIELDS
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GRAVITY GRADIENT STABILIZATION
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R. Moyer, H. Foulke, with General Electric Co.
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SECTION 10
OTHER SPACE TECHNOLOGY EXPERIMENTS

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Electron Content	Propagation Delay
Electron Production Rate	Protonospheric Observations
Equatorial Scintillation	Radio Propagation
Faraday Effect	Ranging
F-Layers	Reflectometer
Geomagnetics	Scintillation Index
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Ionosphere	Solar Cell Radiation
Magnetic Storms	Solar Eclipse
Magnetometer	Solar Flares
Morphology	Solar Protons
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Diurnal Variations	Omnidirectional Detector
Electron Drift	Omnidirectional Spectrometer
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Ion Detector 110700 05
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SIMULTANEOUS MAGNETIC FIELD VARIATIONS AT THE EARTH'S SURFACE AND AT SYNCHRONOUS, EQUATORIAL DISTANCE 2 AND MAGNETIC STORMS
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Magnetometer 110800 12
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Magnetometer 110800 14
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Calif, Univ., Los Angeles, Calif.
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Magnetometer 110800 15
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Magnetometer 110800 16
SIMULTANEOUS MAGNETIC FIELD VARIATIONS AT THE EARTH'S SURFACE AND AT SYNCHRONOUS, EQUATORIAL DISTANCE 1, II.
W. D. Cummings, P. J. Coleman, Jr.
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Magnetometer 110800 17
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Magnetometer 110800 21
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Magnetometer 110800 26
SIMULTANEOUS MEASUREMENTS OF THE MAGNETIC FIELD AT ATS-1 AND EXPLORER 33 DURING MAGNETOSPHERIC SUBSTORMS
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100503	01	c13	A68-13468
DAVIS, R.			
090000	18	c31	A66-10798
090000	18	c31	A67-30663
DAVIS, T. W.			
070209	02	c11	A70-26939
DAWSON, W. P.			
100700	02	c03	N69-14966
100700	03	c03	N69-25365
DAY, J. W. B.			
070300	31	c07	N71-21419
DEDECKER, R.			
080100	56	c20	N71-11618
DEERKOSKI, L. F.			
070700	02	c07	A69-36254
DEES, J. W.			
070300	01	c07	N68-17924
070300	07	c07	W69-028
070300	14	c07	A70-41337
DEFOREST, S. E.			
111400	02	c29	W69-045
111400	03	c29	W70-017
111400	07	c13	A71-31755
111400	08	c13	N71-12774
111400	09	c29	W70-075
111400	11	c29	W71-001
111401	01	c29	W69-044
111402	01	c29	W70-081
111402	02	c29	W71-041
DEHM, G. E.			
060000	05	c07	W67-040
060000	07	c07	A67-20669
DENOYER, J. M.			
080000	33	c31	A71-34244
DE ZOUTE, O. J.			
070203	05	c07	W66-037
DICRISTINA, H.			
020800	02	c31	A67-31927
021100	01	c27	W67-029
DIEMINGER, W.			
100500	61	c07	N70-38482
DIPIETRO, J.			
070800	01	c07	W70-046
DOI, H.			
070100	13	c07	A69-42510
070100	17	c07	W71-011
070400	05	c07	A70-18409
DONALDSON, R. W.			
060000	07	c07	A67-20669
DONNELLY, J.			
020100	01	c09	A69-13239
DONAHOE, M. J.			
021001	01	c18	A71-14896
DOOLITTLE, R. C.			
080900	04	c14	N68-28845
080900	19	c20	N70-30131
DOORE, G. S.			
080800	04	c08	A70-11279
DRUMMOND, R. R.			
080200	01	c20	W66-012
DUBOSE, J. F. ET. AL.			
080400	07	c07, c21	W71-022
DUNGLY, J. W.			
100500	40	c13	N70-27599
-E-			
EASTMAN, F. H.			
080300	01	c14, c20	W66-013
EDBAUER, F.			
070212	04	c21	N70-22391
ELECTRO OPTICAL SYSTEMS			
020900	06	c28	N70-13850
100300	01	c14	N71-10364
100300	05	c30	N71-25965
ELKINS, T. J.			
100500	05	c07	A67-35172
100500	05	c07	A68-29448
100500	26	c13	A69-23831
100500	33	c13	A69-38093
100500	36	c13	N70-32237
100500	58	c13	A70-24810
100504	01	c07	W68-068
ELLION, M. E.			
020800	02	c31	A67-31927
021100	01	c27	W67-029
ENDLICH, R. M.			
080900	08	c07, c20	W68-028
080900	10	c20	W69-020
080900	21	c20	W69-069
ENGE, F. J.			
080400	05	c21	A70-22193
ENGLAND, F. E.			
110000	01	c31	A68-42155
110000	08	c08	A68-44255
ETTINGER, M.			
080800	04	c08	A70-11279

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HANAS, O. J.			
070704 02	c21	N70-34300	
070704 05	c07	A71-18816	
070705 01	c07	W71-002	
HANSON, K. J.			
080100 14	c20	W67-034	
080100 15	c14, c20	W67-035	
080100 16	c14, c20	W67-036	
080100 19	c14, c20	W67-037	
080100 53	c20	N71-11615	
080800 05	c13	W70-011	
HARIHARAN, T. A.			
080000 29	c11, c13, c20	W70-047	
HARMAN, L. K.			
070213 03	c07	A70-41366	
070300 32	c07, c20	W71-042	
HARRIS, A. W.			
110800 10	c13	W68-010	
HARRIS, D. V.			
060300 02	c11	W67-004	
HARTMAN, G. K.			
100500 76	c13	A71-19034	
100500 100	c07	N71-21420	
HASEGAWA, A.			
110300 14	c29	A70-13976	
110300 23	c29	N70-34910	
HATHEWAY, A. E.			
020901 01	c09	A69-39941	
020901 01	c28	A69-39948	
HAUPT, I.			
080000 01	c20	N68-33988	
080000 16	c20	N69-33056	
080000 20	c20	N70-24276	
080000 21	c20	N71-15934	
HAYASHI, I.			
110300 11	c29	N70-11028	
110901 06	c09	N70-36831	
HEANY, J. B.			
100300 02	c33	A69-33270	
100300 04	c29	N71-25311	
HEFFERNAN, P. J.			
070100 01	c07	W66-040	
HELLER, G. B.			
110600 02	c33	A68-21360	
HEMPTON, G. F.			
070206 01	c07	W67-012	
HERMAN, L.			
080100 78	c20	W71-032	
HICKERSON, R. L.			
110800 36	c13, c29	W69-032	
HILBERG, R. H.			
100500 92	c29	W70-067	
HILTON, G. E.			
080400 01	c21	N67-36634	
080400 02	c20, c21	W65-003	
080400 08	c20, c21	W65-004	
080401 03	c20, c21	W66-042	
080401 04	c20	W66-014	
080402 01	c21	W68-058	
080402 02	c21	W68-059	
HINDERMAN, J. D.			
100700 04	c33	A69-33277	
HOBART, D.			
080800 04	c08	A70-11279	
HOBBS, R. B.			
090000 43	c33	A68-14881	
HODGE, D. B.			
070300 23	c07, c20	W70-056	
HOLLENBAUGH, R.			
080400 02	c20, c21	W65-003	
080401 03	c20, c21	W66-042	
HOLZER, R. E.			
110800 19	c13	A68-41693	
HOMES, E. W., JR.			
110300 09	c29	W69-008	
110300 32	c29	W71-034	
110300 38	c30	A71-27912	
HORIUCHI, H.			
080402 01	c21	W68-058	
080402 02	c21	W68-059	
HORN, T. N.			
090000 33	c31	W66-022	
HORNING, B. L.			
110800 41	c29	W70-014	
110800 61	c29	W71-016	
HOSSEINIEH, H. H.			
100500 19	c13	A69-14030	
HOUGHTON, D. D.			
080100 65	c11, c20	W70-062	
HUBERT, L. F.			
080900 02	c14, c20	W67-017	
080900 06	c20	W68-062	
081200 06	c20	W69-021	
HUGHES AIRCRAFT CO.			
010000 01	c34	W66-001	
010000 17	c31	N69-19699	
020200 03	c03	N71-10655	
021100 01	c27	W67-029	
060000 05	c07	W66-024	
070200 13	c07	W67-027	
070200 16	c07	W67-030	
HULL, L.			
081000 02	c20	N68-33032	
HUNDHANSEN, A. J.			
110800 20	c29	A68-41692	
HUNTER, R. E.			
020901 02	c28	A69-21218	
020901 03	c28	A69-21218	
020901 03	c28	A69-43238	

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IKEDA, M.			
070400 08	c07	A70-18412	
ILLIKAINEN, M. E.			
070704 02	c21	N70-34300	
IMAMOTO, S. S.			
110100 01	c29	W67-043	
110100 02	c29	N68-21751	

ROUTT, R. P.			
020600	01	c28	A68-44237
ROUZER, L. E.			
060000	10	c16	N68-33635
RUBIN, P. A.			
010000	42	c31	A71-33588
RUBIN, R.			
020000	11	c09	A68-25454
020000	19	c09	A69-40692
RUIZ, A. L.			
080000	03	c20	W67-026
080000	05	c20	N71-11602
080000	06	c20	N71-11603
RUFF, I.			
080100	25	c14	W69-056
RUSS, M. S.			
021102	01	c31	A70-25464
RUSSELL, C. T.			
110800	19	c13	A68-41693
110800	51	c29	W70-068
110800	52	c29	W70-078
110800	59	c29	W71-018
RUSTARD, L. W.			
110000	02	c31	A68-34852
110000	06	c14	A68-11719
110000	07	c14	A67-34788
110000	09	c11	A68-44303

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SANDERS ASSOCIATES, INC.			
111000	09	c14	W69-060
SANDERS, T. C.			
111300	01	c14	A69-19199
SAUER, H.			
110400	16	c29	W69-013
SCHMID, P. E., JR.			
070103	03	c14	N71-16447
100500	78	c29	N70-39306
SCHMIDT, G.			
100500	61	c07	N70-38482
100500	76	c13	A71-19034
SCHODEL, J. P.			
070212	03	c07	N69-27964
100500	30	c13	A69-32926
100500	76	c13	A71-19034
100512	01	c13	W68-061
SCHRICK, K. W.			
070212	07	c20	A70-42653
070212	08	c21	A70-46201
SCHULZ, M.			
110300	08	c29	A69-16259
110300	19	c29	N70-34906
110300	35	c07	A71-37361
110800	42	c29	W70-013
110900	01	c13	W68-014
SCHWALENBERG, T.			
080100	33	c14, c20	W68-054
SEREBRENY, S. M.			
080000	19	c14	N70-20893
080100	45	c20	N70-46048
080900	11	c20	N70-10792
080900	13	c20	N70-13525
080900	25	c20	W70-086
SESSIONS, W. B.			
100500	97	c29	N71-25025
SHAFRIR, U.			
080100	15	c14, c20	W67-035
080100	64	c11, c20	W70-061
SHARP, R. D.			
111300	03	c29	W69-046
111300	04	c29	W70-016
111300	05	c29	W70-073
111300	06	c29	W70-074
111300	07	c29	W70-069
111300	08	c29	A71-11497
111300	10	c29	W71-040
111302	01	c29	W69-038
111302	02	c29	W69-058
111302	05	c29	N70-41896
111302	10	c29	A71-21216
111302	11	c14	A71-15587
SHAW, D. B.			
080601	01	c14, c20	W66-015
SHAW, R.			
020000	21	c28	A69-21212
SHEETS, R. C.			
081200	10	c20	A71-16662
SHELLY, E. G.			
111300	01	c14	A69-19199
111300	02	c29	W69-049
111300	04	c29	W70-016
111300	05	c29	W70-073
111300	06	c29	W70-074
111300	07	c29	W70-069
111300	08	c29	A71-11497
111300	09	c29	W70-088
111302	10	c29	A71-21216
111302	11	c14	A71-15587
SHEPHARD, B. S.			
090000	62	c32	N70-32728
SHEPHARD, J. D.			
020600	01	c28	A68-44237
SHIVELY, O. R.			
090000	62	c32	N70-32728
SHKOLLER, B.			
080100	64	c11, c20	W70-061
SHRUM, R. E.			
070206	06	c07, c20	W70-030
SIERER, W. H.			
020000	06	c31	A67-35934
020000	15	c31	A69-21988
SIKDAR, D. N.			
080100	24	c20	A71-14204
080100	30	c14, c20	W68-051
080100	43	c20	W70-026
080100	54	c20	N71-11616
080100	74	c20	A71-23553
080100	75	c20	W71-029
080100	77	c20	W71-031
SIMMONS, L. L.			
110800	06	c31	N69-33973
SINGER, S.			
110300	26	c29	N70-34913
110300	38	c30	A71-27912

WADDEL, R. C. (Continued)			
110500	08	c03	N67-35934
110500	09	c03	A69-35704
110500	11	c03	W71-037
WAETJEN, R. M.			
070704	05	c07	A71-18816
WAGNER, C. A.			
050000	03	c30	N70-12925
WALDMAN, H.			
100500	89	c29	W70-072
100509	05	c13	W70-083
WALKER, D. M. C.			
080000	23	c13	A70-31680
WARE, J. N.			
070206	02	c07	W68-015
070206	03	c07	W68-026
070206	04	c07	W69-003
WARNECKE, G.			
080100	10	c13	A68-24442
WARREN, C. S.			
110700	09	c13	W68-038
110700	12	c13	W68-012
110700	14	c13	A68-41672
110700	16	c13	W68-038
110700	20	c29	N70-41910
110700	23	c29	W69-051
WATANABE, K.			
081000	06	c20	A69-42895
081000	13	c20	N69-26282
081200	01	c14, c20	W68-048
WATERS, E. D.			
021000	01	c33	A70-41049
100700	04	c33	A69-33277
WATTERSON, R.			
111000	11	c14	A71-10985
WEBB. H. D.			
100500	29	c30	A69-25161
WEBER, R. R.			
111000	05	c30	A69-19715
WENGROW, G. L.			
110800	12	c13	W68-013
WENSLEY, R. J.			
021003	01	c31	W67-019
030303	01	c33	A70-33926
WERNLEIN, C. E.			
070700	08	c07	N71-24913
WEST, A. H.			
021102	01	c31	A70-25464
WESTINGHOUSE ELECTRIC CORP.			
060000	08	c11, c14	W67-008
060100	01	c11	W66-007
060100	03	c07, c11	W68-003
060200	02	c07	W67-007
060200	03	c11	W67-018
070100	07	c07	W67-041
070101	01	c07	N70-36577
070101	02	c07	N70-41386
070208	03	c07	N69-11858
070209	07	c07	N70-10153
070213	02	c07	N70-32909
070701	01	c07	W71-028
080100	34	c08	N70-22849
090000	47	c15	N68-29903
090000	58	c31	N70-32683
WESTWOOD, D. H.			
070705	01	c07	W71-002
WEYGANDT, P.			
090000	53	c31	A69-18325
WHISNAUT, J. M.			
090000	48	c31	N68-35204
WHITNEY, H. E.			
000000	04	c13	A68-31964
000000	04	c07	A69-32106
100500	21	c13, c29	W70-091
100500	24	c07	A69-22461
100500	25	c13	N69-26422
100500	36	c13	N70-32236
100500	64	c29	W69-054
100500	81	c13, c29	W70-049
100500	87	c07	N71-16232
100500	96	c07	A71-23522
100518	01	c13, c29	W70-037
WHITNEY, M. B.			
080900	04	c14	N68-28845
WIEGMAN, E. J.			
080100	45	c20	A70-46048
080900	11	c20	N70-10792
080900	25	c20	W70-086
WILTSE, J. C.			
070300	01	c07	N68-17924
070300	14	c07	A70-41337
WINCKLER, J. R.			
110400	01	c13	N69-12714
110400	02	c13	N69-12715
110400	04	c13	W68-035
110400	05	c13	W68-036
110400	06	c13	A68-37939
110400	07	c29	A68-37938
110400	08	c13	A68-41689
110400	09	c29	A68-41696
110400	10	c13	N69-29710
110400	12	c13	N70-20652
110400	14	c29	W69-011
110400	16	c29	W69-013
110400	18	c29	W69-010
110400	19	c29	A70-30090
110400	21	c29	A69-40508
110400	22	c13	A69-43172
110400	24	c29	A69-38082
110400	30	c13	A71-14519
110400	32	c29	W70-070
WINSOR, K.			
020200	04	c03	A70-31146
WISCONSIN, UNIVERSITY OF			
080100	03	c13	N68-12817
080100	03	c13	N68-17061
080100	04	c14	N68-12818
080100	61	c20	N71-28598
WISHNA, S.			
070213	01	c07	A70-12566
080200	03	c11	A69-13240
080200	04	c07	N69-23317
WOLF, L. M.			
020800	02	c31	A67-31972
WOOD, O. P.			
020900	02	c31	A68-33752
020900	05	c28	A69-39212
020901	01	c09	A69-39941
020901	01	c28	A69-39948
WOODWARD, W. H.			
020200	02	c30	N68-33173

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