NASA

Management
A Bibliography for NASA Managers

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National Aeronautics and Space Administration

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NASA SP-7500(24)

MANAGEMENT

A BIBLIOGRAPHY FOR NASA MANAGERS

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system during 1989.

National Aeronautics and Space Administration
Office of Management
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Washington, DC 1990

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FOREWORD

Management gathers together references to pertinent documents — reports, journal articles, books — that will assist the NASA manager to be more productive. Items are selected and grouped according to their usefulness to the manager as *manager.* A methodology or approach applied to one technical area may be worthwhile for a manager in a different technical field.

Individual sections can be quickly browsed. Indexes will lead quickly to specific subjects or items.

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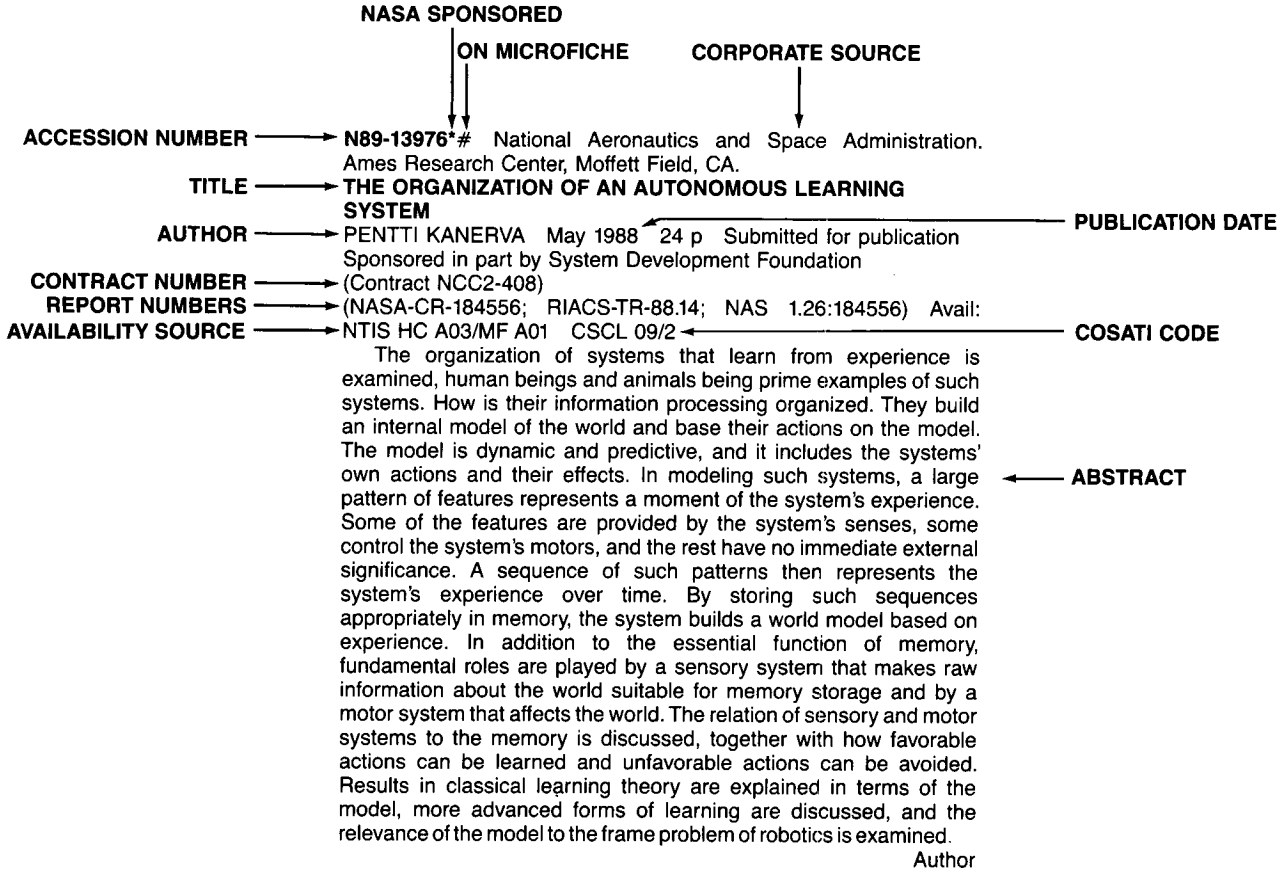
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE AND ABSTRACT

MANAGEMENT

A Bibliography for NASA Managers

MARCH 1990

01

HUMAN FACTORS AND PERSONNEL ISSUES

Includes Organizational Behavior, Employee Relations, Employee Attitudes and Morale, Personnel Management, Personnel Development, Personnel Selection, Performance Appraisal, Training and Education, Computer Literacy, Human Factors Engineering, Ergonomics, Human-Machine Interactions.

A89-10590
THE PILOT'S ASSOCIATE - ENHANCING SITUATIONAL AWARENESS THROUGH COOPERATING EXPERT SYSTEMS
DOUGLAS M. ROUSE and THOMAS C. HUMMEL (USAF, Wright-Patterson AFB, OH) IN: Aerospace Behavioral Engineering Technology Conference, 6th, Long Beach, CA, Oct. 5-8, 1987, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1988, p. 121-125. refs
(SAE PAPER 871896) Copyright

A new concept developed for the cockpit information management, the Pilot's Associate (PA), is discussed. The PA is a network of cooperating expert systems designed to enhance the situational awareness of the pilot by assisting the pilot with information management and aircraft control. The five systems composing the PA network include the Mission Planner, Tactics Planner, Situation Assessment, System Status, and Pilot-Vehicle Interface systems. Besides by converting and reducing data into essential prioritized information in a timely fashion and communicating this information to the pilot, the PA will also analyze the information and advise the pilot on recommended courses of action, enhancing his situational awareness and helping him to make better decisions. I.S.

A89-10655
AEROSPACE TECHNOLOGY - WINDSHEAR FAA: BOEING WINDSHEAR TRAINING AID PROGRAM
CHARLES R. HIGGINS and EDGARS A. KUPCIS (Boeing Commercial Airplane Co., Seattle, WA) IN: International Pacific Air and Space Technology Conference, Melbourne, Australia, Nov. 13-17, 1987, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1988, p. 353-358.
(SAE PAPER 872441) Copyright

Severe microburst windshear has been identified as a significant cause of airline accidents during the takeoff and landing phases of flight. In 1985 the Federal Aviation Administration contracted with an industry team (manufacturers, airline training departments, meteorological experts, pilots groups, other interested parties) to develop a windshear training program for transport pilots. This paper treats the organizational structure used to develop industry consensus on the pilot training issues as well as reports on the principal elements of the training program developed by this industry team. The paper discusses the tools available to flight crews to recognize and avoid microburst windshear, and failing that, how to recover from an inadvertent encounter. Author

A89-12865
SATELLITE TRAINING DEVELOPMENT ACTIVITIES - A STATUS REPORT
H. MICHAEL MOGIL (NOAA, National Environmental Satellite, Data, and Information Service, Camp Springs, MD) IN: Conference on Satellite Meteorology and Oceanography, 3rd, Anaheim, CA, Feb. 1-5, 1988, Preprints. Boston, MA, American Meteorological Society, 1988, p. J29-J34.
Copyright

The U.S. National Environmental Satellite, Data and Information Service (NESDIS) has explored multiagency training methods' development, giving attention to satellite imagery interpretation. Budget and personnel cutbacks, together with the imminent arrival of satellite imagery-in-motion displays, have prompted NESDIS's participation in the first Interagency Training Coordination Working Group at Scott AFB. Other participating agencies were the National Weather Service, the Air Weather service, and the Naval Oceanography Command. O.C.

A89-14857
A WOMAN'S PLACE IN SPACE
DEBRA PLYMATE (FAA, Washington, DC) Space World (ISSN 0038-6332), vol. Y-11-299, Nov. 1988, p. 18-22.
Copyright

The history of women in the space program is reviewed. The first women pilots, the flying records held by various women, and efforts to have women included in the space program are discussed. The role of women in the Space Shuttle program is examined in detail and a list of women who have flown in space is presented. R.B.

A89-16737
AIRCREW SELECTION SYSTEMS
JEFFREY E. KANTOR and THOMAS R. CARRETTA (USAF, Human Resources Laboratory, San Antonio, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 59, Nov. 1988, p. A32-A38.
Copyright

This paper describes a computerized battery of psychomotor and cognitive tests designed to identify candidates who would not complete pilot training or not be qualified for a fighter assignment after training. All or some of the battery's 15 tests were given to 1622 USAF pilot candidates prior to training, and their test scores were regressed against various flying performance measures. It was found that two particular psychomotor tests and the tests of perceptual speed, decision making speed, and the memory function are significant predictors of flying performance. An experimental pilot selection system was designed on the basis of these results and was found to have a substantial practical value in reducing attrition from pilot training. I.S.

A89-17831*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM - A RESOURCE FOR AEROSPACE EDUCATION
ROBERT W. BROWN (NASA, Educational Affairs Div., Washington, DC) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 10 p. refs
(IAF PAPER 88-467) Copyright

The role of the International Space Station in future U.S. aerospace education efforts is discussed from a NASA perspective. The overall design concept and scientific and technological goals of the Space Station are reviewed, and particular attention is given

to education projects such as the Davis Planetarium Student Space Station, the Starship McCullough, the Space Habitat, the working Space Station model in Austin, TX, the Challenger Center for Space Life Education, Space M+A+X, and the Space Science Student Involvement Program. Also examined are learning-theory aspects of aerospace education: child vs adult learners, educational objectives, teaching methods, and instructional materials. T.K.

A89-25471#
THE MANAGEMENT OF GROUP CULTURE IN EXTENDED SPACE FLIGHT
JOHN NICHOLAS (Loyola University, Chicago, IL) and FRANCIS L. ULSCHAK (H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 11 p. refs
(AIAA PAPER 89-0590) Copyright

The hardest thing during a flight is keeping good relations going with the ground and among the crew. With growing fatigue, there is a danger of serious lapses. The flight becomes increasingly difficult. Author

A89-28221
PILOT TRAINING IN THE ROYAL AIR FORCE - PHILOSOPHY, STRUCTURE AND EQUIPMENT
J. K. WALTERS and C. E. VARY (RAF, London, England) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Oct. 3-6, 1988. 33 p.
(SAE PAPER 881464) Copyright

Pilot training philosophies are influenced by a number of national factors. This paper identifies and discusses those factors, and their effect upon the development of pilot training in the Royal Air Force. It describes the present RAF training structure, procedures and equipment, and highlights some of the problem areas. Author

A89-28222
UNITED STATES AIR FORCE TRAINER MASTERPLAN
DARRELL BACH (USAF, Air Training Command, Randolph AFB, TX) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Oct. 3-6, 1988. 48 p. refs
(SAE PAPER 881466) Copyright

The Air Force system of Undergraduate Pilot Training requires both short-term and long-term modification to sustain current operations and meet future requirements. This report examines the present system together with alternatives and recommends the most cost-effective mix of equipment, training practices, and procurement strategies for training pilots into the early part of the 21st century. Author

A89-29734
PROBLEMS AND RESULTS OF ERGONOMIC RESEARCH ON AVIATION [ZU PROBLEMEN UND ERGEBNISSEN DER ERGONOMISCHEN FORSCHUNG AUF DEM GEBIET DER FLIEGERISCHEN ARBEIT]
HORST MATERNA (Interflug Gesellschaft fuer Internationalen Flugverkehr mbH, Berlin, German Democratic Republic) Technisch-oekonomische Information der zivilen Luftfahrt (ISSN 0232-5012), vol. 24, no. 6, 1988, p. 199-201. In German.
Copyright

Progress in aviation ergonomics is discussed. The relationship between flight safety and ergonomic research is examined, and the present needs of ergonomic research in aviation are reviewed. The state of the art in ergonomic research in civil aviation is described. C.D.

A89-31601
HUMAN FACTORS SOCIETY, ANNUAL MEETING, 32ND, ANAHEIM, CA, OCT. 24-28, 1988. PROCEEDINGS. VOLUMES 1 & 2
Meeting sponsored by the Human Factors Society. Santa Monica, CA, Human Factors Society, 1988, p. Vol. 1, 768 p.; vol. 2, 784 p. For individual items see A89-31602 to A89-31678.
Copyright

Papers dealing with human factors in transportation are presented, covering topics such as pilot performance and simulation, Space Station design and performance, human factors design in special-purpose workstations for the Space Station, auditory spatial information and head-coupled display systems, situation awareness in aircraft systems, control and display issues, human factors in maintenance, aging, telephony and video teleconferencing, auditory and vocal communication, and aircrew station workload, design, and automation. Other subjects include approaches to user interface design, speech recognition systems, hypermedia and interfaces, the development of documentation in real time, computer screen and menu design, expert systems, human factors education, design of work environments, forensics issues, human factors and automobiles, industrial ergonomics, international technology transfer, organizational design and management, personality and human performance, mental models of complex performance, and gender, intelligence, and human performance. Additional topics include accident analysis, product safety, transportation safety, robotics/industrial safety, system development, the human-computer interface, human factors in navy systems, workload evaluation, training systems and data bases, skill aquisition, visual performance, information portrayal determinants of complex decision making, and advanced displays. R.B.

A89-31606
AMERICAN AND JAPANESE CONTROL-DISPLAY STEREOTYPES - POSSIBLE IMPLICATIONS FOR DESIGN OF SPACE STATION SYSTEMS
CLIFFORD K. WONG and JOHN LYMAN (California, University, Los Angeles) IN: Human Factors Society, Annual Meeting, 32nd, Anaheim, CA, Oct. 24-28, 1988, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1988, p. 30-34. refs
Copyright

The stimulus-response stereotypes of American and Japanese subjects are tested to aid in the determination of guidelines for the design of control-display systems for the Space Station. A set of 24 display configurations were tested to determine the direction which people from the two cultures most frequently turn control knobs to accomplish a certain direction or motion of a pointer in a vertical display. Only one configuration elicited similar and statistically significant reponse stereotypes from both groups. It is shown that the optimal configuration should have the control knob on the right side of the display and the numerical scale on the side of the display opposite to the control knob, with the display pointer pointing away from the knob and the scale markings increasing from bottom to top. R.B.

A89-31610* Lockheed Engineering and Sciences Co., Houston, TX.
PREVIOUS EXPERIENCE IN MANNED SPACE FLIGHT - A SURVEY OF HUMAN FACTORS LESSONS LEARNED
GEORGE O. CHANDLEE (Lockheed Engineering and Sciences Co., Houston, TX) and BARBARA WOOLFORD (NASA, Johnson Space Center, Houston, TX) IN: Human Factors Society, Annual Meeting, 32nd, Anaheim, CA, Oct. 24-28, 1988, Proceedings. Volume 1. Santa Monica, CA, Human Factors Society, 1988, p. 49-52. refs
(Contract NAS9-17900)
Copyright

Human factors data from Apollo, Skylab, and Space Shuttle flights are reviewed. The sources of data and collection methods are described. A classification scheme for human factors data is proposed. The implications of the results for the design of the Space Station program are considered. R.B.

A89-31645* University of Southern California, Los Angeles.
ESTIMATION OF DURATION AND MENTAL WORKLOAD AT DIFFERING TIMES OF DAY BY MALES AND FEMALES
P. A. HANCOCK, G. J. RODENBURG, W. D. MATHEWS, and M. VERCRUYSSEN (Southern California, University, Los Angeles, CA) IN: Human Factors Society, Annual Meeting, 32nd, Anaheim, CA, Oct. 24-28, 1988, Proceedings. Volume 2. Santa Monica, CA,

Human Factors Society, 1988, p. 857-861. refs
(Contract NCC2-379)
Copyright

Two experiments are reported which investigated whether male and female operator duration estimation and subjective workload followed conventional circadian fluctuation. In the first experiment, twenty-four subjects performed a filled time-estimation task in a constant blacked-out, noise-reduced environment at 0800, 1200, 1600, and 2000 h. In the second experiment, twelve subjects performed an unfilled time estimation task in similar conditions at 0900, 1400, and 1900 h. At the termination of all experimental sessions, participants completed the NASA TLX workload assessment questionnaire as a measure of perceived mental workload. Results indicated that while physiological response followed an expected pattern, estimations of duration and subjective perception of workload showed no significant effects for time-of-day. In each of the experiments, however, there were significant differences in durational estimates and mental workload response depending upon the gender of the participant. Results are taken to support the assertion that subjective workload is responsive largely to task-related factors and indicates the important differences that may be expected due to operator gender. Author

A89-31659
A PHYSICAL MEASURE OF SUBJECTIVE WORKLOAD
DAVID W. BIERS, DONALD J. POLZELLA, and PAUL MCINERNEY (Dayton, University, OH) IN: Human Factors Society, Annual Meeting, 32nd, Anaheim, CA, Oct. 24-28, 1988, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1988, p. 1131-1135. refs
Copyright

The investigation compared a physical measure of subjective workload (i.e., hand dynamometer) with traditional verbal scaling techniques. There were four subjective rating groups. One group employed the Subjective Workload Assessment Technique (SWAT) which required three separate ratings of time stress, mental effort, and psychological stress. A second group used verbal magnitude estimation (ME). Two physical measure groups estimated the magnitude of workload by squeezing a dynamometer in accordance with the magnitude of workload experienced. The DYNAL group made one overall rating of workload similar to the ME group. The DYNA3 group made three workload ratings along the same dimensions as SWAT. All groups rated the workload associated with the performance of a continuous memory task under twelve levels of task difficulty. The physical measure of subjective workload most closely corresponded to actual task performance differences. The results suggest future development of a physical measure of subjective workload which can be utilized on a continuous basis, thus avoiding a major shortcoming of typical verbal measures of subjective workload. Author

A89-31667
SIMULATOR EVALUATION OF INSTRUCTIONAL AND DESIGN FEATURES FOR TRAINING HELICOPTER SHIPBOARD LANDING
DANIEL J. SHEPPARD, SHERRIE A. JONES, DANIEL P. WESTRA (Essex Corp., Orlando, FL), and JOYCE J. MADDEN (U.S. Navy, Naval Training Systems Center, Orlando, FL) IN: Human Factors Society, Annual Meeting, 32nd, Anaheim, CA, Oct. 24-28, 1988, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1988, p. 1261-1265.
(Contract N61339-85-D-0026)
Copyright

The effects of four instructional issues and one simulator design feature for training helicopter shipboard landing on small ships were studied in the VTOL at the Visual Technology Research Simulator Naval Training Systems Center. These were FOV, task chaining, augmented cueing, length of training, and the timing of seastate introduction. The experiment used an in-simulator transfer-of-training paradigm in which pilots who were not proficient in the helicopter shipboard landing task were trained under one of several experimental conditions and then tested on the transfer condition in the simulator. Of the experimental instruction issues, task chaining had the largest effect, with better performance in all segments of the task for pilots who received whole task training. K.K.

A89-34431* Miami Univ., Coral Gables, FL.
HUMAN FACTORS IN AVIATION
EARL L. WIENER, ED. (Miami, University, Coral Gables, FL) and DAVID C. NAGEL, ED. (NASA, Ames Research Center, Moffett Field, CA) San Diego, CA, Academic Press, Inc., 1988, 704 p. For individual items see A89-34432 to A89-34450.
Copyright

The fundamental principles of human-factors (HF) analysis for aviation applications are examined in a collection of reviews by leading experts, with an emphasis on recent developments. The aim is to provide information and guidance to the aviation community outside the HF field itself. Topics addressed include the systems approach to HF, system safety considerations, the human senses in flight, information processing, aviation workloads, group interaction and crew performance, flight training and simulation, human error in aviation operations, and aircrew fatigue and circadian rhythms. Also discussed are pilot control; aviation displays; cockpit automation; HF aspects of software interfaces; the design and integration of cockpit-crew systems; and HF issues for airline pilots, general aviation, helicopters, and ATC. T.K.

A89-34432
INTRODUCTORY OVERVIEW
ELWYN EDWARDS IN: Human factors in aviation. San Diego, CA, Academic Press, Inc., 1988, p. 3-25. refs
Copyright

The history, basic principles, and techniques of human-factors (HF) analysis or ergonomics for aviation applications are reviewed. Consideration is given to studies of aircraft safety and crew stress before and during World War II, the formal definition of HF, the SHEL (software, hardware, environment, and liveware) model of HF analysis, primary areas of HF concern, and operator skill and error. Also provided is a survey of the current status of HF research. T.K.

A89-34436* Illinois Univ., Champaign.
INFORMATION PROCESSING
CHRISTOPHER D. WICKENS and JOHN M. FLACH (Illinois, University, Champaign) IN: Human factors in aviation. San Diego, CA, Academic Press, Inc., 1988, p. 111-155. refs
(Contract NAG2-308)
Copyright

Theoretical models of sensory-information processing by the human brain are reviewed from a human-factors perspective, with a focus on their implications for aircraft and avionics design. The topics addressed include perception (signal detection and selection), linguistic factors in perception (context provision, logical reversals, absence of cues, and order reversals), mental models, and working and long-term memory. Particular attention is given to decision-making problems such as situation assessment, decision formulation, decision quality, selection of action, the speed-accuracy tradeoff, stimulus-response compatibility, stimulus sequencing, dual-task performance, task difficulty and structure, and factors affecting multiple task performance (processing modalities, codes, and stages). T.K.

A89-34440* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
HUMAN ERROR IN AVIATION OPERATIONS
DAVID C. NAGEL (NASA, Ames Research Center, Moffett Field, CA) IN: Human factors in aviation. San Diego, CA, Academic Press, Inc., 1988, p. 263-303. refs
Copyright

The role of human error in commercial and general aviation accidents and the techniques used to evaluate it are reviewed from a human-factors perspective. Topics addressed include the general decline in accidents per million departures since the 1960s, the increase in the proportion of accidents due to human error,

methods for studying error, theoretical error models, and the design of error-resistant systems. Consideration is given to information acquisition and processing errors, visually guided flight, disorientation, instrument-assisted guidance, communication errors, decision errors, debiasing, and action errors. T.K.

A89-34448
GENERAL AVIATION
MALCOLM L. RITCHIE (Ritchie, Inc., Dayton, OH) IN: Human factors in aviation. San Diego, CA, Academic Press, Inc., 1988, p. 561-589. refs
Copyright

Human-factors analysis techniques are applied to characterize the general-aviation (GA) pilot, aircraft, and operational environment. The focus is on the nonprofessional end of the GA spectrum. Consideration is given to pilot skill level and skill maintenance, equipment costs, human performance in GA, the GA cockpit (instrument flight capabilities, controls, and displays), GA performance variables (manipulative skills, information acquisition and processing, decision processes, input processes, and emergency operations), systems management (propulsion, communication, and cruise), in-flight correction of malfunctions, navigation tasks, and ATC-related tasks. Possible improvements in GA avionics based on personal computers and smart data links are described. T.K.

A89-34450
AIR TRAFFIC CONTROL
V. DAVID HOPKIN (RAF, Institute of Aviation Medicine, Farnborough, England) IN: Human factors in aviation. San Diego, CA, Academic Press, Inc., 1988, p. 639-663. refs
Copyright

The application of human-factors (HF) analysis techniques to the ATC task, equipment, and operational environment is discussed in an introductory review. The evolution of HF research since the 1950s is briefly recalled; the typical ATC tasks are listed and characterized; the problems of workstation design are outlined; typical controller selection and training procedures are described; and particular attention is given to the factors leading to human error, the effects of workstation design on controller health, the problems of stress and boredom, the measurement of controller workload and performance, and the impact of automation. It is pointed out that many changes in ATC technology are neither motivated by HF concerns nor necessarily beneficial in the HF sense. T.K.

A89-38270
STUDY OF MAN-SYSTEM FOR JAPANESE EXPERIMENT MODULE (JEM) IN SPACE STATION
HIDETAKA TANAKA, NORIFUMI IKEDA, KIMIKO HASEGAWA (Mitsubishi Heavy Industries, Ltd., Tobishima, Japan), and TAKAO YAMAGUCHI (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 1789-1793.
Copyright

Japanese Experiment Module (JEM) is one of the Space Station elements planned to be launched in 1997, and to be the first manned space system in Japan. The JEM will be attached to the NASA Space Station. In the JEM, various space environment utilization experiments will be carried out under the administration of the JEM management system. Included in the JEM man system is the hardware which supports crew safety, health, hygiene, nutrition, JEM operations, housekeeping and stowage. This paper clarifies the JEM man system concept and main man-machine interfaces such as the workstation, the workbench, etc. Author

A89-39744
HUMAN DIMENSIONS IN SPACE DEVELOPMENT
PHILIP R. HARRIS (California, University; Harris International, La Jolla) Space Policy (ISSN 0265-9646), vol. 5, May 1989, p. 147-154. refs
Copyright

Biological and behavioral science issues related to space exploration and colonization are examined. Problems associated with living in a space environment for long periods of time are discussed, including group behavior and dynamics in space flight, the environment created at space stations, management on earth and in orbit, selection and training of space station inhabitants, and planning, establishing, and governing space settlements. Various aspects of human factors in space development are addressed, such as physical, sociological, financial, legal, managerial, psychological, cultural, political, education, and communication factors. R.B.

A89-43712* Texas Univ., Austin.
PERSONALITY AND ORGANIZATIONAL INFLUENCES ON AEROSPACE HUMAN PERFORMANCE
ROBERT L. HELMREICH (Texas, University, Austin) IN: Space - A new community of opportunity; Proceedings of the Thirty-fourth Annual AAS International Conference, Houston, TX, Nov. 3-5, 1987. San Diego, CA, Univelt, Inc., 1989, p. 231-238. refs
(Contract NCC2-286)
(AAS PAPER 87-646) Copyright

Individual and organizational influences on performance in aerospace environments are discussed. A model of personality with demonstrated validity is described along with reasons why personality's effects on performance have been underestimated. Organizational forces including intergroup conflict and coercive pressures are also described. It is suggested that basic and applied research in analog situations is needed to provide necessary guidance for planning future space missions. Author

A89-45819
REPORT ON THE INTERNATIONAL SPACE UNIVERSITY 1988 SUMMER SESSION AND LUNAR DESIGN PROJECT
TODD B. HAWLEY (International Space University, Boston, MA) IN: Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. New York, American Society of Civil Engineers, 1988, p. 1132-1140.
Copyright

This paper describes the 1988 Summer Session of the International Space University (ISU) and the International Lunar Initiative (ILI) Design Project, taking place for nine weeks in the summer of 1988 at the Massachusetts Institute of Technology (MIT). One hundred graduate students from over a dozen countries will hear lectures from a core of 12 ISU faculty directors, 16 ISU faculty advisors, and scores of visiting lecturers. In addition to ISU courses, the students will work with faculty to define, examine feasibility, and conduct a multidisciplinary set of design activities to establish a permanent, international habitat for a range of human activities on the moon. The students' research and design activities will culminate in an ILI Design Project Final Report at the end of the 1988 Summer Session. Author

A89-47326
AEROSPACE BEHAVIORAL TECHNOLOGY CONFERENCE AND EXPOSITION, 7TH, ANAHEIM, CA, OCT. 3-6, 1988, PROCEEDINGS
Conference and Exposition sponsored by SAE. Warrendale, PA, Society of Automotive Engineers, Inc. (SAE P-216), 1989, 183 p. For individual items see A89-47327 to A89-47342.
(SAE P-216) Copyright

Topics discussed in these proceedings include those on the cockpit, space, workload, crew awareness, air transport system automation, fitness for duty, concerns of the international pilots, training technologies, and graphic tools for cockpit design. Papers are presented on display requirements for a threat response system; flight crew displays for Space Station proximity operations; EVA design integration for Space Station assembly; an assessment of crew workload procedures in full fidelity; the definition, measurement, and enhancement of the situational awareness in the commercial flight deck; and current and future trends in automation in transport aircraft. Attention is also given to the design of crew rest quarters, airline operations and the contaminated

runway, the role of flight planning in aircrew decision performance, requirements for rapid prototyping of crew station displays, and human factors engineering workstation for model-based cockpit design. I.S.

A89-47342
AIR TRAFFIC CONTROLLER AWARENESS AND RESOURCE TRAINING
EDWARD D. HENDERSON (FAA, Seattle Air Route Traffic Control Center, WA) IN: Aerospace Behavioral Technology Conference and Exposition, 7th, Anaheim, CA, Oct. 3-6, 1988, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1989, p. 141-144.
(SAE PAPER 881518) Copyright

The controller awareness and resource training (CART) program being developed at the Seattle Air Route Traffic Control Center is described together with the human behavioral factors which were found as most likely sources of errors in air traffic control and which were used to provide a model for the CART program. The CART is described with respect to the classroom areas of concentration (which include training for abilities for priority analysis, situational awareness, decision making, judgement, communication, time management, problem solving, as well as for abilities to identify available resources, distractions, stress- and fatigue-causing factors, incapacitation, and conflict) and training on a simulator. The simulation scenarios are designed to be performed by the controller interacting as a team and exercising concepts learned in the classroom training. I.S.

A89-48412#
AN EXPERIMENTER OPERATOR STATION FOR HELICOPTER FLIGHT SIMULATOR RESEARCH AND TRAINING
THOMAS A. KAYE (Bell Helicopter Textron, Fort Worth, TX) and L. MICHAEL FREEMAN (Alabama, University, Tuscaloosa) IN: AIAA Flight Simulation Technologies Conference and Exhibit, Boston, MA, Aug. 14-16, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 293-303.
(AIAA PAPER 89-3304) Copyright

A multipurpose research-oriented operator support station for controlling a low-cost helicopter flight simulator while simultaneously monitoring and recording pilot performance data for subsequent display or statistical postprocessing is described. The system is a mouse-oriented menu-driven interactive program, with structured program design methods employed to create a modular software package capable of handling data acquisition and graphic display of flight performance variables at real-time speeds of up to 30 Hz. The system is also designed to handle intermittent user-requested simulator control directives. Recorded data files can be created during simulated flights for subsequent statistical analysis or flight replay, with application to the optimization of simulator pilot training. R.R.

A89-49426#
THE NEW TRAINING METHODOLOGY FOR SAS PILOTS
BJORN SKERN (Scandinavian Airlines System, Flight Academy, Stockholm, Sweden) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 10 p.
(AIAA PAPER 89-2054)

The implementation of computer-based training (CBT) for pilots of a commercial airline is described. The overall training program comprises (1) CBT to teach pilots how the aircraft system operates, (2) a procedure trainer to teach them how to operate the system, and (3) simulators and flight instructors for crew integration and flight-procedures. Thus the cheaper CBT medium prepares the pilots to get the full benefit of the more expensive media (2) and (3). The selection of the CBT system and the development of the courseware are discussed, and data are presented to show that CBT lowers training costs, is an effective training tool, and is well received by the pilots. Also considered are the computer-managed instruction component of CBT (as a possible means of providing feedback to cockpit designers) and CBT for maintenance personnel, flight attendants, etc. The need for more standardization in CBT is indicated. T.K.

A89-54833
AVIATION WEATHER TRAINING AND THE PROFESSIONAL PILOT
ROBERT J. MASSEY (Air Line Pilots Association, Herndon, VA) IN: International Conference on the Aviation Weather System, 3rd, Anaheim, CA, Jan. 30-Feb. 3, 1989, Preprints. Boston, MA, American Meteorological Society, 1989, p. 307-309. refs
Copyright

It is argued that, with the exception of windshear and microburst, most professional pilots have not received formal meteorological training beyond that required in their initial training. The differences in meteorological demands made on military versus civilian pilots are elucidated. The need for improved simulators which ensure a realistic depiction of hazardous weather phenomenon is demonstrated. K.K.

A89-54835
THE AVIATION OUTREACH PROGRAM OF SEATTLES WSFO
ROBERT JACKSON (U.S. National Weather Service Forecast Office, Seattle, WA) IN: International Conference on the Aviation Weather System, 3rd, Anaheim, CA, Jan. 30-Feb. 3, 1989, Preprints. Boston, MA, American Meteorological Society, 1989, p. 313-316.
Copyright

A program at the National Weather Service Forecast Office in Seattle is described, which provides aviation weather training to pilots. Recommendations for giving successful meteorological presentations are made. The specific presentations included in the program are outlined and the establishment of a network for an aviation safety outreach program is examined. The role of the FAA Accident Prevention Specialists in general aviation safety training is discussed. R.B.

A89-54836
THE FAA SPONSORED WINDSHEAR TRAINING AID
EDGARS A. KUPCIS (Boeing Commercial Airplanes, Seattle, WA) IN: International Conference on the Aviation Weather System, 3rd, Anaheim, CA, Jan. 30-Feb. 3, 1989, Preprints. Boston, MA, American Meteorological Society, 1989, p. 317-322.
Copyright

The development of an FAA-sponsored program to train flight crews to minimize the threats of windshear through avoidance and cockpit recognition and recovery techniques is discussed. The program includes of documents concerning windshear for management, a pilot windshear guide, and an example windshear training program, in addition to videotapes on recognition, avoidance, and recovery techniques. The contents of the program's resources are summarized and the objectives and operation of the program are examined. R.B.

N89-10521# Pacific Northwest Lab., Richland, WA.
EFFECT OF A 12-HOUR/DAY SHIFT ON PERFORMANCE
PAUL M. LEWIS and DAN J. SWAIM (Westinghouse Hanford Co., Richland, Wash.) Jun. 1988 11 p Presented at the 4th International Conference on Human Factors and Power Plants, Monterey, Calif., 5 Jun. 1988
(Contract DE-AC06-76RL-01830)
(DE88-013184; PNL-SA-15620; CONF-880633-7) Avail: NTIS HC A03/MF A01

The operating crews at the Fast Flux Facility near Richland, Washington, changed their rotating shift schedule from an 8- to 12- hour per day work schedule. The primary reason for the change was to reduce the attrition of operators by increasing their job satisfaction. Eighty-four percent of the operators favored the change. Plant performance and safety were not adversely affected. A statistical analysis of 53 operator-related, off-normal events in 28 months concluded that there was no significant difference in either the number or the severity of off-normal events on the 12-hour shift. A statistical analysis of 200,000 log entries concluded that the error rate in completing logs actually declined by 25 percent

on the 12-hour shift. Alertness, which was measured using computerized tests of mathematics and logical reasoning, reach a nadir on the first night shift for the 8- and 12-hour schedules alike, which indicates that the primary cause of fatigue was sleep disruption, not cumulative hours of work. All supervisors and 52 percent of the operators believe their crews work more effectively on the 12-hour shift; only 12 percent of the operators believe that their crews work less effectively. The evaluation indicated that the 12-hour shift scheduled is a reasonable alternative to an 8-hour schedule at this facility. DOE

N89-11775*# National Aeronautics and Space Administration, Washington, DC.
HUMANS IN SPACE
JAMES P. JENKINS *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder p 305-314 Sep. 1988
Avail: NTIS HC A23/MF A01 CSCL 22/1

Information is given in viewgraph form on humans in space. Information is given on extravehicular activity/space suit project objectives and program schedule, and space human factors objectives and products. R.J.F.

N89-13082# Indian Inst. of Tech., Bombay. Center of Studies in Resources Engineering.
IMPORTANT ASPECTS OF TECHNOLOGY TRANSFER: TRAINING OF INSERVICE ENGINEERS AND SCIENTISTS; SATELLITE REMOTE SENSING
T. V. PAVATE *In* ESA, Proceedings of the 1988 International Geoscience and Remote Sensing Symposium (IGARSS 1988) on Remote Sensing: Moving Towards the 21st Century, Volume 1 p 607-608 Aug. 1988
Copyright Avail: NTIS HC A99/MF E03; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 120 US dollars or 250 Dutch guilders

Technology transfer, especially with respect to emerging areas such as satellite remote sensing, and operationalization in multidisciplinary user agencies is discussed. There is a certain amount of urgency being felt in this regard as the conventional method of university education has limited scope in training of large numbers of inservice engineers and scientists who are already working in different capacities. A new approach is mandatory in training of very large number of engineers and scientists towards operationalization of uses of satellite remote sensing to identify, quantify, and manage natural resources on the global scale. ESA

N89-13296# Automation Research Systems Ltd., Alexandria, VA.
MANPRINT (MANPOWER AND PERSONNEL INTEGRATION PROGRAM) PRIMER Final Report, 1 May - 24 Jun. 1988
WILLIAM O. BLACKWOOD and JACK W. DICE 24 Jun. 1988 139 p
(Contract MDA903-86-C-0092)
(AD-A197681) Avail: NTIS HC A07/MF A01 CSCL 12/5

The Manpower and Personnel Integration program (MANPRINT) is a comprehensive management and technical program to enhance human performance and reliability in the operation, maintenance and use of weapon systems and equipment (hereafter referred to as system). MANPRINT achieves this objective by focusing attention on human resource goals and constraints during system design, development, production and upgrade. This MANPRINT primer is designed for both Army and industry MANPRINT practitioners. It provides a basis for their activities and specific how to guidance to deal with MANPRINT activities that must occur throughout the materiel acquisition life cycle. Chapter 1 is an introduction to MANPRINT. It provides the Army's conceptual basis and thrust in MANPRINT. Primary roles and responsibilities for Army and industry are shown in Chapter 2 and Appendix F. Chapter 3 focuses on various aspects of program management--organization planning, scheduling, and resourcing of a comprehensive MANPRINT program throughout the design and development cycle. Technical MANPRINT management is addressed in Chapter 4 in discussions of force level analyses; issues in each of the MANPRINT domains; and planning for and selecting analytical techniques and methodologies for use in satisfying information needed. GRA

N89-13976*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE ORGANIZATION OF AN AUTONOMOUS LEARNING SYSTEM
PENTTI KANERVA May 1988 24 p Submitted for publication Sponsored in part by System Development Foundation
(Contract NCC2-408)
(NASA-CR-184556; RIACS-TR-88.14; NAS 1.26:184556) Avail: NTIS HC A03/MF A01 CSCL 09/2

The organization of systems that learn from experience is examined, human beings and animals being prime examples of such systems. How is their information processing organized. They build an internal model of the world and base their actions on the model. The model is dynamic and predictive, and it includes the systems' own actions and their effects. In modeling such systems, a large pattern of features represents a moment of the system's experience. Some of the features are provided by the system's senses, some control the system's motors, and the rest have no immediate external significance. A sequence of such patterns then represents the system's experience over time. By storing such sequences appropriately in memory, the system builds a world model based on experience. In addition to the essential function of memory, fundamental roles are played by a sensory system that makes raw information about the world suitable for memory storage and by a motor system that affects the world. The relation of sensory and motor systems to the memory is discussed, together with how favorable actions can be learned and unfavorable actions can be avoided. Results in classical learning theory are explained in terms of the model, more advanced forms of learning are discussed, and the relevance of the model to the frame problem of robotics is examined. Author

N89-14895*# National Aeronautics and Space Administration, Washington, DC.
SOCIAL SCIENCES AND SPACE EXPLORATION
1988 150 p Original doc. contains color illustrations
(NASA-EP-192; NAS 1.19:192) Avail: SOD HC $5.00 as 033-000-00926-7 CSCL 05/11

The relationship between technology and society is a subject of continuing interest, because technological change and its effects confront and challenge society. College students are especially interested in technological change, knowing that they must cope with the pervasive and escalating effect of wide-ranging technological change. The space shuttle represents a technological change. The book's role is to serve as a resource for college faculty and students who are or will be interested in the social science implications of space technology. The book is designed to provide introductory material on a variety of space social topics to help faculty and students pursue teaching, learning, and research. Space technologies, perspectives on individual disciplines (economics, history, international law, philosophy, political science, psychology, and sociology) and interdiscipline approaches are presented. B.G.

N89-14908*# Hampton Inst., VA. Dept. of Middle and Secondary Education.
CURRICULUM IN AEROSPACE SCIENCE AND TECHNOLOGY IN COOPERATION WITH NASA LANGLEY RESEARCH CENTER Abstract Only
CATHINE GARNER-GILCHRIST *In its* NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1988 p 61-62 Sep. 1988
Avail: NTIS HC A07/MF A01 CSCL 05/9

A curriculum was written to show teachers how to best use the many resources that are available at the Teacher Resource Center (TRC). This curriculum packet was written using teaching units that teachers in both the elementary and middle schools can use to help students better understand some of the research

that has been conducted at NASA and will be conducted in the future. The units are written with certain standards. Each unit contains: (1) specific objectives, using the Virginia standards of learning; (2) the materials that are available from the TRC; (3) many activities that teachers can use in a variety of ways; and (4) specific strategies for measuring the objectives to determine if the students mastered the knowledge, concepts or skills that were taught. The curriculum packet contains specific units on several topics. They are: (1) Careers in Aerospece Science and Technology; (2) The History of Flight; (3) The History of Satellites; (4) The History of the Manned Space Projects and the Future of the Future of the Space Program; (5) The Solar System; and (6) The History of Rockets. Author

N89-15521# Texas Christian Univ., Fort Worth. Dept. of Psychology.
STRATEGY-BASED TECHNICAL INSTRUCTION: DEVELOPMENT AND EVALUATION Final Report, Sep. 1984 - Jun. 1988
DONALD F. DANSEREAU Aug. 1988 196 p Sponsored by ARI, Alexandria, VA
(AD-A199903; REPT-0002AB; ARI-RN-88-82) Avail: NTIS HC A09/MF A01 CSCL 05/8

This research note discusses scripted peer cooperation, an economical and effective technique for improving the acquisition of technical knowledge and skills. Experiences with scripted cooperation have also been shown to facilitate transfer to individual learning situations and to unscripted groups. At a more specific level, the research behind this note has identified parameters relevant to the assignment of participants to dyads based on pre-measured characteristics, to the selection of scripts dependent on target tasks and the outcomes desired, and to the use of node-link knowledge maps as communications props. In addition, we have used our detailed analyses of cooperative interactions to develop models of task-oriented group processing. This research program has thus provided a basis for the development of an information processing model of cooperative learning, and our detailed analysis of this approach has been a first step in providing a conceptual framework for this powerful educational technique. GRA

N89-16263# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.
PERFORMANCE RECOVERY FOLLOWING STARTLE: A LABORATORY APPROACH TO THE STUDY OF BEHAVIORAL RESPONSE TO SUDDEN AIRCRAFT EMERGENCIES
RICHARD I. THACKRAY Aug. 1988 15 p
(Contract FAA-AM-C-69-PSY-21; FAA-AM-C-82/83-PSY-106; FAA-AM-C-88-HRR-111)
(AD-A199827; DOT/FAA/AM-88/4) Avail: NTIS HC A03/MF A01 CSCL 05/8

This paper deals with the use of response/recovery rate to auditory startle as a laboratory technique for simulating some of the principal aspects of the initial shock phase of sudden emergency situations. It is submitted that auditory startle, with its unexpectedness, pronounced autonomic reaction, fear-like subjective experience, and frequent behavioral disruption, approximates the response pattern to be expected in the initial shock phase of sudden traumatic emergencies, and that by studying the time course of performance recovery following startle, as well as individual differences in response/recovery rate, we may gain a better understanding of some of the variables related to extreme reactions displayed by individuals in real-life emergency situations. Research studies conducted in our laboratory and in others on performance impairment/recovery following startle are reviewed. These studies include those dealing with initial reaction time to the startle stimulus itself, disruption and recovery rate of perceptual-motor (tracking) performance following startle, and the time-course of performance recovery in information processing tasks after exposure to startle. Data are also presented showing a relationship of several individual difference variables to performance response/recovery following startle. GRA

N89-16267# Naval Aerospace Medical Research Lab., Pensacola, FL.
A REVIEW OF PERSONALITY MEASUREMENT IN AIRCREW SELECTION Report, for 1987 - 1988
D. L. DOLGIN and G. D. GIBB Jul. 1988 42 p
(AD-A200392; NAMRL-MONOGRAPH-36) Avail: NTIS HC A03/MF A01 CSCL 05/9

A comprehensive review of personality literature as it relates to aircrew selection was conducted. The purpose of the study was to identify tests that warrant further research as potential prediction instruments. The advent of performance-based personality assessment and implications for future test development were examined. The majority of personality tests reviewed were invalid for pilot selection. Several tests appear to be both effective in pilot selection and psychometrically sound, and we recommend continued research of those. These recommended selection tests include the Defense Mechanism Test, the Personality Research Form, and the Strong Vocational Interest Blank. GRA

N89-16309*# General Dynamics Corp., Fort Worth, TX. Corporate Ada Training Curriculum.
LESSONS LEARNED: MANAGING THE DEVELOPMENT OF A CORPORATE ADA TRAINING PROJECT Abstract Only
LINDA F. BLACKMON *In* NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 1 p 1986
Avail: NTIS HC A18/MF A01 CSCL 09/2

The management lessons learned during the implementation of a corporate mandate to develop and deliver an effective Ada training program to all divisions are discussed. The management process involved in obtaining cooperation from all levels in the development of a corporate-wide project is described. The problem areas are identified along with some possible solutions. Author

N89-18007*# McDonnell-Douglas Astronautics Co., Huntington Beach, CA.
SPACE STATION FUNCTIONAL RELATIONSHIPS ANALYSIS Final Technical Report
THOMAS S. TULLIS and BARBRA R. BIED Aug. 1988 112 p
(Contract NAS2-11723)
(NASA-CR-177497; NAS 1.26:177497; MDC-H3068) Avail: NTIS HC A06/MF A01 CSCL 05/9

A systems engineering process is developed to assist Space Station designers to understand the underlying operational system of the facility so that it can be physically arranged and configured to support crew productivity. The study analyzes the operational system proposed for the Space Station in terms of mission functions, crew activities, and functional relationships in order to develop a quantitative model for evaluation of interior layouts, configuration, and traffic analysis for any Station configuration. Development of the model involved identification of crew functions, required support equipment, criteria of assessing functional relationships, and tools for analyzing functional relationship matrices, as well as analyses of crew transition frequency, sequential dependencies, support equipment requirements, potential for noise interference, need for privacy, and overall compatability of functions. The model can be used for analyzing crew functions for the Initial Operating Capability of the Station and for detecting relationships among these functions. Note: This process (FRA) was used during Phase B design studies to test optional layouts of the Space Station habitat module. The process is now being automated as a computer model for use in layout testing of the Space Station laboratory modules during Phase C. Author

N89-18093# Pittsburgh Univ., PA. Learning Research and Development Center.
EXPLANATORY COHERENCE AND BELIEF REVISION IN NAIVE PHYSICS
MICHAEL RANNEY and PAUL THAGARD Jul. 1988 25 p
(Contract N00014-84-K-0223)

(AD-A201093; UPITT/LRDC/ONR/APS-17) Avail: NTIS HC A03/MF A01 CSCL 12/9

Students of reasoning have long tried to understand how people revise systems of beliefs. We maintain that people often change their beliefs in ways driven by considerations of explanatory coherence. This report describes a computational model of how experimental subjects revise their naive beliefs about physical motion. First, instances are presented in which subjects changed their beliefs while learning elementary physics. Each of these cases involved an individual's attempt to explain a surprising observation. Next, we show how their belief revisions can be modeled using ECHO, a connectionist computer program that uses constraint satisfaction techniques to implement a theory of explanatory coherence. The resulting simulations even captured temporal characteristics of the observed changes in beliefs. Finally, the model's representational sensitivity and procedural robustness are discussed and one can show how ECHO can be used to generate empirical predictions about subjects' current beliefs. GRA

N89-18404*# National Aeronautics and Space Administration, Washington, DC.

HUMAN FACTORS: AERONAUTICS

JAMES P. JENKINS *In its* NASA Information Sciences and Human Factors Program p 147-177 Sep. 1988

Avail: NTIS HC A10/MF A01 CSCL 05/8

The objectives of the Aeronautics Human Factors Research and Technology program are to provide the technology base and capability to design effective crew-cockpit systems and to advance solutions to human problems affecting air transport and rotorcraft effectiveness and safety. Advanced automation technologies, information display capabilities under computer control, and concern for the effects of human error in flight operations are elements which drive the directions of the program. Thus, the program has four thrusts: flight management, human engineering methods, rotorcraft, and subsonic transports. Author

N89-18405*# National Aeronautics and Space Administration, Washington, DC.

HUMAN FACTORS: SPACE

JAMES P. JENKINS *In its* NASA Information Sciences and Human Factors Program p 179-201 Sep. 1988

Avail: NTIS HC A10/MF A01 CSCL 05/8

The objectives are to provide a technology base for intelligent operator interfaces, especially with autonomous subsystems, and to develop a new generation of high performance space suits, gloves, and tools/end effectors to meet the requirements of advanced space missions. The technology base is intended to meet the requirements of productivity, efficiency, and safety in complex manned operations within automated onboard systems and extravehicular activities (EVA) environments. Crew station research is the first of two major areas. Development of methods for the astronaut to supervise, monitor, and evaluate the performance of robotic systems, other space subsystems, and orbital vehicles are key areas of research. The second major area is development of an EVA space suit and gloves. Emphasis in the space human factors research program is placed on technology baseline studies and development of methods, techniques, and data to support productive and safe operations by the astronaut and crew as they interface with complex systems, advance automation, and robotic assistants. Author

N89-19890*# Essex Corp., Alexandria, VA.

SARSCEST (HUMAN FACTORS)

H. MCILVAINE PARSONS *In* NASA. Lyndon B. Johnson Space Center, 2nd Annual Workshop on Space Operations Automation and Robotics (SOAR 1988) p 541-552 Nov. 1988

Avail: NTIS HC A22/MF A01 CSCL 05/8

People interact with the processes and products of contemporary technology. Individuals are affected by these in various ways and individuals shape them. Such interactions come under the label 'human factors'. To expand the understanding of those to whom the term is relatively unfamiliar, its domain includes both an applied science and applications of knowledge. It means both research and development, with implications of research both for basic science and for development. It encompasses not only design and testing but also training and personnel requirements, even though some unwisely try to split these apart both by name and institutionally. The territory includes more than performance at work, though concentration on that aspect, epitomized in the derivation of the term ergonomics, has overshadowed human factors interest in interactions between technology and the home, health, safety, consumers, children and later life, the handicapped, sports and recreation education, and travel. Two aspects of technology considered most significant for work performance, systems and automation, and several approaches to these, are discussed. Author

N89-21484# Anthropology Research Project, Yellow Springs, OH.

MEASURER'S HANDBOOK: US ARMY ANTHROPOMETRIC SURVEY, 1987-1988 Final Technical Report, Oct. 1986 - May 1987

CHARLES CLAUSER, ILSE TEBBETTS, BRUCE BRADTMILLER, JOHN MCCONVILLE, and CLAIRE GORDON 4 May 1988 330 p

(Contract DAAK60-86-C-0128)

(AD-A202721; NATICK-TR-88/043) Avail: NTIS HC A15/MF A01 CSCL 05/9

The purpose of this manual is to describe and explain the tools and procedures required for the precise and accurate measurement of U.S. Army men and women. The handbook contains instructions for the measurement of 132 directly measured dimensions of the body, and for obtaining additional head and hand data collected with the use of two pieces fo custom-designed equipment: an electronic headboard and a hand photometric system. Also included in this generously illustrated measurer's guide are instructions for locating and drawing the landmarks required to define and standardize the dimensions, suggestions for handling subjects, and a guide to the operations and care of the personal computers to be used to record and edit the data in the field. The measurements obtained in this anthropometric survey will form the basis for ensuring that Army clothing, equipment, and systems properly accommodate Army personnel who run the body-size gamut from small women to large men. GRA

N89-22327# Ohio State Univ., Columbus.

AERONAUTICAL DECISION MAKING: COCKPIT RESOURCE MANAGEMENT Final Report

RICHARD S. JENSEN Jan. 1989 179 p Prepared for Systems Control Technology, Inc., Arlington, VA

(Contract DTFA01-80-C-10080)

(AD-A205115; DOT/FAA/PM-86/46) Avail: NTIS HC A09/MF A01 CSCL 05/8

Aviation accident data indicate that the majority of aircraft mishaps are due to judgment error. This training manual is part of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates. The results of such tests were statistically significant and ranged from approximately 10 to 50 percent fewer mistakes. This manual is designed to explain the risks associated with flying activities involving multi-crew aircraft, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. The objective of this material is to enhance interpersonal communication and to facilitate effective leadership and coordination between crewmembers. It provides a sophisticated approach to developing concerted action based on optimal decision making. Several Cockpit Resources Management (CRM) principles are presented in the manual; included are delegation of responsibilities, prioritization, vigilance and monitoring, joint discussion and planning, and receptive leadership techniques. This manual is one of a series on Aeronautical Decision Making (ADM) prepared for the following pilot audiences: Student and Private, Instructor, Instrument, Helicopter, and Multi-crew. GRA

N89-23069# CHI Systems, Inc., Blue Bell, PA.
AN EXPERIMENTAL ENVIRONMENT AND LABORATORY FOR STUDYING HUMAN INFORMATION PROCESSING IN NAVAL AIR ASW (NAVAL AIR ANTISUBMARINE WARFARE)
Technical Report, 30 Sep. 1987 - 29 Sep. 1989
WAYNE ZACHARY and MONICA C. ZUBRITZKY 20 Oct. 1988 71 p
(Contract N00014-87-C-0814)
(AD-A204774; TR-881020-8704) Avail: NTIS HC A04/MF A01 CSCL 23/2

This report documents a laboratory facility to support experimental research into human-computer interaction and decision-making in Naval Air Anti-Submarine Warfare mission management. The facility contains three components, all of which run on a SUN Workstation; 1) a simulated Air ASW workstation and mission, 2) experimental design tools, and 3) a data collection and transformation tools. The workstation/simulation simulation provides a realistic yet simplified version of ASW mission management as performed by the Tactical Coordinator (TACCO) on board a Naval ASW aircraft. Embedded in this simulation are automated data collection programs which collect keystroke-level data on TACCO actions as well as on the situational and display context within which the actions were taken. Additional tools translate these data into timelines and other forms needed to support the building of GOMS- and blackboard-based cognitive models of the human operator. The experimental design tools provide experimenter-friendly utilities for the creation of experimental problems with desired physical and cognitive demands on the subject. The laboratory is also designed to support implementation and experimentation with advanced adaptive user interfaces to the TACCO based on the cognitive models currently being developed. GRA

N89-23911*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AGE DISTRIBUTION AMONG NASA SCIENTISTS AND ENGINEERS
MICHAEL L. CIANCONE *In* NASA, Marshall Space Flight Center, The 23rd Aerospace Mechanisms Symposium p 279-287 Mar. 1989
Avail: NTIS HC A15/MF A01 CSCL 20/11

The loss of technical expertise through attrition in NASA and the aerospace industry is discussed. This report documents historical age-related information for scientific and engineering personnel in general and the NASA Lewis Research Center in particular, for 1968 through 1987. Recommendations are made to promote discussion and to establish the groundwork for action. Author

N89-24796# IBM Watson Research Center, Yorktown Heights, NY.
EVALUATION, DESCRIPTION AND INVENTION: PARADIGMS FOR HUMAN-COMPUTER INTERACTION
JOHN M. CARROLL 16 Aug. 1988 25 p
(AD-A204617) Avail: NTIS HC A03/MF A01 CSCL 23/2

Human-Computer Interaction (HCI) is an urgent and rapidly developing area of computer science research and application. As it continues to evolve and to define itself, it is possible to identify distinct paradigms, or orientations to HCI research and application. Initially, HCI work focussed on empirical laboratory evaluation of computer systems and techniques. Subsequently, empirical studies of usability were organized by and addressed to cognitive theoretical description of user behavior and experience. Currently, the focus of HCI work is shifting toward a more directive role in invention, design and development of systems and techniques. The progression of these three paradigms comprises a case study of a field discovering what it is about, and more generally, of the variety of roles available in the psychology of technology. GRA

N89-24804# Office of Technology Assessment, Washington, DC.
THE ELECTRONIC SUPERVISOR: NEW TECHNOLOGY, NEW TENSIONS
Sep. 1987 148 p
(OTA-CIT-333; LC-87-619855) Avail: NTIS HC A07/MF A01; also available SOD HC $6.50 as 052-003-01082-8

The capabilities of new computer and communication technologies for monitoring employees' activities in the work-place are presented. Communication technologies such as digital private branch exchanges (PBXs), local area networks (LANs), and digital telephony in the switched network provide more capability to monitor calling patterns as well as content of telephone calls. Equipment and software for telephone calls accounting (tracking the time, destination, and cost of calls) make up the fastest growing segment of the telecommunication industry. The networking of computers, either through LANs or sometimes through the telephone system provides a broad capacity to monitor work that is performed at the computer terminal. Computer technology makes possible the continuous collection and analysis of management information about work performance and equipment use. This information is useful to managers in managing resources, planning workloads, and reducing costs. When it is applied to individual employees, however, the intensity and continuousness of computer-based monitoring raises questions about fairness, privacy, and quality of work life. Author

N89-25075# Defense Technical Information Center, Alexandria, VA.
A FORECAST OF WORKLOADS AND MANPOWER REQUIREMENTS FOR THE ARCHIVING OF SCIENTIFIC AND TECHNICAL REPORTS BY THE DEFENSE TECHNICAL INFORMATION CENTER USING A SIMULATION MODEL: AN OPERATIONS RESEARCH APPROACH
CHARLES W. ELLIOTT Feb. 1989 49 p
(AD-A206263) Avail: NTIS HC A03/MF A01 CSCL 05/2

At several meetings attended by the Chief of DTIC-LO, Chuck Elliott, concern was raised by several participants concerning the increasing time required to input a technical report (TR) and the growth in backlogs of TRs awaiting input. The Chief of DTIC-LO determined that this was an area that would lend itself to an operations research investigation and, through the Director of DTIC-L, requested and received the Administrator's approval to proceed with a study. Data collection was confined to DTIC-L, with no new data requirements to be imposed upon the operations directorates. There were two purposes for this: first, to refrain from imposing workload on operating units, second, (since DTIC-L is the main repository for top management information) to determine if sufficient data are already being collected by our current automated and manual information systems for management to make decisions. GRA

N89-25111*# National Aeronautics and Space Administration, Washington, DC.
NASA INFORMATION SCIENCES AND HUMAN FACTORS PROGRAM Annual Report, 1988
LEE HOLCOMB, RAY HOOD, MELVIN MONTEMERLO, MARTIN SOKOLOSKI, JAMES JENKINS, PAUL SMITH, and JOHN DIBATTISTA Jul. 1989 264 p
(NASA-TM-4126; NAS 1.15:4126) Avail: NTIS HC A12/MF A01 CSCL 05/4

The FY 1988 descriptions of technical accomplishments is presented in seven sections: Automation and Robotics, Communications Systems, Computer Sciences, Controls and Guidance, Data Systems, Human Factors, and Sensor Technology. Author

N89-26765*# National Aeronautics and Space Administration, Washington, DC.
EDUCATIONAL AFFAIRS PLAN: A FIVE-YEAR STRATEGY
Report, 1988-1992
Oct. 1987 17 p

(NASA-TM-101793; NAS 1.15:101793) Avail: NTIS HC A03/MF A01 CSCL 05/3

A five-year plan is presented to guide the use of NASA resources in administering a focused and consistent set of aeronautics and space science education programs. Major initiatives outlined in this plan fall into two categories: programmatic priorities and institutional priorities. Programmatic priorities for this plan include elementary education, teacher education, under-represented minority participation, educational technology and the Aerospace Education Services Project (AESP). Institutional priorities highlighted in this plan include university programs, educational publications and their distribution, educational partnerships with public and private organizations, educational research and evaluation, and activities of the educational affairs administration. The plan's aim is to directly and indirectly help to ensure an adequate pool of talented scientists, engineers and technical personnel to keep NASA at the forefront of advancements for the 21st century. K.C.D.

N89-27344*# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.
ERGONOMIC MODELS OF ANTHROPOMETRY, HUMAN BIOMECHANICS AND OPERATOR-EQUIPMENT INTERFACES
KARL H. E. KROEMER, ed., STOVER H. SNOOK, ed., SUSAN K. MEADOWS, ed., and STANLEY DEUTSCH, ed. 1988 114 p Proceedings of a Workshop held in Washington, DC, 17-18 Jun. 1985 Sponsored in part by AFOSR, Washington, DC; Army Research Inst. for the Behavioral and Social Sciences, Arlington, VA; NASA, Washington, DC and NSF, Washington, DC
(Contract N00014-85-G-0093)
(NASA-CR-185720; NAS 1.26:185720; PB89-175491) Avail: NTIS HC A06/MF A01 CSCL 06/16

The Committee on Human Factors was established in October 1980 by the Commission on Behavioral and Social Sciences and Education of the National Research Council. The committee is sponsored by the Office of Naval Research, the Air Force Office of Scientific Research, the Army Research Institute for the Behavioral and Social Sciences, the National Aeronautics and Space Administration, and the National Science Foundation. The workshop discussed the following: anthropometric models; biomechanical models; human-machine interface models; and research recommendations. A 17-page bibliography is included. Author

N89-28938# EUROCONSULT B.V., Arnhem (Netherlands).
TRAINING COURSE FOR TROPICAL EARTH RESOURCES SATELLITE (EARS) BRIDGING PHASE Final Report
Dec. 1988 93 p Course held in Bandar, Lampung, Indonesia, 7-12 Dec. 1987 Prepared in cooperation with EUROCONSULT, B.V., Arnhem, Netherlands Original contains color illustrations
(Contract BCRS-PROJ-4533/TO-3.13)
(BCRS-88-16D; ETN-89-95476) Avail: NTIS HC A05/MF A01

A training course, held by Euroconsult in Indonesia, for the counterparts of the Rawa Sragi project, is reported. This project is part of the Tropical Earth Resources Satellite (TERS) bridging phase. The objective of the course was to train these counterparts in remote sensing techniques in order to awaken a latent demand for satellite imagery of the TERS type. The majority of the participiants are connected to the regional planning bureau and data center of the regional planning office. For simulation of TERS imagery, multispectral SPOT scenes of the project are acquired. The course was held from 7 to 12 December 1987 in Bandar, Lampung. The course included lectures on remote sensing techniques, and on the interpretation of satellite images for which purpose field studies were included. It was concluded that without the use of remote sensing, a survey covering the same area would take much more time and produce less accurate results. The best option for remote sensing is LANDSAT imagery with a resolution that matched the mapping scale of the project. The most cost-effective way of processing multispectral satellite imagery is the Diazo method. Remote sensing imagery has a higher interpretation potential in lowlands than in uplands. ESA

02

MANAGEMENT THEORY AND TECHNIQUES

Includes Management Overviews and Methods, Decision Theory and Decision Making, Leadership, Organizational Structure and Analysis, Systems Approaches, Operations Research, Mathematical/Statistical Techniques, Modelling, Problem Solving, Management Planning.

A89-15952
AN INTEGRATED APPROACH TO PROJECT EVALUATION AND SELECTION
REZA KHORRAMSHAHGOL (AT&T Bell Laboratories, Middletown, NJ), HOSSEIN AZANI (District of Columbia, University, Washington), and YVON GOUSTY (Ambassade de France aux Etats Unis, Washington, DC) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 35, Nov. 1988, p. 265-270. refs
Copyright

Effective project evaluation necessitates incorporating the many conflicting objectives of the decision maker(s) into decision models. Among the many proposed methodologies of multicriteria decision making, goal programming is perhaps the most popular and widely used. Although it incorporates multiple objectives and arrives at an optimal solution, its major drawback is that the decision maker(s) must specify goals and priorities a priori. To overcome this problem, the Delphi method is suggested to be applied prior to goal programming formulation so that the objectives and their corresponding aspiration levels can be identified. Another drawback of goal programming is that it does not provide a systematic approach to set priorities and tradeoffs among objectives. For this purpose, the analytic hierarchy process is used. The application of the proposed methodology is discussed and illustrated through an example. I.E.

A89-17653*# NASA Space Station Program Office, Reston, VA.
SPACE STATION FREEDOM - TECHNICAL AND MANAGEMENT CHALLENGES
THOMAS L. MOSER (NASA, Space Station Freedom Program Office, Reston, VA) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 10 p. refs
(IAF PAPER 88-053)

The development of the Space Station is reviewed, focusing on the technical and managerial aspects of the program. The optimization of the Space Station configuration, utilization impacts on design, technical aspects of the distribution systems, and the problems of designing for a lifetime of 30 years or more are discussed. In addition, cost reduction studies, testing and verification, determining the assembly sequence, and operational communications and support systems are examined. Managerial aspects of the program include organization, program control, management tools and processes, and the integration of elements from the international partners. R.B.

A89-18304*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
THE THREE R'S OF TRAINING: RECORDING, RETAINING, AND REPORTING - THE TRAINING MANAGEMENT SYSTEM THAT SYNERGIZES
DICK D. INGRAM (NASA, Kennedy Space Center; Lockheed Space Operations Co., Cocoa Beach, FL) IN: AIAA/SOLE Space Logistics Symposium, 2nd, Costa Mesa, CA, Oct. 3-5, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, 3 p.
(AIAA PAPER 88-4725) Copyright

NASA's Kennedy Space Center employs a Training and Certification Record System (TCRS) which tracks and maintains records for each of its employees, encompassing all aspects of training history: training courses, physical examinations, proficiency tests, on-the-job training, standboards, and certifications with

completions and expiration dates. TCRS, which is fully automated, includes an expiration-alert notification capability to project recurring expirations, thereby functioning as a forecasting tool for training budgets. O.C.

A89-18872
CAPITALIZING ON TODAY'S TECHNOLOGY BY USING COMPUTER BASED TRAINING/INTERACTIVE VIDEO DISC TO ENABLE EFFECTIVE AND EFFICIENT TRAINING TO BE CONDUCTED AND MANAGED IN THE WORK PLACE
THOMAS C. HELMACY (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT) IN: AHS, Annual Forum, 44th, Washington, DC, June 16-18, 1988, Proceedings. Alexandria, VA, American Helicopter Society, 1988, p. 251-254.
Copyright

On-The-Job Training (OJT), because of extensive training and management time requirements, tends to be an unorganized trial and error method of learning. Today through the use of computers and video disk it is possible to overcome this age-old problem and make OJT far more efficient and effective. Computer Based Training/Interactive Video Disk (CBT/IVD) is a management tool that provides for learning while avoiding the costly damage to equipment and the agony of personal injuries associated with previous OJT approaches. CBT/IVD is particularly conducive to training in the work-place because of its size, durability, and cost. Author

A89-20104
BUSINESS STRATEGIES AND LAND REMOTE SENSING CAPABILITIES
PITT G. THOME and STAN A. MORAIN (New Mexico, University, Albuquerque) IN: EASCON '88; Proceedings of the Twenty-first Annual Electronics and Aerospace Conference, Arlington, VA, Nov. 9-11, 1988. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 17-23.
Copyright

It is suggested that land remote sensing in the U.S. is at a critical juncture while the government gives serious study to the direction it will take beyond the privatization of the current Landsats and its investment in Landsat 6. The issues revolve around questions of the relative roles of government and private industry and the attractiveness of future business opportunities. An attempt is made to clarify several aspects of the issues, especially from the marketing point of view of an entrepreneur. The current status of the U.S. remote-sensing industry is summarized; several scenarios for the future are suggested; some of the more critical capability and technology needs to support these scenarios are indicated; and the marketing challenges confronting the industry are set forth. I.E.

A89-23949
FLEXIBLE MANUFACTURING SYSTEMS IN PRACTICE
ROGER BONETTO (Les ateliers flexibles de production /2nd edition/, Paris, Hermes, 1987) New York, Hemisphere Publishing Corp., 1988, 217 p. Translation. refs
Copyright

Technological, management, and economic aspects of flexible manufacturing methods are examined in an overview of the current status. Chapters are devoted to the history of manufacturing technology and the pursuit of productivity; production development; production needs; flexible manufacturing systems; reliability, maintenance, and safety; the required environment; economic aspects; designing a flexible manufacturing system; and future development. Diagrams, graphs, drawings, and a glossary of terms are provided. T.K.

A89-24845
RISK ASSESSMENT FOR SAFETY
CHARLES R. HADLOCK and PETER E. GLASER (Arthur D. Little, Inc., Cambridge, MA) IN: Space safety and rescue 1986-1987. San Diego, CA, Univelt, Inc., 1988, p. 11-16. refs
(IAF PAPER 86-59B) Copyright

The application of probabilistic risk-assessment techniques to space missions is discussed, with a focus on the International Space Station. The types of hazards likely to be caused by random events; design, operational, and management errors; and intentional intervention are examined along with their secondary effects; and the top-level safety requirements defined by NASA are considered. It is suggested that such qualitative stipulations be supplemented with more quantitative measures such as used in the nuclear-power industry; the major features of such quantitative methods are reviewed. T.K.

A89-28429
THE SKUNK WORKS' MANAGEMENT STYLE - IT'S NO SECRET (77TH WILBUR AND ORVILLE WRIGHT MEMORIAL LECTURE)
BEN R. RICH (Royal Aeronautical Society, Wilbur and Orville Wright Memorial Lecture, 77th, Dec. 13, 1988, Paper) Aerospace (UK) (ISSN 0305-0831), vol. 16, March 1989, p. 8-14.
Copyright

Over the course of a period starting in 1943 which witnessed the development of such classic military and reconnaissance aircraft as the P-80, U-2, F-104, and SR-71 by the 'Skunk Works' of Lockheed's Advanced Development Projects organization, Clarence Johnson (in his capacity as founder and manager of the organization) defined a management style expressible in terms of the 14 'rules' here presented. These rules pertain to the relationship of the aircraft design/development team with the military service issuing requirements and funds, the flexibility of design modification-incorporation procedures, the careful recording only of the most important activities, the character of a useful inspection system, and the rewarding of the personnel involved in the given project. O.C.

A89-28459#
METHODOLOGY AND APPROACH TO DEVELOPING COST-EFFECTIVE STANDARDS FOR EARTH OBSERVATIONS
ANDREA M. FEDEROFF (Computer Sciences Corp., Pasadena, CA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12,.1989. 23 p. refs
(AIAA PAPER 89-0776) Copyright

A survey of the work being done by the Space-Based Observation System Committee on Standards is given. The committee was formed in March 1988 to develop standards for space-based earth observations. The objectives of the committee are outlined, including the recommendation of standards which emphasize life-cycle cost savings, may be applied to multiple programs and mission, and are coordinated with national and international activities. Additional tasks of the committee include ensuring that the standards have clearly defined benefits to multiple contractors, government agencies, and users and recommending methods for implementing the standards. The structure and working groups of the committee are discussed. Three projects which have been proposed by the committee are described: a survey of standards which already exist or are being developed, the creation of a direction of civilian earth observation and policy groups, and the development of models for software reliability. R.B.

A89-28734
THE DYNAMICS OF SOFTWARE PROJECT STAFFING - A SYSTEM DYNAMICS BASED SIMULATION APPROACH
TAREK K. ABDEL-HAMID (U.S. Naval Postgraduate School, Monterey, CA) IEEE Transactions on Software Engineering (ISSN 0098-5589), vol. 15, Feb. 1989, p. 109-119. refs
Copyright

The dynamics of software project staffing throughout the software-development life cycles is discussed. The research vehicle is a comprehensive system-dynamics model of the software-development process. A detailed discussion of the model's structure as well as its behavior is provided. The results of a case study in which the model is used to simulate the staffing practices of an actual software project are then presented. The experiment produces some interesting insights into the policies (both explicit and implicit) for managing the human resource and their impact on project behavior. The decision-support capability

of the model to answer what-if questions is also demonstrated. In particular, the model is used to test the degree of interchangeability of men and months on the particular software project. I.E.

A89-28746#
A COMPARISON OF JAPANESE AND U.S. HIGH-TECHNOLOGY TRANSFER PRACTICES
ROBERT S. CUTLER (NSF, Washington, DC) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 36, Feb. 1989, p. 17-24. Research supported by the Japan-U.S. Educational Commission and U. S. Navy. refs

Some empirical results and observations are presented which describe the principal ways in which a sample of industrial researchers in Japan and in the U.S. utilize certain technologies resulting from university research. The findings are from a survey conducted in Japan and the U.S. between October 1986 and December 1987. These results indicate that personal communications and technical collaboration are the key factors in the rapid diffusion of research results in both countries, and that in Japan government agencies and professional societies take a much more active role in organizing and energizing the civilian technology-transfer process than do counterpart organizations in the U.S. I.E.

A89-28747* Texas Univ., Austin.
A TWO-PHASE METHODOLOGY FOR TECHNOLOGY SELECTION AND SYSTEM DESIGN
JONATHAN F. BARD (Texas, University, Austin) and ABE FEINBERG (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California State University, Northridge) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 36, Feb. 1989, p. 28-36. Research supported by DOE. refs
Copyright

A two-phase methodology that can be used to guide R&D managers in the evaluation and selection of competing technologies is presented. Deterministic multiattribute utility theory is used in the first phase to rank the technological alternatives; the example presented involves the evaluation of electric and hybrid passenger vehicles. In all, 39 individuals from eight automotive firms were interviewed to assess their risk preferences and attitudes toward the vehicle design. In the second phase, the decision-maker must allocate a fixed amount of resources to different projects for the technology selected, some of which may be undertaken in parallel, to maximize a given measure of performance. When parallel funding is pursued the best outcome is chosen. The problem is formulated as a probabilistic network and solved heuristically using Monte Carlo simulation. Results are presented for two decision-makers and three budget options. In each case, the heuristic finds the optimal allocation of funds. I.E.

A89-33807
THEORY OF TECHNICAL SYSTEMS: A TOTAL CONCEPT THEORY FOR ENGINEERING DESIGN (2ND REVISED AND ENLARGED EDITION)
VLADIMIR HUBKA (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) and W. ERNST EDER (Royal Military College of Canada, Kingston) Berlin and New York, Springer-Verlag, 1988, 291 p. refs
Copyright

The basic goals, general principles, and methods of engineering science are examined systematically in an introduction intended both for students and practicing engineers and for managers, government planners, and other users of technology. Topics addressed include the socioeconomic roles of technology, the nature of technical systems (TSs), the identification of TS requirements, transformation systems, technical processes, and theoretical models of TSs. Particular attention is given to a systematic classification of TSs, the properties of TSs and their interrelations, the evaluation and representation of TSs, the origination and operation phases of a TS, the evolution of TSs, and applications of the theory of TSs. Extensive diagrams, drawings, and flow charts and a detailed discussion of terminology (in the form of a glossary) are provided. T.K.

A89-35413* Houston Univ., TX.
TRANSITION MANAGEMENT - AN ANALYSIS OF STRATEGIC CONSIDERATIONS FOR EFFECTIVE IMPLEMENTATION
JOHN L. HUNSUCKER and DAVID LOOS (Houston, University, TX) Engineering Management International (ISSN 0167-5419), vol. 5, Feb. 1989, p. 167-178. Research supported by NASA. refs
Copyright

Six managerial guidelines are identified for facilitating successful change in an organization. They are: (1) the need for a catalyst to initiate change; (2) the setting of organizational goals which take into account the impact of technical, political, and cultural factors; (3) requiring a transition team to guide the change; (4) a demonstration by top management of a commitment to the change as well as their acting as change agents; (5) the utilization of employee participation and good communication to help overcome employee resistance; and (6) the evaluation of the change program as important to the success of present and future change programs. A description of each guideline is presented, and its importance is examined. Available options are also presented for management to deal with each of the guidelines. S.A.V.

A89-38976
SPACE POLICY - GETTING THERE FROM HERE
M. GRANGER MORGAN (Carnegie-Mellon University, Pittsburgh, PA) Issues in Science and Technology (ISSN 0748-5492), vol. 5, Spring 1989, p. 72-77. refs
Copyright

An evaluation is made of current NASA space program management practices and prospective methods that may be adopted to enhance agency and program efficiency. It is suggested that while large-payload and manned spaceflight responsibilities may legitimately remain the exclusive domain of NASA and USAF, many more modestly scaled, less safety-critical projects should be allowed to proceed under private management. It is anticipated that the up-to-50-percent cost of spacecraft ground operations may be the most fertile ground for future cost-reducing efficiency improvements. O.C.

A89-39580
INTERGROUP CONFLICT AND CONFLICT MANAGEMENT IN THE R&D DIVISIONS OF FOUR AEROSPACE COMPANIES
MARJORIE CHAN (Youngstown State University, OH) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 36, May 1989, p. 95-104. refs
Copyright

The author examined the intergroup conflict between R&D managers and nonmanagers in four aerospace companies, as well as the relationship between each of the five conflict-handling modes: competition, accommodation, sharing, collaboration, and avoidance, with the following variables: 1) conflict frequency, 2) job satisfaction, and 3) job performance. The research findings indicate that intergroup conflicts were in the areas of goals, reward, control, authority, and insufficient assistance from technical support staff. Furthermore, intergroup conflict and conflict management were found to have both positive and negative consequences. Competition and avoidance were found to have exacerbated the frequency of conflict, and they had a negative impact on performance. Collaboration was found to have ameliorated the frequency of conflict, and it had a rather high positive impact on performance. Both sharing and accommodation were found to be inconsistently related to conflict frequency, and they had an inconsistent impact on performance. For three organizations, job satisfaction was negatively related to conflict frequency and avoidance while it was negatively related to accommodation based on one sample of subjects from one organization only. Competition, sharing, and collaboration were not found to be significantly related to job satisfaction. I.E.

A89-39581
SIGNIFICANCE OF PROJECT MANAGEMENT STRUCTURE ON DEVELOPMENT SUCCESS
ERIK W. LARSON and DAVID H. GOBELI (Oregon State University,

Corvallis) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 36, May 1989, p. 119-125. refs
Copyright

The significance of project management structure on the success of 546 development projects was investigated. Multivariate procedures revealed that success varies according to the project structure used, even when other determinants are accounted for. Projects relying on the functional organization or a functional matrix were less successful than those which used a balanced matrix, project matrix, or project team. The project matrix outperformed the balanced matrix in meeting schedule, and outperformed the project team in controlling cost. Implications for managing development projects are briefly discussed. I.E.

A89-45143
AIRCRAFT DEVELOPMENT TEST AND EVALUATION - AN OFFICE OF THE SECRETARY OF DEFENSE PERSPECTIVE
CHARLES E. ADOLPH (DOD, Washington, DC) IN: Society of Flight Test Engineers, Annual Symposium, 19th, Arlington, TX, Aug. 14-18, 1988, Proceedings. Lancaster, CA, Society of Flight Test Engineers, 1988, p. VI-1.1 to VI-1.4.
Copyright

The development of aircraft test and evaluation programs over the last two decades is reviewed. Aircraft flight test emphasis has recently shifted from airworthiness and aerodynamics testing to avionics subsystem test and integration. Technical problems involved with the integration of aircraft systems and test programs are considered. The impact of advances in weapon systems technology on the aircraft test process is examined. The importance of simulators and other hardware-in-the-loop ground test facilities for the evaluation of software-intensive systems is emphasized. R.R.

A89-46481
PROCEDURAL COMPLIANCE - IT'S NOT THE FIRST QUESTION
JAMES E. MCMUNIGAL and ARTHUR E. GOLDBERGER, JR. (McDonnell Douglas Corp., Saint Louis, MO) IN: Annual Reliability and Maintainability Symposium, Atlanta, GA, Jan. 24-26, 1989, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 221-228. refs
Copyright

The authors address what is required of command media as a computer advantage. The tools which can be used when change occurs and stability is compromised are presented and discussed. The combined usage of the process effectiveness diagram and the playscript to address the competitive advantage procedural compliance issues is examined. I.E.

A89-46727#
THE LEARNING PROCESS OF GETTING TQM INITIATED AT A DIVISION
DAVID GRAVES (Rockwell International Corp., Seal Beach, CA) AIAA, ASME, SAE, and ASEE, Joint Propulsion Conference, 25th, Monterey, CA, July 10-13, 1989. 7 p. refs
(AIAA PAPER 89-2288) Copyright

This paper reviews one company's experience at developing and implementing a total quality management process. It covers the activities, beginning with the work of the planning committee and the development of the training philosophy, and concludes with an objective assessment of the impact of the process. Author

A89-46728#
STATISTICAL PROCESS CONTROL - A KEY ELEMENT OF TOTAL QUALITY MANAGEMENT
GAIL R. DIMITROFF (General Dynamics Corp., Space Systems Div., San Diego, CA) AIAA, ASME, SAE, and ASEE, Joint Propulsion Conference, 25th, Monterey, CA, July 10-13, 1989. 7 p.
(AIAA PAPER 89-2289) Copyright

The role of statistical process control in total quality management is discussed, focusing on the impact of statistical process control in shift from inspection to prevention, the control process, the determination of process capability, and continued improvement and innovation. Consideration is given to the implementation of statistical process control before and after design and in the transformation of the total quality management environment. The statistical tools used in process control and the steps for implementing statistical process control as a management tool are outlined. R.B.

A89-51328*# National Aeronautics and Space Administration, Washington, DC.
NATIONAL AERO-SPACE PLANE TECHNOLOGY DEVELOPMENT OVERVIEW
HOWARD T. WRIGHT (NASA, Washington, DC; USAF, National Aerospace Plane Joint Program Office, Wright-Patterson AFB, OH) AIAA, National Aerospace Plane Conference, 1st, Dayton, OH, July 20, 21, 1989. 9 p.
(AIAA PAPER 89-5003) Copyright

The paper discusses the management structure and organization that was developed in early 1986 to focus the national technology resource pool on the enabling technologies for the NASP. The NASP program is developing technologies in parallel with total system studies that are aimed at single stage to orbit (SSTO) capability. In order to manage the technology development seven teams were established by discipline and charged with the task of recommending specific programs to be funded by the NASP Joint Program Office (JPO). The teams were staffed by representatives from NASA Research Centers, Johns Hopkins University, and the Air Force Laboratories at Wright-Patterson AFB. In addition several special teams were established to recommend development programs for specific areas of technical concern that became apparent when the total system studies identified the technology to be critical and sensitive in the analysis that would enable a single stage to orbit vehicle. Author

A89-51331#
THE NASP CHALLENGE - MANAGEMENT INNOVATION
HERSHEL SAMS (McDonnell Douglas Corp., Saint Louis, MO) AIAA, National Aerospace Plane Conference, 1st, Dayton, OH, July 20, 21, 1989. 6 p.
(AIAA PAPER 89-5006) Copyright

The National Aero-Space Plane (NASP) program challenges the American aerospace industry to pursue a new, high level of technology for the 21st Century. In addition to the technological challenge, the National Program Concept demands innovation in management philosophies and implementation. This paper explores the new concepts of cooperation, trust and teamwork between the government and industry and between contractors. A brief NASP status update is given, as well as a review of innovative management methods used to date on the NASP program. But as the NASP participants look ahead to Phase 3, the building and flight testing of the X-30 experimental vehicle, even more innovation is required. A focusing of effort under one lead contractor is recommended, along with the commitment of all NASP contractors as enthusiastic, supportive team members. Collocation is recommended for the early stages of Phase 3, to facilitate a highly integrated team effort, with work transitioning to individual work centers for detailed design, assembly and test, prior to final assembly and flight testing. Developing and implementing an innovative, cooperative management strategy is critical for the success of this great national effort and will lead to a new method of doing business that will keep America competitive in the world marketplace. Author

N89-10870# Aviation Safety Commission, Washington, DC.
AERONAUTICAL DECISION MAKING FOR COMMERCIAL PILOTS
RICHARD S. JENSEN and JANEEN ADRION Jul. 1988 68 p
Prepared for Systems Control Technology, Inc., Arlington, Va.
(Contract DTFA01-80-C-10080)
(DOT/FAA/PM-86/42) Avail: NTIS HC A04/MF A01

Aviation accident data indicate that the majority of aircraft mishaps are due to judgement error. This training manual is part

of a project to develop materials and techniques to help improve pilot decision making. Training programs using prototype versions of these materials have demonstrated substantial reductions in pilot error rates. The result of such tests were statistically significant and ranged from approximately 10 to 50 percent fewer mistakes. This manual is designed to explain the risks associated with commercial flying activities, the underlying behavioral causes of typical accidents, and the effects of stress on pilot decision making. It provides a means for the individual pilot to develop an attitude profile through a self-assessment inventory and provides detailed explanations of pre-flight and in-flight stress management techniques. The assumption is that pilots receiving this training will develop a positive attitude toward safety and the ability to effectively manage stress while recognizing and avoiding unnecessary risks. Author

N89-12479*# National Aeronautics and Space Administration, Washington, DC.
ISSUES IN NASA PROGRAM AND PROJECT MANAGEMENT
FRANCIS T. HOBAN, ed. Oct. 1988 51 p
(NASA-SP-6101; NAS 1.21:6101) Avail: NTIS HC A04/MF A01 CSCL 05/1

This collection of papers and resources on aerospace management issues is inspired by a desire to benefit from the lessons learned from past projects and programs. Inherent in the NASA culture is a respect for divergent viewpoints and innovative ways of doing things. This publication presents a wide variety of views and opinions. Good management is enhanced when program and project managers examine the methods of veteran managers, considering the lessons they have learned and reflected on their own guiding principles. Author

N89-12480# Texas Univ., Austin. Dept. of Management.
THE RELATIONSHIP BETWEEN TECHNOLOGY AND ORGANIZATIONAL STRUCTURES: EMPIRICAL TRUTH OR THEORETICIANS' WISHFUL THINKING Interim Report, May 1985 - May 1986
C. C. MILLER, WILLIAM H. GLICK, WANG YAU-DE, and GEORGE P. HUBER Feb. 1988 49 p
(AD-A196606; ARI-RN-88-07) Avail: NTIS HC A03/MF A01 CSCL 05/1

This research note reviews and analyzes the results of 34 empirical studies of technology-structure relationships. Previous reviewers have concluded that the across-study variation among sample correlations is attributable to differences in definition of technology, unit of analysis, and measurement strategy. These reviewers did not examine three theoretically important explanations for the mixed results: differences in: (1) organizational size, (2) degree of professionalization, and (3) organizational sector. Meta-analyses indicate that these previously unexamined explanations are important for understanding the technology-structure relationship. GRA

N89-13858*# National Academy of Sciences - National Research Council, Washington, DC. Panel on Meteorological Support for Space Operations.
METEOROLOGICAL SUPPORT FOR SPACE OPERATIONS: REVIEW AND RECOMMENDATIONS Final Report
1988 88 p
(Contract NASW-4272)
(NASA-CR-183015; NAS 1.26:183015; PB88-246376) Avail: NTIS HC A05/MF A01 CSCL 04/2

The current meteorological support provided to NASA by NOAA, Air Weather Service, and other contractors is reviewed and suggestions are offered for its improvement. These recommendations include improvement in NASA's internal management organizational structure that would accommodate continued improvement in operational weather support, installation of new observing systems, improvement in analysis and forecasting procedures, and the establishment of an Applied Research and Forecasting Facility. Author

N89-14186# Pacific Northwest Lab., Richland, WA.
INTEGRATING THE DEVELOPMENT OF INNOVATIVE CONCEPTS INTO CORPORATE STRATEGY
R. M. SMITH Mar. 1988 11 p Presented at the 23rd Intersociety Energy Conversion Engineering Conference, Denver, Colo., 31 Jul. 1988
(Contract DE-AC06-76RL-01830)
(DE88-016314; PNL-SA-15769; CONF-880702-22) Avail: NTIS HC A03/MF A01

Most good innovative ideas come from individuals who become creatively stimulated when they least expect it. The challenge is to convert these good ideas into marketable products. Most scientists contribute greatly to the advancement of technology often without considering that their discoveries may solve a market need. Better communications and understanding of marketing objectives and techniques is needed, since the problem facing most large corporate executives is to convert fragmented developments into total market solutions. Several organizational approaches have evolved in the management of technology designed to address the possibility of maximizing benefits from creative ideas, but two will be discussed in depth in this paper. The first internally directed method is to incorporate innovative ideas into the portfolio structure of strategic business units. The second externally directed method is to form a technology transfer operation which leads to new corporate or external spinoff ventures. Both of these approaches deal with the problems of cost and risk associated with the crucial step of commercialization, but in different ways. The achievements of all participants in technological research will be greatest if individual efforts are clearly and efficiently coordinated. DOE

N89-15772# Colorado Univ., Boulder. Center for Research on Judgment and Policy.
JUDGEMENT AND DECISION MAKING IN DYNAMIC TASKS Interim Report
KENNETH R. HAMMOND Aug. 1988 40 p
(Contract MDA903-86-C-0142)
(AD-A199907; ARI-RN-88-81) Avail: NTIS HC A03/MF A01 CSCL 05/8

This research note presents a theory of task conditions on the grounds that such a theory is a prerequisite for studying dynamic decision making. The principal features of the theory are: (1) a task-cognition inducement principle, (2) a distinction drawn between surface and depth characteristics of tasks, and (3) a task continuum index. Also presented is a theory of cognition in dynamic tasks, the main features of which are a cognitive continuum index set in parallel with the continuum index, and a description of the role of pattern seeking and functional-relation seeking in dynamic tasks. The practical consequences for both designers and operators are indicated. GRA

N89-15775# Department of Defense, Washington, DC. Office of the Inspector General.
ACQUISITION ALERTS FOR PROGRAM MANAGERS
Sep. 1987 45 p
(PB88-223268; DOD-4245.1-H) Avail: NTIS HC A03/MF A01 CSCL 05/2

The primary objective of the publication is to assist in preventing problems during the acquisition process by alerting the acquisition manager to problem areas (past and present) where the acquisition manager must take certain actions and/or ensure the acquisition manager seeks expert advice. The booklet serves as a quick and easy reference guide, although it does not answer all questions. The publication contains five sections: contracting procedures, personal conduct and actions, historical problems in acquisition, a glossary, and topical references. Author

N89-16434*# National Aeronautics and Space Administration, Washington, DC.
NASA STANDARD: TREND ANALYSIS TECHNIQUES
Oct. 1988 85 p
(NASA-STD-8070.5; NAS 1.82:8070.5) Avail: NTIS HC A05/MF A01 CSCL 12/1

This Standard presents descriptive and analytical techniques

for NASA trend analysis applications. Trend analysis is applicable in all organizational elements of NASA connected with, or supporting, developmental/operational programs. Use of this Standard is not mandatory; however, it should be consulted for any data analysis activity requiring the identification or interpretation of trends. Trend Analysis is neither a precise term nor a circumscribed methodology, but rather connotes, generally, quantitative analysis of time-series data. For NASA activities, the appropriate and applicable techniques include descriptive and graphical statistics, and the fitting or modeling of data by linear, quadratic, and exponential models. Usually, but not always, the data is time-series in nature. Concepts such as autocorrelation and techniques such as Box-Jenkins time-series analysis would only rarely apply and are not included in this Standard. The document presents the basic ideas needed for qualitative and quantitative assessment of trends, together with relevant examples. A list of references provides additional sources of information.
Author

N89-16532# Office of Technology Assessment, Washington, DC.
TECHNOLOGY AND THE AMERICAN ECONOMIC TRANSITION: CHOICES FOR THE FUTURE
May 1988 505 p
(PB88-214127; OTA-TET-283) Avail: NTIS HC A22/MF A01; also available SOD HC $20.00 as 052-003-01096-8 CSCL 05/3

The report examines basic U.S. policy choices made necessary by profound changes in America's technology base, changes in international trade, changes in resource costs, and changes in American tastes. The report does this by describing the performance of the U.S. economy as a set of complex networks linking manufacturing and service enterprises to deliver goods and services to American consumers, and by describing how choices made about the management of these networks could affect the quality of American life during the next two decades. GRA

N89-19328# Air War Coll., Maxwell AFB, AL.
A CASE STUDY OF SMALL GROUP DECISION-MAKING AS INFLUENCED BY THE ABILENE PARADOX: THE CHALLENGER MISHAP
JAMES Y. GASKINS May 1988 83 p
(AD-A202102) Avail: NTIS HC A05/MF A01 CSCL 05/8

On 27 January 1986 a group of decision-makers representing the public and private sectors of leadership in our national space exploration program evaluated the risk associated with known discrepancies in solid rocket motor seals. The risk assessment that was made led the group to agree that the discrepancies were within an acceptable margin of safety and authorized the launch of the Space Shuttle Challenger. Two phenomena which describe flawed decision-making processes, groupthink and the Abilene Paradox, provide a framework for a study of the agreements which culminated in the launch of Challenger. Analysis of the pitfalls of the decision-making process reveals various phenomena. One of them is known as groupthink or, e.g., a mode of thinking that people engage in when they are deeply involved in cohesive in-groups. They exhibit the desire for unanimity which overrides their motivation to realistically appraise alternative courses of action. Another pitfall in the decision-making process is described in the Abilene Paradox. It is described as a phenomenon which occurs when decision-making groups take actions in contradiction to available information when dealing with problems. The mismanagement of agreement is central to the issue of understanding dysfunctional organizational behavior. GRA

N89-21694# General Accounting Office, Washington, DC.
STRATEGIC DEFENSE INITIATIVE PROGRAM: BETTER MANAGEMENT DIRECTION AND CONTROLS NEEDED
Nov. 1987 27 p
(GAO/NSIAD-88-26) Avail: NTIS HC A03/MF A01

The Department of Defense's (DOD) Strategic Defense Initiative (SDI) is a multibillion dollar research program to determine the feasibility of establishing a defense system against nuclear ballistic missiles by the early 1990s. A key element of the system is battle management/command, control, and communications (BM/C3) which includes the systems that tie weapons, sensors, and computers together. The BM/C3 is controversial because of its complexity, and it could be a critical limiting factor to the entire SDI system design. The SDI Organization (SDIO) management of the Systems Analysis and Battle Management (SABM) program element was assessed, particularly as it related to the BM/C3 component. Author

N89-21708# Sandia National Labs., Albuquerque, NM.
MIGRATION STRATEGIES ROLES FOR DATA MANAGEMENT IN CIM
OLIN H. BRAY 1989 8 p Presented at the 5th International Congress on CIM Databases, Boston, MA, 19 Mar. 1989
(Contract DE-AC04-76DP-00789)
(DE89-008112; SAND-89-0532C; CONF-890366-2) Avail: NTIS HC A02/MF A01

This paper describes the migration path a company goes through as it moves up the data management learning curve. This migration path is based on four distinct roles for data management in computer integrated manufacturing (CIM). The first two sections review the justification for CIM and data management. The first section describes the changing competitive environment manufacturers face and how CIM addresses the problems this situation creates. The second section identifies the two key characteristics of a database management system and the benefits provided. The third section identifies and discusses the four roles for data management in CIM. These four roles and their variations provide snapshots of where a company is on the data management learning curve. The fourth section describes the migration path a company goes through as it moves up the learning curve. DOE

N89-22523# Illinois Univ., Urbana. Dept. of Psychology.
A THEORY OF COLLECTIVE INDUCTION Technical Report, 1 Jul. 1986 - 23 Jan. 1989
PATRICK R. LAUGHLIN 23 Jan. 1989 65 p
(Contract N00014-86-K-0322; RR04208)
(AD-A205062) Avail: NTIS HC A04/MF A01 CSCL 12/3

Collective induction is the cooperative search for descriptive, predictive, and explanatory generalizations, rules, and principles. This article proposes a theory of collective induction in the form of seven postulates. It then describes a rule induction task that abstracts the two essential aspects of collective induction, group hypothesis formation and group hypothesis evaluation. The theory predicts the conditional probabilities of 11 types of group hypotheses for 38 types of distributions of correct, plausible, and/or nonplausible group member hypotheses on trial (group hypothesis formation). These predictions fit the obtained probabilities for 400 groups better than the predictions of two other plausible theories, each with considerable support in previous research on group problem solving and decision making. Three other sets of predictions were also derived from the seven postulates and supported by the results. GRA

N89-23362# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Technical Information Panel.
THE ORGANISATION AND FUNCTIONS OF DOCUMENTATION AND INFORMATION CENTRES IN DEFENCE AND AEROSPACE ENVIRONMENTS
Mar. 1989 114 p Meeting held in Athens, Greece, 19-20 Oct. 1988
(AGARD-CP-445; ISBN-92-835-0496-8) Copyright Avail: NTIS HC A06/MF A01

Topics addressed include the information scene in the civil and defence sectors in Greece, ways to identify users and their needs, sources of information for a documentation center, ways of handling and managing information including the problems caused by security requirements, and ways of using multiple data bases in information retrieval.

N89-23374# Defense Applied Information Technology Center, Alexandria, VA.
FOSTERING INTERACTION OF GOVERNMENT, DEFENSE, AND AEROSPACE DATABASES
VIKTOR E. HAMPEL *In* AGARD, The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments 20 p Mar. 1989
Copyright Avail: NTIS HC A06/MF A01

The Department of Defense (DOD) knowledge worker needs rapid access to select information contained in government, defense, and aerospace databases. In the United States, information of use to defense and aerospace specialists are contained in multiple government databases as well as in commercial databases. Policy and technology strategies are addressed, which are being developed by the Defense Technical Information Center (DTIC) to foster better interaction among government, defense, and aerospace databases. To improve interactions, considerable progress was made by evolving standards in communication protocols, operating systems of computers, database management systems, and command structures, but it is the Defense Gateway technology that permits interconnectivity and interoperability in the interim period. This makes it possible to make the growing number of heterogeneous databases available to the defense community in a progressively more unified and automated manner. The results of several projects that introduce a high degree of information robotics to Information Resource Management (IRM) with substantial increases in human productivity are described. Author

N89-24064# California Univ., Los Angeles. Western Management Science Inst.
COMPUTER-BASED MODELING ENVIRONMENTS
ARTHUR M. GEOFFRION Dec. 1988 18 p Sponsored in part by Navy; NSF; and Shell Development Co.
(AD-A205828; WMSI-WP-363) Avail: NTIS HC A03/MF A01
CSCL 12/5

This paper gives the author's views on the kind of computer-based modeling environment needed to properly support management science/operations research work, and on the design challenges that need to be met in order to bring such modeling environments into being. It is a written version of the main ideas of two addresses: a plenary at IFORS 87 in Buenos Aires, and the keynote at the 1988 Canadian Operations Research Society Meeting in Montreal (May, 1988). Modeling environments have the potential to greatly increase the productivity of model-based work through better tools, to improve the quality of model-based work through better support for good modeling style and work practices, and to improve the frequency of use of MS/Or by bringing about a more comfortable working relationship between MS/OR professionals and their constituencies. GRA

N89-24222# Environmental Protection Agency, Washington, DC. Office of Information Resources Management.
GEOGRAPHIC INFORMATION SYSTEMS (GIS) GUIDELINES DOCUMENT Final Report
Jan. 1988 131 p
(PB89-132062; EPA/IRM-88/8801) Avail: NTIS HC A01/MF A01
CSCL 05/2

The document provides a comprehensive overview of the management and technical issues involved with Geographic Information Systems (GIS) technology at Environmental Protection Agency (EPA). The guidelines are designed to help determine the appropriateness of initiating GIS technology within the agency as well as to serve as a reference for potential EPA and State GIS applications. Author

N89-27588# Tilburg Univ. (Netherlands). Dept. of Economics.
ESTIMATION OF THE RELATIONSHIP BETWEEN PROJECT ATTRIBUTES AND THE IMPLEMENTATION OF ENGINEERING TOOLS
K. A. BUBSHAIT and W. J. SELEN 1988 29 p
(PB89-149470; FEW-350) Avail: NTIS HC A03/MF A01 CSCL 05/1

The study elaborates on earlier work by Bu-Bshait in identifying which project characteristics significantly intensify the need for a more elaborate use of project management techniques for various project types. A regression model is developed to estimate the number of project management techniques used, based upon a set of project characteristics. As such, the study provides further insight in the understanding of the missing link between project attributes and the implementation of engineering management tools. Author

N89-28506# Systems Control Technology, Inc., Arlington, VA.
RISK MANAGEMENT FOR AIR AMBULANCE HELICOPTERS OPERATORS Final Report
RICH ADAMS and JACK THOMPSON Jun. 1989 57 p Prepared in cooperation with Advanced Aviation Concepts, Jupiter, FL
(Contract DTFA01-87-C-0014)
(DOT/FAA/DS-88/7) Avail: NTIS HC A04/MF A01

This manual is intended to provide an easy reference for dealing with the operating pitfalls, the human frailties, and the risks in managing an air ambulance operation. It is not designed to give the operator step-by-step instructions. Rather, the manual describes techniques and tools that can be used to balance the demands of running a business with the need for maintaining safety. It provides pilot selection and training guidelines, as well as a review of a risk assessment technique that has proven successful. In addition, the manual recommends a workable format for establishing standard operating procedures to reduce risks. Finally, it highlights the key concerns that should be carefully considered from a risk management viewpoint. This operators manual is one of an integrated set of five Aeronautical Decision Making (ADM) manuals developed by the Federal Aviation Administration in a concerted effort to reduce the number of human factor related helicopter accidents. It can be used as one element of a comprehensive program for improving safety, reducing risk and, hopefully, the high cost of helicopter hull and liability insurance. The other four documents of the set are: (1) ADM for Helicopter Pilots (DOT/FAA/PM-86/45); (2) ADM for EMS Helicopter Pilots - Learning from Past Mistakes (DOT/FAA/DS-88/5); (3) ADM for EMS Helicopter Pilots - Situational Awareness Exercises (DOT/FAA/DS-88/6); and (4) ADM for Air Ambulance Hospital Administrators (DOT/FAA/DS-88/8). Author

N89-29668# Compression Lab., Inc., San Jose, CA.
AMERICANS TAKING THE PLUNGE WITH VIDEOCONFERENCING
C. M. MARSZEWSKI *In* ESA, Olympus Utilization Conference p 425-428 May 1989
Copyright Avail: NTIS HC A23/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The growing use of videoconferencing by American businesses and institutions is outlined. Case studies of the use three American firms make of videoconferring techniques are presented. The choice of videoconferencing services offered on the American market is summarized. New developments in the area of standards is predicted to further accelerate the growth of international videoconferencing. ESA

03

INDUSTRIAL MANAGEMENT AND MANUFACTURING

Includes Industrial Management, Engineering Management, Design Engineering, Production Management, Construction, Aerospace/Aircraft Industries, Manufacturing.

A89-10258
CURRENT DEVELOPMENTS IN OPTICAL ENGINEERING II; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUG. 18-21, 1987

ROBERT E. FISCHER, ED. (Ernst Leitz Canada, Ltd., Westlake Village, CA) and WARREN J. SMITH, ED. (Kaiser Aerospace and Electronics Corp., Electro-Optics Div., Carlsbad, CA) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 818), 1987, 469 p. For individual items see A89-10259 to A89-10280.
(SPIE-818) Copyright

Among the topics discussed are physical optics and scattering, scattering and coatings, and lasers and materials. Attention is also given to engineering and applications, optical storage and lens design, detectors and optical fabrication, optical fabrication and testing, and telescope systems and optical design. B.J.

A89-12600
AEROSPACE FIRMS REALIZING PAYOFFS FROM ADVANCED PRODUCTION INVESTMENTS
WILLIAM B. SCOTT Aviation Week and Space Technology (ISSN 0005-2175), vol. 129, Oct. 1988, p. 85, 86, 91.
Copyright

The U.S. DOD's Industrial Modernization Incentives Program encourages industrial contractors to develop high-risk computer-aided manufacturing (CIM) technologies at their own expense, while sharing the cost savings realized from the contractor's innovations. A similar DOD-managed effort, the Manufacturing Resource Planning-2 program, focuses on the development of systems that schedule, track, and report on material and factory-floor processes involved in manufacturing operations. Attention is presently given to the application of these CIM techniques to the inspection and analysis processes employed by a major contractor in fighter aircraft radar production. O.C.

A89-12951
MANUFACTURING - THE CUTTING EDGE
ALAN POSTLETHWAITE Flight International (ISSN 0015-3710), vol. 134, Sept. 17, 1988, p. 36-40.
Copyright

An account is given of the features and productivity improvements demonstrated to date by several major U.S. civilian and military aircraft manufacturers with state-of-the-art manufacturing facilities dedicated to advanced materials. The materials encompass both fiber-reinforced composites and metallics; CIM processes are typically employed to accomplish highly controlled prepreg tape-laying for complex composite structural component geometries, or material storage and retrieval operations for a large-scale machining apparatus that employs robotic vision for work-fixture tooling and control. AI is employed to solve the complex scheduling problems created by such fabrication systems. O.C.

A89-17862#
TECHNICAL STRATEGIES FOR LUNAR MANUFACTURING
TSUTOMU IWATA (National Space Development Agency of Japan, Tsukuba) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 4 p. refs
(IAF PAPER 88-588) Copyright

Several strategies for developing lunar manufacturing are discussed and evaluated. A semiself-sufficient or controlled manufacturing system on the moon is proposed and its evolutional scenario is studied. It is found that the demands for lunar base repair and expansion, lunar liquefied oxygen (LLOX) pilot plant and solar collectors made from lunar iron and ceramics can be appropriately combined to create an evolving system of lunar manufacturing, which will be a sufficient driver for lunar development. Author

A89-25083*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CFD IN DESIGN - A GOVERNMENT PERSPECTIVE
PAUL KUTLER and ANTHONY R. GROSS (NASA, Ames Research Center, Moffett Field, CA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 19 p. refs
(AIAA PAPER 89-0094) Copyright

Some of the research programs involving the use of CFD in the aerodynamic design process at government laboratories around the United States are presented. Technology transfer issues and future directions in the discipline or CFD are addressed. The major challengers in the aerosciences as well as other disciplines that will require high-performance computing resources such as massively parallel computers are examined. C.D.

A89-25513#
AIRCRAFT DESIGN EDUCATION AT NORTH CAROLINA STATE UNIVERSITY
J. N. PERKINS, R. J. VESS (North Carolina State University, Raleigh), and R. A. MITCHELTREE AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 6 p.
(AIAA PAPER 89-0649) Copyright

This paper discusses one of the senior year design programs in Aerospace Engineering at North Carolina State University. The objectives, organization, and management of the final year group projects in aircraft design are described. Emphasis is placed on introducing some of the real world into the course by requiring the students to build and fly, by remote means, a scaled model of their design. Details of the design activities, construction techniques, and flight testing are discussed. Author

A89-36293* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MECHANICS OF COMPOSITE MATERIALS - PAST, PRESENT AND FUTURE
CHRISTOS C. CHAMIS (NASA, Lewis Research Center, Cleveland, OH) Journal of Composites Technology and Research (ISSN 0885-6804), vol. 11, Spring 1989, p. 3-14. Previously announced in STAR as N88-17744. refs
Copyright

Composite mechanics disciplines are presented and described at their various levels of sophistication and attendant scales of application. Correlation with experimental data is used as the prime discriminator between alternative methods and level of sophistication. Major emphasis is placed on: (1) where composite mechanics has been; (2) what it has accomplished; (3) where it is headed, based on present research activities; and (4) at the risk of being presumptuous, where it should be headed. The discussion is developed using selected, but typical examples of each composite mechanics discipline identifying degree of success, with respect to correlation with experimental data, and problems remaining. The discussion is centered about fiber/resin composites drawn mainly from the author's research activities/experience spanning two decades at Lewis. Author

A89-41592
POWDER METALLURGY MANUFACTURING PROCESSES - APPROACHES, STATUS, AND FUTURE DIRECTIONS
ALAN LAWLEY (Drexel University, Philadelphia, PA) IN: Competitive advances in metals and processes; Proceedings of the First International SAMPE Metals and Metals Processing Conference, Cherry Hill, NJ, Aug. 18-20, 1987. Covina, CA, Society for the Advancement of Material and Process Engineering, 1987, p. 228-239. refs
Copyright

A development status and prospective advancements evaluation is presented for P/M technologies applicable to the specialty alloys encountered in the aerospace and automotive fields. Attention is given to such state-of-the-art processes (some of which have reached, or are approaching, the full commercialization stage) as gas-atomization prealloyed metal powder production, the rotating-electrode powder-production process, soluble gas atomization of powders, centrifugal atomization, and ultrasonic gas atomization. The conventional pressing and sintering processes for consolidation of P/M powders are being joined by injection molding, powder-preform consolidation, hot extrusion, HIPing, and spray-deposition. O.C.

A89-43717
STRUCTURAL DESIGN AND VALIDATION CHALLENGES OF LARGE SPACE SYSTEMS

KETO SOOSAAR (Cambridge Research, MA) IN: Space - A new community of opportunity; Proceedings of the Thirty-fourth Annual AAS International Conference, Houston, TX, Nov. 3-5, 1987. San Diego, CA, Univelt, Inc., 1989, p. 313-317.
(AAS PAPER 87-661) Copyright

Issues related to the design and validation of large space systems are discussed. The engineering aspects of design and validation process are reviewed. Consideration is given to the educational preparation of the engineer, the availability of suitable analysis and design tools, appropriate organizational structures for developing technologies, and long-term support to the development of large space systems. R.B.

A89-45726 BDM Corp., Albuquerque, NM.
ENGINEERING, CONSTRUCTION, AND OPERATIONS IN SPACE; PROCEEDINGS OF THE SPACE '88 CONFERENCE, ALBUQUERQUE, NM, AUG. 29-31, 1988
STEWART W. JOHNSON, ED. and JOHN P. WETZEL, ED. (BDM Corp., Albuquerque, NM) Conference sponsored by ASCE, AIAA, NASA, et al. New York, American Society of Civil Engineers, 1988, 1363 p. For individual items see A89-45727 to A89-45835.
Copyright

The broad topics considered are extraterrestrial basing, the Space Station and orbiting structures, and areas of special interest. The section on extraterrestrial basing considers the processing of lunar soils, lunar surface construction and operations, lunar base design, and Martian basing. The section on the Space Station and orbiting structures considers the mechanics of space structures and materials, space environmental effects, robotic construction and planning, and maintenance and operations associated with the Space Station. Areas of special interest include space power, life support systems, human factors, astronomy, education, and management and planning of systems for space facilities. B.J.

A89-47350
ENGINEERING DESIGN: A SYSTEMATIC APPROACH
GERHARD PAHL and WOLFGANG BEITZ London/Berlin and New York, Design Council/Springer-Verlag, 1988, 418 p. Translation. refs
Copyright

Due to the complexity of contemporary technology, product and system design efforts often require intensive organization and communication within teams; the design venture must accordingly be carefully planned and systematically executed, integrating the various aspects of the design process into a logical and comprehensible whole. The present comprehensive and systematic treatment of this methodology proceeds by clarifying the design task, establishing the function structures of a conceptual design, and finally determining the definitive layout embodying the design. Illustrative examples of actual product design processes and their results are presented and evaluated. O.C.

A89-52513
ARE THE SOVIETS SET TO MAKE THE BIG TIME?
OLIVER SUTTON Interavia (ISSN 0020-5168), vol. 44, Aug. 1989, p. 772-776.
Copyright

The commercial viability of Soviet-manufactured airliners is evaluated in light of current production airframe production-capacity saturation in both the U.S. and Western Europe, opening opportunities for Soviet airframe manufacturing enterprises capable of delivering aircraft ahead of Western competitors. The Il-96-300 and the Tu-204 airliners are noted to respectively fit into two popular aircraft categories, namely those for the long-range routes that are eventually to be served by the A 340, and those for the medium-range routes currently served by such aircraft as the B 757. Attention is given to Western certification criteria for the Soviet aircraft and the prospects for cooperative efforts with Western manufacturers. O.C.

N89-13486*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN INTEGRATED IN-SPACE CONSTRUCTION FACILITY FOR THE 21ST CENTURY
MARTIN M. MIKULAS, JR. and JOHN T. DORSEY Nov. 1988 31 p
(NASA-TM-101515; NAS 1.15:101515) Avail: NTIS HC A03/MF A01 CSCL 22/2

Preliminary results are presented of studies being conducted by NASA on the construction of very large spacecraft. The various approaches are discussed for constructing spacecraft and their relative merits. It is observed that the Space Station Freedom has all of the basic design characteristics to permit its growth into an in-space construction facility for very large spacecraft. Also it is noted that if disturbances from construction operations are intolerable to other Space Station experiments, a co-orbiting construction facility could be built using previously developed Space Station truss hardware and systems. A discussion is also presented of a new PATHFINDER research initiative on on-orbit construction. This research effort is aimed at developing construction methods for very large spacecraft and includes the development of a 100 meter long space crane. Author

N89-13637# Office of Technology Assessment, Washington, DC.
ADVANCED MATERIALS BY DESIGN
Jul. 1988 337 p
(PB88-243548; OTA-E-358; LC-87-619860) Avail: NTIS HC A15/MF A01; also available SOD HC $14.00 as 052-003-01095-0 CSCL 11/3

The military and commercial opportunities presented by new structural materials technologies are analyzed and the Federal policy objectives that are consistent with those opportunities are outlined. The impact of advanced structural materials on the competitiveness of the U.S. manufacturing sector is also addressed and policy options for accelerating the commercial utilization of the materials are offered. Author

N89-21845# Argonne National Lab., IL.
ADVANCED MATERIALS IN THE MANUFACTURING REVOLUTION: PROCEEDINGS
MICHAEL V. NEVITT, ed. and NORMAN D. PETERSON, ed. Feb. 1989 91 p Conference held in Argonne, IL, 14 Jun. 1988
(Contract W-31-109-ENG-38)
(DE89-008190; ANL-89/3; CONF-8806303) Avail: NTIS HC A05/MF A01

A conference at Argonne National Laboratory for senior executives of small and medium-size manufacturing companies covered technical and managerial issues involved in adapting advanced materials and new manufacturing methods. Seven speakers discussed how high performance metals, alloys, ceramics, polymerics and their composites are replacing conventional mill-product materials and how these new materials are impacting manufacturing methods and products. DOE

N89-21937# Applied Ordnance Technologies, Fort Washington, MD.
MULTI-OPTIONAL DESIGN LABORATORY Final Report, 8 Jun. 1987 - 31 Dec. 1988
JOHN H. SMITH and EUGENE E. ELZUFON Jun. 1988 25 p
(Contract F04611-87-C-0051)
(AD-A202803; AFAL-TR-88-040) Avail: NTIS HC A03/MF A01 CSCL 19/1

A study has been completed covering a preliminary design for a laboratory size solid propellant mixing facility. The objective was to design a facility in which, if possible, the man was removed from the hazardous portion of the operation. Five options were considered ranging from minimal to full automation. All five options are presented and discussed in detail. For the Phase 2 effort, a system where the mixing cell is fully automated is recommended. GRA

N89-23681# Clemson Univ., SC. Dept. of Industrial Engineering.
RESEARCH NEEDS IN CERAMIC MACHINING
ERIC C. SKAAR and W. J. KENNEDY, JR. 1988 26 p
(Contract NSF DMC-86-12943)
(PB89-148191; NSF/ENG-88015) Avail: NTIS HC A03/MF A01
CSCL 11/3

A workshop was organized to address three main topics: conventional ceramic machining; nontraditional ceramic machining; and material effects of machining. Attendees recommended research topics ranging from modification of existing machinery to the development of several nontraditional machining methods. They observed that the entire manufacturing process must be examined, and not just the maching step. They placed emphasis on optimization and modeling. GRA

N89-27002# Argonne National Lab., IL. Energy and Environmental Systems Div.
FUTURE APPLICATIONS OF ENGINE CERAMICS: FACTORS INFLUENCING MARKET OPPORTUNITIES, TIMING, AND GROWTH
ROBERT P. LARSEN 1989 5 p Presented at the Ceramtec '89, Dearborn, MI, 30 Jan. 1989
(Contract W-31-109-ENG-38)
(DE89-012426; CONF-890108-1) Avail: NTIS HC A02/MF A01

Since 1986, the Center for Transportation Research (CTR) at Argonne National Laboratory has conducted market-based research focusing on the use of ceramics in heat engines for transportation applications. The purpose of my presentation is to share some of the insights we have gained over the past several years and some of the techniques we have found useful in making projections for engine ceramics. For these studies, which are funded by the U.S. Department of Energy, we developed a modeling technique that is useful in examining different scenarios for the timing and growth of the market for engine ceramics. I want to make you aware of these models and how to interpret them and use their results and other information from our research for decisions in your organizations. The data used in developing the models were gathered in a comprehensive worldwide Delphi survey designed to determine when ceramic engine components and ceramic intensive engines would become available in the United States. Information was also gathered on the rate of market growth for engine ceramics, incentives and barriers to their use, and the status of international competition for the worldwide engine ceramics market. DOE

04

ROBOTICS AND EXPERT SYSTEMS

Includes Artificial Intelligence, Robots and Robotics, Automatic Control and Cybernetics, Expert Systems, Automation Applications, Computer-Aided Design (CAD), Computer-Aided Manufacturing.

A89-11711* Georgia Tech Research Inst., Atlanta.
APPLICATIONS OF ARTIFICIAL INTELLIGENCE V; PROCEEDINGS OF THE MEETING, ORLANDO, FL, MAY 18-20, 1987
JOHN F. GILMORE, ED. (Georgia Institute of Technology, Atlanta) Meeting sponsored by SPIE, University of Alabama, NASA, et al. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 786), 1987, 624 p. For individual items see A89-11712 to A89-11725.
(SPIE-786) Copyright

The papers contained in this volume focus on current trends in applications of artificial intelligence. Topics discussed include expert systems, image understanding, artificial intelligence tools, knowledge-based systems, heuristic systems, manufacturing applications, and image analysis. Papers are presented on expert system issues in automated, autonomous space vehicle rendezvous; traditional versus rule-based programming techniques; applications to the control of optional flight information; methodology for evaluating knowledge-based systems; and real-time advisory system for airborne early warning. V.L.

A89-11803
SPACE STATION AUTOMATION III; PROCEEDINGS OF THE MEETING, CAMBRIDGE, MA, NOV. 2-4, 1987
WUN C. CHIOU, SR., ED. Meeting sponsored by SPIE, IEEE, NASA, et al. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 851), 1987, 192 p. For individual items see A89-11804 to A89-11828.
(SPIE-851) Copyright

The conference presents papers on the application of artificial intelligence technology to national space programs, system and subsystem autonomy, telerobotic technology for space applications, and remote servicing platforms. Topics include testing and validation in artificial intelligence programming, common sense knowledge framework for subsystem autonomy, mission planning and simulation via intelligent agents, and system autonomy hooks and scars for Space Station. Consideration is also given to sensor integration by system and operator, intelligent training system for payload-assist module deploys, telerobot experiment concepts in space, common sense planning applied to grasping and manipulating, and Space Station flight telerobotic servicer functional requirements development. K.K.

A89-12178
INTEGRATED DESIGN SUPPORT SYSTEM
T. N. BERNSTEIN (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) Engineering with Computers (ISSN 0177-0667), vol. 4, no. 1-2, 1988, p. 27-37.
Copyright

The integrated design support system (IDS) is a concept for capturing the 'critical' technical engineering information necessary to perform the functions of maintenance, modification, repair, and reprocurement of Air Force weapon systems. The program will first construct an architecture to define the required information. Next, IDS will construct prototype software to acquire, store, distribute, and perform configuration management on the data. The program will conclude with software simulation of the full-scale IDS system operating in a production environment to determine performance characteristics together with development and operational costs for the system. Author

A89-12181
AN INTEGRATED DATA BASE MANAGEMENT SYSTEM FOR ENGINEERING APPLICATIONS BASED ON AN EXTENDED RELATIONAL MODEL
J. S. ARORA and S. MUKHOPADHYAY (Iowa, University, Iowa City) Engineering with Computers (ISSN 0177-0667), vol. 4, no. 1-2, 1988, p. 65-73. refs
(Contract AF-AFOSR-82-0322)
Copyright

Some general research issues involved in the design and implementation of a new integrated data base management system (DBMS) are examined. A generalized relational model is introduced to handle large matrices and tables encountered in many engineering applications. The model forms the basis for the design of the new DBMS MIDAS/GR (Management of Information for Design and Analysis of Systems/Generalized Relational model) system. The system supports run-time data management as well as data sharing among software components. Some details of the design and performance of the system are discussed, as are results of some applications. V.L.

A89-20601
ROBOTICS AND FACTORIES OF THE FUTURE '87; PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE, SAN DIEGO, CA, JULY 28-31, 1987
R. RADHARAMANAN, ED. (San Diego State University, CA) Conference sponsored by the International Society for Productivity Enhancement, San Diego State University, U.S. Navy, et al. Berlin

and New York, Springer-Verlag, 1988, 862 p. For individual items see A89-20602 to A89-20610.
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The conference presents papers on planning of automation, CAD/CAM, CIM/FMS, kinematic analysis, dynamics and control, trajectory planning, and sensors and vision systems. Other topics include AI and expert systems, mobile robots/robotic devices, robot applications, automation and innovation in mining, and CAD/CAM and robotics education/training. Particular attention is given to the use of CAD systems in the design of Space Station and space robots, a kinematic model of flexible robot arms, and a state-of-the-art survey of robot programming languages. K.K.

A89-21801* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
1988 GODDARD CONFERENCE ON SPACE APPLICATIONS OF ARTIFICIAL INTELLIGENCE, GREENBELT, MD, MAY 24, 1988, PROCEEDINGS
JAMES L. RASH, ED. (NASA, Goddard Space Flight Center, Greenbelt, MD) Conference sponsored by NASA. Telematics and Informatics (ISSN 0736-5853), vol. 5, no. 3, 1988, 218 p. For individual items see A89-21802 to A89-21816; Previously announced in STAR as N88-30330.
Copyright

This publication comprises the papers presented at the 1988 Goddard Conference on Space Applications of Artificial Intelligence held at the NASA/Goddard Space Flight Center, Greenbelt, Maryland on May 24, 1988. The purpose of this annual conference is to provide a forum in which current research and development directed at space applications of artificial intelligence can be presented and discussed. The papers in these proceedings fall into the following areas: mission operations support, planning and scheduling; fault isolation/diagnosis; image processing and machine vision; data management; modeling and simulation; and development tools methodologies. Author

A89-22172* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
INTELLIGENT, AUTONOMOUS SYSTEMS IN SPACE
H. LUM and E. HEER (NASA, Ames Research Center, Moffett Field, CA) Acta Astronautica (ISSN 0094-5765), vol. 17, Oct. 1988, p. 1081-1091. refs
Copyright

The Space Station is expected to be equipped with intelligent, autonomous capabilities; to achieve and incorporate these capabilities, the required technologies need to be identitifed, developed and validated within realistic application scenarios. The critical technologies for the development of intelligent, autonomous systems are discussed in the context of a generalized functional architecture. The present state of this technology implies that it be introduced and applied in an evolutionary process which must start during the Space Station design phase. An approach is proposed to accomplish design information acquisition and management for knowledge-base development. Author

A89-25362*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A STUDY OF KNOWLEDGE-BASED SYSTEMS FOR THE SPACE STATION
PETER FRIEDLAND (NASA, Ames Research Center, Moffett Field, CA), GREGG SWIETEK (NASA, Washington, DC), and BRUCE BULLOCK (ISX Corp., Thousand Oaks, CA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 12 p.
(AIAA PAPER 89-0443) Copyright

A rapid turnaround study on the potential uses of knowledge-based systems for Space Station Freedom was conducted from October 1987 through January 1988. Participants included both NASA personnel and experienced industrial knowledge engineers. Major results of the study included five recommended systems for the Baseline Configuration of the Space Station, an analysis of sensor hooks and scars, and a proposed plan for evolutionary growth of knowledge-based systems on the Space Station. Author

A89-27601
INTERNATIONAL CONFERENCE ON INDUSTRIAL AND ENGINEERING APPLICATIONS OF ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS, 1ST, UNIVERSITY OF TENNESSEE, TULLAHOMA, JUNE 1-3, 1988, PROCEEDINGS. VOLUMES 1 & 2
Conference sponsored by the University of Tennessee. Tullahoma, TN, University of Tennessee, 1988, p. Vol. 1, 654 p.; vol. 2, 566 p. For individual items see A89-27602 to A89-27630.
Copyright

The conference presents papers on expert systems for fault diagnosis, expert system technology, expert systems applications, expert systems for design, and expert systems for process control. Consideration is given to pattern-based fault diagnosis using neural networks, diagnosing multiple faults using knowledge about malfunctioning behavior, approximate spatial reasoning, and integrating causal reasoning at different levels of abstraction. Other topics include uncertainty management in intelligent design aiding systems, a representational language for qualitative process control, and a neural control element in a control systems application. K.K.

A89-28901
APPLIED ARTIFICIAL INTELLIGENCE IN JAPAN: CURRENT STATUS, KEY RESEARCH AND DEVELOPMENT PERFORMERS, STRATEGIC FOCUS
BRUCE RUBINGER (Global Competitiveness Council, Boston, MA) New York, Hemisphere Publishing Corp., 1988, 270 p.
Copyright

The current status of AI research and applications in Japan is surveyed in a reference guide and source book intended for U.S. commercial use. Chapters are devoted to the Japanese AI market; key meetings, professional organizations, and information sources; leading organizations in AI research, development, and utilization; and leading personalities in Japanese AI. T.K.

A89-29002
NEURAL INFORMATION PROCESSING SYSTEMS; PROCEEDINGS OF THE FIRST IEEE CONFERENCE, DENVER, CO, NOV. 8-12, 1987
DANA Z. ANDERSON, ED. (Colorado, University, Boulder) Conference sponsored by IEEE. New York, American Institute of Physics, 1988, 881 p. For individual items see A89-29003 to A89-29063.
Copyright

Theoretical aspects of neural computational networks are discussed in reviews and reports of recent investigations. Topics addressed include stochastic learning networks and their electronic implementation, supervised learning of probability distributions by neural networks, learning algorithms for pattern-association problems, high-density associative memories, tropistic processing and its applications, an optimization network for matrix inversion, and associative-memory performance measures. Consideration is given to bit-serial neural networks, a programmable synaptic chip for neural networks, constrained differential optimization, learning by state-recurrence detection, the spatial organization of neural networks, temporal pattern processing, implementing neural-net connections on SIMD architectures, neuromorphic networks based on sparse optical orthogonal codes, and synchronization in neural nets. T.K.

A89-29041
MURPHY - A ROBOT THAT LEARNS BY DOING
BARTLETT W. MEL (Illinois, University, Champaign) IN: Neural information processing systems; Proceedings of the First IEEE Conference, Denver, CO, Nov. 8-12, 1987. New York, American Institute of Physics, 1988, p. 544-553. refs
Copyright

Murphy consists of a camera looking at a robot arm, with a connectionist network architecture situated in between. By moving its arm through a small, representative sample of the 1 billion possible joint configurations, Murphy learns the relationships, backward and forward, between the positions of its joints and the

state of its visual field. Murphy can use its internal model in the forward direction to 'envision' sequences of actions for planning purposes, such as in grabbing a visually presented object, or in the reverse direction to 'imitate', with its arm, autonomous activity in its visual field. Furthermore, by taking explicit advantage of continuity in the mappings between visual space and joint space, Murphy is able to learn nonlinear mappings with only a single layer of modifiable weights. Author

A89-29110
REPORT OF RESEARCH FORUM ON SPACE ROBOTICS AND AUTOMATION: EXECUTIVE SUMMARY
YOJI UMETANI, KAZUYA YOSHIDA (Tokyo Institute of Technology, Japan), YOSHIAKI OKAMI (National Aerospace Laboratory, Tokyo, Japan), MASARU UCHIYAMA (Tohoku University, Sendai, Japan), TSUTOMU IWATA (National Space Development Agency of Japan, Tokyo) et al. Research supported by the National Space Development Agency of Japan. Tokyo, Japan Space Utilization Promotion Center, 1988, 37 p.
Copyright

A NASDA report on Japanese policies concerning space robotics and automation development is summarized. A scenario in which orbiting robots construct and operate space structures is presented and the element technologies needed to realize the scenario are discussed. Recommendations for Japanese policy are given, focusing on three project proposals: the construction of space structures using robots, the development of a space experiment module, and the creation of ground-based testing facilities for the performance evaluation and verification of space robots. R.B.

A89-31076* Heer Associates, Inc., LaCanada, CA.
MACHINE INTELLIGENCE AND AUTONOMY FOR AEROSPACE SYSTEMS
EWALD HEER, ED. (Heer Associates, Inc., La Canada, CA) and HENRY LUM, ED. (NASA, Ames Research Center, Moffett Field, CA) Washington, DC, American Institute of Aeronautics and Astronautics, Inc. (Progress in Astronautics and Aeronautics. Volume 115), 1988, 369 p. For individual items see A89-31077 to A89-31091.
Copyright

The present volume discusses progress toward intelligent robot systems in aerospace applications, NASA Space Program automation and robotics efforts, the supervisory control of telerobotics in space, machine intelligence and crew/vehicle interfaces, expert-system terms and building tools, and knowledge-acquisition for autonomous systems. Also discussed are methods for validation of knowledge-based systems, a design methodology for knowledge-based management systems, knowledge-based simulation for aerospace systems, knowledge-based diagnosis, planning and scheduling methods in AI, the treatment of uncertainty in AI, vision-sensing techniques in aerospace applications, image-understanding techniques, tactile sensing for robots, distributed sensor integration, and the control of articulated and deformable space structures. O.C.

A89-31078#
MANDATE FOR AUTOMATION AND ROBOTICS IN THE SPACE PROGRAM
DAVID R. CRISWELL (Universities Space Research Association, La Jolla, CA) IN: Machine intelligence and autonomy for aerospace systems. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 15-30. refs
Copyright

The U.S. Congress has been so concerned about the role of automation and robotics (A&R) technologies in the NASA Space Station that NASA's Advanced Technology Advisory Committee has been directed to report on progress made on the implementation of its 13-point April 1, 1985 recommendations. One NASA objective pursuant to this A&R development thrust has been the enhancement of personnel and procedures' sophistication on A&R-related matters to the point where only the most dynamically technology-driving design requirements for the Space Station will be countenanced. Attention has also been given to prospective A&R technology spinoffs in the rest of the U.S. economy. Author

A89-31085*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
PLANNING AND SCHEDULING IN AI
PETER CHEESEMAN (NASA, Ames Research Center, Moffett Field, CA) IN: Machine intelligence and autonomy for aerospace systems. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 209-231. refs
Copyright

An account is given of the many related activities employing AI that are classifiable as 'automatic planning and scheduling'. A human can form plans and successfully execute them, but no current automatic-planning AI system can match this robustness and generality; it is in fact suggested that automatic planning is unlikely to be achieved by a general-purpose planning system. It is judged likely that partially-specialized planners will emerge for the efficient solution of specific classes of problems. Current planners are also found to make unrealistic informational demands, especially in the requirement that the 'state of the world' be known at all times, and that the only changes that occur are under the planner's control. O.C.

A89-31086*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
TREATMENT OF UNCERTAINTY IN ARTIFICIAL INTELLIGENCE
HAMID R. BERENJI (NASA, Ames Research Center; Heer Associates, Inc., Moffett Field, CA) IN: Machine intelligence and autonomy for aerospace systems. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 233-247. refs
Copyright

The present assessment of the development status of research efforts concerned with AI reasoning under conditions of uncertainty emphasizes the importance of appropriateness in the approach selected for both the epistemic and the computational levels. At the former level, attention is given to the form of uncertainty-representation and the fidelity of its reflection of actual problems' uncertainties; at the latter level, such issues as the availability of the requisite information and the complexity of the reasoning process must be considered. The tradeoff between these levels must always be the focus of AI system-developers' attention. O.C.

A89-35251
INTERNATIONAL CONFERENCE ON CONTROL 88, OXFORD, ENGLAND, APR. 13-15, 1988, PROCEEDINGS
Conference organized by IEE. London, Institution of Electrical Engineers, 1988, 755 p. For individual items see A89-35252 to A89-35305.
Copyright

The conference presents papers on the application of control, computer-aided design, systems identification, self-tuning control applications, flexible manufacturing systems, design methods, knowledge-based systems, sensors, numerical methods, optimization, electrical systems applications, fault detection, and robotics. Other topics include industrial systems applications, digital control systems, self-tuning control implementation, the hierarchical control of large-scale systems, robust design, and self-tuning algorithms. Consideration is also given to large-scale systems such as power and water systems, marine systems, H(infinity) methods, aerospace, and nonlinear systems. K.K.

A89-39492* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
ADDING INTELLIGENCE TO SCIENTIFIC DATA MANAGEMENT
WILLIAM J. CAMPBELL, NICHOLAS M. SHORT, JR., and LLOYD A. TREINISH (NASA, Goddard Space Flight Center, Greenbelt,

MD) Computers in Physics (ISSN 0894-1866), vol. 3, May-June 1989, p. 26-32. refs
Copyright

NASA plans to solve some of the problems of handling large-scale scientific data bases by turning to artificial intelligence (AI) are discussed. The growth of the information glut and the ways that AI can help alleviate the resulting problems are reviewed. The employment of the Intelligent User Interface prototype, where the user will generate his own natural language query with the assistance of the system, is examined. Spatial data management, scientific data visualization, and data fusion are discussed. C.D.

A89-43125
ADVANCED ROBOTICS FOR AIR FORCE OPERATIONS
Washington, DC, National Academy Press, 1989, 110 p. No individual items are abstracted in this volume.

The results of a technology survey on the potential applications of robots in U.S. Air Force operations are summarized. Topics discussed include robotics in primary, secondary, and support operations; robots for maintenance, remanufacture, and modification; material handling tasks; recommended applications; and enabling technologies (computer control systems, sensors, actuators, and man-machine interfaces). Consideration is given to technological and economic constraints on robotics development, organizational issues for robotics R&D, the projected evolution of robotics markets, and technology-lifetime questions. Drawings, diagrams, and flow charts are provided. T.K.

A89-43719* National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AUTOMATION AND ROBOTICS FOR THE SPACE STATION - AN ATAC PERSPECTIVE
ROBERT R. NUNAMAKER (NASA, Langley Research Center, Hampton, VA) IN: Space - A new community of opportunity; Proceedings of the Thirty-fourth Annual AAS International Conference, Houston, TX, Nov. 3-5, 1987. San Diego, CA, Univelt, Inc., 1989, p. 343-348.
(AAS PAPER 87-666) Copyright

The study of automation and robotics for the Space Station by the Advanced Technology Advisory Committee is surveyed. The formation of the committee and the methodology for the Space Station automation study are discussed. The committee's recommendations for automation and robotics research and development are listed. R.B.

A89-45135
ESTABLISHING ARTIFICIAL INTELLIGENCE TECHNOLOGY IN A FLIGHT TEST ENVIRONMENT
JOSEPH N. BEASLEY and RICHARD T. BLACK (USAF, Flight Test Center, Edwards AFB, CA) IN: Society of Flight Test Engineers, Annual Symposium, 19th, Arlington, TX, Aug. 14-18, 1988, Proceedings. Lancaster, CA, Society of Flight Test Engineers, 1988, p. III-5.1 to III-5.7.
Copyright

The application of AI technology to flight testing has been motivated by such problems as the recent data explosion, increased flying schedules, inexperienced engineers, and engineer attrition. Special attention is given to the development of an expert system that identifies flight maneuvers (such as sidelip, 1-g roll, windup turning, maximum g roll, slowdown turning, and 1-g deceleration) from flight data. It is pointed out that the knowledge base for the event identifier is simple, readable, and easily modified. Limitations of the system are addressed. R.R.

A89-53401
1989 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION, SCOTTSDALE, AZ, MAY 14-19, 1989, PROCEEDINGS. VOLUMES 1, 2, & 3
Conference sponsored by IEEE. Washington, DC, IEEE Computer Society Press, 1989, p. Vol. 1, 656 p.; vol. 2, 653 p.; vol. 3, 636 p. For individual items see A89-53402 to A89-53469.
Copyright

Recent advances in robotics technology and applications are discussed in reviews and reports. Topics addressed include algorithmic motion planning, shape and reflectance, assembly planning, force control, redundant robots, tactile devices, shape modeling, heuristic motion planning, recognition, closed-chain kinematics, grasping, visual inspection and assembly, manufacturing systems, impedance control, and kinematic calibration. Consideration is given to planning with uncertainty, sensor fusion, the dynamics of flexible-link manipulators, fine motion control, wrist kinematics, optimal trajectories, visual navigation and road following, control of telerobotic systems, neural networks, inertial-parameter identification, microactuation, legged locomotion, piezoelectric actuation, decentralized control, computer implementation of dynamics, and EM and pneumatic actuation. T.K.

A89-54909
MANAGING CHANGE WITH CAD AND CAD/CAM
GLORIA L. LEE (Aston University, Birmingham, England) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 36, Aug. 1989, p. 227-233. refs
Copyright

A model is developed for the analysis of factors influencing organizational and technological changes associated with CAD and CAD/CAM. Different pressures for adoption and the sociopolitical environment of the organization are related to managerial strategies and their impact on skills, tasks, training, and changes in work organization. Opportunities are illustrated through the experiences of seven British engineering companies implementing the technologies. Six of the companies are in manufacturing and one is an engineering services organizaton. Four of the companies are of small to medium size (under 500 employees) and the other three are large, multisite organizations. Key elements of the technological change are identified, and the position of the seven companies in relation to these elements is summarized and discussed. I.E.

N89-10063*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
PROCEEDINGS OF 1987 GODDARD CONFERENCE ON SPACE APPLICATIONS OF ARTIFICIAL INTELLIGENCE (AI) AND ROBOTICS
ELLEN G. STOLARIK, ed., RONALD G. LITTLEFIELD, ed., and DAVID S. BEYER, ed. 1987 718 p Conference held in Greenbelt, Md., 13-14 May 1987
(NASA-TM-89663; NAS 1.15:89663) Avail: NTIS HC A99/MF E03 CSCL 22/1

Topics addressed include: planning/scheduling expert systems; fault isolation/diagnosis expert systems; data processing/analysis expert systems; expert system tools/techniques; and robotics.

N89-10082*# George Washington Univ., Washington, DC. Inst. for Artificial Intelligence.
TOWARD AN EXPERT PROJECT MANAGEMENT SYSTEM
BARRY G. SILVERMAN, ARTHUR MURRAY, COTY DIAKITE (Intellitek, Inc., Rockville, Md.), and KOSTAS FEGGOS *In* NASA, Goddard Space Flight Center, Proceedings of 1987 Goddard Conference on Space Applications of Artificial Intelligence (AI) and Robotics 18 p 1987
Avail: NTIS HC A99/MF E03 CSCL 05/1

The purpose of the research effort is to prescribe a generic reusable shell that any project office can install and customize for the purposes of advising, guiding, and supporting project managers in that office. The prescribed shell is intended to provide both: a component that generates prescriptive guidance for project planning and monitoring activities, and an analogy (intuition) component that generates descriptive insights of previous experience of successful project managers. The latter component is especially significant in that it has the potential to: retrieve insights, not just data, and provide a vehicle for expert PMs to easily transcribe their current experiences in the course of each new project managed. Author

N89-12482# Computer Resources International A/S (Denmark).
EXPERT PLANNING SYSTEMS: A STUDY ON THE USE OF EXPERT PLANNING SYSTEMS FOR SPACE RELATED PLANNING APPLICATIONS Final Report
J. J. FUCHS, J. GULDBERG, B. OLALAINTY, J. M. DARROY, and K. CURRIE Paris, France ESA 8 Apr. 1988 92 p
(Contract ESA-6982/NL-MAC)
(EP-CRI-FR-0001-1988; ESA-CR(P)-2634; ETN-88-93166) Avail: NTIS HC A05/MF A01

The potential of knowledge based planning systems in relation to ESA operations; a mock-up of a system for evaluation by the potential user group; and an engineering approach to develop expert systems for ESA are discussed. Planning of missions for Earth observation satellites was chosen as the potentially most useful case study. It is concluded that knowledge based approaches to planning are useful, but the operational characteristics of the system should be sufficiently fast so as not to hinder the planning personnel. This cannot be achieved within the knowledge engineering environment used for the mock-up construction; however, rewriting functions in LISP should alleviate the time performance inadequacies. For the engineering approach, the formalization of the development, accompanied by the creation of deliverable documents, creates a substantial overhead in contrast to the more conventional, and experimental manner of building expert systems. ESA

N89-14754# Boeing Aerospace Co., Seattle, WA.
A MAINTENANCE AND DIAGNOSTIC INFORMATION SYSTEM
DAVID R. ANTONELLI *In* Colorado Univ., Proceedings of the Air Force Workshop on Artificial Intelligence Applications for Integrated Diagnostics p 268-275 Jul. 1987
Avail: NTIS HC A23/MF A01 CSCL 12/9

MDIS is a an interactive computer program that will accept the description of any piece of equipment (unit) from a person knowledgeable of that piece of equipment. MDIS elicits the information in a conversational bootstrap manner. It acts like a knowledge engineer in the area of diagnostics and maintenance, but asks the experts for a description of the unit rather than how to diagnose it. Two types of people interact with MDIS. A builder, the engineer who describes the unit to the MDIS, and the user, a novice technician who will use it to diagnose problems on the unit described. In addition to a description of any piece of equipment, MDIS asks for operating conditions, symptoms, testing, repair and preventive maintenance procedures. It never asks the builder or user how to diagnose the piece of equipment. All diagnostics are handled by the MDIS diagnostic procedure. As the system is used, it gathers information about each individual piece of equipment it diagnoses (by serial number). As it matures with use, it learns more about diagnosing a particular piece of equipment and revises its diagnostic strategy based on history. Author

N89-14769# Colorado Univ., Boulder.
ARTIFICIAL INTELLIGENCE IN TEST PROGRAM DEVELOPMENT
J. JEFFREY RICHARDSON and GEORGE H. BARTHELENGHI (Giordano Associates, Inc., Sparta, NJ.) *In its* Proceedings of the Air Force Workshop on Artificial Intelligence Applications for Integrated Diagnostics p 453-467 Jul. 1987
Avail: NTIS HC A23/MF A01 CSCL 12/9

This paper reviews artificial intelligence research pertinent to the fault isolation requirement of test program development for factory and field test. Diagnosis as classification problem-solving is defined and described. The diagnostic problem solving AI literature is divided into two major groups. Specification-based diagnosis solves diagnostic problems by reasoning from a device model, enabling reasoning directly from a deep theory consisting of information about intended structure and behavior. Symptom-based diagnosis solves diagnostic problems by manipulating a set of associations between symptoms and faults where principled rationale for association is inaccessible or unknown. Specification-based diagnosis is the approach of choice for test program development for fault isolation during system design and development, while symptom-based diagnosis is appropriate for maintaining test programs for fielded systems. Therefore, a hybrid architecture is desirable in which the two approaches can be integrated. Extensive references to the literature are provided. Author

N89-15004*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
AN OVERVIEW OF THE PROGRAM TO PLACE ADVANCED AUTOMATION AND ROBOTICS ON THE SPACE STATION
RICHARD P. HEYDORN *In its* Experiments in Planetary and Related Sciences and the Space Station 6 p Nov. 1987
Avail: NTIS HC A09/MF A01 CSCL 22/2

The preliminary design phase of the Space Station has uncovered a large number of potential uses of automation and robotics, most of which deal with the assembly and operation of the Station. If NASA were to vigorously push automation and robotics concepts in the design, the Station crew would probably be free to spend a substantial portion of time on payload activities. However, at this point NASA has taken a conservative attitude toward automation and robotics. For example, the belief is that robotics should evolve through telerobotics and that uses of artificial intelligence should be initially used in an advisory capacity. This conservativeness is in part due to the new and untested nature of automation and robotics; but, it is also due to emphases plased on designing the Station to the so-called upfront cost without thoroughly understanding the life cycle cost. Presumably automation and robotics has a tendency to increase the initial cost of the Space Station but could substantially reduce the life cycle cost. To insure that NASA will include some form of robotic capability, Congress directed to set aside funding. While this stimulates the development of robotics, it does not necessarily stimulate uses of artificial intelligence. However, since the initial development costs of some forms of artificial intelligence, such as expert systems, are in general lower than they are for robotics one is likely to see several expert systems being used on the Station. Author

N89-15549*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FOURTH CONFERENCE ON ARTIFICIAL INTELLIGENCE FOR SPACE APPLICATIONS
STEPHEN L. ODELL, comp., JUDITH S. DENTON, comp., and MARY VEREEN, comp. Oct. 1988 485 p Conference held in Huntsville, AL, 15-16 Nov. 1988; sponsored by NASA and Alabama Univ., Huntsville
(NASA-CP-3013; M-599; NAS 1.55:3013) Avail: NTIS HC A21/MF A01 CSCL 09/2

Proceedings of a conference held in Huntsville, Alabama, on November 15-16, 1988. The Fourth Conference on Artificial Intelligence for Space Applications brings together diverse technical and scientific work in order to help those who employ AI methods in space applications to identify common goals and to address issues of general interest in the AI community. Topics include the following: space applications of expert systems in fault diagnostics, in telemetry monitoring and data collection, in design and systems integration; and in planning and scheduling; knowledge representation, capture, verification, and management; robotics and vision; adaptive learning; and automatic programming.

N89-15591*# Arizona Univ., Tucson. Dept. of Electrical and Computer Engineering.
DESIGN OF A SIMULATION ENVIRONMENT FOR LABORATORY MANAGEMENT BY ROBOT ORGANIZATIONS
BERNARD P. ZEIGLER, FRANCOIS E. CELLIER, and JERZY W. ROZENBLIT *In* NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 313-321 Oct. 1988
(Contract NCC2-525)
Avail: NTIS HC A21/MF A01 CSCL 05/1

This paper describes the basic concepts needed for a simulation environment capable of supporting the design of robot organizations for managing chemical, or similar, laboratories on the planned

U.S. Space Station. The environment should facilitate a thorough study of the problems to be encountered in assigning the responsibility of managing a non-life-critical, but mission valuable, process to an organized group of robots. In the first phase of the work, we seek to employ the simulation environment to develop robot cognitive systems and strategies for effective multi-robot management of chemical experiments. Later phases will explore human-robot interaction and development of robot autonomy.
Author

N89-15592*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXPLANATION PRODUCTION BY EXPERT PLANNERS
SUSAN BRIDGES and JAMES D. JHANNES *In* NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 323-330 Oct. 1988
Avail: NTIS HC A21/MF A01 CSCL 09/2

Although the explanation capability of expert systems is usually listed as one of the distinguishing characteristics of these systems, the explanation facilities of most existing systems are quite primitive. Computer generated explanations are typically produced from canned text or by direct translation of the knowledge structures. Explanations produced in this manner bear little resemblance to those produced by humans for similar tasks. The focus of our research in explanation is the production of justifications for decisions by expert planning systems. An analysis of justifications written by people for planning tasks has been taken as the starting point. The purpose of this analysis is two-fold. First, analysis of the information content of the justifications will provide a basis for deciding what knowledge must be represented if human-like justifications are to be produced. Second, an analysis of the textual organization of the justifications will be used in the development of a mechanism for selecting and organizing the knowledge to be included in a computer-produced explanation. This paper describes a preliminary analysis done of justifications written by people for a planning task. It is clear that these justifications differ significantly from those that would be produced by an expert system by tracing the firing of production rules. The results from the text analysis have been used to develop an augmented phrase structured grammar (APSG) describing the organization of the justifications. The grammar was designed to provide a computationally feasible method for determining textual organization that will allow the necessary information to be communicated in a cohesive manner.
Author

N89-15608*# Rockwell International Corp., Huntsville, AL. Rocketdyne Div.
USING HYPERMEDIA TO DEVELOP AN INTELLIGENT TUTORIAL/DIAGNOSTIC SYSTEM FOR THE SPACE SHUTTLE MAIN ENGINE CONTROLLER LAB
DANIEL OREILLY, ROBERT WILLIAMS, and KEVIN YARBOROUGH *In* NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 467-476 Oct. 1988
Avail: NTIS HC A21/MF A01 CSCL 14/2

This is a tutorial/diagnostic system for training personnel in the use of the Space Shuttle Main Engine Controller (SSMEC) Simulation Lab. It also provides a diagnostic capable of isolating lab failures at least to the major lab component. The system was implemented using Hypercard, which is an program of hypermedia running on Apple Macintosh computers. Hypercard proved to be a viable platform for the development and use of sophisticated tutorial systems and moderately capable diagnostic systems. This tutorial/diagnostic system uses the basic Hypercard tools to provide the tutorial. The diagnostic part of the system uses a simple interpreter written in the Hypercard language (Hypertalk) to implement the backward chaining rule based logic commonly found in diagnostic systems using Prolog. Some of the advantages of Hypercard in developing this type of system include sophisticated graphics, animation, sound and voice capabilities, its ability as a hypermedia tool, and its ability to include digitized pictures. The major disadvantage is the slow execution time for evaluation of rules (due to the interpretive processing of the language). Other disadvantages include the limitation on the size of the cards, that color is not supported, that it does not support grey scale graphics, and its lack of selectable fonts for text fields.
Author

N89-15610*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CONSIDERATIONS IN DEVELOPMENT OF EXPERT SYSTEMS FOR REAL-TIME SPACE APPLICATIONS
S. MURUGESAN *In* NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 487-496 Oct. 1988
Avail: NTIS HC A21/MF A01 CSCL 05/1

Over the years, demand on space systems has increased tremendously and this trend will continue for the near future. Enhanced capabilities of space systems, however, can only be met with increased complexity and sophistication of onboard and ground systems. Artificial Intelligence and expert system techniques have great potential in space applications. Expert systems could facilitate autonomous decision making, improve in-orbit fault diagnosis and repair, enhance performance and reduce reliance on ground support. However, real-time expert systems, unlike conventional off-line consultative systems, have to satisfy certain special stringent requirements before they could be used for onboard space applications. Challenging and interesting new environments are faced while developing expert system space applications. This paper discusses the special characteristics, requirements and typical life cycle issues for onboard expert systems. Further, it also describes considerations in design, development, and implementation which are particularly important to real-time expert systems for space applications.
Author

N89-16326*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
FIRST INTERNATIONAL CONFERENCE ON ADA (R) PROGRAMMING LANGUAGE APPLICATIONS FOR THE NASA SPACE STATION, VOLUME 2
RODNEY L. BOWN, ed. 1986 504 p Conference held in Houston, TX, 2-5 Jun. 1986 Prepared in cooperation with Houston Univ., Clear Lake, TX
(Contract NAS9-17010)
(NASA-TM-101202; NAS 1.15:101202) Copyright Avail: NTIS HC A22/MF A01 CSCL 09/2

Topics discussed include: reusability; mission critical issues; run time; expert systems; language issues; life cycle issues; software tools; and computers for Ada.

N89-16406# Ohio State Univ., Columbus. Dept. of Computer and Information Science.
GENERIC TASKS IN EXPERT SYSTEM DESIGN AND THEIR ROLE IN EXPLANATION OF PROBLEM SOLVING
B. CHANDRASEKARAN *In* National Academy of Sciences - National Research Proceedings of the Workshop on AI (Artificial Intelligence), and Distributed Problem Solving p 119-135 May 1985
(Contract F30602-85-C-0010; AF-AFOSR-0255-82)
Avail: NTIS HC A08/MF A01 CSCL 09/2

The elements of a framework for expert system design are outlined. This framework is based on the claim that complex knowledge-based reasoning tasks can often be decomposed into a number of generic tasks each with associated types of knowledge and family of control regimes. At different stages of reasoning, the system will typically engage in one of the tasks, depending on the knowledge available and the state of problem solving. Six generic tasks that researchers found useful in knowledge-based reasoning work are briefly described: classification, state abstraction, knowledge-directed retrieval, object synthesis by plan selection and refinement, hypothesis matching, and assembly of compound hypothesis for abduction.
Author

N89-18116# Stanford Univ., CA. Dept. of Computer Science.
MAKING INTELLIGENT SYSTEMS ADAPTIVE: REVISION
BARBARA HAYES-ROTH Oct. 1988 28 p

(Contract N00039-83-C-0136)
(AD-A200913; SU-STAN-CS-88-1226-REV; KSL-88-64-REV)
Avail: NTIS HC A03/MF A01 CSCL 12/6

Contemporary intelligent systems are isolated problem-solvers. They accept classes of problems, reason about them, perhaps request additional information, and eventually produce solutions. By contrast, human beings and other intelligent animals continuously adapt to the demands and opportunities presented by a dynamic environment. Adaptation plays a critical role in everyday behaviors, such as conducting a conversation, as well as in sophisticated professional behaviors, such as monitoring critically ill medical patients. To make intelligent systems similarly adaptive, we must augment their reasoning capabilities with capabilities for perception and action. Equally important, we must endow them with an attentional mechanism to allocate their limited computational resources among competing perceptions, actions, and cognitions, in real time. In this paper, we discuss functional objectives for adaptive intelligent systems, an architecture designed to achieve those objectives, and continuing study of these objectives and architecture in the context of particular tasks.
GRA

N89-18257# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
INTELLIGENT SEARCH OF FULL-TEXT DATABASES
SUSAN GAUCH and JOHN B. SMITH 1987 10 p
(Contract N00014-86-K-0680)
(AD-A201088; TR88-035) Avail: NTIS HC A02/MF A01 CSCL 12/7

This project applies expert system technology to the task of searching online collections of documents. We are developing an intelligent search intermediary to help end-users locate relevant passages in large full-text databases. Our expert system will automatically reformulate contextual Boolean queries to improve search results and will present retrieved passages in decreasing order of relevance. It differs from other intelligent database functions in two ways: it works with semantically unprocessed text and the expert systems contains a knowledge base of search strategies independent of any particular content domain. The goals for our current project are to demonstrate the feasibility of the approach and to evaluate the effectiveness of the system through a controlled experiment. While the work we report here has limited objectives, the system and techniques are general and can be extended to large, real-world databases.
GRA

N89-18258# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
AN EXPERT SYSTEM FOR SEARCHING IN FULL-TEXT
SUSAN GAUCH and JOHN B. SMITH 1988 17 p
(Contract N00014-86-K-0680)
(AD-A201091) Avail: NTIS HC A03/MF A01 CSCL 05/2

This project applies expert system technology to the task of searching online full-text documents. We are developing an intelligent search intermediary to help end-users locate relevant passages in large full-text databases. Our expert system automatically reformulates contextual Boolean queries to improve search results and presents retrieved passages in decreasing order of estimated relevance. It differs from other intelligent database functions in two ways: it works with semantically unprocessed text and the expert systems contains a knowledge base of search strategies independent of any particular contend domain. The goals for the current project are to demonstrate the feasibility of the approach and to evaluate the effectiveness of the system through a controlled experiment. While the work reported here has limited objectives, the system and techniques are general and can be extended to large, real-world databases.
GRA

N89-18398*# National Aeronautics and Space Administration, Washington, DC.
AUTOMATION AND ROBOTICS
MELVIN MONTEMERLO *In its* NASA Information Sciences and Human Factors Program p 1-28 Sep. 1988
Avail: NTIS HC A10/MF A01 CSCL 13/9

The Autonomous Systems focus on the automation of control systems for the Space Station and mission operations. Telerobotics focuses on automation for in-space servicing, assembly, and repair. The Autonomous Systems and Telerobotics each have a planned sequence of integrated demonstrations showing the evolutionary advance of the state-of-the-art. Progress is briefly described for each area of concern.
B.G.

N89-19830*# General Dynamics Corp., San Diego, CA.
ARTIFICIAL INTELLIGENT DECISION SUPPORT FOR LOW-COST LAUNCH VEHICLE INTEGRATED MISSION OPERATIONS
GERARD P. SZATKOWSKI and ROGER SCHULTZ (Abacus Programming Corp., Van Nuys, CA.) *In* NASA. Lyndon B. Johnson Space Center, 2nd Annual Workshop on Space Operations Automation and Robotics (SOAR 1988) p 87-94 Nov. 1988
Sponsored in part by AF
Avail: NTIS HC A22/MF A01 CSCL 22/2

The feasibility, benefits, and risks associated with Artificial Intelligence (AI) Expert Systems applied to low cost space expendable launch vehicle systems are reviewed. This study is in support of the joint USAF/NASA effort to define the next generation of a heavy-lift Advanced Launch System (ALS) which will provide economical and routine access to space. The significant technical goals of the ALS program include: a 10 fold reduction in cost per pound to orbit, launch processing in under 3 weeks, and higher reliability and safety standards than current expendables. Knowledge-based system techniques are being explored for the purpose of automating decision support processes in onboard and ground systems for pre-launch checkout and in-flight operations. Issues such as: satisfying real-time requirements, providing safety validation, hardware and Data Base Management System (DBMS) interfacing, system synergistic effects, human interfaces, and ease of maintainability, have an effect on the viability of expert systems as a useful tool.
Author

N89-19861*# Lockheed Engineering and Sciences Co., Houston, TX.
SIMULATION OF THE HUMAN-TELEROBOT INTERFACE
MARK A. STUART and RANDY L. SMITH *In* NASA. Lyndon B. Johnson Space Center, 2nd Annual Workshop on Space Operations Automation and Robotics (SOAR 1988) p 321-326 Nov. 1988
(Contract NAS9-17900)
Avail: NTIS HC A22/MF A01 CSCL 05/8

A part of NASA's Space Station will be a Flight Telerobotic Servicer (FTS) used to help assemble, service, and maintain the Space Station. Since the human operator will be required to control the FTS, the design of the human-telerobot interface must be optimized from a human factors perspective. Simulation has been used as an aid in the development of complex systems. Simulation has been especially useful when it has been applied to the development of complex systems. Simulation should ensure that the hardware and software components of the human-telerobot interface have been designed and selected so that the operator's capabilities and limitations have been accommodated for since this is a complex system where few direct comparisons to existent systems can be made. Three broad areas of the human-telerobot interface where simulation can be of assistance are described. The use of simulation not only can result in a well-designed human-telerobot interface, but also can be used to ensure that components have been selected to best meet system's goals, and for operator training.
Author

N89-19907# Army Construction Engineering Research Lab., Champaign, IL.
INTELLIGENT EMBEDDED INSTRUCTION FOR COMPUTER-AIDED DESIGN (CAD) SYSTEMS
DORIS S. SHAW, L. M. GOLISH, and ROBERT L. JOHNSON Oct. 1988 51 p
(AD-A201811; CERL-TR-P-89/03) Avail: NTIS HC A04/MF A01 CSCL 12/5

User training on computer-aided design (CAD) systems traditionally has been expensive and ineffective. In addition, rapid

changes in CAD software demand frequent update instruction to be able to take full advantage of the system's capabilities. As the U.S. Army Corps of Engineers begins using CAD technology to an increasing degree, there is a great need for low-cost, effective teaching programs. Embedded instruction programs represent a promising answer to this need. This technology involves the incorporation of tutorial programs directly into the software being taught, with the software used to drive the training session. Such a teaching method allows users to participate in self-paced study on the system they will be using in actual day-to-day operations. The U.S. Army Construction Engineering Research Laboratory (USE-CERL) has developed and tested an embedded instruction program for teaching CAD. The Program was demonstrated in a field test funded under the Technology Transfer Test Bed program. The field test results indicate that architects and engineers profit from online instruction embedded in the CAD system that they are learning. There is wide variability in the time spent studying the lessons as well as in learning strategies employed by different students. Follow-up questionnaires revealed a preference for this type of instruction over traditional methods. GRA

N89-20481*# Oak Ridge National Lab., TN.
TELEROBOTIC MANIPULATOR DEVELOPMENTS FOR GROUND-BASED SPACE RESEARCH
J. N. HERNDON, S. M. BABCOCK, P. L. BUTLER, H. M. COSTELLO, R. L. GLASSELL, REID L. KRESS, D. P. KUBAN, J. C. ROWE, D. M. WILLIAMS, and A. J. MEINTEL (National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.) 1988 21 p Presented at the 3rd Topical Meeting on Robotics and Remote Systems, Charleston, SC, 13-16 Mar. 1989 Sponsored by NASA
(Contract DE-AC05-84OR-21400)
(NASA-CR-184736; NAS 1.26:184736; DE89-005109; CONF-890304-31) Avail: NTIS HC A03/MF A01 CSCL 13/9

New opportunities for the application of telerobotic systems to enhance human intelligence and dexterity in the hazardous environment of space are presented by the National Aeronautics and Space Administration (NASA) Space Station Program. Because of the need for significant increases in extravehicular activity and the potential increase in hazards associated with space programs, emphasis is being heightened on telerobotic systems research and development. The Automation Technology Branch at NASA Langley Research Center currently is sponsoring the Laboratory Telerobotic Manipulator (LTM) program at Oak Ridge National Laboratory to develop and demonstrate ground-based telerobotic manipulator system hardware for research and demonstrations aimed at future NASA applications. The LTM incorporates traction drives, modularity, redundant kinematics, and state-of-the-art hierarchical control techniques to form a basis for merging the diverse technological domains of robust, high-dexterity teleoperations and autonomous robotic operation into common hardware to further NASA's research. DOE

N89-20679# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
INTELLIGENCE IN SCIENTIFIC COMPUTING
HAROLD ABELSON, MICHAEL EISENBERG, MATHEW HALFANT, JACOB KATZENELSON, and ELISHA SACK Nov. 1988 37 p
(Contract N00014-86-K-0180)
(AD-A203815; AI-M-1094) Avail: NTIS HC A03/MF A01 CSCL 12/9

Combining numerical techniques with ideas from symbolic computation and with methods incorporating knowledge of science and mathematics leads to a new category of intelligent computational tools for scientists and engineers. These tools autonomously prepare simulation experiments from high-level specifications of physical models. For computationally intensive experiments, they automatically design special-purpose numerical engines optimized to perform the necessary computations. They actively monitor numerical and physical experiments. They interpret experimental data and formulate numerical results in qualitative terms. They enable their human users to control computational experiments in terms of high-level behavioral descriptions. GRA

N89-23132# SRI International Corp., Menlo Park, CA. Artificial Intelligence Center.
CORE KNOWLEDGE SYSTEM: STORAGE AND RETRIEVAL OF INCONSISTENT INFORMATION
THOMAS M. STRAT and GRAHAME B. SMITH *In* Science Applications International Corp., Proceedings: Image Understanding Workshop, Volume 2 p 660-665 Apr. 1988
Avail: NTIS HC A99/MF E03 CSCL 05/2

An information storage and retrieval mechanism that avoids the requirement of consistency maintenance imposed by tradition knowledge-based systems is described. By viewing data as opinions rather than facts, the system is able to combine knowledge that is generally accepted as being true with data that may be from unreliable sources. A formal account of the semantics of the approach is also given. The information management system described has been implemented and used to store information derived from image processing along with opinions from other sources about objects in the visible world. It appears to be well suited for the requirements of an autonomous robot, and for information storage in general. Author

N89-23181*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A KNOWLEDGE-BASED TOOL FOR MULTILEVEL DECOMPOSITION OF A COMPLEX DESIGN PROBLEM
JAMES L. ROGERS Washington May 1989 23 p
(NASA-TP-2903; L-16557; NAS 1.60:2903) Avail: NTIS HC A03/MF A01 CSCL 09/2

Although much work has been done in applying artificial intelligence (AI) tools and techniques to problems in different engineering disciplines, only recently has the application of these tools begun to spread to the decomposition of complex design problems. A new tool based on AI techniques has been developed to implement a decomposition scheme suitable for multilevel optimization and display of data in an N x N matrix format. Author

N89-25162*# Georgia Inst. of Tech., Atlanta.
TRUSS: AN INTELLIGENT DESIGN SYSTEM FOR AIRCRAFT WINGS
PRESTON R. BATES and DANIEL P. SCHRAGE *In* NASA. Langley Research Center, Recent Advances in Multidisciplinary Analysis and Optimization, Part 1 p 333-355 Apr. 1989
Avail: NTIS HC A23/MF A01 CSCL 09/2

Competitive leadership in the international marketplace, superiority in national defense, excellence in productivity, and safety of both private and public systems are all national defense goals which are dependent on superior engineering design. In recent years, it has become more evident that early design decisions are critical, and when only based on performance often result in products which are too expensive, hard to manufacture, or unsupportable. Better use of computer-aided design tools and information-based technologies is required to produce better quality United States products. A program is outlined here to explore the use of knowledge based expert systems coupled with numerical optimization, database management techniques, and designer interface methods in a networked design environment to improve and assess design changes due to changing emphasis or requirements. The initial structural design of a tiltrotor aircraft wing is used as a representative example to demonstrate the approach being followed. Author

N89-25635*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
AN EXPERT SYSTEM DEVELOPMENT METHODOLOGY WHICH SUPPORTS VERIFICATION AND VALIDATION
CHRIS CULBERT, GARY RILEY, and ROBERT T. SAVELY 1987 9 p Presented at the 4th IEEE Conference on Artificial Intelligence Applications, San Diego, CA, Mar. 1988
(NASA-TM-101782; NAS 1.15:101782) Avail: NTIS HC A02/MF A01 CSCL 09/2

Expert systems have demonstrated commercial viability in a wide range of applications, but still face some obstacles to

widespread use. A major stumbling block is the lack of well defined verification and validation (V and V) techniques. The primary difficulty with expert system V and V is the use of development methodologies which do not support V and V. As with conventional code, the key to effective V and V is the development methodology. An expert system development methodology is described which is based upon a panel review approach, that allows input from all parties concerned with the expert system. Author

N89-25774# Oak Ridge National Lab., TN. Information Research and Analysis.
AN EXPERT SYSTEM TO FACILITATE SELECTING A DATABASE MANAGEMENT SYSTEM
L. M. ROSEBERRY and D. C. KILGORE Jun. 1989 7 p Presented at the DOE Technical Information Meeting: INFOTECH, Oak Ridge, TN, 6 Jun. 1989
(Contract DE-AC05-84OR-21400)
(DE89-012350; CONF-8906113-2) Avail: NTIS HC A02/MF A01

An investigation has been initiated to develop an expert system to assist information professionals in selecting a database management system (DBMS). The system attempts to consider DBMS basic design, theory, and performance standard as well as the specific needs of the project. The user is queried for needs, wants, and resource restrictions. The inference engine tests these data against its rule set and generates prioritized recommendations. The rule set design will be discussed. The usefulness of such a tool will be discussed as well as plans for its continued evolution. DOE

N89-26600*# Martin Marietta Corp., Denver, CO. Information and Communications Systems.
A RAPID PROTOTYPING/ARTIFICIAL INTELLIGENCE APPROACH TO SPACE STATION-ERA INFORMATION MANAGEMENT AND ACCESS
RICHARD S. CARNAHAN, JR., STEPHEN M. COREY, and JOHN B. SNOW *In* NASA. Goddard Space Flight Center, The 1989 Goddard Conference on Space Applications of Artificial Intelligence p 265-279 Apr. 1989
Avail: NTIS HC A17/MF A01 CSCL 09/2

Applications of rapid prototyping and Artificial Intelligence techniques to problems associated with Space Station-era information management systems are described. In particular, the work is centered on issues related to: (1) intelligent man-machine interfaces applied to scientific data user support, and (2) the requirement that intelligent information management systems (IIMS) be able to efficiently process metadata updates concerning types of data handled. The advanced IIMS represents functional capabilities driven almost entirely by the needs of potential users. Space Station-era scientific data projected to be generated is likely to be significantly greater than data currently processed and analyzed. Information about scientific data must be presented clearly, concisely, and with support features to allow users at all levels of expertise efficient and cost-effective data access. Additionally, mechanisms for allowing more efficient IIMS metadata update processes must be addressed. The work reported covers the following IIMS design aspects: IIMS data and metadata modeling, including the automatic updating of IIMS-contained metadata, IIMS user-system interface considerations, including significant problems associated with remote access, user profiles, and on-line tutorial capabilities, and development of an IIMS query and browse facility, including the capability to deal with spatial information. A working prototype has been developed and is being enhanced. Author

N89-26601*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
AN INTELLIGENT USER INTERFACE FOR BROWSING SATELLITE DATA CATALOGS
ROBERT F. CROMP and SHARON CROOK *In its* The 1989 Goddard Conference on Space Applications of Artificial Intelligence p 281-299 Apr. 1989
Avail: NTIS HC A17/MF A01 CSCL 09/2

A large scale domain-independent spatial data management expert system that serves as a front-end to databases containing spatial data is described. This system is unique for two reasons. First, it uses spatial search techniques to generate a list of all the primary keys that fall within a user's spatial constraints prior to invoking the database management system, thus substantially decreasing the amount of time required to answer a user's query. Second, a domain-independent query expert system uses a domain-specific rule base to preprocess the user's English query, effectively mapping a broad class of queries into a smaller subset that can be handled by a commercial natural language processing system. The methods used by the spatial search module and the query expert system are explained, and the system architecture for the spatial data management expert system is described. The system is applied to data from the International Ultraviolet Explorer (IUE) satellite, and results are given. Author

N89-29992*# Martin Marietta Corp., Denver, CO. Dept. of Advanced Automation Technology.
KEY TECHNOLOGY ISSUES FOR SPACE ROBOTIC SYSTEMS
ROGER T. SCHAPPELL 1987 18 p Presented at the 1987 Conference on Space Applications of Artificial Intelligence (AI) and Robotics, Greenbelt, MD, 13-14 May 1987
(NASA-TM-101872; NAS 1.15:101872) Avail: NTIS HC A03/MF A01 CSCL 09/2

Robotics has become a key technology consideration for the Space Station project to enable enhanced crew productivity and to maximize safety. There are many robotic functions currently being studied, including Space Station assembly, repair, and maintenance as well as satellite refurbishment, repair, and retrieval. Another area of concern is that of providing ground based experimenters with a natural interface that they might directly interact with their hardware onboard the Space Station or ancillary spacecraft. The state of the technology is such that the above functions are feasible; however, considerable development work is required for operation in this gravity-free vacuum environment. Furthermore, a program plan is evolving within NASA that will capitalize on recent government, university, and industrial robotics research and development (R and D) accomplishments. A brief summary is presented of the primary technology issues and physical examples are provided of the state of the technology for the initial operational capability (IOC) system as well as for the eventual final operational capability (FOC) Space Station. Author

05

COMPUTERS AND INFORMATION MANAGEMENT

Includes Information Systems and Theory, Information Dissemination and Retrieval, Management Information Systems, Database Management Systems and Databases, Data Processing, Data Management, Communications and Communication Theory, Documentation and Information Presentation, Software, Software Acquisition, Software Engineering and Management, Computer Systems Design and Performance, Configuration Management (Computers), Networking, Office Automation, Information Security.

A89-16539
COMPUTER-AGE VULNERABILITY IN THE INTERNATIONAL AIRLINE INDUSTRY
CHRIS LYLE (International Civil Aviation Organization, Montreal, Canada) Journal of Air Law and Commerce (ISSN 0021-8642), vol. 54, Fall 1988, p. 161-178. refs
Copyright

The implications of computer applications in the international airline industry are discussed, focusing on the vulnerability of airlines, travel agents, and passengers without access to sophisticated computer reservation systems. The limited number of options which can be displayed on a visual display unit and the potential monopoly or collusive power which could arise in

markets dominated by one or two computer reservation systems are discussed. Possible solutions to these problems are considered. R.B.

A89-17669*# NASA Space Station Program Office, Reston, VA.
INTERNATIONAL INTERFACE DESIGN FOR SPACE STATION FREEDOM - CHALLENGES AND SOLUTIONS
RICHARD E. MAYO (NASA, Reston, VA), GORDON R. BOLTON, and DANIELE LAURINI (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 13 p.
(IAF PAPER 88-085) Copyright

The definition of interfaces for the International Space Station is discussed, with a focus on negotiations between NASA and ESA. The program organization and division of responsibilities for the Space Station are outlined; the basic features of physical and functional interfaces are described; and particular attention is given to the interface management and documentation procedures, architectural control elements, interface implementation and verification, and examples of Columbus interface solutions (including mechanical, ECLSS, thermal-control, electrical, data-management, standardized user, and software interfaces). Diagrams, drawings, graphs, and tables listing interface types are provided. T.K.

A89-17672#
COLUMBUS DATA MANAGEMENT
X. LABORDE and PH. DELBEY (Matra Espace, Toulouse, France) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 6 p.
(IAF PAPER 88-091)

Plans for the data-processing and data-storage systems of Columbus, the ESA contribution to the International Space Station, are discussed. The need for high degrees of autonomy and automation is indicated; maintenance and servicing problems are examined; and the possibility of remote operation of scientific payloads is considered. Particular attention is given to fault tolerance and safety, system standards for communication protocols and software, standardized electrical interfaces, and the current Columbus data-system baseline technology (architecture, computers, memories and data base, software, and man-machine interfaces). A block diagram of the baseline system is provided. T.K.

A89-17998
AUTOTESTCON '88; PROCEEDINGS OF THE IEEE INTERNATIONAL AUTOMATIC TESTING CONFERENCE, MINNEAPOLIS, MN, OCT. 4-6, 1988
Conference sponsored by IEEE. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, 341 p. For individual items see A89-17999 to A89-18037.
Copyright

The conference presents papers on ATE prognostics for the 90s, testing perspectives, the international session, specialized ATE applications, software trends, IFTE, portable testers, diagnostic techniques, MATE, and integrated diagnostics. Other topics include CASS, BIT testability, supercomputing, TPS, artificial intelligence, advanced technology, RF/EW, and procurement in the 1990s. Consideration is also given to DoD initiatives in the automation of the testability/diagnostic design process, analysis tools for the evaluation of maintenance software, and a portable miniature anechoic chamber. K.K.

A89-18118#
THE NASA INFORMATION SYSTEM LIFE-CYCLE TRANSITION MANAGEMENT WITHIN THE SOFTWARE PROJECT
MICHAEL W. EVANS, W. M. WILSON, and D. SOVA IN: AIAA/IEEE Digital Avionics Systems Conference, 8th, San Jose, CA, Oct. 17-20, 1988, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 471-477. refs
(AIAA PAPER 88-3947) Copyright

The complexity and critical nature of mission software within NASA has necessitated the development of a structured process for acquiring and assuring software. This paper discusses NASA Information System Life-Cycle and Standard, the framework that NASA will use for developing major software-intensive projects like the Space Station. The objectives, relationships, and hierarchy of the process life cycles are examined, and the process design phases are discussed. The documentation scheme that has evolved from putting software in the information life-cycle context and the restructuring of the internal software documentation standards to reflect the documentation philosophy and accommodate mission risk are addressed. C.D.

A89-19679
DEVELOPING ERROR-FREE SOFTWARE
B. G. KOLKHORST and A. J. MACINA (IBM Corp., Systems Integration Div., Houston, TX) IEEE Aerospace and Electronic Systems Magazine (ISSN 0885-8985), vol. 3, Nov. 1988, p. 25-31.
Copyright

The authors describe experience gained in designing reconfiguration-error-free software. From 1982-1985, this division reduced software product defects to 0.11 errors per thousand lines of source code. Four measurements defining software quality are described. Also discussed is NASA's development of a standardized software support environment, and the US Department of Defense Software Technology for Adaptive Reliable Systems (STARS) program. These environments provide for early control, standardization, and integration of requirements, leading to more easily maintained software and reduction of critical skill level for its maintenance. I.E.

A89-20110*# National Aeronautics and Space Administration, Washington, DC.
TELESCIENCE IN THE SPACE STATION ERA
E. R. SCHMERLING (NASA, Washington, DC) IN: EASCON '88; Proceedings of the Twenty-first Annual Electronics and Aerospace Conference, Arlington, VA, Nov. 9-11, 1988. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 87-91.

Telescience refers to the development of systems where participants involved in research in space can access their fellow scientists and the appropriate NASA services before flight, during flight, and after flight, preferably from their home institutions and through the same equipment. Telescience requires integration of available technologies to develop computer environments that maintain interoperability across different disciplines and different portions of the lifetimes of space experiments, called teledesign, teleoperations, and teleanalysis. Participants in the NASA Telescience Testbed Program are using a rigid prototyping approach to evaluate the necessary technologies and select the options and tradeoffs that best suit their accustomed modalities. The concept of transaction management is described, where the emphasis is placed on the effects of commands, whether event-generated onboard the spacecraft or sent up from the ground. Interoperability, security, and privacy issues are also discussed, and the Telescience Testbed Pilot Program is described. I.E.

A89-20115
SATELLITES VS. FIBER OPTICS BASED NETWORKS AND SERVICES - ROAD MAP TO STRATEGIC PLANNING
JAMES H. R. MARANDI (M.I.L., Inc., Lincroft, NJ) IN: EASCON '88; Proceedings of the Twenty-first Annual Electronics and Aerospace Conference, Arlington, VA, Nov. 9-11, 1988. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 115-117.
Copyright

An overview of a generic telecommunications network and its components is presented, and the current developments in satellite and fiber optics technologies are discussed with an eye on the trends in industry. A baseline model is proposed, and a cost comparison of fiber- vs satellite-based networks is made. A step-by-step 'road map' to the successful strategic planning of telecommunications services and facilities is presented. This road

map provides for optimization of the current and future networks and services through effective utilization of both satellites and fiber optics. The road map is then applied to different segments of the telecommunications industry and market place, to show its effectiveness for the strategic planning of executives of three types: (1) those heading telecommunications manufacturing concerns, (2) those leading communication service companies, and (3) managers of telecommunication/MIS departments of major corporations. Future networking issues, such as developments in integrated-services digital network standards and technologies, are addressed. I.E.

A89-23475
PRINCIPLES OF OPTIMAL DESIGN: MODELING AND COMPUTATION
PANOS Y. PAPALAMBROS (Michigan, University, Ann Arbor) and DOUGLASS J. WILDE (Stanford University, CA) Research supported by NSF and DOE. Cambridge and New York, Cambridge University Press, 1988, 432 p. refs
Copyright

The fundamental principles of mathematical modeling for design optimization are examined in an introductory text for graduate engineering students. Chapters are devoted to optimization models, model boundedness, interior optima, boundary optima, model reduction, global-bound construction, local computation, and practical applications. Diagrams, graphs, and exercises are provided. T.K.

A89-24115
AEROSPACE COMPUTER SECURITY APPLICATIONS CONFERENCE, 4TH, ORLANDO, FL, DEC. 12-16, 1988, PROCEEDINGS
Conference sponsored by AIAA, IEEE, American Society for Industrial Security, et al. Washington, DC, IEEE Computer Society Press, 1988, 450 p. For individual items see A89-24116 to A89-24120.
Copyright

The conference presents papers on computer viruses, database security, trusted systems development, risk analysis and contingency planning, and NASA programs. Topics include the denial of service flaws in SDI software, secure DBMS requirements, implications of multilevel security on the data dictionary of a secure relational DBMS, and the implementation design for a kernelized trusted DBMS. Consideration is also given to an alternative implementation of the reference monitor concept, and the use of CASE tools to improve the security of applications systems. K.K.

A89-24116
EXPLORING COMPUTER VIRUSES
RUSSELL DAVIS (Ford Aerospace Corp., Space Missions Group, Reston, VA) IN: Aerospace Computer Security Applications Conference, 4th, Orlando, FL, Dec. 12-16, 1988, Proceedings. Washington, DC, IEEE Computer Society Press, 1988, p. 7-11.
Copyright

The author presents some thoughts on viruses and then explores the anatomy of a sample computer virus. Using C language programs, some of the fundamental parts associated with viruses are detailed and it is shown how these viruses can be detected. It is concluded that the final decision for any virus controls rests with risk management. It is suggested that, at the least, contingency plans for virus recovery along with configuration control and software screening will be found cost effective. I.E.

A89-24120* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SYSTEM SECURITY IN THE SPACE FLIGHT OPERATIONS CENTER
DAVID A. WAGNER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Aerospace Computer Security Applications Conference, 4th, Orlando, FL, Dec. 12-16, 1988, Proceedings. Washington, DC, IEEE Computer Society Press, 1988, p. 426-430. refs
Copyright

The Space Flight Operations Center is a networked system of workstation-class computers that will provide ground support for NASA's next generation of deep-space missions. The author recounts the development of the SFOC system security policy and discusses the various management and technology issues involved. Particular attention is given to risk assessment, security plan development, security implications of design requirements, automatic safeguards, and procedural safeguards. I.E.

A89-25573#
AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS DOMESTIC AND INTERNATIONAL AEROSPACE STANDARDS DEVELOPMENT
CLAIRE JOHNSTON (AIAA, Washington, DC) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 8 p.
(AIAA PAPER 89-0775) Copyright

Developing aerospace standards is AIAA's latest major initiative. This paper briefly chronicles the history of the AIAA Standards Program and exmaines how the new standards effort can help the Institute achieve its objectives of long term future growth and viability. It also charts the current status of the Standards Program and discusses its future goals and prospects. Author

A89-25619#
DOD INFORMATION ANALYSIS CENTERS - THEIR RESOURCES AND AVAILABILITY
PAUL M. KLINEFELTER (DOD, Defense Technical Information Center, Alexandria, VA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 12 p.
(AIAA PAPER 89-0850)

From their inception after World War II and particularly since their recognition and official sponsorship by the Deprtment of Defense (DOD) in 1965, information analysis centers have proved their worth as dependable sources of subject expertise in support of DOD research and engineering projects and policies. They provide state-of-the-art answers and evaluated supporting data within their respective areas of subject specialization, complementing the technical document reference and access furnished by libraries and information centers. Author

A89-25620#
HOW AN ENGINEER ACQUIRES AND USES INFORMATION THROUGH THE DIALOG SYSTEM
PAUL ZARCHAN (Charles Stark Draper Laboratory, Inc., Cambridge, MA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 9 p.
(AIAA PAPER 89-0851) Copyright

The use of the DIALOG Information Retrieval Service in the daily work of an aerospace engineer is discussed. Consideration is given to the technical aspects and cost of using the system. The various types of data bases included in the DIALOG system are discussed, focusing on data bases which are useful to engineers. Sample searches using the Aerospace DataBase are presented to illustrate the operation of research oriented data bases. Examples are given for other DIALOG data bases which provide national, international, business, and technological news. Other examples using the DIALOG system include searching resumes when recruiting new employees and obtaining information on the research and business activities of prominent persons. It is concluded that operation of the DIALOG system on a daily basis provides an extensive amount of information pertinent to engineers. R.B.

A89-26668#
COMPUTER VIRUS THREATENS TO BECOME EPIDEMIC
ERIC J. LERNER Aerospace America (ISSN 0740-722X), vol. 27, Feb. 1989, p. 14-16, 38.
Copyright

Unlike biological viruses, computer viruses are products of human intelligence. Virtually any defense known to the attacker of a computer system can accordingly be defeated, but the converse is not always the case; it remains of paramount importance for a defender to know whether a given program or

memory storage disk has been infected. The defender must, moreover, protect against not only one but a host of viruses that are often of unknown character. An account is presently given of the advancements made to date in addressing the difficulties faced by a computer system's defenders, which are intrinsically greater than those of an attacker. O.C.

A89-27194
INTELLIGENT ACCESS TO A BIBLIOGRAPHICAL FULL TEXT DATA BASE
H.-M. ADORF (European Southern Observatory, Garching, Federal Republic of Germany) and E. K. BUSCH (Information Access Systems, Inc., Boulder, CO) IN: Astronomy from large databases: Scientific objectives and methodological approaches; Proceedings of the Conference, Garching, Federal Republic of Germany, Oct. 12-14, 1987. Garching, Federal Republic of Germany, European Southern Observatory, 1988, p. 143-147. refs
Copyright

Searching for and evaluating relevant literature is an integral part of scientific activity. The availability of large data-base facilities (such as those created within the Hubble Space Telescope project) makes it possible to consider their use for storage and retrieval of astronomical bibliographical information. The storage and processing requirements for a bibliographical full-text base are analyzed, and it is shown that user requirements for information retrieval can largely be met by today's commercial 'intelligent' text-retrieval systems. Author

A89-27239
NASA ASTROPHYSICAL DATA SYSTEM (ADS) STUDY
G. F. SQUIBB (California Institute of Technology, Pasadena) and CYNTHIA Y. CHEUNG (BDM Corp., McLean, VA) IN: Astronomy from large databases: Scientific objectives and methodological approaches; Proceedings of the Conference, Garching, Federal Republic of Germany, Oct. 12-14, 1987. Garching, Federal Republic of Germany, European Southern Observatory, 1988, p. 489-496.
Copyright

The objectives and current status of a study initiated by NASA with the goal of defining the functional concepts for an astrophysics data system that would serve the astrophysics community into and through the 1990s are summarized. Major functional areas of particular importance are identified and discussed. These include availability of data, observation planning and operations, inter- and intra-agency interfaces, research support, and distributed system attributes. V.L.

A89-29067* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE TRANSPORTABLE APPLICATIONS ENVIRONMENT - AN INTERACTIVE DESIGN-TO-PRODUCTION DEVELOPMENT SYSTEM
DOROTHY C. PERKINS, DAVID R. HOWELL, and MARTHA R. SZCZUR (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Digital image processing in remote sensing. London and Philadelphia, PA, Taylor and Francis, 1988, p. 39-64. refs
Copyright

An account is given of the design philosophy and architecture of the Transportable Applications Environment (TAE), an executive program binding a system of applications programs into a single, easily operable whole. TAE simplifies the job of a system developer by furnishing a stable framework for system-building; it also integrates system activities, and cooperates with the host operating system in order to perform such functions as task-scheduling and I/O. The initial TAE human/computer interface supported command and menu interfaces, data displays, parameter-prompting, error-reporting, and online help. Recent extensions support graphics workstations with a window-based, modeless user interface. O.C.

A89-29941
EFFECTIVE SYSTEMS ENGINEERING FOR VERY LARGE SYSTEMS - AN OVERVIEW OF SYSTEMS ENGINEERING CONSIDERATIONS
PAUL E. LEWKOWICZ (Hughes Aircraft Co., Space and Communications Group, Los Angeles, CA) IN: 1988 IEEE Aerospace Applications Conference, Park City, UT, Feb. 7-12, 1988, Digest. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, 10 p. refs
Copyright

The challenges of very-large-scale systems are discussed and the process of systems engineering is described as a systematic method for increasing the efficiency of design and production engineering. A generalized definition of the term 'systems engineering' and some variations on that approach are presented, and the relationship between the level of systems engineering involvement and project size is explored. The systems engineering method is further dissected, with special emphasis placed on the requirements levied on the performing organization, in order to show the cost/benefit tradeoff associated with implementing this design methodology on a large project. Some conclusions are drawn with respect to the promise of systems engineering for providing an effective, efficient technical and financial management system for large-scale projects. I.E.

A89-31060* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A NEW MULTI-MISSION DATA SYSTEM FOR SPACE FLIGHT SUPPORT THROUGH THE 1990'S
A. J. GAINSBOROUGH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: ITC/USA/'88; Proceedings of the International Telemetering Conference, Las Vegas, NV, Oct. 17-20, 1988. Research Triangle Park, NC, Instrument Society of America, 1988, p. 745-748. refs
Copyright

The Space Flight Operations Center (SFOC) is described with attention given to historical and technical aspects. The SFOC is designed to support each new JPL mission with all of its mission-unique processing as a ready adaptation of some set of baseline capabilities. Another goal of the SFOC is to allow the migration of current older JPL missions from their current systems that use aging and costly hardware and software to newer systems with similar functionality. Upon its completion, the planned support includes both downlink and uplink processing for a projected six mission set. K.K.

A89-31211
THE AEROSPACE DATABASE
STEPHEN K. KAVANAGH and JAY G. MILLER (AIAA, Technical Information Service, New York) Database (ISSN 0162-4105), April 1986, p. 61-67.
Copyright

The AIAA Aerospace Database, which first became available in June, 1985, on the DIALOG search system and has subsequently become accessible on Mead Data Central's Reference Service as FileAERO, is the combined electronic form of two abstract/index periodicals, International Aerospace Abstracts (IAA) and Scientific and Technical Aerospace Reports (STAR). IAA, which comprises approximately 60 percent of the database, covers over 1600 periodicals; STAR covers NASA, NASA-contractor, and NASA grantee reports, as well as NASA-owned patents, domestic dissertations and theses, foreign reports, and other U.S. Government agency reports. The multidisciplinary subject coverage of the Aerospace Database is its major strength. O.C.

A89-34706
ACCESSING REMOTE SENSING TECHNOLOGY - THE MICROBRIAN EXAMPLE
B. A. HARRISON, D. L. B. JUPP, P. G. HUTTON, and K. K. MAYO (CSIRO, Div. of Water Resources, Canberra, Australia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 10, Feb. 1989, p. 301-309. Research supported by CSIRO and MPA International Pty., Ltd. refs
Copyright

The development of the microBRIAN system, a PC compatible version of the BRIAN system (Jupp et al., 1985), is discussed. The system identifies remote sensing applications and provides

access to the image processing and operational required for individual applications. The user requirements and range of applications of the system are examined. Consideration is given to the technology available for data analysis and the integration of the system with other data sets. R.B.

A89-41157
USE OF A GEOGRAPHIC INFORMATION SYSTEM (GIS) TO IMPROVE PLANNING FOR AND CONTROL OF THE PLACEMENT OF DREDGED MATERIAL
CYNTHIA A. ABRAHAMSON, ANDREW J. BRUZEWICZ (U.S. Army, Corps of Engineers, Rock Island, IL), and MARK O. JOHNSON (U.S. Army, Construction Engineering Research Laboratory, Champaign, IL) IN: 1988 ACSM-ASPRS Annual Convention, Saint Louis, MO, Mar. 13-18, 1988, Technical Papers. Volume 4. Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1988, p. 60-68.
Copyright

The use of spatial data and a data base management system to plan for the disposal of dredged material has been studied. The geographic resources data analysis support system (GRASS) software developed at the U.S. Army Construction Engineering Research Laboratory was used on a digital data base developed for the Keithsburg lower dredge cut located 20 miles north of Burlington, Iowa, on the Mississippi River. The use of a National High Altitude Program (NHAP) color IR aerial photograph transparency was digitized with 5- by 5-meter pixels and rectified for use as a base map. K.K.

A89-41158* California Univ., Santa Barbara.
KNOWLEDGE-BASED IMAGE DATA MANAGEMENT - AN EXPERT FRONT-END FOR THE BROWSE FACILITY
DAVID M. STOMS, JEFFREY L. STAR, and JOHN E. ESTES (California, University, Santa Barbara) IN: 1988 ACSM-ASPRS Annual Convention, Saint Louis, MO, Mar. 13-18, 1988, Technical Papers. Volume 4. Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1988, p. 69-78. refs
(Contract NAGW-987)
Copyright

An intelligent user interface being added to the NASA-sponsored BROWSE testbed facility is described. BROWSE is a prototype system designed to explore issues involved in locating image data in distributed archives and displaying low-resolution versions of that imagery at a local terminal. For prototyping, the initial application is the remote sensing of forest and range land. K.K.

A89-41452
THE ERS-1 MISSION MANAGEMENT AND CONTROL CENTRE (MMCC)
A. G. HAIRE and P. G. STARKEY (Marcol Computer Systems, Ltd., Aldermaston, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 42, May 1989, p. 195-204.
Copyright

ERS-1 (the first European Remote Sensing Satellite), to be launched in 1990, will be the world's first end-to-end remote sensing system in that all activities performed on-board and on the ground, up to data product delivery to the user, are an integral part of the ERS-1 system. ERS-1 will be operated from the Mission Management and Control Center (MMCC) at the European Space Operations Center (ESOC), Darmstadt, West Germany. The on-line software for the MMCC is being developed by Marcol Computer Systems Limited. There are several unique aspects of the ERS-1 mission which are reflected in the design of the MMCC software. These include remote station control, data product transfer, the telemetry traffic characteristics, and the telecommanding and mission planning constraints. This paper discusses how the MMCC software is being developed to provide the essential satellite and remote station monitoring and control facilities, plus support for mission planning and data product handling. Author

A89-41685* Naval Research Lab., Washington, DC.
AN EVALUATION OF EXPERT SYSTEMS FOR SOFTWARE ENGINEERING MANAGEMENT
CONNIE LOGGIA RAMSEY (U.S. Navy, Naval Research Laboratory, Washington, DC) and VICTOR R. BASILI (Maryland, University, College Park) IEEE Transactions on Software Engineering (ISSN 0098-5589), vol. 15, June 1989, p. 747-759. refs
(Contract NSG-5123)
Copyright

The development of four separate prototype expert systems to aid in software engineering management is described. Given the values for certain metrics, these systems provide interpretations which explain any abnormal patterns of these values during the development of a software project. The four expert systems, which solve the same problem, were built using two different approaches to knowledge acquisition, a bottom-up approach and a top-down approach, and two different expert system methods, rule-based deduction and frame-based abduction. In a comparison to see which methods might better suit the needs of this field, it was found that the bottom-up approach led to better results than did the top-down approach, and the rule-based deduction systems using simple rules provided more complete and correct solutions than did the frame-based abduction systems. I.E.

A89-46491
FAST DATA GENERATION FOR FRONT-END SYSTEM DESIGN
ROBERT A. BUTLER (Systems Exchange, Los Angeles, CA) IN: Annual Reliability and Maintainability Symposium, Atlanta, GA, Jan. 24-26, 1989, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 288-290.
Copyright

The author addresses the issue of fast data generation for use in front-end analysis. The objective of generating data is to allow the use of the analytical tools required to study system design issues early. By early, the author means before the design has matured enough to produce the required data as a byproduct. The method of generating data described here is called the system design utility (SDU). While it has been given the more general name because it is useful for a range of design issues, it was developed with the reliability data generation problem in mind. SDU provides a means of developing a system's tentative hardware breakdown structure, performing reliability allocation based on a system goal, and adjusting the results according to judgement, experience, or available field data. I.E.

A89-47334
AUTOMATION IN TRANSPORT AIRCRAFT - CURRENT AND FUTURE TRENDS
A. G. LIDDLE (British Air Line Pilots Association, Harlington, England) IN: Aerospace Behavioral Technology Conference and Exposition, 7th, Anaheim, CA, Oct. 3-6, 1988, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1989, p. 73-77.
(SAE PAPER 881468) Copyright

Current automation technology for transport aircrafts, from the design stage to the operational use, is discussed together with human factors involved. Recently introduced automation systems AB757/767 and A320 are assessed with respect to their instrumentation, and the advantages and disadvantages of these aircraft are discussed and compared with those of older systems. The danger of overautomation is emphasized. I.S.

A89-48718
COLUMBUS DATA MANAGEMENT SYSTEM
PH. DELBEY, PH. PITARD, and X. LABORDE (Matra, S.A., Toulouse, France) (ESA, Ministry for Science and Technology of Italy, and BMFT, Columbus Symposium, 4th, Friedrichshafen, Federal Republic of Germany, Sept. 12-15, 1988) Space Technology - Industrial and Commercial Applications (ISSN 0892-9270), vol. 9, no. 1-2, 1989, p. 105-107.
Copyright

The data management system (DMS) for Columbus users is

discussed with regard to user support requirements. Operational and utilization concepts of autonomy and automation, crew operation support, maintenance and servicing, and remote payload operation for telescience are considered. The DMS functional and hardware architecture are examined along with fault tolerance and safety. The impact of commonality with international partners is briefly addressed. C.D.

A89-48764
THE SOFTWARE FACTORY: A FOURTH GENERATION SOFTWARE ENGINEERING ENVIRONMENT
MICHAEL W. EVANS (Expertware, Inc., Morgan Hill, CA) New York, Wiley-Interscience, 1989, 332 p. refs
Copyright
The software-development process and its management are examined in a text intended for engineering managers and students of computer science. A unified concept based on the principle that software design is an engineering science rather than an art is applied, and a software engineering environment (SEE) analogous to an industrial plant is proposed. Chapters are devoted to the classical software environment, the history of software engineering, the evolution of the SEE, the fourth-generation SEE, the engineering process, software-data relationships, the SEE data base, data control in the SEE, software life cycles, information-system product assurance, business management and control, and automating and adapting the SEE. T.K.

A89-49453#
A NETWORK - THE MISSING ELEMENT
MARC COHN (Northrop Corp., Pico Rivera, CA) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 11 p. refs
(AIAA PAPER 89-2095) Copyright
The Advanced Avionics Architecture (A3) of the next generation of avionics systems requires a high-performance, logical interconnect for advanced aircraft. The High Speed Data Bus (HSDB) does not meet the requirements for the A3; a network is the missing element. Here, the limitations of current HSDB approaches are reviewed, and an overview is given of the Fiber Optic Data Distribution Network (FDDN), an alternative to the HSDB for the A3 requirement. The management of the FDDN is discussed. C.D.

A89-50097
A CONCEPTION OF MODULE LIBRARY AND DATA BASE MANAGEMENT SYSTEM FOR FINITE ELEMENT ANALYSIS
SHOUMEI WANG (Beijing Institute of Aeronautics and Astronautics, People's Republic of China) Computers and Structures (ISSN 0045-7949), vol. 32, no. 5, 1989, p. 1073-1083.
Copyright
The paper discusses the necessity and feasibility of developing an F.E. program module library instead of the currently prevailing F.E. codes. Emphases are put on 'adoptability', which means that the modules can be readily adopted by users in their own programs, and 'extensibility', which means that the library can be readily extended by users with their own subroutines, and 're-organizability', which means that the library can be readily 'tailored' to compose a special purpose program. To this end, a data base and its management system written in FORTRAN and independent of any operating system, has been created. The paper will describe in detail the main features of them. Furthermore, the paper will try to introduce the architecture of this kind of F.E. module library in structural analysis. It is deemed that the development of the library will greatly benefit F.E. analysers, especially those who are faced with new ideas, new algorithms, new materials and new structures. Author

A89-52180
TOEPLITZ NETWORKS AND THEIR PROPERTIES
NARSINGH DEO (Central Florida, University, Orlando, FL) and M. S. KRISHNAMOORTHY (Rensselaer Polytechnic Institute, Troy, NY) IEEE Transactions on Circuits and Systems (ISSN 0098-4094), vol. 36, Aug. 1989, p. 1089-1092. refs
(Contract DAAG29-82-K-0107)
Copyright
Toeplitz networks are investigated as a source of interconnection networks. These networks posses many desirable properties including low diameter and high connectivity. Further, their diversity allows the generation of new networks with some specific parameters. Theorems are proved that can be used to analyze these graphs with respect to diameter, connectivity, fault tolerance, etc. A number of examples are included. I.E.

A89-52249
CONCURRENT MANAGEMENT OF PRIORITY QUEUES FOR ADAPTIVE ALGORITHMS
J. KAPENGA and E. DE DONCKER (Western Michigan University, Kalamazoo, MI) IN: Parallel processing for scientific computing; Proceedings of the Third SIAM Conference, Los Angeles, CA, Dec. 1-4, 1987. Philadelphia, PA, Society for Industrial and Applied Mathematics, 1989, p. 347-351. refs
Copyright
A study of the demands of several types of parallel numerical algorithms, which are synchronized by a task pool, is presented. This is used to evaluate different methods of concurrent priority queue management on various shared memory architectures. Both an analytic model and empirical results from the Denelcor HEP, Sequent Balance, Alliant FX-8, and Encore Multimax are considered. This work is part of an effort to develop a set of macros, layered over the Argonne macro package, which provide a means of producing portable programs for adaptive partitioning problems. Portable efficient concurrent priority queue management is critical to this endeavor. Author

A89-52613#
MAP, OPERATOR, MAINTENANCE STATIONS
RICK POPE (Horizons Technology, Inc., San Diego, CA) IN: AIAA Guidance, Navigation and Control Conference, Boston, MA, Aug. 14-16, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 847-849.
(AIAA PAPER 89-3523) Copyright
The complexity of mission planning has grown proportionally with the sophistication of the planes that fly the missions. Due to that complexity, mission planning has gravitated to the mainframe computer, creating a physical gap between the development of mission planning data and the application of that data. The Map, Operator, and Maintenance Stations (MOMS), has bridged that gap by allowing the development of mission planning to be carried to the operational area of the aircraft. The MOMS system is three coordinated stations that can generate map data, develop mission plans, and perform integrated maintenance support. Author

A89-54250
NASA'S DATA DELUGE
RICHARD WOLKOMIR Air and Space (ISSN 0886-2257), vol. 4, Oct.-Nov. 1989, p. 78-82.
Copyright
NASA's data management problems are discussed. The difficulties associated with analyzing all the space data, and then sorting, and managing the data are examined. Problems encountered due to the funding are also discussed. The use of technologies, such as optical disks, on-line data, and high-density tapes, for the management of space data is studied. I.F.

A89-54906* Wisconsin Univ., Madison.
VISUALIZING LARGE DATA SETS IN THE EARTH SCIENCES
WILLIAM HIBBARD and DAVID SANTEK (Wisconsin, University, Madison) Computer (ISSN 0018-9162), vol. 22, Aug. 1989, p. 53-57. refs
(Contract NAS8-33799; NAS8-36292)
Copyright
The authors describe the capabilities of McIDAS, an interactive visualization system that is vastly increasing the ability of earth scientists to manage and analyze data from remote sensing

instruments and numerical simulation models. McIDAS provides animated three-dimensionsal images and highly interactive displays. The software can manage, analyze, and visualize large data sets that span many physical variables (such as temperature, pressure, humidity, and wind speed), as well as time and three spatial dimensions. The McIDAS system manages data from at least 100 different sources. The data management tools consist of data structures for storing different data types in files, libraries of routines for accessing these data structures, system commands for performing housekeeping functions on the data files, and reformatting programs for converting external data to the system's data structures. The McIDAS tools for three-dimensional visualization of meteorological data run on an IBM mainframe and can load up to 128-frame animation sequences into the workstations. A highly interactive version of the system can provide an interactive window into data sets containing tens of millions of points produced by numerical models and remote sensing instruments. The visualizations are being used for teaching as well as by scientists. I.E.

N89-10670# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
ATTITUDES TO THE USE OF COMPUTERISED INFORMATION SYSTEMS FOR PRODUCTION MANAGEMENT IN MANUFACTURING INDUSTRY: A SURVEY
D. GILLINGWATER Aug. 1987 56 p
(TT-8706) Avail: NTIS HC A04/MF A01

The application of computers in production management is receiving considerable attention at the present time. A frequent claim from those supporting the adoption of such information technology is that it can help the production manager to make complex decisions about sequencing and timing production activities to satisfy competing priorities: for example, meeting delivery deadlines, using resources more efficiently, minimizing stock levels, and maintaining production quality. Until recently such claims were not treated to any systematic appraisal. This report seeks to get at the facts. It consists of the presentation of findings gleaned from a survey of 107 companies in manufacturing, together with case studies of two companies who have recently ventured into the application of computerized information systems for production management (CISPMs). The overall aim of the survey was to obtain as objective an assessment as possible of the level of CISPM applications in UK manufacturing and the attitudes of production managers to their use (and usefulness). Author

N89-11434# Mitre Corp., Bedford, MA.
SOFTWARE MANAGEMENT METRICS Final Report
HERMAN P. SCHULTZ May 1988 52 p
(Contract F19628-86-C-0001)
(AD-A196916; M88-1; ESD-TR-88-001) Avail: NTIS HC A04/MF A01 CSCL 12/5

The metrics presented in this document are used to monitor the progress of a software development offer. They provide visibility into developing trends and thereby can be used to forecast potential problems. These metrics are based on Government and industry experiences with a previous set of their use. The term reporting has been changed to management to more precisely describe the metrics' application. This new report includes: a total of 10 metrics instead of 8; 4 new metrics (design progress, design complexity, schedule progress, and requirements volatility); reporting and analysis recommendations; structured descriptions for each metric that include tailoring, interpretation, and behavior discussions; sample Data Item Description (DID) backup sheets for requiring metrics; notes on applications to Ada; and charting and presentation recommendations. GRA

N89-11621# National Bureau of Standards, Gaithersburg, MD. Information Systems Engineering Div.
COMPUTER SCIENCE AND TECHNOLOGY: GUIDE TO DISTRIBUTED DATABASE MANAGEMENT
E. N. FONG and B. K. ROSEN Apr. 1988 36 p
(PB88-201561; NBS/SP-500/154) Avail: NTIS HC A03/MF A01 CSCL 05/2

Distributed Database Management Systems are exciting and potentially very powerful. However, distributed database management systems often have created increased complexity of database management and controls without providing the expected benefit to the organization's operations. Distributed database management systems may not be desirable for every organization. Their benefits can be realized only with careful planning, and evaluation of alternative strategies. The guide provides an organization's decision makers the appropriate information to make good decisions in evaluating distributed database management technologies for their individual environments. Also, the guide aids in planning for an orderly migration path into a distributed database environment. GRA

N89-11626# King Research, Inc., Rockville, MD.
EVALUATING THE EFFECTIVENESS OF INFORMATION USE
DONALD W. KING and JOSE-MARIE GRIFFITHS *In* AGARD, Evaluating the Effectiveness of Information Centres and Services 5 p Sep. 1988
Copyright Avail: NTIS HC A05/MF A01

An approach to evaluating the use, usefulness and value of published/recorded information on the work of its users is described. The reading patterns of professionals and the application of information derived from reading is discussed in detail. Several different indicators of productivity of professionals are developed and correlated with the amount of reading that is done. Finally, several different perspectives on the value of information centers to the professionals they serve are presented. Author

N89-12229# Physics and Electronics Lab. TNO, The Hague (Netherlands).
AN ANALYSIS MODEL FOR THE SECURITY DESIGN OF COMPUTER AND COMMUNICATION SYSTEMS
F. G. J. VANAKEN, C. EBERWIJN, and P. C. A. M. KARSTEN Jun. 1987 18 p
(FEL-1987-37; TD-87-4242; ETN-88-93407) Avail: NTIS HC A03/MF A01

In order to be able to define a security architecture for open computer and communication systems, security items involved are structured. Security threats in computer networks and the measures to be taken to provide a certain level of security are reviewed. The overall system is divided in subsystems with a horizontal and vertical segmentation method. The result is an analyzing method which can be used for the security design in computer and communication systems. ESA

N89-12245# Air Force Operational Test and Evaluation Center, Kirtland AFB, NM.
SOFTWARE SUPPORT RESOURCES EVALUATION GUIDE, VOLUME 5
2 May 1988 52 p
(AD-A196598; AFOTEC-PAM-800-2-VOL-5) Avail: NTIS HC A04/MF A01 CSCL 12/5

The Air Force Operational Test and Evaluation Center's (AFOTEC) approach to software operational test and evaluation (OT&E) has evolved since 1976. This evolution has resulted in structured tools and management techniques that permit consistent evaluations of various computer system applications. This volume describes a standardized technique for evaluating the software support resources (SSR) for mission critical computer resources (MCCR). A typical system may include several mission critical computers. An SSR evaluation may be targeted at each MCCR within a system or at the system of computer resources as whole. This guide is divided into the following chapters: Chapter 1 provides general information about the evaluation methodology; Chapter 2 provides guidance for the Headquarters (HQ) AFOTEC software evaluation manager and OT&E test team deputy for software evaluation (DSE) in planning and conducting the software support resources evaluation; and Chapter 3 gives specific guidance for the software evaluation members in accomplishing the software support resources evaluation. GRA

N89-12488 National Academy of Public Administration, Washington, DC.
FEDERAL INFORMATION RESOURCES MANAGEMENT: BRIDGING VISION AND ACTION
SHARON L. CAUDLE Jun. 1987 179 p
Copyright Avail: Issuing Activity

Information resources management (IRM) in federal cabinet-level executive departments and a random sample of bureaus under most of these departments is studied. An analysis of the perceptions of the managers and officials was performed. The study suggests three models for IRM in the federal government: an oversight model, a management model compared to the ideal IRM model in legislation and IRM founding documents, and a critical success factors model. Recommendations for practice are included. The study also recommends reasearch in the areas of information management, IRM skills, resource control, and program level IRM. B.G.

N89-13304# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A LEXICAL CONCEPTUAL APPROACH TO GENERATION FOR MACHINE TRANSLATION Memorandum Report, Sep. 1987 - Jan. 1988
BONNIE J. DORR Jan. 1988 26 p
(Contract N00014-85-K-0124)
(AD-A197356; AI-M-1015) Avail: NTIS HC A03/MF A01 CSCL 12/9

Current approaches to generation for machine translation make use of direct-replacement templates, large grammars, and knowledge-based inferencing techniques. Not only are rules language-specific, but they are too simplistic to handle sentences that exhibit more complex phenomena. Furthermore, these systems are not easily extendable to other languages because the rules that map the internal representation to the surface form are entirely dependent on both the domain of the system and the language being generated. Finally an adequate interlingual representation has not yet been discovered; thus, knowledge-based inferencing is necessary and syntactic cross-linguistic generalization cannot be exploited. This report introduces a plan for the development of a theoretically based computational scheme of natural language generation for a translation system. The emphasis of the project is the mapping from the lexical conceptual structure of sentences to an underlying or base syntactic structure called deep structure. This approach tackles the problems of thematic and structural divergence, i.e., it allows generation of target language sentences that are not thematically or structurally equivalent to their conceptually equivalent source language counterparts. GRA

N89-13901# Colorado State Univ., Fort Collins.
COMPUTER SCIENCE AND STATISTICS. PROCEEDINGS OF THE 18TH SYMPOSIUM ON THE INTERFACE Final Report, 15 Feb. 1986 - 14 Feb. 1987
THOMAS J. BOARDMAN, ed. and IRENE M. STEFANSKI, ed. (American Statistical Association, Washington, D. C.) 26 Aug. 1987 451 p Symposium held in Fort Collins, Colo., 19-21 Mar. 1986
(Contract AF-AFOSR-0070-86; AF PROJ. 2304)
(AD-A191296; AFOSR-88-0153TR) Avail: NTIS HC A20/MF A01 CSCL 12/6

The procedings of a conference on the interface between computer science and statistics are given. Parallel algorithms, parallel architecture, decision making, computer graphics, programming languages, data management, data base management systems, expert systems, survey sampling, supercomputer techniques, and simulation are among the topics discussed.

N89-13927# Ottawa Univ. (Ontario).
PUBLISHING STATISTICAL SOFTWARE
JOHN C. NASH *In* Colorado State Univ., Computer Science and Statistics. Proceedings of the 18th Symposium on the Interface p 244-247 26 Aug. 1987
Avail: NTIS HC A20/MF A01 CSCL 12/6

Statistical computation is at the heart of a large part of all statistical research and analysis. The growing complexity and diversity of software for statistical computations implies that statisticians spend a growing proportion of their professional lives developing, learning, and using such software. The mechanisms by which statistical software is published, that is, made available to statistical practitioners are discussed. In particular, emphasis is placed on the issue of academic or commercial credit for the research and development work which good software demands. Potential approaches to inclusion of software are discussed.
Author

N89-13966# Los Alamos National Lab., NM.
KNOWLEDGE-BASED SYSTEM FOR COMPUTER SECURITY
WILLIAM J. HUNTEMAN 1988 13 p Presented at the 11th National Computer Security Conference, Baltimore, Md., 17 Oct. 1988
(Contract W-7405-ENG-36)
(DE88-006447; LA-UR-88-648; CONF-881039-1) Avail: NTIS HC A03/MF A01

The rapid expansion of computer security information and technology has provided little support for the security officer to identify and implement the safeguards needed to secure a computing system. The Department of Energy Center for Computer Security is developing a knowledge-based computer security system to provide expert knowledge to the security officer. The system is policy-based and incorporates a comprehensive list of system attack scenarios and safeguards that implement the required policy while defending against the attacks. DOE

N89-13967# Lawrence Livermore National Lab., CA.
A FRAMEWORK FOR PASSWORD SELECTION
ANA MARIA DEALVARE and E. EUGENE SCHULTZ, JR. 1988 15 p Presented at the UNIX Security Workshop, Portland, Oreg., 29 Aug. 1988
(Contract W-7405-ENG-48)
(DE88-016281; UCRL-99382; CONF-8808118-1) Avail: NTIS HC A03/MF A01

A major problem in computer security is intrusion into systems due to compromised authentication procedures. This paper focuses on the most commonly used authentication procedure--use of passwords. We have developed a framework for a methodology to estimate the guessability of passwords. We assume that passwords are usually based on a simple rule. If someone discovers one of a series of rule-based passwords, it is easier to guess other passwords. The framework we propose is that computer security experts can conduct guessability studies on a large number of passwords which are candidates for assignment to users. People who attempt to guess what a password is can be provided with cues, such as what a password for another account in the system is or a nickname. Hit rates (the percentage of passwords correctly guessed within a limited number of attempts) can then be obtained. This method can be used to develop metrics for guessability of classes of passwords. A system manager might utilize results of guessability studies by encouraging users to avoid choosing passwords which are closely associated with account names or which have been shown to be highly vulnerable to guessing, or by not assigning passwords which are from vulnerable classes of passwords. A pilot study confirmed the feasibility of this framework. Participants were given 20 attempts to guess an eight-character password which was either a common English word or two unrelated words joined by a control character (eight characters in all). The common English word was vulnerable to guessing, but only when cues about this word were provided. Participants never guessed the other password, however, even when cues were provided. The results not only demonstrate feasibility of our framework, but also suggest guidelines for selecting passwords which are less likely to result in compromised authentication procedures. DOE

N89-13973# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
A GUIDE TO THE ASSESSMENT OF SOFTWARE DEVELOPMENT METHODS Final Technical Report
BILL WOOD, RICHARD PETHIA, LAUREN R. GOLD, and ROBERT FIRTH Apr. 1988 43 p
(Contract F19628-85-C-0003)
(AD-A197416; CMU/SEI-88-TR-8; ESD-TR-88-009) Avail: NTIS HC A03/MF A01 CSCL 12/5

Over the past decade, the term software engineering method has been attached to a variety of procedures and techniques that attempt to provide an orderly, systematic way of developing software. Existing methods approach the task of software engineering in different ways. Deciding which methods to use to reduce development costs and improve the quality of produced products is a difficult task. This report outlines a five step process and an organized set of questions that provide method assessors with a systematic way to improve their understanding and form opinions on the ability of existing methods to meet their organization's needs: (1) Needs analysis; (2) Constraint identification, (3) User requirements, (4) Management requirements, and (5) Introduction plan. GRA

N89-15548# Oak Ridge National Lab., TN. Energy Div.
WHY ARE COMPUTER SYSTEMS SO DIFFICULT TO BUILD
JAMES L. HARDEE and AL H. VOELKER 1988 5 p Presented at the 24th Annual Meeting of the Institute of Management Science - Southeastern Chapter, Myrtle Beach, SC, 6 Oct. 1988
(Contract DE-AC05-84OR-21400)
(DE89-001204; CONF-8810187-1) Avail: NTIS HC A02/MF A01

The difficulties experienced in computer systems development have been widely documented and discussed over the past two decades. According to a recent survey, 75 percent of all systems development efforts are either never completed or, if completed, never used. There is a growing consensus that most computer system problems relate to social rather than technical aspects of systems development and implementation. This paper argues that the development success rate can be improved, but only after a broader conceptual view of systems development matures that is sensitive to social, organizational, and political issues. Furthermore, this conceptual view can only be developed after we have destroyed some of the fallacies in current systems development practice that are largely responsible for the insensitivity to these issues. The paper lists and describes some of the most serious of these fallacies. DOE

N89-15573*# Alabama Univ., Huntsville. Dept. of Computer Science.
EXTENDING THE DATA DICTIONARY FOR DATA/KNOWLEDGE MANAGEMENT
CECILE L. HYDRICK and SARA J. GRAVES *In* NASA, Marshall Space Flight Center, Fourth Conference on Artificial Intelligence for Space Applications p 173-181 Oct. 1988
Avail: NTIS HC A21/MF A01 CSCL 05/2

Current relational database technology provides the means for efficiently storing and retrieving large amounts of data. By combining techniques learned from the field of artificial intelligence with this technology, it is possible to expand the capabilities of such systems. This paper suggests using the expanded domain concept, an object-oriented organization, and the storing of knowledge rules within the relational database as a solution to the unique problems associated with CAD/CAM and engineering data. Author

N89-15779*# National Aeronautics and Space Administration, Washington, DC.
THE NASA SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM: ITS SCOPE AND COVERAGE
Dec. 1988 216 p
(NASA-SP-7065; NAS 1.21:7065) Avail: NTIS HC A10/MF A01 CSCL 05/2

A general description of the subject areas covered in the NASA scientific and technical information system is presented. In addition, it establishes subject-based selection criteria for guiding decisions related to the addition of new documents to the NASA collection. Author

N89-15780 California Univ., Berkeley.
CLIENT/SERVICE PROVIDER PERCEPTIONS OF REFERENCE SERVICE OUTCOMES IN ACADEMIC LIBRARIES: EFFECTS OF FEEDBACK AND UNCERTAINTY Ph.D. Thesis
JO BELL WHITLATCH 1987 388 p
Avail: Univ. Microfilms Order No. DA8814115

The principal focus concerns client participation in academic libraries. A model of the major variables influencing academic library reference service outcomes is tested. This model is based primarily on the boundary spanning theory. Organizational boundaries can be expected to create perceptual differences between clients and service providers in evaluating information services. Additional theories form the field or organizational behavior used in developing the model are: communication, social exchange, socialization, feedback, uncertainty, and organizational effectiveness. Independent variables included in the model are: client socialization, service orientation, feedback, time constraints, task uncertainty, size, discipline paradigm, and type of assistance. The dependent variables or service outcomes are: librarian value of service outcomes, user value of service outcomes, and user success in locating needed materials. The study also identifies user and reference librarian differences in perceptions for the following service outcomes: general quality of service, relevance of information, and amount of information. Dissert. Abstr.

N89-15789*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN EVALUATION OF SELECTED NASA SCIENTIFIC AND TECHNICAL INFORMATION PRODUCTS: RESULTS OF A PILOT STUDY
THOMAS E. PINELLI and MYRON GLASSMAN (Old Dominion Univ., Norfolk, VA.) Jan. 1989 95 p
(Contract NAS1-18584)
(NASA-TM-101533; NAS 1.15:101533) Avail: NTIS HC A05/MF A01 CSCL 05/2

A pilot study was conducted to evaluate selected NASA scientific and technical information (STI) products. The study, which utilized survey research in the form of a self-administered mail questionnaire, had a two-fold purpose -- to gather baseline data regarding the use and perceived usefulness of selected NASA STI products and to develop/validate questions that could be used in a future study concerned with the role of the U.S. government technical report in aeronautics. The sample frame consisted of 25,000 members of the American Institute of Aeronautics and Astronautics in the U.S. with academic, government or industrial affiliation. Simple random sampling was used to select 2000 individuals to participate in the study. Three hundred fifty-three usable questionnaires (17 percent response rate) were received by the established cutoff date. The findings indicate that: (1) NASA STI is used and is generally perceived as being important; (2) the use rate for NASA-authored conference/meeting papers, journal articles, and technical reports is fairly uniform; (3) a considerable number of respondents are unfamiliar with STAR (Scientific and Technical Aerospace Reports), IAA (International Aerospace Abstracts), SCAN (Selected Current Aerospace Notices), and the RECON on-line retrieval system; (4) a considerable number of respondents who are familiar with these media do not use them; and (5) the perceived quality of NASA-authored journal articles and technical reports is very good. Author

N89-16279*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
FIRST INTERNATIONAL CONFERENCE ON ADA (R) PROGRAMMING LANGUAGE APPLICATIONS FOR THE NASA SPACE STATION, VOLUME 1
RODNEY L. BOWN, ed. 1986 420 p Conference held in Houston, TX, 2-5 Jun. 1986 Prepared in cooperation with Houston Univ., Clear Lake, TX

(Contract NAS9-17010)
(NASA-TM-101201; NAS 1.15:101201) Copyright Avail: NTIS HC A18/MF A01 CSCL 09/2

Topics discussed include: test and verification; environment issues; distributed Ada issues; life cycle issues; Ada in Europe; management/training issues; common Ada interface set; and run time issues.

N89-16290*# Rational, Mountain View, CA.
RATIONAL'S EXPERIENCE USING ADA FOR VERY LARGE SYSTEMS
JAMES E. ARCHER, JR. and MICHAEL T. DEVLIN *In* NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 12 p 1986
Avail: NTIS HC A18/MF A01 CSCL 09/2

The experience using the Rational Environment has confirmed the advantages forseen when the project was started. Interactive syntatic and semantic information makes a tremendous difference in the ease of constructing programs and making changes to them. The ability to follow semantic references makes it easier to understand exisiting programs and the impact of changes. The integrated debugger makes it much easier to find bugs and test fixes quickly. Taken together, these facilites have helped greatly in reducing the impact of ongoing maintenance of the ability to produce a new code. Similar improvements are anticipated as the same level of integration and interactivity are achieved for configuration management and version control. The environment has also proven useful in introducing personnel to the project and existing personnel to new parts of the system. Personnel benefit from the assistance with syntax and semantics; everyone benefits from the ability to traverse and understand the structure of unfamiliar software. It is often possible for someone completely unfamiliar with a body of code to use these facilities, to understand it well enough to successfully with a body of code to use these facilities to understand it well enough to successfully diagnose and fix bugs in a matter of minutes. Author

N89-16293*# Honeywell Systems and Research Center, Minneapolis, MN.
DISTRIBUTED ADA: METHODOLOGY, NOTATION AND TOOLS
GREG EISENHAUER, RAKESH JHA, and J. MICHEAL KAMRAD, II *In* NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 8 p 1986
Avail: NTIS HC A18/MF A01 CSCL 09/2

The task of creating software to run on a distributed system brings with it many problems not encountered in a uni-processor environment. The designer, in addition to creating a solution to meet the functional requirements of the applicaiton, must determine how to distribute that functionality in order to meet the nonfunctional requirements such as performance and fault tolerance. In the traditional approach to building distributed software systems, decisions of how to partition the software must be made early in the design process so that a separate program can be written for each of the processors in the system. This design paradigm is extremely vulnerable to changes in the target hardware environment, as well as being sensitive to poor initial guesses about what distribution of functionality will satisfy the nonfunctional requirements. The paradigm is also weak in that no compiler has a complete view of the system. Many of the advantages of using a powerful language system are lost in a one-program-per-processor environment. Another approach to the development of distributed software systems, Honeywell's Distributed Ada program, is presented. Author

N89-16313*# EVB Software Engineering, Inc., Frederick, MD.
TOWARDS A SOFTWARE PROFESSION
EDWARD V. BERARD *In* NASA, Lyndon B. Johnson Space Center, First International Conference on Ada (R) Programming Language Applications for the NASA Space Station, Volume 1 15 p 1986
Avail: NTIS HC A18/MF A01 CSCL 09/2

An increasing number of programmers have attempted to change their image. They have made it plain that they wish not only to be taken seriously, but they also wish to be regarded as professionals. Many programmers now wish to referred to as software engineers. If programmers wish to be considered professionals in every sense of the word, two obstacles must be overcome: the inability to think of software as a product, and the idea that little or no skill is required to create and handle software throughout its life cycle. The steps to be taken toward professionalization are outlined along with recommendations. Author

N89-16531# Defense Applied Information Technology Center, Alexandria, VA. Hypermedia Lab.
DOD GATEWAY INFORMATION SYSTEM (DGIS) COMMON COMMAND LANGUAGE: THE DECISION FOR ARTIFICIAL INTELLIGENCE
ALLAN D. KUHN, RANDY L. BIXBY, and DUC T. TRAN Mar. 1988 30 p
(AD-A199215; DAITC/TR-88/003; DTIC/TR/88/12) Avail: NTIS HC A03/MF A01 CSCL 12/5

The results of our first prototyping experiences with the DGIS Common Command Language (CCL) are related. DGIS began its initial prototyping in C language with DIALOG, BRS, NASA/RECON, and DROLS. These prototypes in a third generation algorithmic language brought to surface a number of problems and questions in dealing with the distinctions of information approach. Experiences, results, and conclusions in working with these systems are brought out. The decision to convert to and continue our CCL development with Artificial Intelligence tools is explained. Our effort is a merging of PROLOG and C capabilities, to provide the DGIS user an AI-based searcher assistant interface that makes the human-machine interaction more human-like on DGIS. GRA

N89-17033# Ontario Research Foundation, Mississauga.
SYSTEM ENGINEERING AND LOGISTICS FOR KC-135 EXPERIMENTATION
B. G. SELLARS *In* National Research Council of Canada, Workshop on Microgravity Experimentation in Aircraft and Rockets p 79-81 1988
Avail: NTIS HC A07/MF A01; also available from Publication Sales and Distribution, National Research Council of Canada, Ottawa, ON, Canada K1A OR6

This paper provides a generic overview of Ontario Research Foundation (ORF) experience for KC-135 experiment design, engineering and execution as affected by operational, safety and logistical factors. The ORF Sol/Spherol experiment flew on NASA's KC-135 in February and October 1987. Examples from this experiment are used to illustrate factors affecting system and experiment design. Author

N89-17412# Sandia National Labs., Albuquerque, NM.
IMPROVING SOFTWARE QUALITY THROUGH HIERARCHICAL DESIGN
S. L. SARDALOS 1988 10 p Presented at the Structured Development Forum X, San Francisco, CA, 8 Aug. 1988
(Contract DE-AC04-76DP-00789)
(DE88-014919; SAND-88-1662C; CONF-880894) Avail: NTIS HC A02/MF A01

This paper discusses hierarchical software design through its application to an example software product. Decomposition of the software product into discrete functional software sub-products is addressed. Potential improvements in managing and performing software quality assurance activities, such as review, inspection and test, are presented. Resulting simplification of software configuration management, product definition, and reusability is discussed. Finally, the hierarchical approach to software design and production is extended to describe a possible software design environment of the future. DOE

N89-17545# Oak Ridge National Lab., TN.
LIFE CYCLE MANAGEMENT HANDBOOK
C. E. SYNDER, T. D. MOTT (Evaluation Research Corp., Vienna,

VA.), and J. W. CRUTCHER Sep. 1988 118 p
(Contract DE-AC05-84OR-21400)
(DE89-004315; ORNL/DSRD-13) Avail: NTIS HC A06/MF A01

Life cycle management (LCM) is a standard management discipline for acquiring and using information system resources in a cost-effective manner throughout the life of an information system. Three life cycle management strategies are presented in this report. Section 2, which comprises most of the document, describes the full (five-phase) LCM strategy. The condensed LCM strategy and the one-phase LCM strategy are briefly discussed in Section 3. Appendix A gives examples of formats for system decision and project management documentation; Appendix B provides a list of defined acronyms; and an expanded contents, intended to serve as an index, appears in Appendix C. DOE

N89-18000# National Library of Medicine, Bethesda, MD.
PERMUTED MEDICAL SUBJECT HEADINGS, 1989
Jul. 1988 446 p
(PB88-100036; NLM/MED-89/03) Avail: NTIS HC A19/MF A01 CSCL 06/16

Permuted Medical Subject Headings, 1989, is a computer generated display of all terms, i.e., descriptors and cross references, in alphabetic list of the National Library of Medicine's Medical Subject Headings (MeSH) for 1988, as well as all citation type, check tag, and geographic descriptors in the Annotated Alphabetic MeSH, 1989. The Permuted MeSH takes each significant word that appears in each MeSH term and then lists all the MeSH terms in which that word appears. Author

N89-18049# New York Univ., New York. Inst. of Mathematical Sciences.
ULTRACOMPUTER PROGRESS, 1988
1988 9 p
(Contract DE-FG02-88ER-25052)
(DE89-004863; DOE/ER-25052/1) Avail: NTIS HC A02/MF A01

This paper discusses progress on the ultracomputer project in the following areas: operating systems, debugging, algorithms, environment, network simulation, analytical modeling of network behavior, random number generation for parallel computers, architecture, applications, and programming language design. DOE

N89-18069# Lawrence Livermore National Lab., CA.
HOW CRACKERS CRACK PASSWORDS OR WHAT PASSWORDS TO AVOID
ANA MARIA DEALVARE 30 Sep. 1988 10 p
(Contract W-7405-ENG-48)
(DE89-003715; UCID-21515) Avail: NTIS HC A03/MF A01

Computer security is a growing concern in research, development, marketing, and most other areas of everyday life. The first and foremost task in computer security is to prevent unauthorized access to systems. This report tells how crackers (computer wizards who use their talents for illegal and destructive purposes) obtain access to computer systems and gives specific advice on how to prevent them from doing it. DOE

N89-18446# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Avionics Panel.
SOFTWARE ENGINEERING AND ITS APPLICATION TO AVIONICS
Nov. 1988 405 p In ENGLISH and FRENCH Symposium held in Cesme, Turkey, 25-29 Apr. 1988
(AGARD-CP-439; ISBN-92-835-0483-6; AD-A203892) Copyright Avail: NTIS HC A18/MF A01

Software engineering has evolved rapidly but the gap between demand and software output continues to grow. By the end of the decade research programs in North America, Europe, and Japan will begin to produce results in the areas such as software tools, and computer architecture. The symposium considered how their advances might be applied to the avionics systems of the nineties and beyond and their impact on the aspirations in areas such as operation, and fault tolerances. The software element of modern weapons systems continues to grow in size and complexity; offering major advantages but also potential risks.

N89-18452# Aerospatiale, Marignane (France). Div. Helicopteres.
CONTROL OF ON-BOARD SOFTWARE [MAITRISE DES LOGICIELS EMBARQUES]
MONIQUE SLISSA and PIERRE VILLEDIEU *In* AGARD, Software Engineering and Its Application to Avionics 10 p Nov. 1988 In FRENCH
Copyright Avail: NTIS HC A18/MF A01

Various aspects of the flight software development process are examined including the evolution of the industrial environment, the general strategy for system management, and the politics of software development. Productivity concepts such as code reusability and error minimization are addressed. Specific attention is given to the software development cycle and methodologies utilized by the Aerospatiale Helicopter Division. Author

N89-18757# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PLANS FOR THE DEVELOPMENT OF EOS SAR SYSTEMS USING THE ALASKA SAR FACILITY
F. D. CARSEY and W. WEEKS (Alaska Univ., Fairbanks.) *In* ESA, Proceedings of the 1988 International Geoscience and Remote Sensing Symposium (IGARSS) '88 on Remote Sensing: Moving Towards the 21st Century, Volume 3 p 1491-1494 Aug. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Division, ESTEC, Noordwijk, Netherlands, $120 US or 250 Dutch guilders

The Alaska SAR Facility (ASF) program for the acquisition and processing of data from the ESA ERS-1, the NASDA ERS-1, and Radarsat and to carry out a program of science investigations using the data is introduced. Agreements for data acquisition and analysis are in place except for the agreement between NASA and Radarsat which is in negotiation. The ASF baseline system, consisting of the Receiving Ground System, the SAR Processor System and the Archive and Operations System, passed critical design review and is fully in implementation phase. Augments to the baseline system for systems to perform geophysical processing and for processing of J-ERS-1 optical data are in the design and implementation phase. The ASF provides a very effective vehicle with which to prepare for the Earth Observing System (EOS) in that it will aid the development of systems and technologies for handling the data volumes produced by the systems of the next decades, and it will also supply some of the data types that will be produced by EOS. ESA

N89-19913# Stanford Univ., CA. Systems Optimization Lab.
AN EXACT CEILING POINT ALGORITHM FOR GENERAL INTEGER LINEAR PROGRAMMING
ROBERT M. SALTZMAN and FREDERICK S. HILLIER Nov. 1988 81 p
(Contract N00014-85-K-0343)
(AD-A202286; SU-SOL-88-20) Avail: NTIS HC A05/MF A01 CSCL 12/4

This report describes an exact algorithm for the pure, general Integer Linear Programming problem (ILP). Common applications of this model occur in capital budgeting (project selection), resource allocation and fixed-charge (plant location) problems. The central theme of our algorithm is to enumerate a subset of all solutions called feasible 1-ceiling points. A feasible 1-ceiling point may be thought of as an integer solution lying on or near the boundary of the feasible region for the LP-relaxation associated with (ILP). Precise definitions of 1-ceiling points and the role they play in an integer linear program are presented in a recent report by the authors. One key theorem therein demonstrates that all optimal solutions for an (ILP) whose feasible region is non-empty and bounded are feasible 1-ceiling points. Consequently, such a problem may be solved by enumerating just its feasible 1-ceiling points. Our approach is to implicitly enumerate 1-ceiling points with respect to one constraint at a time while simultaneously considering feasibility. Computational results from applying this

incumbent-improving Exact Ceiling Point Algorithm to 48 test problems taken from the literature indicate that this enumeration scheme may hold potential as a practical approach for solving problems with certain types of structure. GRA

N89-20041*# Auburn Univ., AL. Dept. of Aerospace Engineering.
THE NINEVAH MISSION: ANALYTICAL ANALYSES AND CALCULATIONS FOR TRAJECTORY AND PROPULSION, VOLUME 2
Jun. 1988 55 p
(Contract NGT-21-002-080)
(NASA-CR-184706; NAS 1.26:184706) Avail: NTIS HC A04/MF A01 CSCL 03/2

Mathematical models, diagrams, and computer programs involving an unmanned mission to the planet Venus are presented. This work was done in support of the proposed project called Ninevah. The specific subjects covered are trajectory analysis, propulsion analysis, and structural analysis. NASA

N89-20062*# Illinois State Univ., Normal. Dept. of Applied Computer Science.
COMPUTER TECHNOLOGIES AND INSTITUTIONAL MEMORY Final Report
CHRISTOPHER BELL and ROY LACHMAN (Houston Univ., TX.) *In* NASA, Lyndon B. Johnson Space Center, National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1988, Volume 1 22 p Feb. 1989
Avail: NTIS HC A09/MF A01 CSCL 09/2

NASA programs for manned space flight are in their 27th year. Scientists and engineers who worked continuously on the development of aerospace technology during that period are approaching retirement. The resulting loss to the organization will be considerable. Although this problem is general to the NASA community, the problem was explored in terms of the institutional memory and technical expertise of a single individual in the Man-Systems division. The main domain of the expert was spacecraft lighting, which became the subject area for analysis in these studies. The report starts with an analysis of the cumulative expertise and institutional memory of technical employees of organizations such as NASA. A set of solutions to this problem are examined and found inadequate. Two solutions were investigated at length: hypertext and expert systems. Illustrative examples were provided of hypertext and expert system representation of spacecraft lighting. These computer technologies can be used to ameliorate the problem of the loss of invaluable personnel. Author

N89-20605# National Library of Medicine, Bethesda, MD.
MEDICAL SUBJECT HEADINGS, TREE STRUCTURES, 1989
Jul. 1988 521 p
(PB89-100028; NLM/MED-89/02) Avail: NTIS HC A22/MF A01 CSCL 06/16

All Medical Subject Headings currently in use by the National Library of Medicine's indexers, catalogers, and searchers are arranged in a hierarchical manner showing relationships between broader and narrower terms. Included are minor and geographical descriptors. GRA

N89-20619*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
CUMULATIVE REPORTS AND PUBLICATIONS THROUGH DECEMBER 31, 1988 Final Report
Feb. 1989 64 p Prepared in cooperation with NASA, Langley Research Center, Hampton, VA
(Contract NAS1-18107; NAS1-18605)
(NASA-CR-181784; NAS 1.26:181784) Avail: NTIS HC A04/MF A01 CSCL 12/1

This document contains a complete list of ICASE Reports. Since ICASE Reports are intended to be preprints of articles that will appear in journals or conference proceedings, the published reference is included when it is available. Author

N89-20859# General Accounting Office, Washington, DC.
SPACE OPERATIONS: TESTING OF NASA'S TECHNICAL AND MANAGEMENT INFORMATION SYSTEM
Mar. 1988 8 p
(GAO/IMTEC-88-28) Avail: NTIS HC A02/MF A01

The status of the development of the National Aeronautics and Space Administration's Technical and Management Information System (TMIS) is presented. TMIS is intended to support the design, development, and operation of the planned space station. The parameters involved in the development of TMIS are data base management, project management, document management, electronic mail, workstations, hardware, interfaces and networking. It is estimated that initial operating capability (IOC) will be available at all NASA Centers by June 1988. M.G.

N89-20864# Office of Technology Assessment, Washington, DC.
REPORT ON FEDERAL INFORMATION DISSEMINATION: RESPONSES TO DECISION ANALYSIS FRAMEWORK FOR GPO (GOVERNMENT PRINTING OFFICE) STRATEGIC ALTERNATIVES
F. J. ROMANO 4 Jan. 1988 65 p
(PB89-114649) Avail: NTIS HC A04/MF A01 CSCL 05/2

To address the issues, OTA has developed a decision analysis framework to collect data and opinions as a prelude to the establishment of meaningful alternatives that will best serve the American people, the Federal infrastructure and the GPO. The specific task was an evaluation of GPO technology, products and relationships with its customers. To accomplish the task it was necessary to develop alternative sources of data since neither GPO nor any other Government entity maintains the kind of information considered necessary to understand and analyze many relevant aspects. The result is a snapshot of Federal information as viewed from the standpoint of the GPO and sample Executive agencies. GRA

N89-20866# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
USING ENGLISH FOR INDEXING AND RETRIEVING
BORIS KATZ Oct. 1988 32 p
(Contract N00014-85-K-0124)
(AD-A202227; AI-M-1096) Avail: NTIS HC A03/MF A01 CSCL 05/7

This paper describes a natural language system START. The system analyzes English text and automatically transforms it into an appropriate representation, the knowledge base, which incorporates the information found in the text. The user gains access to information stored in the knowledge base by querying it in English. The system analyzes the query and decides through a matching process what information in the knowledge base is relevant to the question. Then it retrieves this information and formulates its response in English. GRA

N89-21538*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE ENVIRONMENT FOR APPLICATION SOFTWARE INTEGRATION AND EXECUTION (EASIE) VERSION 1.0. VOLUME 1: EXECUTIVE OVERVIEW
LAWRENCE F. ROWELL and JOHN S. DAVIS (Computer Sciences Corp., Hampton, VA.) Mar. 1989 41 p
(NASA-TM-100573; NAS 1.15:100573) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Environment for Application Software Integration and Execution (EASIE) provides a methodology and a set of software utility programs to ease the task of coordinating engineering design and analysis codes. EASIE was designed to meet the needs of conceptual design engineers that face the task of integrating many stand-alone engineering analysis programs. Using EASIE, programs are integrated through a relational database management system. Volume 1, Executive Overview, gives an overview of the functions provided by EASIE and describes their use. Three operational design systems based upon the EASIE software are briefly described. Author

N89-21541*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DATAMAP UPGRADE VERSION 4.0
MICHAEL E. WATTS and SHABOB R. DEJPOUR (Sterling Software, Palo Alto, CA.) Mar. 1989 59 p
(NASA-TM-100993; A-88164; NAS 1.15:100993) Avail: NTIS HC A04/MF A01 CSCL 09/2

The changes made on the data analysis and management program DATAMAP (Data from Aeromechanics Test and Analytics - Management and Analysis Package) are detailed. These changes are made to Version 3.07 (released February, 1981) and are called Version 4.0. Version 4.0 improvements were performed by Sterling Software under contract to NASA Ames Research Center. The increased capabilities instituted in this version include the breakout of the source code into modules for ease of modification, addition of a more accurate curve fit routine, ability to handle higher frequency data, additional data analysis features, and improvements in the functionality of existing features. These modification will allow DATAMAP to be used on more data sets and will make future modifications and additions easier to implement. Author

N89-21559# Naval Ocean Systems Center, San Diego, CA.
GRAPS (GRAPHICAL PLOTTING SYSTEM) USER'S GUIDE. A GRAPHICAL PLOTTING SYSTEM FOR DISPLAYING SCIENTIFIC AND ENGINEERING DATA Final Report, Sep. 1987 - Sep. 1988
JAMES C. LOGAN and JOHN STRAUCH Oct. 1988 31 p
(AD-A202583; NOSC/TD-1326) Avail: NTIS HC A03/MF A01 CSCL 12/5

This document provides an introduction and update to the Graphical Plotting System (GRAPS), a plotting utility developed by the Naval Ocean Systems Center for the personal computer. GRAPS provides a convenient, user-friendly tool for the display of engineering and scientific data in a number of conventional plot formats. Linear, semi-log, polar, log-log, Smith, and contour plot formats are among those that can be selected. User-friendly features include auto and user-defined scaling, text editing on graphics screens, and data file management options. Auto and user-defined scaling are new GRAPS features. The polar plots have been significantly improved and the contour plot added. The data file management options have also been expanded. GRAPS will plot any data stored in ASCII files in the GRAPS format. GRAPS is intended to be used as a stand-alone utility for the preparation and display of engineering and scientific data. It is not suitable for inclusion as part of another program, although subroutines could be stripped out for inclusion in other programs. GRAPS is set up to read data from a disk file written (in ASCII) to a simple format. The disk file may be created by using an editor or word processor. Preferably, a subroutine may be included in the applications program to write the raw data directly to a disk file in the GRAPS format. GRA

N89-21572# Air Force Avionics Lab., Wright-Patterson AFB, OH.
SOFTWARE DEVELOPMENT GUIDELINES
DENICE S. JACOBS 1 Apr. 1988 5 p
(AD-A203332; AFWAL-TR-88-1142) Avail: NTIS HC A02/MF A01 CSCL 12/5

Due to the growing complexity of avionic systems, the development cycle for mission critical software has evolved into a collective process of organized tasks. These tasks are distinct levels of effort which are implemented by the developer to ensure the creation of a reliable, operational system. This paper summarizes four principle tasks which have proven to be excellent procedures for developing avionics software. The first and foremost task of the project manager is to establish a Configuration Control Board (CCB) as the central core of technical management. It consists of a group of key hardware and software engineers who mutually govern the status of system development, and incorporate design changes on an agreed-to basis. The second task is to logically separate the software project into well-defined phases of development. This, too, requires the cooperation of both hardware and software teams to work together in accordance with master schedule. The third task is to create an automated data base which contains the latest interface specifications (ICDs) and system message definitions for use by the engineers. Finally, the last task is to procure hardware emulators and stand-alone test stations as an effective means of testing software prior to system integration and test. GRA

N89-21576# Massachusetts Inst. of Tech., Cambridge. Microsystems Research Center.
COMPUTER-AIDED FABRICATION SYSTEM IMPLEMENTATION Semiannual Technical Report, 1 Oct. 1987 - 31 Mar. 1988
PAUL PENFIELD, JR. 31 Mar. 1988 31 p
(Contract N00014-85-K-0213)
(AD-A203651) Avail: NTIS HC A03/MF A01 CSCL 12/6

The purpose of the work reported on here is to design, develop, implement, and deploy information management systems to aid in the fabrication of integrated circuits, particularly in the context of flexible manufacturing. The work includes the development of a hardware-software system, named CAFE, and the support of this program and its use in the MIT Integrated Circuits Laboratory. CAFE should support both manufacturing of ICs and the design of processes, so part of the effort is directed toward the development of a suitable process-development environment. Other projects are concerned with equipment and mechanical-property models and scheduling. GRA

N89-21582*# Draper (Charles Stark) Lab., Inc., Cambridge, MA.
ADVANCED INFORMATION PROCESSING SYSTEM: LOCAL SYSTEM SERVICES
LAURA BURKHARDT, LINDA ALGER, ROY WHITTREDGE, and PETER STASIOWSKI Apr. 1989 190 p
(Contract NAS1-18061)
(NASA-CR-181767; NAS 1.26:181767) Avail: NTIS HC A09/MF A01 CSCL 09/2

The Advanced Information Processing System (AIPS) is a multi-computer architecture composed of hardware and software building blocks that can be configured to meet a broad range of application requirements. The hardware building blocks are fault-tolerant, general-purpose computers, fault- and damage-tolerant networks (both computer and input/output), and interfaces between the networks and the computers. The software building blocks are the major software functions: local system services, input/output, system services, inter-computer system services, and the system manager. The foundation of the local system services is an operating system with the functions required for a traditional real-time multi-tasking computer, such as task scheduling, inter-task communication, memory management, interrupt handling, and time maintenance. Resting on this foundation are the redundancy management functions necessary in a redundant computer and the status reporting functions required for an operator interface. The functional requirements, functional design and detailed specifications for all the local system services are documented. Author

N89-21606# Tennessee Univ., Knoxville. Management Science Program.
TRIANGULARITY OF THE BASIS IN LINEAR PROGRAMS FOR MATERIAL REQUIREMENTS PLANNING, REVISION
JAMES K. HO and WILLIAM A. MCKENNY Dec. 1988 16 p
(Contract N00014-87-K-0163)
(AD-A203039; MSP-87-3-REV) Avail: NTIS HC A03/MF A01 CSCL 12/4

It is shown that the basis in a class of linear programs arising from material requirements planning can be triangularized. This allows for efficient adaptation of the Simplex Method similar to those for network problems. It also suggests that for finite-loading (i.e., capacitated) MRP, a decomposition approach exploiting both subproblem structure and parallel processing can be effective for handling complex problems in multiproduct, multistage, multiperiod production systems. GRA

N89-21706# Tennessee Univ., Knoxville.
AUTOMATED LIBRARY SYSTEMS AND DOCUMENT TRACKING SYSTEMS: COMMERCIAL SOFTWARE ALTERNATIVES, VOLUME 1
J. T. PHILLIPS and P. M. TARRANT Feb. 1989 138 p Sponsored in part by Pacific Missile Test Center, Point Mugu, CA Prepared for Oak Ridge Gaseous Diffusion Plant, TN
(Contract DE-AC05-84OT-21400)
(DE89-007716; K/DSRD-55-VOL-1) Avail: NTIS HC A07/MF A01

Automated Library Systems (ALS) have become complex and powerful applications, and they are increasingly selected as appropriate solutions to the challenge of tracking reports and other documents within organizations. The present ALS prototype at the Pacific Missile Testing Center (PMTC) at Point Mugu, California, was developed in-house and has been in existence for some time. However, with an expected change in the present computing environment on which the ALS presently resides (UNIVAC 1100), a discussion of the features of potential commercial software alternatives was requested. The purpose of this study was to provide an information base of presently available software systems that are similar in operation or capabilities to the present ALS at PMTC. A future step will entail review of this data and begin a selection process. Various Automated Library Systems and Automated Records Management Systems were profiled to allow comparison of their features to the present system. A bibliography of selected readings was provided to assist the PMTC in its initial effort to assess future needs. DOE

N89-21730*# Tennessee Univ., Chattanooga. Center of Excellence for Computer Applications.
SIRE: A SIMPLE INTERACTIVE RULE EDITOR FOR NICBES
ALEX BYKAT *In* Alabama Univ., Research Reports: 1988 NASA/ASEE Summer Faculty Fellowship Program 22 p Dec. 1988
Avail: NTIS HC A99/MF E03 CSCL 09/1

To support evolution of domain expertise, and its representation in an expert system knowledge base, a user-friendly rule base editor is mandatory. The Nickel Cadmium Battery Expert System (NICBES), a prototype of an expert system for the Hubble Space Telescope power storage management system, does not provide such an editor. In the following, a description of a Simple Interactive Rule Base Editor (SIRE) for NICBES is described. The SIRE provides a consistent internal representation of the NICBES knowledge base. It supports knowledge presentation and provides a user-friendly and code language independent medium for rule addition and modification. The SIRE is integrated with NICBES via an interface module. This module provides translation of the internal representation to Prolog-type rules (Horn clauses), latter rule assertion, and a simple mechanism for rule selection for its Prolog inference engine. Author

N89-22120# Lawrence Livermore National Lab., CA.
MODELING THE RELIABILITY OF A REAL-TIME SYSTEM
J. DENNIS LAWRENCE 1988 19 p Presented at the Computer Management Group International Conference on Management and Performance Evaluation of Computer Systems, Dallas, TX, 12-16 Dec. 1988
(Contract W-7405-ENG-48)
(DE89-006784; UCRL-98452; CONF-881265-1) Avail: NTIS HC A03/MF A01

Under some circumstances, computer controlled systems can be quite dangerous. One of the tools used to analyze such situations is the construction of reliability and safety models. Four types of models are described briefly: reliability block diagrams, fault trees, Markov models and reliability growth models. There are many analogies to performance models, and the expertise of Computer Management Group (CMG) members could be usefully applied to computer system reliability problems in addition to performance problems. This paper is an introduction to reliability modeling. DOE

N89-22334*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SPACE DATA MANAGEMENT AT THE NSSDC (NATIONAL SPACE SCIENCES DATA CENTER): APPLICATIONS FOR DATA COMPRESSION
JAMES L. GREEN *In its* Proceedings of the Scientific Data Compression Workshop p 85-98 Feb. 1989
Avail: NTIS HC A19/MF A01 CSCL 05/2

The National Space Science Data Center (NSSDC), established in 1966, is the largest archive for processed data from NASA's space and Earth science missions. The NSSDC manages over 120,000 data tapes with over 4,000 data sets. The size of the digital archive is approximately 6,000 gigabytes with all of this data in its original uncompressed form. By 1995 the NSSDC digital archive is expected to more than quadruple in size reaching over 28,000 gigabytes. The NSSDC digital archive is expected to more than quadruple in size reaching over 28,000 gigabytes. The NSSDC is beginning several thrusts allowing it to better serve the scientific community and keep up with managing the ever increasing volumes of data. These thrusts involve managing larger and larger amounts of information and data online, employing mass storage techniques, and the use of low rate communications networks to move requested data to remote sites in the United States, Europe and Canada. The success of these thrusts, combined with the tremendous volume of data expected to be archived at the NSSDC, clearly indicates that innovative storage and data management solutions must be sought and implemented. Although not presently used, data compression techniques may be a very important tool for managing a large fraction or all of the NSSDC archive in the future. Some future applications would consist of compressing online data in order to have more data readily available, compress requested data that must be moved over low rate ground networks, and compress all the digital data in the NSSDC archive for a cost effective backup that would be used only in the event of a disaster. Author

N89-22366# General Electric Co., Cincinnati, OH. Aircraft Engines.
INTERFACE 2: ADVANCED DIAGNOSTIC SOFTWARE Final Report, Jul. 1985 - Jul. 1988
LEE R. LAPIERRE, PETER A. COSTEN, DAVID L. DOEL, and RASIK P. SHAH 14 Dec. 1988 168 p
(Contract F33657-85-C-2131)
(AD-A204527; AFWAL-TR-88-2096) Avail: NTIS HC A08/MF A01 CSCL 01/3

JET-X is an expert system for the diagnosis and maintenance of the TF34-100 jet engine as installed on the USAF A-10A aircraft. JET-X uses input supplied by the TEMS (turbine engine monitoring system) installed on the airplane and, in addition, uses data retrieved from the CEMS (comprehensive engine management system) data base that is part of the ground computer support system. Both of these monitoring systems generate alarms which are the starting points for JET-X analyses. As part of an earlier contract, diagnostic troubleshooting procedures had been established for resolving each of these alarms. These diagnostic procedures have been embedded into the JET-X system, generally in a much expanded form. In addition, a number of help facilities have been developed for JET-X to assist the novice diagnostician. JET-X has been designed to be both a flight-line diagnostic tool and a training aid. Although the system is not complete at this point, a first good prototype has been developed, and some field experience has been gained in order to evaluate the system and to guide future enhancements. This report describes the development of the JET-X system, its features and limitations, results of the field trial, and gives conclusions and recommendations for future work. GRA

N89-22527# Department of Energy, Washington, DC.
INFORMATION TECHNOLOGY RESOURCES LONG-RANGE PLAN: FY90 TO FY94
Dec. 1988 325 p
(DE89-007784; DOE/MA-0351) Avail: NTIS HC A14/MF A01

The principle objective of the Information Technology Resources

Plan is to describe the information technology resources and capabilities of the Department, the future requirements, and the strategies and plans to satisfy the identified requirements. The long-range planning process provides the systematic means to meet this objective and assists the Department in assuring that information technology support is provided in an efficient, effective, and timely manner so that the programmatic missions can be accomplished. Another important objective of the Plan is to promote better understanding, both within and external to the Department, of its information technology environment, requirements, issues, and recommended solutions as well as a description of the Departmental unclassified computer security program. DOE

N89-22612*# Systems Technology, Inc., Hawthorne, CA.
ORBITER FLYING QUALITIES (OFQ) WORKSTATION USER'S GUIDE Final Report, Oct. 1988
THOMAS T. MYERS, ZAREH PARSEGHIAN, and JEFFREY R. HOGUE Jun. 1988 202 p
(Contract NAS2-12454)
(NASA-CR-179440; H-1537; NAS 1.26:179440) Avail: NTIS HC A10/MF A01 CSCL 22/2

This project was devoted to the development of a software package, called the Orbiter Flying Qualities (OFQ) Workstation, for working with the OFQ Archives which are specially selected sets of space shuttle entry flight data relevant to flight control and flying qualities. The basic approach to creation of the workstation software was to federate and extend commercial software products to create a low cost package that operates on personal computers. Provision was made to link the workstation to large computers, but the OFQ Archive files were also converted to personal computer diskettes and can be stored on workstation hard disk drives. The primary element of the workstation developed in the project is the Interactive Data Handler (IDH) which allows the user to select data subsets from the archives and pass them to specialized analysis programs. The IDH was developed as an application in a relational database management system product. The specialized analysis programs linked to the workstation include a spreadsheet program, FREDA for spectral analysis, MFP for frequency domain system identification, and NIPIP for pilot-vehicle system parameter identification. The workstation also includes capability for ensemble analysis over groups of missions. Author

N89-22979*# California Univ., Santa Barbara.
REMOTE SENSING INFORMATION SCIENCES RESEARCH GROUP: BROWSE IN THE EOS ERA Final Report
JOHN E. ESTES and JEFFREY L. STAR 1 May 1989 155 p
(Contract NAGW-987)
(NASA-CR-184637; NAS 1.26:184637) Avail: NTIS HC A06/MF A01 CSCL 08/2

The problem of science data browse was examined. Given the tremendous data volumes that are planned for future space missions, particularly the Earth Observing System in the late 1990's, the need for access to large spatial databases must be understood. Work was continued to refine the concept of data browse. Further, software was developed to provide a testbed of the concepts, both to locate possibly interesting data, as well as view a small portion of the data. Build II was placed on a minicomputer and a PC in the laboratory, and provided accounts for use in the testbed. Consideration of the testbed software as an element of in-house data management plans was begun. Author

N89-23072# Sandia National Labs., Albuquerque, NM.
IMPLEMENTING SECURITY MEASURES FOR COMPUTER-BASED SECURITY SYSTEMS
DEBRA A. FACULJAK Feb. 1989 55 p
(Contract DE-AC04-76DP-00789)
(DE89-008995; SAND-88-3114) Avail: NTIS HC A04/MF A01

The purpose of this document is to ensure that system designers: (1) become familiar with security issues, policy, and directives, and (2) are able to integrate protection of the computer, its peripherals, and its data into the system at an early stage in its design. This document provides a comprehensive and uniform review of those security issues that are pertinent to the applications developed within Directorate 5200. The intention of this document is to provide guidance in the development of appropriate computer security protection for the SNLA-developed security systems. The policies and standards of computer security, set forth by the Department of Defense (DOD) and the DOE, are provided to enhance the designers' understanding of the rationale for such security. DOE

N89-23189# Techplan Corp., San Diego, CA.
OVERVIEW OF THE SOFTWARE TECHNOLOGY PROJECT RS34C71, DOCUMENTATION, MANAGEMENT/TECHNICAL ADVANCED CONCEPTS FOR SOFTWARE ENGINEERING Final Report
Jul. 1988 63 p
(Contract N66001-86-D-0020)
(AD-A204921; NOSC/TD-1301) Avail: NTIS HC A04/MF A01 CSCL 12/5

An overview of the Software Technology Project is presented. This multi-laboratory exploratory development program is taking a unique approach to the identification and demonstration of new technologies capable of facilitating the entire life-cycle of the software development process. GRA

N89-23204# Software Sciences Ltd., Farnborough (England).
HOOD TOOLSET DEVELOPMENT PROJECT: ECLIPSE/HOOD/REP, ISSUE 1.1 Final Report
A. E. ELLISTON and P. FLOOD Paris, France ESA 16 Nov. 1988 45 p Prepared in cooperation with Computer Resources International A/S, Denmark; CISI Ingenierie, Toulouse, France and MATRA Espace, Toulouse, France
(Contract ESTEC-7435/87/NL/MAC)
(ESA-CR(P)-2746; ETN-89-94467) Copyright Avail: NTIS HC A03/MF A01

A toolset was developed for the Hierarchical Object Oriented Design method (HOOD) for the architectural design phase of the ESA software engineering lifecycle, specifically for software to be developed in Ada. The main functions provided by the Toolset are: HOOD diagram editing, HOOD text editing, design checking, document production, Ada code production, management services, and Toolset maintenance facilities. The Toolset itself follows the object oriented approach. Hence, to perform an operation on an entity, the user first has to select the entity and then select the operation to be performed. The Toolset uses the multiwindow capabilities of the SUN3 workstation. Within each window user interaction with the tool is accomplished largely using the mouse. Keyboard input is also used for efficiency during text editing. ESA

N89-23370# National Technical Information Service, Springfield, VA.
IDENTIFYING USERS AND HOW TO REACH THEM
JOSEPH F. CAPONIO, FREDERICK L. HAYNES, and A. RAHMAN KHAN *In* AGARD, The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments 5 p Mar. 1989
Copyright Avail: NTIS HC A06/MF A01

The importance of timely use of scientific and technical information is increasingly being recognized by the developing nations as well as the developed nations. It is recognized that it is not only important to develop a better mouse-trap but also it is equally important to ascertain that there is proper diffusion of such an innovation. Knowledge could lay dormant if it does not reach the end-users when they most need it. An attempt is made to address why this is important and focuses on some of the factors involved in identifying and reaching the end-users. Author

N89-23371# Horton (Forest W., Jr.), Washington, DC.
INFORMATION RESOURCES MANAGEMENT
FOREST W. HORTON, JR. *In* AGARD, The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments 5 p Mar. 1989
Copyright Avail: NTIS HC A06/MF A01

The transfer of scientific and technical information between and among nations poses increasing challenges because of: larger and larger volumes of data exchanged; the increasing variety of information interchange media; larger and larger numbers of intermediaries and end-users all along the information transfer chain; and increasing incompatibility of bibliographic and telecommunications formatting conventions. The emerging field of Information Resources Management (IRM) offers promise in helping to cope with these serious information exchanges. In particular, experiments in the U.S. Federal Government with a technique called information mapping, helps information managers identify, describe, inventory/survey, and control their total data, document, and literature flows and holdings, whether automated or manual, more completely. This approach of IRM, and the technique of information mapping, in several organizational contexts - one private (an Australian mineral and mining company), the other public (the U.S. Department of State) are introduced. Author

N89-23373# Bergen Univ. (Norway). Library.
DECENTRALIZATION OF DATABASES AND THE COMMUNICATION BETWEEN THEM
LEIF MAGNE IVERSLAND *In* AGARD, The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments 5 p Mar. 1989
Copyright Avail: NTIS HC A06/MF A01

Database management systems (DBMS) were for many years used to develop centralized information systems, where the database and the application programs are stored at a central computer. The DBMS have also resulted in decentralized information systems in which data and programs are stored at several sites with none or very little communication between the sites. With the advent of distributed database management systems (DDBMS) possibilities for developing information systems have emerged. An ideal DDBMS supports an information system database stored at several sites in a computer network in such a way that users can access data at any site in the network as if they were stored at the local site. Some of the necessary properties of an ideal DDBMS including location, replication, and fragmentation transparencies are examined. Author

N89-23377# RANA Associates, Santa Clara, CA.
MICROFILM AND COMPUTER FULL-TEXT OF ARCHIVAL DOCUMENTS
13 Oct. 1988 9 p
(Contract N00014-85-C-0653)
(AD-A204055) Avail: NTIS HC A02/MF A01 CSCL 14/4

The development of the computer, and more recently the personal computer, has provided a possible solution to the major logistics problem of the storage and retrieval of archival data. An efficient or economical manual solution was precluded by the number of people necessary to support a very large data-base and the main bottleneck has occurred in the retrieval and later refiling of the data of interest. In addition, original documents have a finite lifetime, which is adversely affected each time a document is handled. Microfilm retention of data has provided a partial solution, but does suffer from several serious drawbacks. In general, it has very poor spatial resolution especially when archival information contains diagrams, figures, and photographs in addition to alpha-numeric data. Storage parameters such as heat and humidity, as well as the amount of usage by individuals also affect the lifetime of the microfilm itself. A very large microfilm data-base requires the services of information retrieval specialists to provide an efficient library function for users, thereby increasing the overhead. The intent of this contract is to develop and demonstrate the archival storage of documents using computer-based imaging techniques and the retrieval of these documents by standard database management software. GRA

N89-24049# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
HUMAN-MACHINE INTERACTION CONSIDERATIONS FOR INTERACTIVE SOFTWARE Final Technical Report
LEN BASS and JOELLE COUTAZ (Grenoble-1 Univ., France) Feb. 1989 117 p
(Contract F19628-85-C-0003)
(AD-A206574; CMU/SEI-89-TR-4; ESD-TR-89-04) Avail: NTIS HC A06/MF A01 CSCL 23/2

This document introduces current concepts and techniques relevant to the design and implementation of user interfaces. A user interface refers to those aspects of a system that the user refers to, perceives, knows and understands. A user interface is implemented by code that mediates between a user and a system. This document covers both aspects. The first chapter is an introduction to the psychology of human-computer interaction. It presents the theoretical models that have had a significant impact on the evolution of the field. These models offer a way to organize the design process and help understand the cognitive process involved in interacting with a computer. The rest of the document is concerned with the software design of user interfaces and shows how the principles established by the cognitive principles can be put into practice. Following a presentation on the abstractions involved in the organization of an interactive system, attention is then directed to the tools for constructing user interfaces: windowing systems, tool kits and user interface management systems. GRA

N89-24051# Federal Aviation Administration, Atlantic City, NJ.
HOST COMPUTER SYSTEM CAPACITY MANAGEMENT PROCEDURES Technical Note, 1987
NORMAN W. WATTS, PAUL CONNOLLY, ROBERT GOETTGE, GARY MORFITT, ROBERT WISEMAN, GARY WRIGHT, and FRANK YAZEK Feb. 1988 48 p
(Contract FAA-T0503-M)
(AD-A193416; DOT/FAA/CT-TN87/43) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Federal Aviation Administration's Advanced Automation Program Office recognized the need for monitoring and assessing the National Airspace System's operational performance and for long term planning during the life-cycle of the Host Computer System. The assessment of the operational performance involved the acquisition and analysis of field measurement data, while the long-term capacity planning entails execution of a Host Computer System analytical model using current and project traffic and other system loads. The procedures document defines the activities to be executed in: measuring and monitoring operational performance; measuring projecting system workloads; predicting system performance using an analytical performance model; and analyzing and reporting current and predicted future performance of the Host Computer System. Author

N89-24056# Technische Hogeschool, Delft (Netherlands). Dept. of Mathematics and Informatics Computer Science.
USER INTERFACE AND HIGHLY INTERACTIVE SYSTEMS: SURVEY OF CURRENT RESEARCH
J. M. VERSENDAAL 1988 35 p
(PB89-146088; REPT-88-60) Copyright Avail: NTIS HC A03/MF A01 CSCL 09/2

Highly interactive systems are those systems that have a strong emphasis on the dialogue between computer system and user. The state of the art in highly interactive system design is described, particularly in design of user-computer dialogues. Section 2 describes methodologies for interactive system design. Section 3 describes the current research with respect to user-computer dialogues. In section 4, management systems for user interfaces and interactive applications are discussed. Section 5 describes the object oriented approach for user interface and interactive system design. In the final section a brief summary and conclusions are given. Author

N89-24223# European Space Agency, Paris (France).
ESABASE: A MOST VERSATILE AND FLEXIBLE SYSTEM ENGINEERING TOOL
NORMAN LONGDON, ed. Sep. 1988 38 p Original contains color illustrations
(ESA-BR-54; ISSN-0250-1589; ETN-89-94236) Copyright Avail: NTIS HC A03/MF A01

The ESABASE is an engineering tool supporting a wide variety of space-specific analyses. It is a framework consisting of data management, processing and application steering utilities, that has a number of application programs connected to it. In ESABASE the space system is described (and documented) in an easily understood language, only once. Appropriate data are automatically extracted from this description and passed to the chosen application as needed. Any changes in the description are thus known by all applications concerned. The applications connected to the framework provide: mass analysis, thermal analysis, outgassing contamination analysis, radiation analysis, spacecraft charging analysis, pointing behavior analysis, occultation analysis, perturbation analysis, atomic oxygen recession analysis, plume-impingement analysis, electrical wiring monitoring (harness), and attitude and orbit control system analysis. ESA

N89-24290*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DESIGN OF AUTOMATED SYSTEM FOR MANAGEMENT OF ARRIVAL TRAFFIC
HEINZ ERZBERGER and WILLIAM NEDELL (San Jose State Univ., CA.) Jun. 1989 50 p Original contains color illustrations
(NASA-TM-102201; A-89116; NAS 1.15:102201) Avail: NTIS HC A03/MF A01 CSCL 17/7

The design of an automated air traffic control system based on a hierarchy of advisory tools for controllers is described. Compatibility of the tools with the human controller, a key objective of the design, is achieved by a judicious selection of tasks to be automated and careful attention to the design of the controller system interface. The design comprises three interconnected subsystems referred to as the Traffic Management Advisor, the Descent Advisor, and the Final Approach Spacing Tool. Each of these subsystems provides a collection of tools for specific controller positions and tasks. The design of two of these tools, the Descent Advisor, which provides automation tools for managing descent traffic, and the Traffic Management Advisor, which generates optimum landing schedules is focused on. The algorithms, automation modes, and graphical interfaces incorporated in the design are described. Author

N89-24624*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CSM TESTBED DEVELOPMENT AND LARGE-SCALE STRUCTURAL APPLICATIONS
NORMAN F. KNIGHT, JR., R. E. GILLIAN, SUSAN L. MCCLEARY, C. G. LOTTS, E. L. POOLE, A. L. OVERMAN, and S. C. MACY (Planning Research Corp., Washington, DC.) Washington Apr. 1989 25 p Original contains color illustrations
(NASA-TM-4072; L-16499; NAS 1.15:4072) Avail: NTIS HC A03/MF A01 CSCL 20/11

A research activity called Computational Structural Mechanics (CSM) conducted at the NASA Langley Research Center is described. This activity is developing advanced structural analysis and computational methods that exploit high-performance computers. Methods are developed in the framework of the CSM Testbed software system and applied to representative complex structural analysis problems from the aerospace industry. An overview of the CSM Testbed methods development environment is presented and some new numerical methods developed on a CRAY-2 are described. Selected application studies performed on the NAS CRAY-2 are also summarized. Author

N89-24637*# Lockheed Missiles and Space Co., Palo Alto, CA. Research and Development Div.
THE COMPUTATIONAL STRUCTURAL MECHANICS TESTBED ARCHITECTURE. VOLUME 5: THE INPUT-OUTPUT MANAGER DMGASP
CARLOS A. FELIPPA (Colorado Univ., Boulder.) Mar. 1989 158 p
(Contract NAS1-18444)
(NASA-CR-178388; NAS 1.26:178388; LMSC/D878511-VOL-5) Avail: NTIS HC A08/MF A01 CSCL 20/11

This is the fifth of a set of five volumes which describe the software architecture for the Computational Structural Mechanics Testbed. Derived from NICE, an integrated software system developed at Lockheed Palo Alto Research Laboratory, the architecture is composed of the command language (CLAMP), the command language interpreter (CLIP), and the data manager (GAL). Volumes 1, 2, and 3 (NASA CR's 178384, 178385, and 178386, respectively) describe CLAMP and CLIP and the CLIP-processor interface. Volumes 4 and 5 (NASA CR's 178387 and 178388, respectively) describe GAL and its low-level I/O. CLAMP, an acronym for Command Language for Applied Mechanics Processors, is designed to control the flow of execution of processors written for NICE. Volume 5 describes the low-level data management component of the NICE software. It is intended only for advanced programmers involved in maintenance of the software. Author

N89-25073*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UNIX-BASED DATA MANAGEMENT SYSTEM FOR THE MOBILE SATELLITE PROPAGATION EXPERIMENT (PIFEX)
ANIL V. KANTAK 15 Sep. 1987 76 p
(NASA-CR-185023; JPL-PUBL-87-24; NAS 1.26:185023) Avail: NTIS HC A05/MF A01 CSCL 05/2

A new method is presented for handling data resulting from Mobile Satellite propagation experiments such as the Pilot Field Experiment (PiFEx) conducted by JPL. This method uses the UNIX operating system and C programming language. The data management system is implemented on a VAX minicomputer. The system automatically divides the large data file housing data from various experiments under a predetermined format into various individual files containing data from each experiment. The system also has a number of programs written in C and FORTRAN languages to allow the researcher to obtain meaningful quantities from the data at hand. Author

N89-25591# Los Alamos National Lab., NM.
DETECTION OF ANOMALOUS COMPUTER SESSION ACTIVITY
HENRY S. VACCARO 1988 24 p Presented at the Symposium on Security and Privacy, Oakland, CA, 1 May 1989
(Contract W-7405-ENG-36)
(DE89-003607; LA-UR-88-3656; CONF-890536-2) Avail: NTIS HC A03/MF A01

This paper describes recent Los Alamos National Laboratory (LANL) applications of research into automated anomaly detection. In the context of computer security, anomaly detection seeks to identify events shown in audit records that are inconsistent with routine operation and therefore may be indicative of an intrusion into the computer, serious human errors, or malicious behavior by a legitimate user. Access by an intruder, execution of Trojan horses and viruses, as well as malicious, destructive behavior are all assumed to produce anomalous events that are recorded in a computer audit trail. This trail, perhaps with augmented data collection capabilities, is processed, in real-time, to detect such events, alert a knowledgeable computer security officer to the threat, and help resolve the situation. DOE

N89-25599*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
THE FAST ENCRYPTION PACKAGE
MATT BISHOP (Dartmouth Coll., Hanover, NH.) Aug. 1988 50 p
(Contract NCC2-398)
(NASA-CR-185397; NAS 1.26:185397; RIACS-M-88.3) Avail: NTIS HC A03/MF A01 CSCL 09/2

The organization of some tools to help improve passwork security at a UNIX-based site is described along with how to install and use them. These tools and their associated library enable a site to force users to pick reasonably safe passwords (safe being site configurable) and to enable site management to try to crack existing passworks. The library contains various versions of a very fast implementation of the Data Encryption Standard and of the

one-way encryption functions used to encryp the password.
Author

N89-25619*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCURRENT IMAGE PROCESSING EXECUTIVE (CIPE)
MEEMONG LEE, GREGORY T. COOPER, STEVEN L. GROOM, ALAN S. MAZER, and WINIFRED I. WILLIAMS 1 Oct. 1988 102 p
(Contract NAS7-918)
(NASA-CR-185460; NAS 1.26:185460; JPL-PUBL-88-32) Avail: NTIS HC A06/MF A01 CSCL 09/2

The design and implementation of a Concurrent Image Processing Executive (CIPE), which is intended to become the support system software for a prototype high performance science analysis workstation are discussed. The target machine for this software is a JPL/Caltech Mark IIIfp Hypercube hosted by either a MASSCOMP 5600 or a Sun-3, Sun-4 workstation; however, the design will accommodate other concurrent machines of similar architecture, i.e., local memory, multiple-instruction-multiple-data (MIMD) machines. The CIPE system provides both a multimode user interface and an applications programmer interface, and has been designed around four loosely coupled modules; (1) user interface, (2) host-resident executive, (3) hypercube-resident executive, and (4) application functions. The loose coupling between modules allows modification of a particular module without significantly affecting the other modules in the system. In order to enhance hypercube memory utilization and to allow expansion of image processing capabilities, a specialized program management method, incremental loading, was devised. To minimize data transfer between host and hypercube a data management method which distributes, redistributes, and tracks data set information was implemented. Author

N89-25622# Sandia National Labs., Albuquerque, NM.
DESIGN AND CONSTRUCTION OF A COMPUTER SYSTEM MODEL FOR APPLICATION DEVELOPMENT WORKLOADS
GERALD F. QUINLAN, RICHARD A. REID, and NEAL D. WENDERLICH (International Business Machines Corp., Armonk, NY.) Feb. 1989 30 p
(Contract DE-AC04-76DP-00789)
(DE89-010519; SAND-89-0109) Avail: NTIS HC A03/MF A01

This report describes a capacity planning project for Engineering Information Management (EIM) systems at Sandia National Laboratories, Albuquerque. The purpose of the project was to develop a method for predicting the ability of current hardware computer systems to meet future demands and to quantify the magnitude of required upgrades. The project phases included the analysis of alternative, the selection of analytic modeling as the appropriate vehicle, construction of the model, the development of recommendations for its use as a capacity planning tool, and the formulation of proposals for future enhancements. DOE

N89-25767 Politecnico di Milano (Italy). Lab. di Calcolatori.
TEMPORAL DATA MANAGEMENT IN REAL-TIME SYSTEMS: A COMPARATIVE VIEW
R. MAIOCCHI and B. PERNICI 1988 56 p
(REPT-88-046; ETN-89-94681) Avail: Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

The requirements of systems for temporal data management are investigated on the basis of a case study. Representative approaches are selected, with the goal of identifying features of systems proposed in different areas. On the basis of this analysis a framework for evaluation of temporal systems and for specifying temporal data management systems for real time applications is proposed. ESA

N89-25773*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
PERFORMANCE ISSUES IN MANAGEMENT OF THE SPACE STATION INFORMATION SYSTEM
MARJORY J. JOHNSON Sep. 1988 22 p Revised
(Contract NCC2-387)
(NASA-CR-185409; NAS 1.26:185409; RIACS-TR-88.22) Avail: NTIS HC A03/MF A01 CSCL 05/2

The onboard segment of the Space Station Information System (SSIS), called the Data Management System (DMS), will consist of a Fiber Distributed Data Interface (FDDI) token-ring network. The performance of the DMS in scenarios involving two kinds of network management is analyzed. In the first scenario, how the transmission of routine management messages impacts performance of the DMS is examined. In the second scenario, techniques for ensuring low latency of real-time control messages in an emergency are examined. Author

N89-25856*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE GONG DATA REDUCTION AND ANALYSIS SYSTEM
JAMES A. PINTAR, BO NYBORG ANDERSEN, EDWIN R. ANDERSEN, DAVID B. ARMET, TIMOTHY M. BROWN, DAVID H. HATHAWAY, FRANK HILL, and HARRISON P. JONES (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.) *In* ESA, Seismology of the Sun and Sun-Like Stars p 217-221 Dec. 1988
Copyright Avail: NTIS HC A99/MF E03 CSCL 03/2

Each of the six GONG observing stations will produce three, 16-bit, 256X256 images of the Sun every 60 sec of sunlight. These data will be transferred from the observing sites to the GONG Data Management and Analysis Center (DMAC), in Tucson, on high-density tapes at a combined rate of over 1 gibabyte per day. The contemporaneous processing of these data will produce several standard data products and will require a sustained throughput in excess of 7 megaflops. Peak rates may exceed 50 megaflops. Archives will accumulate at the rate of approximately 1 terabyte per year, reaching nearly 3 terabytes in 3 yr of observing. Researchers will access the data products with a machine-independent GONG Reduction and Analysis Software Package (GRASP). Based on the Image Reduction and Analysis Facility, this package will include database facilities and helioseismic analysis tools. Users may access the data as visitors in Tucson, or may access DMAC remotely through networks, or may process subsets of the data at their local institutions using GRASP or other systems of their choice. Elements of the system will reach the prototype stage by the end of 1988. Full operation is expected in 1992 when data acquisition begins. ESA

N89-26403*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
MEMORY PROTECTION
PETER J. DENNING 21 Jul. 1988 14 p Submitted for publication
(Contract NCC2-387)
(NASA-CR-184961; NAS 1.26:184961; RIACS-TR-88.17) Avail: NTIS HC A03/MF A01 CSCL 09/2

Accidental overwriting of files or of memory regions belonging to other programs, browsing of personal files by superusers, Trojan horses, and viruses are examples of breakdowns in workstations and personal computers that would be significantly reduced by memory protection. Memory protection is the capability of an operating system and supporting hardware to delimit segments of memory, to control whether segments can be read from or written into, and to confine accesses of a program to its segments alone. The absence of memory protection in many operating systems today is the result of a bias toward a narrow definition of performance as maximum instruction-execution rate. A broader definition, including the time to get the job done, makes clear that cost of recovery from memory interference errors reduces expected performance. The mechanisms of memory protection are well understood, powerful, efficient, and elegant. They add to performance in the broad sense without reducing instruction execution rate. Author

N89-26421*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
COMPUTER VIRUSES

PETER J. DENNING 21 Mar. 1988 15 p Submitted for publication
(Contract NCC2-387)
(NASA-CR-184680; NAS 1.26:184680; RIACS-TR-88.10) Avail: NTIS HC A03/MF A01 CSCL 09/2

The worm, Trojan horse, bacterium, and virus are destructive programs that attack information stored in a computer's memory. Virus programs, which propagate by incorporating copies of themselves into other programs, are a growing menace in the late-1980s world of unprotected, networked workstations and personal computers. Limited immunity is offered by memory protection hardware, digitally authenticated object programs,and antibody programs that kill specific viruses. Additional immunity can be gained from the practice of digital hygiene, primarily the refusal to use software from untrusted sources. Full immunity requires attention in a social dimension, the accountability of programmers. Author

N89-26473*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REAL-TIME HIERARCHICALLY DISTRIBUTED PROCESSING NETWORK INTERACTION SIMULATION
W. F. ZIMMERMAN and C. WU *In its* Proceedings of the Workshop on Space Telerobotics, Volume 1 p 173-180 1 Jul. 1987
Avail: NTIS HC A16/MF A01 CSCL 09/2

The Telerobot Testbed is a hierarchically distributed processing system which is linked together through a standard, commercial Ethernet. Standard Ethernet systems are primarily designed to manage non-real-time information transfer. Therefore, collisions on the net (i.e., two or more sources attempting to send data at the same time) are managed by randomly rescheduling one of the sources to retransmit at a later time interval. Although acceptable for transmitting noncritical data such as mail, this particular feature is unacceptable for real-time hierarchical command and control systems such as the Telerobot. Data transfer and scheduling simulations, such as token ring, offer solutions to collision management, but do not appropriately characterize real-time data transfer/interactions for robotic systems. Therefore, models like these do not provide a viable simulation environment for understanding real-time network loading. A real-time network loading model is being developed which allows processor-to-processor interactions to be simulated, collisions (and respective probabilities) to be logged, collision-prone areas to be identified, and network control variable adjustments to be reentered as a means of examining and reducing collision-prone regimes that occur in the process of simulating a complete task sequence. Author

N89-26602*# Boeing Aerospace Co., Seattle, WA. Advanced Technology Center.
NATURAL LANGUAGE PROCESSING AND ADVANCED INFORMATION MANAGEMENT
JAMES E. HOARD *In* NASA. Goddard Space Flight Center, The 1989 Goddard Conference on Space Applications of Artificial Intelligence p 301-315 Apr. 1989
Avail: NTIS HC A17/MF A01 CSCL 09/2

Integrating diverse information sources and application software in a principled and general manner will require a very capable advanced information management (AIM) system. In particular, such a system will need a comprehensive addressing scheme to locate the material in its docuverse. It will also need a natural language processing (NLP) system of great sophistication. It seems that the NLP system must serve three functions. First, it provides an natural language interface (NLI) for the users. Second, it serves as the core component that understands and makes use of the real-world interpretations (RWIs) contained in the docuverse. Third, it enables the reasoning specialists (RSs) to arrive at conclusions that can be transformed into procedures that will satisfy the users' requests. The best candidate for an intelligent agent that can satisfactorily make use of RSs and transform documents (TDs) appears to be an object oriented data base (OODB). OODBs have, apparently, an inherent capacity to use the large numbers of RSs and TDs that will be required by an AIM system and an inherent capacity to use them in an effective way. Author

N89-26779# Naval Ocean Systems Center, San Diego, CA. Decision Support and Artificial Intelligence Systems Branch.
AN ASYNCHRONOUS INTERFACE BETWEEN A NATURAL LANGUAGE QUERY INTERPRETER AND A DATABASE MANAGEMENT SYSTEM Final Report, Feb. - Apr. 1988
L. E. GADBOIS Feb. 1989 22 p
(AD-A206918; NOSC/TD-1482) Avail: NTIS HC A03/MF A01 CSCL 12/5

This report documents computer software which interfaces a Data Base Management System (DBMS) to a program which generates database requests. The software described controls the passing of Structured Query Language (SQL) commands into ORACLE and the capture of its output for return to the program which made the request. The software was designed for a DBMS running on a UNIX computer to be accessed by a program on the same or a remote computer. This remote can be running any hardware or operating system which has File Transfer Protocol (FTP) connection with the UNIX machine. GRA

N89-26780# Naval Postgraduate School, Monterey, CA.
A MULTIMEDIA DATABASE MANAGEMENT SYSTEM SUPPORTING CONTENTS SEARCH IN MEDIA DATA Progress Report, Oct. 1988 - Jan. 1989
VINCENT Y. LUM and KLAUS MEYER-WEGENER Mar. 1989 33 p
(AD-A207070; NPS52-89-020) Avail: NTIS HC A03/MF A01 CSCL 12/7

It is now feasible to store and manage in computers new types of data like text, images, graphics, and sound recordings. It is proposed that database management systems should be extended to organize these new types of data and to enable search based on their contents. Media objects are modeled as attributes of abstract data types. The contents are captured in terms of natural language descriptions and are translated by a parser into predicates for easy matching with query phrases. The implications of this approach are discussed: Data organization for multimedia including contents representation, the dictionary used by the parser to recognize words and assign predicates, rules to use semantic relationships in the query evaluation, and access paths to speed up the search for the descriptions. The result is an architecture for multimedia database management systems that combines the additional components needed with the conventional data management and identifies their ways of interaction. Three types of user interfaces are offered that require different levels of skill. The architecture is modular and allows the integration of more advanced AI techniques once they become available. GRA

N89-27369# Rome Air Development Center, Griffiss AFB, NY.
SOFTWARE DEFICIENCY ISSUES CONFRONTING THE UTILIZATION OF NON-VON NEUMANN ARCHITECTURES Report, Jan. - Jun. 1988
PAUL M. ENGELHART Jan. 1989 103 p
(AD-A207268; RADC-TR-88-319) Avail: NTIS HC A06/MF A01 CSCL 12/5

Work is summarized for the current state-of-the-art in software engineering issues confronting the effective implementation of non-sequential architecture-based computers. Since these architectures do not conform to the model of the von Neumann machine, the Non-von Neumann computers. It is apparent that utilization of Non-von Neumann computer systems is necessary to many of today's as well as the future's computational requirements. Advances in computer architecture technology, VLSI technology, and interconnection network topologies, to name but a few, have led to a multitude of relatively inexpensive but very powerful high performance processors. The development and utilization of Non-von Neumann systems requires a strong knowledge of the development and utilization of Non-von Neumann systems requires a strong knowledge of the underlying hardware and software structures. However, the largest problem in utilizing

Non-von Neumann computers is not in the hardware, but in the software where software engineering remains oriented towards conventional von Neumann methodologies. Since these machines are highly concurrent in nature, a deep-rooted understanding is necessary to determine exactly what software engineering tools and techniques are necessary for their exploitation. GRA

N89-27372# Carnegie-Mellon Univ., Pittsburgh, PA.
COMPETITIVE MANAGEMENT OF DISTRIBUTED SHARED MEMORY
DAVID L. BLACK, ANOOP GUPTA, and WOLF-DIETRICH WEBER (Stanford Univ., CA.) 1988 8 p
(Contract N00014-87-K-0828)
(AD-A207322) Avail: NTIS HC A02/MF A01 CSCL 12/5

This paper presents and analyzes algorithms for managing the distributed shared memory present in non-uniform memory access multiprocessors and related systems. The competitive properties of these algorithms guarantee that their performance is within a small constant factor of optimal even though they make no use of any information about memory reference patterns. Both hardware and software implementation concerns are covered. A case study of the Mach operating systems indicates that integration of these algorithms into operating systems does not pose major problems. On the other hand, hardware support is required to obtain the full functionality of the algorithms. We also sketch possible algorithm extensions to additional hardware architectures and software programming models. GRA

N89-27390*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
INDIRECT ADDRESSING AND LOAD BALANCING FOR FASTER SOLUTION TO MANDELBROT SET ON SIMD ARCHITECTURES Final Report
SHERRYL TOMBOULIAN (MasPar Computer Corp., Santa Clara, CA.) May 1989 11 p
(Contract NAS1-18605)
(NASA-CR-181847; NAS 1.26:181847; ICASE-89-33) Avail: NTIS HC A03/MF A01 CSCL 09/2

SIMD computers with local indirect addressing allow programs to have queues and buffers, making certain kinds of problems much more efficient. Examined here are a class of problems characterized by computations on data points where the computation is identical, but the convergence rate is data dependent. Normally, in this situation, the algorithm time is governed by the maximum number of iterations required by each point. Using indirect addressing allows a processor to proceed to the next data point when it is done, reducing the overall number of iterations required to approach the mean convergence rate when a sufficiently large problem set is solved. Load balancing techniques can be applied for additional performance improvement. Simulations of this technique applied to solving Mandelbrot Sets indicate significant performance gains. Author

N89-27413*# Draper (Charles Stark) Lab., Inc., Cambridge, MA.
ADVANCED INFORMATION PROCESSING SYSTEM: INPUT/OUTPUT SYSTEM SERVICES
TOM MASOTTO and LINDA ALGER Aug. 1989 186 p
(Contract NAS1-18565)
(NASA-CR-181874; NAS 1.26:181874) Avail: NTIS HC A09/MF A01 CSCL 09/2

The functional requirements and detailed specifications for the Input/Output (I/O) Systems Services of the Advanced Information Processing System (AIPS) are discussed. The introductory section is provided to outline the overall architecture and functional requirements of the AIPS system. Section 1.1 gives a brief overview of the AIPS architecture as well as a detailed description of the AIPS fault tolerant network architecture, while section 1.2 provides an introduction to the AIPS systems software. Sections 2 and 3 describe the functional requirements and design and detailed specifications of the I/O User Interface and Communications Management modules of the I/O System Services, respectively. Section 4 illustrates the use of the I/O System Services, while Section 5 concludes with a summary of results and suggestions for future work in this area. Author

N89-27590# Economic Systems Analysis, Inc., Oak Ridge, TN.
TECHNOLOGY MASTER LIST DATA BASE MANAGEMENT SYSTEM, USER'S MANUAL
JEANNE YATES RIMPO and MARLENE J. OWENS Sep. 1988 111 p
(Contract GRI-5088-450-1667)
(PB89-177802; GRI-88/0249) Avail: NTIS HC A06/MF A01 CSCL 05/2

In order to track the movement of Gas Research Institute (GRI) projects from the drawing-board concept to commercialized product, GRI developed a Master List of these technologies and research applications. An interactive data base management program (titled WIN) was developed to permit manipulation and updating of the Master List data base. The user's manual provides information on using this data base management program, including record management (adding, editing, deleting, and moving records), report generation (selecting, sorting, and printing), and data base maintenance. The system is designed to be used with the dBase III Plus software on IBM or compatible personal computers. Author

N89-27593# Sandia National Labs., Albuquerque, NM. Geo-Science Analysis Div.
DEVELOPING A GEOLOGIC AND ENGINEERING PROPERTIES DATA BASE WITH INGRES
MARGARET L. KREBS-JESPERSEN 1989 26 p Presented at the INGRES User Association Meeting, New Orleans, LA, 23 Apr. 1989
(Contract DE-AC04-76DP-00789)
(DE89-013520; SAND-89-0838C; CONF-8904194-3) Avail: NTIS HC A03/MF A01

The design of a data base for storing diverse geological and site engineering properties data from various sources using the INGRES data base management system has required: (1) designing tables for data that are similar but have very different test conditions to be reported; (2) determining what data is necessary to ensure that all records are unique; (3) changing, as necessary, the design of data base tables to accommodate the needs of new data submittals; (4) defining limits to comments and descriptions of test conditions to be stored in the data base; (5) solving problems caused by the limitations of the available field types in INGRES; and (6) designing a tracking system for data submissions to satisfy Project quality assurance requirements. The resulting relational data base design is simple, flexible, and capable of accommodating changes in requirements for data storage and user needs. The INGRES Report Writer utility has proven to be a powerful tool for generating reports because the Report Writer code is easily revised as table structure changes. Separate data storage tables can be joined for report production, and output can be customized for each user. DOE

N89-27597# Sandia National Labs., Albuquerque, NM. Organic Materials Div.
MANAGEMENT INFORMATION DATABASE SYSTEM
NANCY L. LEISHMAN May 1989 34 p
(Contract DE-AC04-76DP-00789)
(DE89-014595; SAND-88-3439) Avail: NTIS HC A03/MF A01

This is a description of a computerized database tool for use by operational management. The Management Information Database System was created to more efficiently maintain the information needed by managers for time and material cost accounting and resource scheduling. Reports produced reflect the current status of assignments and balances of F-orders. DOE

N89-27650# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Avionics Panel.
SYSTEMS ENGINEERING
May 1989 132 p In ENGLISH and FRENCH Lecture series held in Kettering, OH, 15-16 May 1989, in Delft, Netherlands,

22-23 May 1989, and in Rome, Italy, 25-26 May 1989
(AGARD-LS-164; ISBN-92-835-0513-1; AD-A211104) Copyright Avail: NTIS HC A07/MF A01

Recent AGARD activities have indicated a strong need for more effective avionics system engineering. There is a growing need for reducing development time, effecting savings in costs of ownership, and in extending the life-time of avionics systems. This must be accomplished along with meeting needs of the user faced with a growing threat. With the growing complexity of avionics systems (as well as other systems), it is important to develop and maintain expertise in system planning, architecture, and management. The important systems engineering aspects of requirements, system integration, prototyping, and design are addressed. In addition, the impact of technology on system architecture are discussed. Methodologies are described and actual case histories will serve as practical examples of modern systems engineering.

N89-27916*# Spar Aerospace Ltd., Ste-Anne-de-Bellevue (Quebec). Communications Group.
MSAT SIGNALLING AND NETWORK MANAGEMENT ARCHITECTURES
PETER GARLAND and J. MALCOLM KEELTY *In* Jet Propulsion Lab., California Inst. of Tech., Proceedings of the Mobile Satellite System Architectures and Multiple Access Techniques Workshop p 91-101 Mar. 1989
Avail: NTIS HC A06/MF A01 CSCL 17/2

Spar Aerospace has been active in the design and definition of Mobile Satellite Systems since the mid 1970's. In work sponsored by the Canadian Department of Communications, various payload configurations have evolved. In addressing the payload configuration, the requirements of the mobile user, the service provider and the satellite operator have always been the most important consideration. The current Spar 11 beam satellite design is reviewed, and its capabilities to provide flexibility and potential for network growth within the WARC87 allocations are explored. To enable the full capabilities of the payload to be realized, a large amount of ground based Switching and Network Management infrastructure will be required, when space segment becomes available. Early indications were that a single custom designed Demand Assignment Multiple Access (DAMA) switch should be implemented to provide efficient use of the space segment. As MSAT has evolved into a multiple service concept, supporting many service providers, this architecture should be reviewed. Some possible signalling and Network Management solutions are explored. Author

N89-27951# Mission Research Corp., Nashua, NH.
MATH AND PHYSICS STUDIES-MULTI-PROJECT SUPPORT ENTROPY-BASED IMAGE RESTORATION: MODIFICATIONS AND ADDDITIONAL RESULTS Technical Report, 29 Sep. 1987 - 29 Sep. 1988
JOHN P. KENNEALY and ROSE M. KORTE 31 Oct. 1988 11 p
(Contract F19628-87-C-0230)
(AD-A209972; MRC-NSH-R-88-0008; AFGL-TR-88-0330; SR-1)
Avail: NTIS HC A03/MF A01 CSCL 17/5

The contract effort was toward the development of a data management program for the SDIO Infrared Background Signature Survey, a shuttle-based experiment to be launched in mid 1990, and the super resolution of special data observations of IRAS satellite sensor images of galaxies. The attached report addresses the latter. A new approach to the application of maximum entropy principles in image restoration is being developed. It is an iterative process which combines a Wiener filter restoration and modification to the Weiner image that are Entropy based. The result is an image with well restored frequency content and very little of the spuriousness commonly introduced by inverse filters. The algorithm is fast, stable to convergence, and will accommodate any specifiable distorting function. GRA

N89-28308# Oak Ridge National Lab., TN. Engineering Technology Div.
APPROACHING DISTRIBUTED DATABASE APPLICATIONS USING A PROGRAMMABLE TERMINAL EMULATOR
J. A. CLINARD, J. J. ROBINSON, J. T. PHILLIPS, JR., and G. L. JOHNSON Jun. 1989 68 p Sponsored in part by Pacific Missile Testing Center
(Contract DE-AC05-84OT-21400)
(DE89-014831; K/DSRD-80) Avail: NTIS HC A04/MF A01

Two separate approaches were used to develop a prototype for entering data into a remote host computer in an automated manner. In the first approach, revisions were implemented in the IBM PC's terminal emulator VTEK 4.2. These revisions allowed prewritten script files to be processed to the host based operating system and applications software as if the script file information had been entered on the keyboard. The script processing capability was implemented taking advantage of existing user defined key capability and the DEC VT100 asynchronous terminal emulation of VTEK communications software. At present the script command and data files must be manually created at the PC using an editor or word processor. The script processing capability works with any host based operating system or application software that interacts with a DEC VT100 terminal. An example is provided where VTEK script processing is used to automatically interact with a VAX-based Database Management System (DBMS), INGRES, appending PC resident data records to an INGRES table, creating a default report, aborting to VMS, and disposing of the report, all without touching a key. An appendix is provided which discusses the second approach of developing a prototype VT100 emulator specifically designed for data entry to a remote host computer system. This software loads data automatically into a Vax Datatrieve data base. It provides an alternative method of prototype development. The challenges for future development are identified and discussed. The use of the programmable terminal emulator for data control in the case of distributed database applications is also discussed. DOE

N89-28332# Massachusetts Univ., Amherst. Dept. of Electrical and Computer Engineering.
RESOURCE CONTENTION MANAGEMENT IN PARALLEL SYSTEMS Final Report, Jun. - Dec. 1987
CHRISTOS G. CASSANDRAS, JAMES F. KUROSE, and DON TOWSLEY Apr. 1989 151 p
(Contract F30602-81-C-0169)
(AD-A208809; RADC-TR-89-48) Avail: NTIS HC A08/MF A01 CSCL 12/7

This research effort explored two issues: (1) The comparative study of simple load balancing algorithms for distributed real-time systems which showed that simple policies perform just as well as complex policies in a majority of the cases; (2) The second task was to development of on-line optimization procedures for load balancing algorithms and of task scheduling policies with real-time constraints. GRA

N89-28440*# George Washington Univ., Washington, DC.
DATA BASE DEVELOPMENT AND RESEARCH AND EDITORIAL SUPPORT Final Report, 17 Apr. 1978 - 30 Jun. 1988
30 Jun. 1988 100 p
(Contract NASW-3165)
(NASA-CR-183249; NAS 1.26:183249) Avail: NTIS HC A05/MF A01 CSCL 05/2

The Life Sciences Bibliographic Data Base was created in 1981 and subsequently expanded. A systematic, professional system was developed to collect, organize, and disseminate information about scientific publications resulting from research. The data base consists of bibliographic information and hard copies of all research papers published by Life Sciences-supported investigators. Technical improvements were instituted in the database. To minimize costs, take advantage of advances in personal computer technology, and achieve maximum flexibility and control, the data base was transferred from the JSC computer to personal computers at George Washington University (GWU). GWU also performed a

range of related activities such as conducting in-depth searches on a variety of subjects, retrieving scientific literature, preparing presentations, summarizing research progress, answering correspondence requiring reference support, and providing writing and editorial support. Author

N89-28444*# Dartmouth Coll., Hanover, NH. Dept. of Mathematics and Computer Science.
THEFT OF INFORMATION IN THE TAKE-GRANT PROTECTION MODEL
MATT BISHOP 1989 27 p
(Contract NAG2-480)
(NASA-CR-185835; NAS 1.26:185835; PCS-TR88-137) Avail: NTIS HC A03/MF A01 CSCL 05/2

Using the information transfer extensions to the Take-Grant Protection Model, the concept of theft of information is defined and necessary and sufficient conditions for such theft to occur are presented, as well as bounds on the number of actors involved in such theft. Finally, the application of these results to reference monitors are explored. Author

N89-28445*# Dartmouth Coll., Hanover, NH. Dept. of Mathematics and Computer Science.
THE SHARING OF RIGHTS AND INFORMATION IN A CAPABILITY-BASED PROTECTION SYSTEM
MATT BISHOP 1989 36 p Sponsored in part by a Burke Award from Dartmouth Coll.
(Contract NAG2-480)
(NASA-CR-185388; NAS 1.26:185388; PCS-TR88-136) Avail: NTIS HC A03/MF A01 CSCL 05/2

The question of sharing of rights and information in the Take-Grant Protection Model is examined by concentrating on the similarities between the two; in order to do this, new theorems are stated and proven for each that specifically show the similarities. The proof for one of the original theorems is also provided. These statements of necessary and sufficient conditions are contrasted to illustrate the proposition that transferring rights and transferring information are fundamentally the same, as one would expect in a capability-based system. Directions are then discussed for future research in light of these results. Author

N89-28446*# Dartmouth Coll., Hanover, NH. Dept. of Mathematics and Computer Science.
A MODEL OF SECURITY MONITORING
MATT BISHOP 1989 23 p
(Contract NAG2-480)
(NASA-CR-185845; NAS 1.26:185845) Avail: NTIS HC A03/MF A01 CSCL 05/2

A model of security monitoring is presented that distinguishes between two types of logging and auditing. Implications for the design and use of security monitoring mechanisms are drawn from this model. The usefulness of the model is then demonstrated by analyzing several different monitoring mechanisms. Author

N89-29042# Software Architecture and Engineering, Inc., Arlington, VA.
SOFTWARE TECHNOLOGY TO SUPPORT REAL-TIME EMBEDDED ARTIFICIAL INTELLIGENCE-BASED APPLICATIONS, PHASE 1 Final Report, 1 Oct. 1988 - 31 Mar. 1989
THOMAS E. SHIELDS 4 May 1989 25 p
(Contract DAAL03-88-C-0033)
(AD-A209133; ARO-25998.1-EL-SBI-PHASE-1) Avail: NTIS HC A02/MF A01 CSCL 12/5

Current-generation KB systems run-time implementations are too abstract and non-deterministic for use in real time systems. The real time applications designer just cannot deal with systems that are non-deterministic and do not provide explicit control. The proposed research ideas were either abandoned or were not developed much beyond their initial conception. However, the fundamental conclusion, herein, is that the proposed ideas were really attempting to tackle the wrong problems. GRA

N89-29067# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
TOOLS FOR THE DEVELOPMENT AND USAGE OF INDUSTRIAL MATHEMATICAL SOFTWARE
F. J. HEEREMA, W. LOEVE, and J. J. P. VANHULZEN 17 Mar. 1987 30 p Presented at the 1st International Conference on Industrial and Applied Mathematics, Paris, France, 29 Jun. - 3 Jul. 1987
(NLR-MP-87020-U; ETN-89-95411; AD-B135569L) Avail: NTIS HC A03/MF A01

An infrastructure for information processing, comprising hardware and software, is discussed. This infrastructure can be applied to support research and engineering activities of the industry. A computer, a terminal network, and a supercomputer for fast computations are developed. The network allows access from outside to software, information from experiments, and digital simulations. The kernel of the software infrastructure consists of an engineering data management system with 4th generation characteristics. A standardized command language system (COLAS) for user interaction, and a method base system (MEBAS), which supports the management, assemblage and use of software components, are created. The main components of the infrastructure are facilities for data management, method management, and user interfaces, all implemented on a computer and terminal network. ESA

N89-29092 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
APPRAISAL OF SECURITY OF DATA HANDLING SYSTEMS AND PRODUCTS: A TUTORIAL AND DISCUSSION DOCUMENT
W. L. PRICE Mar. 1989 18 p
(NPL-DITC-141/89; ETN-89-95251) Copyright Avail: National Physical Laboratory, Teddington, Middlesex, TW11 0LW, United Kingdom

Technical aspects of appraisal of security of data handling systems and products, in the civil domain, are discussed. The behavior of security personnel is not considered. The points of view of the U.S. Department of Defense (DOD) Orange and Red books and the UK Department of Trade and Industry (DTI) Commercial Computer Security Center are discussed. Products claiming conformance to particular International Standard Organization (ISO), or other organizations, security standards and the methods avaiable for testing the claimed conformance, are analyzed. The essential features of security analysis are outlined, but further studies on the subject are required. ESA

N89-29955*# National Aeronautics and Space Administration. Pasadena Office, CA.
COMPUTER ACCESS SECURITY CODE SYSTEM Patent Application
EARL R. COLLINS, JR., inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 5 Dec. 1988 16 p
(Contract NAS7-918)
(NASA-CASE-NPO-17525-1-CU; NAS 1.71:NPO-17525-1-CU; US-PATENT-APPL-SN-279630) Avail: NTIS HC A03/MF A01 CSCL 09/2

A security code system is disclosed for controlling access to computers and computer controlled entry situations. It is comprised of a plurality of subsets of alpha-numeric characters disposed in random order in matrices of at least two dimensions forming theoretical rectangles, or cubes, such that when access is denied, at least one pair of previously unused character subsets not found in the same row or column of the matrix is chosen at random and transmitted by the computer. The proper response to gain access is transmittal of subsets which complete the rectangle, and/or a parallelpiped whose opposite corners were defined by the first groups of the code. Once used, subsets are not used again to absolutely defeat unauthorized access by eavesdropping, and the like. NASA

N89-29957# Minnesota Univ., Minneapolis. Dept. of Computer Science.
SYSTEM ARCHITECTURE FOR FAULT-TOLERANT PROCESSES IN DISTRIBUTED SYSTEMS Final Technical Report, Apr. 1986 - Sep. 1987
ANAND TRIPATHI, S. AZADEGAN, S. RANKA, S. DONG, and V. RAGHAVAN Feb. 1989 91 p
(Contract F30602-81-C-0205)
(AD-A208233; RADC-TR-88-66) Avail: NTIS HC A05/MF A01
CSCL 12/6

The primary focus of this report is on system architectures and protocols for building fault-tolerant distributed systems. Algorithms and protocols are addressed in four different areas: fault-diagnosis, error recovery in replicated systems, error recovery based on self-stabilization, and the use of masking redundancy in replicated systems using agreement protocols. This report is a collection of six technical papers that present the results obtained in these areas. The first paper describes a system architecture for building resilient processes using replication and checkpointing. It describes the protocols for process replication management. The second paper presents an agreement protocol which provides the same view of the computation state to each correctly functioning copy of the process. The third paper presents a protocol for self-stabilization in binary trees. This protocol is a generalization of one of Dijkstra's protocols and for normal operations is sufficient to guarantee recovery from any erroneous state. The fourth paper presents a protocol for detecting the termination of a set of cooperating communicating processes. The last two papers address the problems related to fault-diagnosis in interconnected systems. The first presents a survey of the various fault-diagnosis algorithms based on the model proposed by Preparata, Metze and Chen (PMC Model). The second presents some results in direction of designing more efficient fault-diagnosis algorithms.
GRA

06

RESEARCH AND DEVELOPMENT

Includes Contracts and Contract Management, Project Management, Program Management, Research Projects and Research Facilities, Scientific Research, Innovations and Inventions, Technology Transfer and Utilization, R & D Resources, Agency, National and International R & D.

A89-10673* National Aeronautics and Space Administration, Washington, DC.
SPACE STATION UTILIZATION
SHERWIM BECK and RICHARD E. HALPERN (NASA, Office of Space Station, Washington, D.C.) IN: International Pacific Air and Space Technology Conference, Melbourne, Australia, Nov. 13-17, 1987, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1988, p. 519-528.
(SAE PAPER 872462) Copyright

This paper focuses on the emphasis NASA has placed on Space Station utilization and the approach used to develop informed user communities in science, technology, and space commercialization. A major program objective continues to be the identification of potential Space Station users, assimilation of user requirements, and the use of those requirements both to drive the Station's design and to guide the Station's evolution. NASA's goal is the creation of a user friendly, multipurpose, multidiscipline research facility that will evolve on-orbit and maintain the position of a premiere space laboratory during its projected 30-year useful life.
Author

A89-12540
SCIENCE AND PERESTROIKA - A LONG WAY TO GO
ROALD Z. SAGDEEV (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Issues in Science and Technology (ISSN 0748-5492), vol. 4, Summer 1988, p. 48-52.
Copyright

The Soviet contribution to science in the 20th century is examined critically by a leading Soviet scientist, with emphasis on changes under perestroika and problems relating to bureaucratization. It is suggested that the majority of Soviet academic institutes have grown too large, resulting in inflexibility. It is noted that perestroika has altered the system of lifetime tenure for institute directors. Also considered are problems resulting from the lack of coordinated science planning and budgeting, and the emphasis on manned space flights at the expense of unmanned efforts. Examples of productive international cooperation include the discovery of hard radiation from SN 1987A and the Vega mission to study Comet Halley.
R.R.

A89-12542
LET'S GO TO MARS TOGETHER
JOHN L. MCLUCAS and BURTON I. EDELSON Issues in Science and Technology (ISSN 0748-5492), vol. 5, Fall 1988, p. 52-55. refs
Copyright

Arguments for cooperative U.S.-Soviet missions to Mars are presented. The history of space competition since the 1950s is briefly recalled; the current status is surveyed; and Soviet plans for Martian missions (including the Phobos probe launched in July 1988, a heavy automated Mars lander with robotic rover for 1994, a sample-return mission for 1996-1998, and eventual manned missions) are described and contrasted with NASA planning, where the Mars Observer (1992) is the only firm program, although Mars exploration has been established as a policy goal. Concrete steps toward joint or international Mars missions are proposed, building on the 1986 U.S.-Soviet cooperative agreement (which includes four Mars-related projects): (1) defining a general concept of cooperation, (2) setting robotic exploration in the 1990s and manned exploration in the next century as primary goals, and (3) convening a joint planning team to assign tasks and set schedules in detail.
T.K.

A89-13450
NASA EXPLORES THE HIGH FRONTIER
DAVID BAKER New Scientist (ISSN 0262-4079), vol. 119, Sept. 29, 1988, p. 60-64.
Copyright

The history of NASA is reviewed, emphasizing the period from the Soviet launch of Sputnik 1 to the American decision to race for the moon. Bureaucratic personnel changes and project developments are described. Budgetary considerations are addressed.
C.D.

A89-15953#
EVALUATION OF PROPOSED AND EXISTING ACCELERATED RESEARCH PROGRAMS BY THE OFFICE OF NAVAL RESEARCH
RONALD N. KOSTOFF (U.S. Navy, Office of Naval Research, Arlington, VA) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 35, Nov. 1988, p. 271-279.

A process for evaluating proposed and existing accelerated research programs is described. The key component of the process is the use of mixed-level review panels, consisting of bench-level researchers, research managers, transitioning experts, technology experts, and US Navy requirements experts, to review multiple programs (nominally) in technical areas of similar science. The panel members score specific research quality and mission relevance rating factors as well as an overall program quality rating factor. As evidenced by multiple regression analyses, the research quality and mission relevance factors that the reviewers rated have been their dominant considerations in determining the overall program-quality rating-factor score. This implies that rating factors that the reviewers felt were important were not omitted. The operational components of the review process are described in detail, and results of experiments in which program presentation,

evaluation, and discussion times were varied are presented. Application experience of the process to the US Office of Naval Research program evaluation is presented. I.E.

A89-16201
RADIO TECHNICAL COMMISSION FOR AERONAUTICS, ANNUAL ASSEMBLY MEETING AND TECHNICAL SYMPOSIUM, WASHINGTON, DC, NOV. 17-19, 1987, PROCEEDINGS
JOANN C. JAGO, ED. (Radio Technical Commission for Aeronautics, Washington, DC) Washington, DC, Radio Technical Commission for Aeronautics, 1987, 119 p. For individual items see A89-16202 to A89-16205.

The present conference discusses international considerations concerning novel aircraft communications and navigation technologies' applications, human factors-related issues in new aircraft cockpit technology, the process of transition to novel cockpit technologies, and the role of military organizations in providing and using emerging technologies. Also discussed are modernization plans in the U.S., modernization planning in the Western Pacific, and a European perspective on the process of evolution towards new technology systems. O.C.

A89-16522*# Booz-Allen and Hamilton, Inc., Arlington, VA.
SPACE STATION ASSEMBLY SEQUENCE PLANNING - AN ENGINEERING AND OPERATIONAL CHALLENGE
JAMES T. KAIDY and WILLIAM G. BASTEDO (Booz-Allen and Hamilton, Inc., Reston, VA) AIAA, Space Programs and Technologies Conference, Houston, TX, June 21-24, 1988. 10 p. refs
(Contract NASW-4300)
(AIAA PAPER 88-3500)

This paper discusses the Space Station assembly sequence planning and development process. It presents the planning methodologies from both historial and current perspectives. It is shown that planning the assembly sequence is a new and unique challenge and its solution requires the simultaneous satisfaction of many diverse variables and constants. The considerations which influence the development of the assembly sequence include launch vehicle integration and lift capabilities, on-orbit assembly flight operations, vehicle flight dynamics, spacecraft system capabilities and resource availability. Many of these considerations are described in this paper. In addition, the examples presented demonstrate the current process for assembly sequence planning and show many of the complex trade-offs that must be performed. Author

A89-17275
CHINA ADVANCES IN SPACE
G. LYNWOOD MAY Spaceflight (ISSN 0038-6340), vol. 30, Nov. 1988, p. 428-433.
Copyright

The Chinese space industry is examined, focusing on the commercial aspects of the Chinese space program. The Long March expendable launch vehicles are examined, including the vehicle configurations and capabilities, and efforts to market the vehicles. Developments in communications satellites are reviewed, listing Chinese recoverable satellites and discussing the use of these satellites by other countries. Chinese launch sites, environmental test equipment, the supporting space network, and the tracking and control network are considered. R.B.

A89-17639*# National Aeronautics and Space Administration, Washington, DC.
THE NASA TECHNOLOGY PUSH TOWARDS FUTURE SPACE MISSION SYSTEMS
STANLEY R. SADIN, FREDERICK P. POVINELLI, and ROBERT ROSEN (NASA, Office of Aeronautics and Space Technology, Washington, DC) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 6 p. refs
(IAF PAPER 88-033) Copyright

As a result of the new Space Policy, the NASA technology program has been called upon to a provide a solid base of national capabilities and talent to serve NASA's civil space program, commercial, and other space sector interests. This paper describes the new technology program structure and its characteristics, traces its origin and evolution, and projects the likely near- and far-term strategic steps. It addresses the alternative 'push-pull' approaches to technology development, the readiness levels to which the technology needs to be developed for effective technology transfer, and the focused technology programs currently being implemented to satisfy the needs of future space systems. Author

A89-17646*# National Aeronautics and Space Administration, Washington, DC.
FUTURE DIRECTIONS IN TECHNOLOGY DEVELOPMENT - INCREASED USE OF SPACE AS A FACILITY
JUDITH H. AMBRUS, LEONARD A. HARRIS, JACK LEVINE, and RICHARD W. TYSON (NASA, Office of Aeronautics and Space Technology, Washington, DC) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 10 p. refs
(IAF PAPER 88-042) Copyright

As human activities in space continue to grow in size and scope, the role of in-space technology experiments, as a necessary tool for essential technological development, will also grow. NASA has recognized the increasing importance of such experiments, and has instituted programs to plan, organize, and coordinate future in-space technology experiment activities within the overall space community. This paper discusses the history of in-space technology experiments, and expected future trends. It also describes NASA activities in this growing area of experimentation, and provides several examples of such experiments. Author

A89-17830#
AN INTERNATIONAL SPACE YEAR PROJECT - GLOBAL AEROSPACE EDUCATION BY SATELLITE
JAMES J. HARFORD (AIAA, Washington, DC) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 10 p.
(IAF PAPER 88-463) Copyright

The use of satellite communication technology to disseminate the data collected by the Mission to Planet Earth (MPE) proposed by the Space Agency Forum on International Space Year (1992) is discussed. MPE is a long-term project in which both in situ methods and satellite remote sensing will be used to measure changes in cloud cover, vegetation, ice cover, rainfall, soil moisture, sea-surface parameters, tectonics, and atmospheric composition; an MPE data base for use by scientists, engineers, policy makers, and educators will be established. Here it is proposed that a satellite communication network be established for this purpose, with support from governments, international institutions, and philanthropic foundations. A list of parameters to be measured by MPE and the satellite sensors capable of obtaining them is included. T.K.

A89-17832*# National Aeronautics and Space Administration, Washington, DC.
NASA'S NEW UNIVERSITY ENGINEERING SPACE RESEARCH PROGRAMS
STANLEY R. SADIN (NASA, Office of Aeronautics and Space Technology, Washington, DC; Universities Space Research Association, Columbia, MD) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 6 p.
(IAF PAPER 88-468) Copyright

The objective of a newly emerging element of NASA's university engineering programs is to provide a more autonomous element that will enhance and broaden the capabilities in academia, enabling them to participate more effectively in the U.S. civil space program. The programs utilize technical monitors at NASA centers to foster collaborative arrangements, exchange of personnel, and the sharing of facilities between NASA and the universities. The elements include: the university advanced space design program, which funds advanced systems study courses at the senior and graduate levels; the university space engineering research program that supports cross-disciplinary research centers; the outreach flight experiments program that offers engineering research opportunities

to universities; and the planned university investigator's research program to provide grants to individuals with outstanding credentials. Author

A89-17852*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE NASA SETI SKY SURVEY - RECENT DEVELOPMENTS
MICHAEL J. KLEIN, SAMUEL GULKIS, EDWARD T. OLSEN, and NICHOLAS A. RENZETTI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 15 p.
(Contract NAS7-918)
(IAF PAPER 88-538)

NASA's Search for Extraterrestrial Intelligence (SETI) project utilizes two complimentary search strategies: a sky survey and a targeted search. The SETI team at the Jet Propulsion Laboratory have primary responsibility to develop and carry out the sky survey part of the Microwave Observing Project. The paper describes progress that has been made to develop the major elements of the survey including a two-million channel wideband spectrum analyzer system that is being developed and constructed by JPL for the Deep Space Network. The new system will be a multiuser instrument that will serve as a prototype for the SETI Sky Survey processor. This system will be used to test the signal detection and observational strategies on deep-space network antennas in the near future. Author

A89-19391
US AND SOVIET PLANETARY EXPLORATION - THE NEXT STEP IS MARS, TOGETHER
BURTON I. EDELSON and JOHN L. MCLUCAS Space Policy (ISSN 0265-9646), vol. 4, Nov. 1988, p. 337-349.
Copyright

The history of U.S. and Soviet lunar and planetary exploration efforts is recalled, and arguments in favor of a joint program to explore Mars are presented. The competitive nature of the previous and current space programs is discussed; the technological fields in which the U.S. or USSR has an advantage are indicated; and the need to follow up on the 1986 Soviet proposal of a joint mission is stressed. The first steps recommended to the U.S. administration are (1) establishing a bilateral or international Mars program concept, (2) setting robotic exploration in the late 1990s and manned exploration in the next century as goals, and (3) convening an international group of engineers and scientists to make detailed plans. T.K.

A89-19850
INTRODUCTION TO SPACE: THE SCIENCE OF SPACEFLIGHT
THOMAS D. DAMON (Pikes Peak Community College, CO) Malabar, FL, Orbit Book Co., 1989, 238 p. refs
Copyright

The history, current status, and future potential of astronautics are examined, with a focus on technological aspects, in an introduction for general readers. Chapters are devoted to the early Soviet and NASA space missions, propulsion systems, orbits, the space environment, satellites, remote sensing, space defense, the Space Shuttle, living in space, working in space, space stations, planetary colonization, and SETI. Extensive drawings, diagrams, photographs, and a glossary are provided. T.K.

A89-21806
KNOWLEDGE BASED TOOLS FOR HUBBLE SPACE TELESCOPE PLANNING AND SCHEDULING - CONSTRAINTS AND STRATEGIES
GLENN MILLER, KELLY LINDENMAYER (Computer Sciences Corp.; Space Telescope Science Institute, Baltimore, MD), MARK JOHNSTON, SHON VICK, and JEFF SPONSLER (Space Telescope Science Institute, Baltimore, MD) (NASA, 1988 Goddard Conference on Space Applications of Artificial Intelligence, Greenbelt, MD, May 24, 1988) Telematics and Informatics (ISSN 0736-5853), vol. 5, no. 3, 1988, p. 197-212. Previously announced in STAR as N88-30338. refs
Copyright

The Hubble Space Telescope (HST) presents an especially challenging scheduling problem since a year's observing program encompasses tens of thousands of exposures facing numerous coupled constraints. Recent progress in the development of planning and scheduling tools is discussed which augment the existing HST ground system. General methods for representing activities, constraints, and constraint satisfaction, and time segmentation were implemented in a scheduling testbed. The testbed permits planners to evaluate optimal scheduling time intervals, calculate resource usage, and to generate long and medium range plans. Graphical display of activities, constraints, and plans are an important feature of the system. High-level scheduling strategies using rule based and neural net approaches were implemented. Author

A89-22957
A CHANGING UNIVERSITY ROLE IN SPACE RESEARCH
JEFFREY D. ROSENDHAL (George Washington University, Washington, DC) and LOUIS J. LANZEROTTI (AT&T Bell Laboratories, Murray Hill, NJ) Issues in Science and Technology (ISSN 0748-5492), vol. 5, Winter 1988-89, p. 61-66. refs
Copyright

University involvement in the U.S. space program is examined, focusing on adapting the university role to changes in the scale, duration, and complexity of space research. With programs such as the IUE Explorer, the IRAS, and the Hubble Space Telescope, the emphasis of university participation has shifted toward data analysis. The implications of this change for future capabilities in developing new technology and flight instrumentation are considered. Also, the importance of suborbital programs and small missions in university-based space research is discussed. Collaborations between universities, NASA, government agencies, and industries are also examined. R.B.

A89-23280* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
SPACE ELECTROCHEMICAL RESEARCH AND TECHNOLOGY CONFERENCE, CLEVELAND, OH, APR. 14-16, 1987, PROCEEDINGS
LAWRENCE H. THALLER, ED. (NASA, Lewis Research Center, Cleveland, OH) Conference sponsored by NASA. Journal of Power Sources (ISSN 0378-7753), vol. 22, March-Apr. 1988, 259 p. Previously announced in STAR as N87-29914.
Copyright

The conference provided a forum to assess critical needs and technologies for the NASA electrochemical energy conversion and storage program. It was aimed at providing guidance to NASA on the appropriate direction and emphasis of that program. A series of related overviews were presented in the areas of NASA advanced mission models (space stations, low and geosynchronous Earth orbit missions, planetary missions, and space transportation). Papers were presented and workshops conducted in a variety of technical areas, including advanced rechargeables, advanced concepts, critical physical electrochemical issues, and modeling. Author

A89-23281* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
STATUS OF THE SPACE STATION POWER SYSTEM
COSMO R. BARAONA and DEAN W. SHEIBLEY (NASA, Lewis Research Center, Cleveland, OH) (NASA, Space Electrochemical Research and Technology Conference, Cleveland, OH, Apr. 14-16, 1987) Journal of Power Sources (ISSN 0378-7753), vol. 22, March-Apr. 1988, p. 195-203. Previously announced in STAR as N87-29915.
Copyright

The major requirements and guidelines that affect the manned Space Station configuration and the power systems are explained. The evolution of the Space Station power system from the NASA program development feasibility phase through the current preliminary design phase is described. Several early station concepts are described and linked to the present concept. The recently completed phase B tradeoff study selections of

photovoltaic system technologies are described. The present solar dynamic and power management and distribution systems are also summarized for completeness. Author

A89-23851
SOVIETS IN SPACE
PETER M. BANKS and SALLY K. RIDE (Stanford University, CA) Scientific American (ISSN 0036-8733), vol. 260, Feb. 1988, p. 32-40. refs
Copyright
The Soviet space program is discussed, focusing on satellite, space station, and space shuttle programs. The history of Soviet activities in space is reviewed. Soviet launch vehicles and spacecraft are illustrated, including the Soviet space shuttle and the Proton and Energiya launch vehicles. The programs of the Salyut and Mir space stations are examined, including the experiments aboard the Kvant module. R.B.

A89-24323*# National Aeronautics and Space Administration, Washington, DC.
REBUILDING THE SPACE TECHNOLOGY BASE
FREDERICK P. POVINELLI, FRANK W. STEPHENSON, MARTIN M. SOKOLOSKI, MELVIN D. MONTEMERLO, SAMUEL L. VENNERI, DANIEL R. MULVILLE, MURRAY S. HIRSCHBEIN, PAUL H. SMITH, A. DAN SCHNYER (NASA, Washington, DC), HENRY LUM (NASA, Ames Research Center, Moffett Field, CA) et al. Aerospace America (ISSN 0740-722X), vol. 27, Jan. 1989, p. 28-33, 36-40.
Copyright
NASA's Civil Space Technology Initiative (CSTI) will not only develop novel technologies for space exploration and exploitation, but also take mature technologies into their demonstration phase in earth orbit. In the course of five years, CSTI will pay off in ground- and space-tested hardware, software, processes, methods for low-orbit transport and operation, and fundamental scientific research on the orbital environment. Attention is given to LOX/hydrogen and LOX/hydrocarbon reusable engines, liquid/solid fuel hybrid boosters, and aeroassist flight experiments for the validation of aerobraking with atmospheric friction. Also discussed are advanced scientific sensors, systems autonomy and telerobotics, control of flexible structures, precise segmented reflectors, high-rate high-capacity data handling, and advanced nuclear power systems. O.C.

A89-25574#
THE FUTURE OF SPACE SYSTEMS - THE CHALLENGE OF STANDARDS AND INTEROPERABILITY
JOHN S. MORRISON (USAF, National Test Bed Joint Program Office, Falcon AFB, CO) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 7 p.
(AIAA PAPER 89-0777)
Interoperability among space systems will improve capabilities, reduce costs, and create a clear path for technology-insertion. Simplified, standard interfaces will be easier to manage, and will allow new systems to be inserted quickly in order to perform new missions. SDI is noted to be an important region of the total space systems interoperability problem, and may accordingly be taken as the kernel from which an encompassing national policy on this issue can grow. It is presently recommended that interoperability standards be developed, tested, and evaluated in parallel with SDI-related simulations and experiments. O.C.

A89-26384*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SPACE TRANSPORTATION - OPTIONS AND OPPORTUNITIES
J. P. LOFTUS, JR., R. C. RIED, and R. B. BRISTOW (NASA, Johnson Space Center, Houston, TX) IN: Commercial opportunities in space; Symposium, Taipei, Republic of China, Apr. 19-24, 1987, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 114-133. refs
Copyright
The development space transportation options to earth orbit and beyond are summarized. The performance of available launch systems is reviewed, including the Scout, Delta, Long March 3, Atlas Centaur, Ariane 3, Titan 34D, Proton, the Japanese M-3S-II, N-1, and H-1, and the Space Shuttle. Launch vehicle which are planned or are under development are examined, including the Conestoga, Industrial Launch Vehicle, Titan II, Delta II, H-II, Ariane 5, Titan IV, and the NASA/DOD Heavy Lift Launch Vehicle. Also, issues pertinent to the development of space transportation vehicles are considered, such as reliability, reduced unit cost, reduced lead time, and improved payload accommodations. R.B.

A89-26669*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTINATIONAL MARS EXPLORATION
DONALD G. REA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Aerospace America (ISSN 0740-722X), vol. 27, Feb. 1989, p. 18-21.
Copyright
A primary concern in the formation of a multinational Mars-exploration program is that of technology transfer, which would be most acute in the U.S./U.S.S.R. case but would exist in lesser degree among other nations. Another concern is that of management-complexity, which could inflate total costs and substantially counteract the anticipated benefits of spreading program costs among a number of nations. It is presently suggested that these problems can be substantially reduced by having each nation become responsible for one (or more) complete flight system. Each nation's role in mission operations must be clear, and the cleanliness of interfaces among flight systems must carry over into mission operations. O.C.

A89-27914* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
OPERATIONAL CONSIDERATIONS FOR THE SPACE STATION LIFE SCIENCE GLOVEBOX
DARYL N. RASMUSSEN (NASA, Ames Research Center, Moffett Field, CA), JOHN J. BOSLEY, KRISTOFER VOGELSONG (NASA, Ames Research Center; Bionetics Corp., Moffett Field, CA), TERY A. SCHNEPP (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA), and ROBERT W. PHILLIPS (Colorado State University, Fort Collins) SAE, Intersociety Conference on Environmental Systems, 18th, San Francisco, CA, July 11-13, 1988. 9 p. refs
(SAE PAPER 881123) Copyright
The U.S. Laboratory (USL) module on Space Station will house a biological research facility for multidisciplinary research using living plant and animal specimens. Environmentally closed chambers isolate the specimen habitats, but specimens must be removed from these chambers during research procedures as well as while the chambers are being cleaned. An enclosed, sealed Life Science Glovebox (LSG) is the only locale in the USL where specimens can be accessed by crew members. This paper discusses the key science, engineering and operational considerations and constraints involving the LSG, such as bioisolation, accessibility, and functional versatility. Author

A89-29651#
JAPAN BROADENS ITS AEROSPACE INTERESTS
NEIL W. DAVIS Aerospace America (ISSN 0740-722X), vol. 27, March 1989, p. 12-18.
Copyright
Japanese aerospace research, development, and production programs are reviewed. The products, American and European partners, and large shareholders of the ten leading Japanese aerospace companies are listed. The R&D programs discussed include the FSX close-supporter fighter, the four-engine quiet short takeoff and landing test bed, a hypersonic transport, the H-II launch vehicle, a reusable orbital aircraft named HOPE, and the Japanese Experiment Module for the Space Station. In addition, computer science and observation and communication satellite programs are considered. R.B.

A89-30848*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NACA/NASA RESEARCH RELATED TO EVOLUTION OF U.S. GUST DESIGN CRITERIA
HAROLD N. MURROW, KERMIT G. PRATT, and JOHN C. HOUBOLT (NASA, Langley Research Center, Hampton, VA) IN: AIAA, ASME, ASCE, AHS, and ASC, Structures, Structural Dynamics and Materials Conference, 30th, Mobile, AL, Apr. 3-5, 1989, Technical Papers. Part 4. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 1869-1882. refs
(AIAA PAPER 89-1373)

This paper traces the evolution of gust design criteria in the U.S. particularly from the standpoint of research that was used in the substantiation for the various versions in the evolution. The mathematical models of airplanes and of atmospheric turbulence and their rationale are described. Emphasis is given to the revisions and refinements made starting in the 1920's up to the present time. The major steps, beginning with the sharp edged gust formula, are traced through the modified formula specifying ramp-platform gusts and later to one-minus-cosine gusts and finally to criteria for continuous gust analyses. The influence of aircraft design developments on design criteria development needs is also addressed. A brief summary of military criteria is included. Significant discussion is devoted to measurements that have been made, including onboard recordings, to provide an extensive data base of (1) atmospheric turbulence experienced in routine flight operations, (2) specially-instrumented research aircraft measurements to provide atmospheric characterization for various flight and meteorological conditions, and (3) comparisons of measured and calculated aircraft responses in turbulence. Some features of the instrumentation used will be depicted. Author

A89-31421
HIGH SPEED COMMERCIAL FLIGHT: FROM INQUIRY TO ACTION; PROCEEDINGS OF THE SECOND SYMPOSIUM, COLUMBUS, OH, OCT. 19, 20, 1988
JAMES P. LOOMIS, ED. (Battelle Center for High Speed Commercial Flight, Columbus, OH) Symposium sponsored by Battelle Memorial Institute. Columbus, OH, Battelle Press, 1989, 223 p. No individual items are abstracted in this volume.
Copyright

The current development status of high-speed commercial transport aircraft is surveyed and analyzed by industry and government experts, with an emphasis on economic and policy implications. Sections are devoted to aircraft research and development, operations and markets, consortia and financing, and institutional considerations. Diagrams and graphs are provided, as well as an executive summary and summaries of the discussion at the symposium. T.K.

A89-33922*# National Aeronautics and Space Administration, Washington, DC.
EXPLORATION CASE STUDIES
JIMMY M. UNDERWOOD (NASA, Office of Exploration, Washington, DC) Aerospace America (ISSN 0740-722X), vol. 27, April 1989, p. 40-43.
Copyright

NASA's Office of Exploration has undertaken four case studies for prospective expansion of manned space activities beyond earth orbit. The subjects of these studies are (1) an expedition to the Martian moon Phobos; (2) a three-mission expedition to Mars; (3) the construction of a man-tended lunar observatory; and (4) the construction of a lunar outpost to serve as the basis for construction of a Martian outpost. The fourth alternative would follow the recommendation of the National Commission on Space for the creation of a 'bridge between worlds' in which explorers would develop ways in which to 'live off the land' in a space environment. O.C.

A89-34360
PREPARING TO BRIDGE THE LUNAR GAP
STEPHEN J. SIMMERER (U.S. Army, Directorate of Evaluation and Standardization, Fort Belvoir, VA) Journal of Aerospace Engineering (ISSN 0893-1321), vol. 1, April 1988, p. 117-128. refs
Copyright

The U.S. is committed to the exploration of and the expansion into space. A manned earth-orbiting Space Station is planned for the next decade and studies continue looking at manned lunar bases. Appropriate planning should be initiated for such a mission now as a high national priority. Many systems must be examined and technologies developed as soon as possible. Some of these include types of power sources, life support systems, construction equipment and techniques, construction methods, lunar mapping, and logistical constraints. Author

A89-35874#
APPLYING REMOTE SENSING TECHNOLOGY TO THE BUREAU OF LAND MANAGEMENT'S MINERAL MANAGEMENT PROGRAM
JAMES A. TURNER (U.S. Bureau of Land Management, Denver, CO) IN: Thematic Conference on Remote Sensing for Exploration Geology, 6th, Houston, TX, May 16-19, 1988, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1988, p. 269-282.

The use of high-resolution satellite imagery in mineral material resources management is demonstrated in a test study to identify and document authorized and unauthorized aggregate removal areas. Landsat TM and SPOT HRV imagery were rectified, enhanced, and merged to generate digital data filed and hard copy image maps for areas in Alaska, Nevada, and New Mexico. It is found that the satellite imagery is useful for monitoring the location and size of surface disturbances associated with mineral extraction. R.B.

A89-38229
PROGRESS IN THE EUROPEAN COMMERCIAL LAUNCH SYSTEM
JEAN-LOUIS CLAUDON (Arianespace, Tokyo, Japan) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 1479-1483.
Copyright

The development, production schedule, and operations setup of the European commercial launch system are discussed. Special attention is given to the evolution of Ariane, a conventional unmanned launch vehicle with multiple-launch capability, from the Ariane 3 to the Ariane 4. Ariane 4 is equipped with the SPELDA dual launch system and has maximum GTO capability. Two launch pads are presently available, the ELA 1 and the ELA 2, and the Ariane 5 will be launched from the new ELA 3 pad. R.R.

A89-38297
RESEARCH AND DEVELOPMENT OF MILLIMETER-WAVE TRANSPONDER FOR PERSONAL SATELLITE COMMUNICATIONS
ISAO IZUMI, AKIHIKO INOUE, MASAYUKI ISHIZAKI, NOBUO ISHIZU, and YUICHI OTSU (Space Communications Research Corp., Tokyo, Japan) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 1975-1980.
Copyright

This paper describes key technology development for the millimeter-wave transponder used in personal satellite communications. A basic concept and key parameters of the transponder equipment are described along with a technological development theme and its major performance requirements. Author

A89-38376
INTOSPACE'S TASKS AND ROLE IN EUROPEAN INDUSTRIAL RESEARCH UNDER MICROGRAVITY
RAINER M. A. FELLERER (Intospace GmbH, Hanover, Federal Republic of Germany) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988,

Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2527-2531.
Copyright

Technological and economic aspects of space industrialization are discussed from a European commercial perspective. Topics addressed include the organization of an FRG corporation to facilitate commercial space projects on a European scale; promotional, research, and coordinating activities; the severe time limitations imposed on microgravity experiments or manufacturing processes by ground, aircraft, and sounding-rocket techniques; and the much longer experiment durations possible on Spacelab (7-9 d), Eureca (6 months), and Columbus (as required). Also considered are the current learning-phase status of space industrialization and the risks and opportunities of space investment. T.K.

A89-38393
CONTRIBUTIONS OF SPACE SCIENCE AND TECHNOLOGY TO INDONESIA DEVELOPMENT PROGRAM
WIRANTO ARISMUNANDAR and J. SOEGIJO (Indonesian National Institute of Aeronautics and Space, Jakarta, Indonesia) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2639-2641.
Copyright

The major elements of the Indonesian space program are reviewed, with a focus on their immediate and long-term benefits for the national economy. Areas addressed include the utilization of satellite remote-sensing data by agriculture, fisheries, forestry, mining, and transportation; the Palapa domestic satellite-communication system; space science and research in cooperation with other nations; and the acquisition of high-technology capabilities in the framework of aerospace development. T.K.

A89-38395
AUSTRALIA'S CSIRO SPACE PROGRAM
KENNETH GORDON MCCRACKEN, JOHN PRYTZ (CSIRO, Office of Space Science and Applications, Dickson, Australia), and CHRISTINE ASTLEY-BODEN (CSIRO, Institute of Minerals, Energy and Construction, North Ryde, Australia) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2647-2660.
Copyright

The work of the CSIRO Office of Space Science and Applications (COSSA) in promoting and organizing space activities is characterized in a general overview. Topics examined include the history of space programs in Australia, the organizational structure and functions of COSSA, and the role of COSSA within the CSIRO. Consideration is given to space communication technology (antenna design and testing), remote-sensing technology (data interpretation), the CSIRO research-aircraft facility, COSSA scientific-information services, support of the Australian space industry through specific projects, and international cooperation. T.K.

A89-39005
ARABSAT - A NEGLECTED ASSET
CHRIS BULLOCH Interavia Space Markets (ISSN 0258-4212), Mar.-Apr. 1989, p. 36-44.
Copyright

A development history and a current status evaluation are presented for the Arabsat satellite-telecommunications/television system of the Arab League's Arab Satellite Communications Organization. Arabsat has been the subject of criticism for asset-underutilization, especially with regard to the TV programming dissemination role for which Arabsat was first conceived. The system's two satellites are currently halfway through their nominal service life. There are 16 ground stations being operated by Arabsat member nations, and an additional three are expected to come online in 1989. A third satellite is in storage, awaiting a launch decision. O.C.

A89-39181
THE SOVIET PROGRAMME OF SPACE EXPLORATION FOR THE PERIOD TO THE YEAR 2000 - PLANS, PROJECTS, AND INTERNATIONAL COOPERATION
Postepy Astronautyki (ISSN 0373-5982), vol. 21, no. 3-4, 1988, p. 76-106.
Copyright

The main projects to be carried out in the Soviet fundamental space research program up to the year 2000 are discussed. Particular attention is given to the Interball project, investigating the magnetospheric plasma and the sun/earth relationship; the Apex project, involving active plasma experiments; the Active-IK project, involving an orbital plasma-wave laboratory; the Coronas project, a comprehensive study of solar activity from near-earth orbit; the Soviet long-term program for space exploration; the Phobos project; the Granat astrophysical observatory; the Gamma-1 project; and the Radioastron project. B.J.

A89-41560#
CURRENT AND FUTURE DEVELOPMENTS IN DIESEL POWERED HOVERCRAFT
J. C. LEONARD, M. J. STEVENS, and J. A. BUTTIGIEG (British Hovercraft Corp., Ltd., East Cowes, England) IN: Intersociety Advanced Marine Vehicles Conference and Exhibit, Arlington, VA, June 5-7, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 242-250. (AIAA PAPER 89-1481) Copyright

After evaluating the development status of the application of diesel power to air-cushion vehicles (ACVs) and surface-effect ships (SESs), attention is given to the AP1-88 ACV, which is both the first and largest operational diesel-powered amphibious craft of this type. An account is given of the ACV and SES features that are dictated by the need to accommodate diesel power sources; the major advantages and disadvantages of diesel (vs gas turbine) engines are discussed. Although cost reductions are achievable against gas turbine powerplant use, lower payload fractions and slightly lower performance capabilities appear to be inescapable. O.C.

A89-41698* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
A RAPID PROTOTYPING FACILITY FOR FLIGHT RESEARCH IN ADVANCED SYSTEMS CONCEPTS
EUGENE L. DUKE (NASA, Flight Research Center, Edwards, CA), RANDAL W. BRUMBAUGH, and JAMES D. DISBROW (PRC Systems Services, McLean, VA) Computer (ISSN 0018-9162), vol. 22, May 1989, p. 61-66. Previously announced in STAR as N87-12273. refs
Copyright

The Dryden Flight Research Facility of the NASA Ames Research Facility of the NASA Ames Research Center is developing a rapid prototyping facility for flight research in flight systems concepts that are based on artificial intelligence (AI). The facility will include real-time high-fidelity aircraft simulators, conventional and symbolic processors, and a high-performance research aircraft specially modified to accept commands from the ground-based AI computers. This facility is being developed as part of the NASA-DARPA automated wingman program. This document discusses the need for flight research and for a national flight research facility for the rapid prototyping of AI-based avionics systems and the NASA response to those needs. Author

A89-42926
RESEARCH AND DEVELOPMENT: TECHNICAL AND SCIENTIFIC PUBLICATIONS 1988 [FORSCHUNG UND ENTWICKLUNG: TECHNISCH-WISSENSCHAFTLICHE VEROEFFENTLICHUNGEN 1988]
Munich, Federal Republic of Germany, Messerschmitt-Boelkow-Blohm GmbH, 1988, 372 p. In German and English. For individual items see A89-42927 to A89-42945.
Copyright

Various papers on fighter aircraft, transport aircraft, helicopter, defense technology, and space travel are presented. Individual

topics addressed include: new developments in air and space research of the German aircraft and space industry, modular avionic architecture for modern fighter aircraft, threat management for modern fighter aircraft, development of a monolithic fuselage shell using CFRP, and Cabin Intercommunication Data System. Also discussed are: system testing in the A320-landing flap flight control system, project for an advanced regional civil aircraft, airborne imaging radar systems for monitoring sea pollution, recent theoretical studies of missiles, validation of missile simulation, modern terrain following and flight control system, characterization of radar backscattering measurements using scaled time models, the German Saenger space transportation system concept. C.D.

A89-43329* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
STATUS OF TETHERED SATELLITE SYSTEM (TSS) DEVELOPMENT
JAY H. LAUE (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Space tethers for science in the space station era; Proceedings of the Second International Conference, Venice, Italy, Oct. 4-8, 1987. Bologna, Societa Italiana di Fisica, 1988, p. 14-25. refs
Copyright

The Tethered Satellite System (TSS) is a cooperative space system and science development activity being carried out by the U.S. and Italy. The TSS will involve an instrument-laden satellite that can be deployed from the cargo bay of the Shuttle Orbiter using a long tether to altitudes both above and below that of the Orbiter. This paper discusses the predevelopment activities, development approach and management relationships, current hardware and software designs and interfaces, overall science experiment status and plans, and mission operation planning for the first TSS mission. C.D.

A89-43703
TRANSFER OF SATELLITE APPLICATIONS AND TECHNOLOGY - THE NEED FOR A U.S. INITIATIVE
HEATHER E. HUDSON (San Francisco, University, CA) IN: Space - A new community of opportunity; Proceedings of the Thirty-fourth Annual AAS International Conference, Houston, TX, Nov. 3-5, 1987. San Diego, CA, Univelt, Inc., 1989, p. 89-97. refs
(AAS PAPER 87-617) Copyright

In the brief history of satellite communications, the United States has passed through three major eras: the Era of Conjecture, the Era of Experiments and the Era of Services. NASA took the lead in the experimental era to demonstrate both technology and applications - and to ensure their transfer for commercial use. The developing world has also entered the Era of Services, but without the benefit of an experimental phase. Several developing countries now have their own domestic systems; others share regqional systems or lease domestic capacity from INTELSAT. However, the record of developmental applications of these satellites has been disappointing to date. Much capacity sits idle. The U.S. has a great deal to share with the developing world to assist in the effective utilization of this technology. A U.S. Satellite Applications and Technology Transfer (SATT) program is proposed. Author

A89-44074
SPACE APPLICATIONS FOR DISASTER MITIGATION AND MANAGEMENT
GLORIA W. HEATH (SAR-ASSIST, Greenwich, CT), GEIR HOVMORK (Norwegian Space Centre, Oslo, Norway), HARTMUT SAX (DLR, Cologne, Federal Republic of Germany), and DAVID CARTER Acta Astronautica (ISSN 0094-5765), vol. 19, March 1989, p. 229-249.
Copyright

The use of space-based systems for disaster prevention and disaster and distress response is discussed. The 1983 UN Disaster Relief Office recommendations for establishing space technology for disaster management are presented. The present state of satellite-based disaster management systems is evaluated, including Inmarsat, Cospas/Sarsat, and an Indian system using GOES, Landsat, SPOT, and IRS-1 data. The use of satellites in disaster prevention is examined, including the use of satellite data for flood warnings, food security, and maintenance of natural resources. Also, the use of satellites after a disaster for assessment, communication, search and rescue, training, education, and information is considered. Also, the legal, regulatory, operational, and financial considerations of an international disaster management satellite system are outlined. R.B.

A89-44643#
DORNIER'S ROLE IN THE 'EUROPEAN FIGHTER AIRCRAFT' EFA PROGRAM
Dornier Post (ISSN 0012-5563), no. 2, 1989, p. 49-52.
Copyright

This paper describes the required performances and system capabilities of the European Fighter Aircraft (EFA) which is to fulfill the harmonized requirements of the air forces of the German Federal Republic, Great Britain, Italy, and Spain, as expressed in the joint document 'the European Staff Requirements'. The industrial arrangements that have been made to develop the EFA are summarized, and Dornier's participation in that development is addressed. In particular, management and technical development aspects are considered. C.D.

A89-45156
THE ATF IS ON ITS WAY
JAY JABOUR and DON NEWMAN (USAF, Advanced Tactical Fighter System Program Office, Edwards AFB, CA) IN: 1988 report to the aerospace profession; Society of Experimental Test Pilots, Symposium, 32nd, Beverly Hills, CA, Oct. 13-15, 1988, Proceedings. Lancaster, CA, Society of Experimental Test Pilots, 1988, p. 90-108.
Copyright

This paper presents an overview of the development of the USAF's next air superiority fighter - the Advanced Tactical Fighter (ATF). The management of the Demonstration/Validation phase of the ATF is discussed, and the avionics approach of the ATF is examined. The testing that will be done in the Demonstration/Validation phase is described. C.D.

A89-45833
POTENTIAL APPLICATION OF SPACE STATION TECHNOLOGY IN LUNAR BASES AND MANNED MARS MISSIONS
J. M. GARVEY and M. M. MANKAMYER (McDonnell Douglas Astronautics Co., Space Station Div., Huntington Beach, CA) IN: Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. New York, American Society of Civil Engineers, 1988, p. 1308-1319. refs
Copyright

To meet the goals of its Space Station program, NASA is developing a large set of improved space systems capabilities. In areas such as power generation and distribution, on-board data management, and life support, Station technology will represent a major advance over current systems. Given the substantial investment required to create these capabilities, it is worthwhile to consider other potential uses for them. This paper constitutes an early attempt to assess such follow-on applications, particularly in manned space exploration initiatives such as a lunar base and/or manned Mars expedition. Author

A89-46735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NASA'S CHEMICAL TRANSFER PROPULSION PROGRAM FOR PATHFINDER
NED P. HANNUM, FRANK D. BERKOPEC (NASA, Lewis Research Center, Cleveland, OH), and ROBERT L. ZURAWSKI (NASA, Washington, DC) AIAA, ASME, SAE, and ASEE, Joint Propulsion Conference, 25th, Monterey, CA, July 10-13, 1989. 17 p. refs
(AIAA PAPER 89-2298) Copyright

Pathfinder is a research and technology project, initiated by NASA in 1989 to support the U.S. civil space program studies for

the preparation for future space exploration missions. This paper describes the goals and objectives, the management, the technical plan, and technology transfer for the Chemical Transfer Propulsion program, which is a key element of one of the four programmatic thrusts (the Space Transfer) of the Pathfinder. The Chemical Transfer Propulsion will provide the technology for high-performance liquid oxygen/liquid hydrogen expander cycle engines for space-based transfer vehicles as well as for lunar and Mars landers. I.S.

A89-48575#
MARS TETHERED SAMPLE RETURN
S. ALAN STERN (Colorado, University, Boulder) Journal of Spacecraft and Rockets (ISSN 0022-4650), vol. 26, July-Aug. 1989, p. 294-296. refs
Copyright

The primary advantage of a Mars tethered sample-return mission lies in its obviation of the requirement for lander and rover development. It would also obviate an automated Mars orbit rendezvous, and allow the use of a smaller launch vehicle. Quicker response times, lower costs, and greater reliability would thereby be obtained. The deployment of a tethered sample platform into the Martian upper atmosphere also provides unique opportunities for in situ investigations of the Martian aerodynamic environment. O.C.

A89-49417#
EXPERIENCE ON INTERNATIONAL COOPERATION AND LESSONS LEARNED
BRUCE G. LANE (International Aero Engines AG, East Hartford, CT) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 6 p.
(AIAA PAPER 89-2037) Copyright

International cooperation in the design, development, and manufacture of the V2500 turbofan engine is discussed. The V2500, delivering 25,000 pounds of thrust, is used on 40 percent of the A320 aircraft sold to date and is being offered on the A320 Stretch and the MD90 series aircraft. Advantages achieved in international cooperation include greater marketing strength, greater research and development capacity, greater manufacturing capacity, and the sharing of resources to enhance problem solving. Problems related to the development program and the support of the common interests of shareholders are addressed. R.R.

A89-49418#
THE CFM56 VENTURE
JEAN BILIEN and RAM MATTA (CFM International, Inc., Cincinnati, OH) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 11 p.
(AIAA PAPER 89-2038) Copyright

This paper is intended to describe how two companies, GE in the U.S.A. and SNECMA in France, initiated the CFM56 engine program and nurtured it to the point where it is widely recognized as a model of successful international cooperation. The paper summarizes the history of the program, which started 18 years ago in 1971, explains how the program is organized, and provides a technical review of the various engine models which make up the CFM56 family. The paper also addresses the key factors which, in the opinion of the authors, have made the GE/SNECMA cooperation so successful. Author

A89-49420#
INTERNATIONAL COOPERATION IN MILITARY AIRCRAFT PROGRAMS
R. H. TRICE (General Dynamics Corp., Fort Worth, TX) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 8 p.
(AIAA PAPER 89-2040) Copyright

This paper summarizes General Dynamics' approach to international cooperation in advanced military aircraft programs, specifically the F-16 Fighting Falcon. International cooperation has provided opportunities to expand the F-16 sales base, which in turn has increased the company's ability to accommodate unique customer requirements. The success of these efforts has created further incentives for foreign partners to support the program through follow-on buys, providing additional economic benefits and enhanced security. This paper outlines some of the various programmatic arrangements that have taken the notion of cooperation from concept to the production of actual hardware. Author

A89-49438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ON THE THRESHOLD - THE OUTLOOK FOR SUPERSONIC AND HYPERSONIC AIRCRAFT
ROY V. HARRIS, JR. (NASA, Langley Research Center, Hampton, VA) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 12 p. refs
(AIAA PAPER 89-2071)

A development history and current development status evaluation is presented with a view to the prospective viability of supersonic, hypersonic, and transatmospheric vehicle R&D efforts. It is stressed that such high-speed vehicles will not supplant the current fleet of subsonic aircraft, but simply address the growing need for very long range commercial and military missions. Mach 2-3 airliners could be developed by the year 2000; Mach 5-6 military reconnaissance aircraft could be operational soon after. Transatmospheric, mixed airbreathing/rocket propulsion single-stage vehicles capable of orbital insertion will require several years of additional development beyond hypersonic ones to become operational. O.C.

A89-51327#
PROJECT OVERVIEW
DON HORTON (USAF, National Aerospace Plane Joint Program Office, Wright-Patterson AFB, OH) AIAA, National Aerospace Plane Conference, 1st, Dayton, OH, July 20, 21, 1989. 6 p.
(AIAA PAPER 89-5002)

The challenges posed by the NASP program are primarily encountered in the field of technological development and, no less critically, in management practices. An account is presently given of the management activities thus far employed, as well as a groundplan of a prospective NASP management strategy suited for the 5000 personnel in hundreds of companies and universities that are involved in this effort. The primary risks identified are in the areas of scramjet (especially inlet and nozzle) performance, refractory structural materials, CFD codes calibration, low-speed propulsion, control system integration, cryotank/airframe primary structure integration, and active structural cooling. O.C.

A89-51333#
SPACE PLANE RESEARCH ACTIVITIES IN JAPAN
T. YAMANAKA (National Aerospace Laboratory, Chofu, Japan) AIAA, National Aerospace Plane Conference, 1st, Dayton, OH, July 20, 21, 1989. 12 p.
(AIAA PAPER 89-5008) Copyright

The philosophical and strategic considerations guiding Japan's aerospacecraft conceptual design and component technology development efforts are presented. Attention is given to NASDA's H-II Orbiting Plane, or 'HOPE', an unmanned reusable winged reentry spacecraft intended for ferry service to the orbiting Japanese Experiment Module of the NASA Space Station. The ISAS space-launch organization is also conducting conceptual studies concerned with the Highly Maneuverable Experimental Space Vehicle, 'HIMES'. NAL supports both NASDA and ISAS efforts with wind tunnel and CFD facilities. O.C.

A89-51340#
INTERNATIONAL COMPETITION - THE NASP CHALLENGE
ARMAND J. CHAPUT (General Dynamics Corp., Fort Worth, TX) AIAA, National Aerospace Plane Conference, 1st, Dayton, OH, July 20, 21, 1989. 9 p.
(AIAA PAPER 89-5018) Copyright

Aerospace is the premier export category among U.S. manufacturing sectors. It is responsible for much of the positive

trade balance needed to offset the import demand. It is critical that U.S. aerospace maintain its lead in the technological state-of-the-art which determines wheter U.S. products are competitive in the international marketplace. For the 21st century, the state-of-the-art will be hypersonic, and U.S. industry has to be prepared to step up to the challenge. Author

A89-51843
INDUSTRIAL SPACE FACILITY
JOSEPH P. ALLEN (Space Industries, Inc., Houston, TX) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 181-200.
Copyright

The Industrial Space Facility (ISF) is a commercial project with the long-range goal of design, construction, operation, and ownership of a facility that will complement the infrastructure of the U.S. space program, including the International Space Station. The near-term plan is to place the ISF, a man-tended space platform, into commercial operation on a lease-for-service basis at the beginning of the next decade. The concept for the platform allows for growth both in size and function, allowing the ISF to become a prototype industrial park in space. The ISF is designed to reach full operational status with a single Space Shuttle launch. Individual ISF modules will provide up to 12 kW of sustainable power along with cooling and telemetry capabilities in an environment of ultralow microgravity. Author

A89-51850* National Aeronautics and Space Administration, Washington, DC.
TIMELY TRANSFER OF TECHNOLOGY TO THE MARKETPLACE
H. HOLLISTER CANTUS (NASA, Washington, DC) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 301-308.
Copyright

NASA has had a very successful technology transfer program since its inception. This program has two components, technology dissemination and technology applications. NASA disseminates technology information through various publications, such as its Technical Briefs, and through dissemination centers located throughout the U.S. The agency's technology application program, often in cooperation with other federal agencies, assists the private sector in utilizing existing aerospace technoloogies to develop commercial products and processes. Author

A89-51888
SOVIET SPACE IN TRANSIT
SERGEI LESKOV Space Policy (ISSN 0265-9646), vol. 5, Aug. 1989, p. 183-185.
Copyright

The importance of space shuttles to the US and Soviet space programs is considered. The development of the US Space Shuttle is discussed. The potential benefits of the Buran-Energia system to the Soviet space program are examined. I.F.

A89-51890
EVALUATING APOLLO
JOHN M. LOGSDON (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Aug. 1989, p. 188-192. refs
Copyright

The impact of the Apollo missions on the US space program and people is considered. The political significance of the Apollo missions, in particular the first one, are discussed. Scientific advances that have resulted from the missions are examined. I.F.

A89-52950
AHS NATIONAL SPECIALISTS' MEETING ON THE ROTARY WING AIRCRAFT CONCEPTUAL DESIGN PROCESS, ATLANTA, GA, APR. 3-5, 1989, PROCEEDINGS
Meeting sponsored by AHS. Alexandria, VA, American Helicopter Society, 1989, 725 p. No individual items are abstracted in this volume.

This volume contains the viewgraphs and charts for papers presented at the April 1989 AHS National Specialists' Meeting. Topics covered include the development history of VSTOL aircraft; future operational requirements and market opportunities for helicopters; the presentation of requests for proposals (RFPs) in military and commercial programs; weight and cost methods; and technology assessment of rotors and propellers, engines and drive systems, structures and materials, flight controls, avionics, and cockpit equipment. Consideration is given to vertiports and ATC, the problems of new development programs, industry presentations of point-design solutions to military and commercial RFPs, the advanced counter-air fighter, and techniques for improving the conceptual-design process for rotorcraft. T.K.

A89-54326 North Dakota Univ., Grand Forks.
INTERNATIONAL CONFERENCE ON HYPERSONIC FLIGHT IN THE 21ST CENTURY, 1ST, UNIVERSITY OF NORTH DAKOTA, GRAND FORKS, SEPT. 20-23, 1988, PROCEEDINGS
MARY E. HIGBEA, ED. and JAMES A. VEDDA, ED. (North Dakota, University, Grand Forks) Conference sponsored by NASA, ESA, AIAA, et al. Grand Forks, ND, University of North Dakota, 1988, 545 p. For individual items see A89-54327 to A89-54374.
Copyright

The present conference on the development status of configurational concepts and component technologies for hypersonic-cruise and transatmospheric vehicles discusses topics relating to the U.S. National Aerospace Plane program, ESA-planned aerospace vehicles, Japanese spaceplane concepts, the integration of hypersonic aircraft into existing infrastructures, hypersonic airframe designs, hypersonic avionics and cockpit AI systems, hypersonic-regime CFD techniques, the economics of hypersonic vehicles, and possible legal implications of hypersonic flight. Also discussed are Soviet spaceplane concepts, propulsion systems involving laser power sources and hypervelocity launch technologies, and the management of support systems operations for hypersonic vehicles. O.C.

A89-54332
PERSPECTIVE ON JAPANESE SPACE PLANE RESEARCH AND DEVELOPMENT
SHIGEO KOBAYASHI, MASATAKA MAITA, TATSUO YAMANAKA, and YOSHIAKI OHKAMI (National Aerospace Laboratory, Chofu, Japan) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 117-124. refs
Copyright

The organization of the long-range goal-oriented activities of the Japanese aerospaceplane R&D establishment, encompassing the NAL, NASDA, and ISAS, is presented. Both airbreathing launchers and hypersonic cruise aircraft and propulsion systems are under consideration; single-stage-to-orbit and two-stage-to-orbit configurations will be investigated for spacecraft launch services. An account is given of the development timetable for aerospacecraft spanning from the present to 2010 and beyond. O.C.

A89-54335
SOVIET APPLICATIONS FOR HYPERSONIC VEHICLES
REUBEN F. JOHNSON (General Dynamics Corp., Fort Worth, TX) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 143-148. refs
Copyright

Consistent with Soviet historical practice in the fields of space

vehicle design and aircraft procurement, a hypersonic-cruise aerospacecraft will be used only for specialized missions. Most Soviet surveillance of seas and landmasses will be conducted via satellite, while military missions will be carried out by conventional aircraft and ASAT missions will be performed by unmanned systems. An aerospace vehicle will fill the gaps that have ineluctably emerged between these established systems' capabilities due to their comparatively modest technological sophistication. It can be confidently expected that the aerospaceplane's design will involve the synergistic integration of existing technologies. O.C.

A89-54337
SST/CONCORDE - LESSONS FOR HYPERSONIC PROGRAMS
ROBERT L. BLEDSOE and JOAN JOHNSON-FREESE (Central Florida, University, Orlando, FL) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 159-165. refs
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The development of hypersonic aircraft in the coming years will involve great technological complexity, unforseeable development costs, and as yet unclear definitions of project goals. Given current Federal budgetary constraints, it becomes conceivable that the U.S. Government and/or the aerospace industry will seek a collaborative arrangement for the development of a second-generation SST and/or some type of hypersonic cruise-capable aircraft. Attention is presently given to the collaborative development and manufacturing management experience gained by French and British industry in the course of the Concorde SST program. O.C.

A89-54370
THE ADVANCED AERONAUTIC DESIGN PROGRAM - DESIGNING FOR THE FUTURE
SUSAN K. DURLAK (California, University, Los Angeles) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 445-454. refs
Copyright

Work carried out as part of the NASA/USRA (University Space Research Association) Advanced Design Program for Aeronautics at UCLA during 1987-1988 is presented. The program was divided into the following three groups: (1) propulsion, (2) thermal management, and (3) flight systems. Each group focused on one portion of the design of a hypersonic (Mach 10) drone aircraft. It was found that, after being involved in the design program, the students had greater experience with design teams and familiarity with NASA projects. K.K.

A89-54854
THE FEDERAL AVIATION ADMINISTRATION'S LOW LEVEL WINDSHEAR ALERT SYSTEM - A PROJECT MANAGEMENT PERSPECTIVE
CRAIG R. GOFF (FAA, Washington, DC) and RICHARD H. GRAMZOW (Martin Marietta Corp., Washington, DC) IN: International Conference on the Aviation Weather System, 3rd, Anaheim, CA, Jan. 30-Feb. 3, 1989, Preprints. Boston, MA, American Meteorological Society, 1989, p. 408-413. refs
Copyright

The Low-Level Windshear Alert System (LLWAS) is a network of conventional wind sensing devices linked by radio to a central computer which issues wind-shear advisories to air-traffic controllers. This paper discusses the first significant improvements since the initial LLWAS was installed in 1977, which consist of increasing the network density by adding new wind sensor sites to the original six; making software and network design enhancements to distinguish microburst windshears from other types of shear, provide the air-traffic controllers and pilots with runway-oriented windshear information, and provide shear detection capability at centerfield. I.S.

N89-10255# Oak Ridge National Lab., TN.
OVERVIEW OF GROUND COUPLED HEAT PUMP RESEARCH AND TECHNOLOGY TRANSFER ACTIVITIES
V. D. BAXTER and V. C. MEI 1988 9 p Presented at the 2nd DOE/ORNL Heat Pump Conference: Research and Development on the Heat Pump for Space Conditioning Applications, Washington, D.C., 17 Apr. 1988
(Contract DE-AC05-84OR-21400)
(DE88-012938; CONF-8804100-18) Avail: NTIS HC A02/MF A01

Highlights of DOE-sponsored ground coupled heat pump (GCHP) research at Oak Ridge National Laboratory (ORNL) are presented. ORNL, in cooperation with Niagara Mohawk Power Company, Climate Master, Inc., and Brookhaven National Laboratory developed and demonstrated an advanced GCHP design concept with shorter ground coils that can reduce installed costs for northern climates. In these areas it can also enhance the competitiveness of GCHP systems versus air-source heat pumps by lowering their payback from 6 to 7 years to 3 to 5 years. Ground coil heat exchanger models (based primarily on first principles) have been developed and used by others to generate less conservative ground coil sizing methods. An aggressive technology transfer initiative was undertaken to publicize results of this research and make it available to the industry. Included in this effort were an international workshop, trade press releases and articles, and participation in a live teleconference on GCHP technology. DOE

N89-10525# Office of Science and Technology, Washington, DC.
FEDERAL COORDINATING COUNCIL ON SCIENCE, ENGINEERING AND TECHNOLOGY, COMMITTEE ON COMPUTER RESEARCH AND APPLICATIONS, SUBCOMMITTEE ON SCIENCE AND ENGINEERING COMPUTING Annual Report, 1987
Mar. 1988 13 p
(DE88-013228; DOE/ER-0368) Avail: NTIS HC A03/MF A01

In the past year the committee initiated efforts that resulted in the report A Research and Development Strategy for High Performance Computing and will presently provide a government-wide implementation plan to address the technological opportunities possible with the achievement of significantly enhanced supercomputer capability. The committee met on a regular basis to review government supported programs in research, development and application of new supercomputer technology. The Committee annually visits supercomputer manufacturers to be briefed on their plans for future generation machines. Cray Research and ETA Systems continue to make progress toward developing more advanced supercomputers. Reports by the Defense Science Board and the National Security Council/Economic Policy Council, which addressed semiconductor issues, were completed during the year with advice and input from the Committee. IBM has re-entered the supercomputer marketplace. The current 3090 series with expandable vector processing capability has achieved a low end position in the supercomputer performance spectrum. Subsequent development and marketing by IBM of more powerful machines would have important and far reaching impact on the domestic and world supercomputer market. Computers with massively parallel architecture--thousands of processors--are entering the market place and are beginning to become more of a factor in the computational productivity scale. DOE

N89-10665*# National Aeronautics and Space Administration, Washington, DC.
CIVIL SPACE TECHNOLOGY INITIATIVE: A FIRST STEP
1988 25 p Original contains color illustrations
(NASA-TM-100949; NAS 1.15:100949) Avail: NTIS HC A03/MF A01 CSCL 05/1

This is the first published overview of OAST's focused program, the Civil Space Technology Initiative, (CSTI) which started in FY88. This publication describes the goals, technical approach, current status, and plans for CSTI. Periodic updates are planned. Author

N89-10872*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AVIATION TECHNOLOGY APPLICABLE TO DEVELOPING REGIONS
JOHN ZUK and LARRY R. ALTON Sep. 1988 94 p
(NASA-TM-89425; A-87093; NAS 1.15:89425) Avail: NTIS HC A05/MF A01 CSCL 01/3

This paper is an analysis of aviation technologies useful for formulation of development plans to the year 2000 for emerging nations. The Caribbean Basin was used as a specific application. This development promises to be so explosive over the next 15 years as to be virtually unpredictable. Author

N89-10903*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE FIRST CHINESE STUDENT SPACE SHUTTLE GETAWAY SPECIAL PROGRAM
MARK C. LEE, XUN-SHU JIN, SHOU-QUAN KE, and BING-CHEN FU (Chinese Society of Astronautics, Beijing.) *In* NASA, Goddard Space Flight Center, The 1988 Get Away Special Experimenter's Symposium p 1-8 Sep. 1988
Avail: NTIS HC A07/MF A01 CSCL 22/1

The first Chinese Getaway Special program is described. Program organization, the student proposal evaluation procedure, and the objectives of some of the finalist's experiments are covered. The two experiments selected for eventual flight on the space shuttle are described in detail. These include: (1) the control of debris in the cabin of the space shuttle; and (2) the solidification of two immiscible liquids in space. Author

N89-11636# Argonne National Lab., IL.
TECHNOLOGY TRANSFER AT ARGONNE NATIONAL LABORATORY
R. T. FROST and G. J. BESIO 1988 7 p Presented at the 1st World Congress on Superconductivity, Houston, Tex., 22 Feb. 1988 Prepared in cooperation with ARCH Development Corp., Argonne, Ill.
(Contract W-31-109-ENG-38)
(DE88-012062; CONF-880210-3) Avail: NTIS HC A02/MF A01

The Technology Transfer Center is industry's pathway to Argonne. Through the Center, Argonne has established a number of prototype programs for forging alliances with industry, providing leadership among the national laboratories. Argonne has in place programs for cooperative research and development, industrial residencies and staff exchanges, post doctoral appointments, contract research, patent licensing and joint ventures through the ARCH Development Corporation, research consortia, and educational outreach initiatives. Each of these programs is described briefly, with examples cited to illustrate implementation. All programs are relevant to the commercialization of superconductor technologies developed at Argonne. DOE

N89-11765*# National Aeronautics and Space Administration, Washington, DC.
SPACE RESEARCH AND TECHNOLOGY BASE OVERVIEW
LANA M. COUCH *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder p 107-130 Sep. 1988
Avail: NTIS HC A23/MF A01 CSCL 22/1

Information in viewgraph form is given on aerothermodynamics, space energy conversion, spacecraft propulsion, spacecraft construction materials, spacecraft communications, spacecraft control, human factors engineering, and systems analysis. R.J.F.

N89-11766*# National Aeronautics and Space Administration, Washington, DC.
IN-SPACE TECHNOLOGY EXPERIMENTS PROGRAM: INSTEP
JUDITH H. AMBRUS *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder p 131-142 Sep. 1988
Avail: NTIS HC A23/MF A01 CSCL 22/1

Information is given in viewgraph form on space research and technology strategy, space shuttle experiments, experiments' planning, industry/university experiments, plasma arc welding in space, and international in-space experiments. R.J.F.

N89-11767*# National Aeronautics and Space Administration, Washington, DC.
UNIVERSITY PROGRAM
STEVEN C. HARTMAN *In its* Technology for Future NASA Missions: Civil Space Technology Initiative (CSTI) and Pathfinder p 143-155 Sep. 1988
Avail: NTIS HC A23/MF A01 CSCL 22/1

Information on university programs, program growth, and space research and technology strategy, are given in viewgraph form. R.J.F.

N89-12496# Committee on Science, Space and Technology (U.S. House).
INTERNATIONAL SPACE POLICY FOR THE 1990'S AND BEYOND, NO. 86
Washington GPO 1988 132 p Hearing before the Committee on Science, Space, and Technology, 100th Congr., 1st Sess., 10 Dec. 1987
(GPO-82-156) Avail: Subcommittee on Space Science and Applications, House of Representatives, Washington, D.C. 20510 HC free

The Subcommitteee on Space Science and Applications of the Committee on Science, Space and Technology of the U.S. House of Representatives met on 10 December, 1987, to discuss International Space Policy for the 1990's and Beyond. Expert witness was given by Herman Pollack, Chairman, NASA Advisory Council Task Force on International Relations in Space, Dr. James C. Fletcher, NASA Administrator, Michael Michaud, Acting Deputy Assistant Secretary for Science and Technology, Department of State, and Jerry Grey, Director, Science and Technology Policy, American Institute of Aeronautics and Astronautics. F.M.R.

N89-12539*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AIRCRAFT TECHNOLOGY OPPORTUNITIES FOR THE 21ST CENTURY
JAMES A. ALBERS and JOHN ZUK Nov. 1988 49 p Presented at the Conference on New Technology and the Aviation System, Los Angeles, Calif., 16-18 Nov. 1988
(NASA-TM-101060; A-89009; NAS 1.15:101060) Avail: NTIS HC A03/MF A01 CSCL 01/2

New aircraft technologies are presented that have the potential to expand the air transportation system and reduce congestion through new operating capabilities, and at the same time provide greater levels of safety and environmental compatibility. Both current and planned civil aeronautics technology at the NASA Ames, Lewis, and Langley Research Centers are addressed. The complete spectrum of current aircraft and new vehicle concepts is considered including rotorcraft (helicopters and tiltrotors), vertical and short takeoff and landing (V/STOL) and short takeoff and landing (STOL) aircraft, subsonic transports, high speed transports, and hypersonic/transatmospheric vehicles. New technologies for current aircraft will improve efficiency, affordability, safety, and environmental compatibility. Research and technology promises to enable development of new vehicles that will revolutionize or greatly change the transportation system. These vehicles will provide new capabilities which will lead to enormous market opportunities and economic growth, as well as improve the competitive position of the U.S. aerospace industry. Author

N89-13307# Federal Lab. Consortium, Washington, DC.
FEDERAL LABORATORY CONSORTIUM FOR TECHNOLOGY TRANSFER: PUTTING TECHNOLOGY TO WORK. EXAMPLES OF INDUSTRY-LABORATORY COOPERATION CONTRIBUTING TO OUR NATION'S ECONOMIC STRENGTH
Mar. 1988 141 p
(PB88-243357) Avail: NTIS HC A07/MF A01 CSCL 05/1

The Nations's Federal laboratories are proving increasingly effective in contributing to the economy through technology

transfer. Laboratory technologies, expertise, and mission program interests have formed the basis for many commercial innovations. From the spinoff of small high technology companies into local incubator facilities, to long-term joint research and development with large companies, many Federal laboratories and agencies are demonstrating their commitment, the workability of their cooperative mechanisms, and the wealth of commercially attractive opportunities. The document is a collection of examples from 31 laboratories representing 7 government agencies; it should be viewed as indicative of the full potential for industry-laboratory cooperation to contribute to the nation's economic strength.
GRA

N89-13392# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD HANDBOOK
Jun. 1988 53 p
Copyright Avail: NTIS HC A04/MF A01
This handbook is intended as an introduction to AGARD and its activities. The handbook includes the official texts of the AGARD charter and by-laws. Author

N89-13393*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
RESEARCH AND TECHNOLOGY Annual Report, 1987
Mar. 1988 209 p Original contains color illustrations
(NASA-TM-100051; A-88044; NAS 1.15:100051) Avail: NTIS HC A10/MF A01 CSCL 05/4
This report describes various research and technology activities at Ames Moffett and Ames Dryden Research Centers. Highlights of these accomplishments indicate the Centers' varied and highly productive research efforts for 1987. Author

N89-14172*# National Aeronautics and Space Administration, Washington, DC.
THE 1989 LONG-RANGE PROGRAM PLAN
19 Dec. 1988 229 p
Avail: NTIS HC A11/MF A01 CSCL 05/1
The President's National Space Policy of 1988 reaffirms that space activities serve a variety of vital national goals and objectives, including the strengthening of U.S. scientific, technological, political, economic, and international leadership. The new policy stresses that civil space activities contribute significantly to enhancing America's world leadership. Goals and objectives must be defined and redefined, and each advance toward a given objective must be viewed as a potential building block for future programs. This important evolutionary process for research and development is reflected, describing NASA's program planning for FY89 and later years. This plan outlines the direction of NASA's future activities by discussing goals, objectives, current programs, and plans for the future. The 1989 plan is consistent with national policy for both space and aeronautics, and with the FY89 budget that the President submitted to Congress in February 1988. Author

N89-14179# Committee on Science, Space and Technology (U.S. House).
THE COMMERCIAL SPACE LAUNCH ACT AMENDMENTS
1988 365 p Hearings on H.R. 3765 before the Subcommittee on Space Science and Applications of the Committee on Science, Space and Technology, 100th Congress, 2d Session, No. 114, 16-17 Feb. 1988
(GPO-84-644) Avail: Subcommittee on Space Science and Applications, House of Representatives, Washington, D.C. 20515 HC free; SOD SN-552-070-048-81-2 HC $11.00
This congressional report of the hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology of the U.S. House of Representatives of the 100th Congress, concerns itself with H.R. 3765, the Commercial Space Launch Act Amendments. The progress made toward developing a truly commercial launch industry is discussed. E.R.

N89-14212*# National Aeronautics and Space Administration, Washington, DC.
HISTORY AT NASA
Jun. 1986 59 p
(NASA-HHR-50) Avail: NTIS HC A04/MF A01 CSCL 05/4
The efforts of the National Aeronautics and Space Administration to capture and record the events of the past are described, particularly the research accomplishments of NASA's agency-wide history program. A concise guide to the historical research resources available at NASA Headquarters in Washington, D.C., at NASA facilities around the country, and through the federal records systems is given. R.J.F.

N89-14481*# California Univ., Santa Barbara.
REMOTE SENSING INFORMATION SCIENCES RESEARCH GROUP Final Report, Year 5
JOHN E. ESTES, TERENCE SMITH, and JEFFREY L. STAR 1 Jun. 1988 61 p
(Contract NAGW-455)
(NASA-CR-183374; NAS 1.26:183374) Avail: NTIS HC A04/MF A01 CSCL 05/2
Research conducted under this grant was used to extend and expand existing remote sensing activities at the University of California, Santa Barbara in the areas of georeferenced information systems, matching assisted information extraction from image data and large spatial data bases, artificial intelligence, and vegetation analysis and modeling. The research thrusts during the past year are summarized. The projects are discussed in some detail.
B.G.

N89-14851*# Fusion Power Associates, Gaithersburg, MD.
COMMERCIAL OBJECTIVES, TECHNOLOGY TRANSFER, AND SYSTEMS ANALYSIS FOR FUSION POWER DEVELOPMENT
STEPHEN O. DEAN *In* NASA, Lewis Research Center, Lunar Helium-3 and Fusion Power p 169-192 Sep. 1988 Submitted for publication
Avail: NTIS HC A11/MF A01 CSCL 20/9
Fusion is an inexhaustible source of energy that has the potential for economic commercial applications with excellent safety and environmental characteristics. The primary focus for the fusion energy development program is the generation of central station electricity. Fusion has the potential, however, for many other applications. The fact that a large fraction of the energy released in a DT fusion reaction is carried by high energy neutrons suggests potentially unique applications. In addition, fusion R and D will lead to new products and new markets. Each fusion application must meet certain standards of economic and safety and environmental attractiveness. For this reason, economics on the one hand, and safety and environment and licensing on the other, are the two primary criteria for setting long range commercial fusion objectives. A major function of systems analysis is to evaluate the potential of fusion against these objectives and to help guide the fusion R and D program toward practical applications. The transfer of fusion technology and skills from the national labs and universities to industry is the key to achieving the long range objective of commercial fusion applications.
Author

N89-14934*# National Aeronautics and Space Administration, Washington, DC. Small Business Innovation Research Program.
PROGRAM SOLICITATION CLOSING DATE: JULY 22, 1988
1988 102 p
(NASA-TM-101217; NAS 1.15:101217; SBIR-88-1) Avail: NTIS HC A06/MF A01 CSCL 05/1
The sixth annual Small Business Innovation Research (SBIR) solicitation by NASA, describes the program, identifies eligibility requirements, outlines proposal preparation and submission requirements, describes the proposal evaluation and award selection process, and provides other information to assist those interested in participating in the SBIR program. It also identifies in Section 8.0 and Appendix D, the specific technical topics and subtopics in which SBIR Phase 1 proposals are solicited in 1988.
Author

N89-14995*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
WELCOME TO AMES RESEARCH CENTER (1987 FORUM ON FEDERAL TECHNOLOGY TRANSFER)
WILLIAM F. BALLHAUS, JR. Nov. 1988 15 p
(NASA-TM-100088; A-88124; NAS 1.15:100088) Avail: NTIS HC A03/MF A01 CSCL 05/4

NASA Ames Research Center has a long and distinguished history of technology development and transfer. Recently, in a welcoming speech to the Forum on Federal Technology Transfer, Director Ballhouse of Ames described significant technologies which have been transferred from Ames to the private sector and identifies future opportunities. Author

N89-14996# Department of Energy, Washington, DC.
RESEARCH AND TECHNOLOGY UTILIZATION
Aug. 1988 149 p
(DE88-016749; DOE/S-0067) Avail: NTIS HC A07/MF A01

This report responds to the request of the Secretary of Energy to evaluate the technology transfer programs of the DOE and its laboratories and to make recommendations to improve national economic competitiveness through the transfer of DOE science and technology to American industry. The report describes the current technology transfer policies and practices of the DOE and its major research and development programs. It considers the transfer efforts of the multiprogram laboratories and several of the single purpose laboratories. Current activities are examined in the light of recent changes in legislation, proprietary practices and attitudes, and they are compared to past successes and failures. The report also examines the views of industrial companies on the benefits of DOE technology and the role of U.S. research universities in technology transfer. DOE

N89-14997# Sandia National Labs., Albuquerque, NM.
TECHNOLOGY TRANSFER: TRANSFERRING FEDERAL R AND D RESULTS FOR DOMESTIC COMMERCIAL UTILIZATION
J. P. DEBRIUM and J. D. COREY Aug. 1988 153 p
(Contract DE-AC04-76DP-00789)
(DE89-000419; SAND-88-1716) Avail: NTIS HC A08/MF A01

This study is intended to provide a policy-oriented overview and grounding in concepts, issues, and considerations involved in the complex field of Federal technology transfer. It is intended primarily for policy planners and higher-level decision-makers concerned with Federal technology transfer, but at the same time it should provide a good introduction to the field for all technology transfer personnel. A primary objective of this study is to assemble, condense, and interpret a significant amount of the existing knowledge and wisdom relating to technology transfer. It further attempts to clarify and comment on the important issues and concerns which affect the Federal sector, and the Department of Energy in particular. No document on technology transfer can be the final word or deal comprehensively with all topics, but hopefully this study will make a substantial contribution to the practice and practical application of Federal technology transfer. DOE

N89-15142# National Academy of Sciences - National Research Council, Washington, DC. Commission on Physical Sciences, Mathematics and Resources.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015, OVERVIEW
1988 105 p
(LC-87-43329; ISBN-0-309-03838-3) Avail: NTIS HC A06/MF A01

The opportunities for space science in the period from 1995 to 2015 are discussed. A perspective on progress in the six disciplines (the planet Earth; planetary and lunar exploration; solar system space physics; astronomy and astrophysics; fundamental physics and chemistry; and life sciences) of space science are reviewed. The prospectives for major achievements by 1995 from missions already underway or awaiting new starts are included. A set of long range goals for these disciplines are presented for the first two decades of the twenty-first century. Broad themes for future scientific pursuits are presented and some examples of high-priority missions for the turn of the century are highlighted. A few recommendations are cited for each discipline to suggest how these themes might be developed. Author

N89-15143# National Academy of Sciences - National Research Council, Washington, DC. Commission on Physical Sciences, Mathematics and Resources.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015. MISSION TO PLANET EARTH
1988 37 p
(LC-87-43336; ISBN-0-309-03890-1) Avail: NTIS HC A03/MF A01

A unified program is outlined for studying the Earth, from its deep interior to its fluid envelopes. A system is proposed for measuring devices involving both space-based and in-situ observations that can accommodate simultaneously a large range of scientific needs. The scientific objectices served by this integrated infrastructure are cased into a framework of four grand themes. In summary these are: to determine the composition, structure, dynamics, and evolution of the Earth's crust and deeper interior; to establish and understand the structure, dynamics, and chemistry of the oceans, atmosphere, and cryosphere, and their interaction with the solid Earth; to characterize the history and dynamics of living organisms and their interaction with the environment; and to monitor and understand the interaction of human activities with the natural environment. A focus on these grand themes will help to understand the origin and fate of the planet, and to place it in the context of the solar system. Author

N89-15150*# Eagle Engineering, Inc., Houston, TX.
ADVANCED SPACE TRANSPORTATION SYSTEM SUPPORT CONTRACT Summary Final Report
30 Oct. 1988 75 p
(Contract NAS9-17878)
(NASA-CR-172104; NAS 1.26:172104; EEI-88-210) Avail: NTIS HC A04/MF A01 CSCL 22/2

The general focus is on a phase 2 lunar base, or a lunar base during the period after the first return of a crew to the Moon, but before permanent occupancy. The software effort produced a series of trajectory programs covering low earth orbit (LEO) to various node locations, the node locations to the lunar surface, and then back to LEO. The surface operations study took a lunar scenario in the civil needs data base (CNDB) and attempted to estimate the amount of space-suit work or extravehicular activity (EVA) required to set up the base. The maintenance and supply options study was a first look at the problems of supplying and maintaining the base. A lunar surface launch and landing facility was conceptually designed. The lunar storm shelter study examined the problems of radiation protection. The lunar surface construction and equipment assembly study defined twenty surface construction and assembly tasks in detail. Author

N89-15168# Aerospace Industries Association of America, Inc., Washington, DC. Rocket Propulsion Committee.
A DETAILED TECHNOLOGY ROADMAP FOR ROCKET PROPULSION
1 Oct. 1988 76 p
Avail: NTIS HC A05/MF A01

The Aerospaces Industries Association (AIA) initiative, called Key Technologies for the 1990's, proposes a three-pronged national strategy with the goal of ensuring U.S. technological superiority in aerospace products and military capability well into the 21st century. The first element of this effort is to create a cooperative national effort among industry, government, and academia to focus on the development of selected key technologies. The second is to cooperatively mold innovative policies that will stimulate technology development and facilitate its rapid application to new commercial and military products. The third element will focus on development of methodologies, tools, and disciplines required to increase the competitive advantage of our technology base. AIA is committed to a leadership role, working cooperatively with government and universities. Author

N89-15507# National Academy of Sciences - National Research Council, Washington, DC. Task Group on Life Sciences.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015. LIFE SCIENCES
1988 155 p
(LC-87-43334; ISBN-0-309-03880-4) Avail: NTIS HC A08/MF A01

The status and goals of the five areas of research (exobiology, global biology, controlled ecological life support systems, space biology, and space medicine) are discussed. Also discussed are the instrumentation and technologies required to achieve these goals. Author

N89-15682# National Academy of Sciences - National Research Council, Washington, DC. Task Group on Fundamental Physics and Chemistry.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015. FUNDAMENTAL PHYSICS AND CHEMISTRY
1988 107 p
(LC-87-43331; ISBN-0-309-03841-3) Avail: NTIS HC A06/MF A01

The focus of the task group was in two principal areas: relativistic gravitation, which involves testing of the general theory of relativity and microgravity science. A possible long-term research program in physics and chemistry in a microgravity environment and its rationale are outlined. The program is illustrated with examples of experiments, some of which are not in various stages of development and others which are envisioned for later. The common element in the historical perspective of progress in gaining empirical evidence for relativistic gravitation is the close coupling to technical advances in both direct experiments and observational techniques. The space program is expected to play a decisive role in this research. Basic issues, gravitation wave astronomy, current space research in gravitation, expected research prior to 1995, programs after 1995, and technical requirements are discussed. Author

N89-15828# National Academy of Sciences - National Research Council, Washington, DC. Task Group on Astronomy and Astrophysics.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015: ASTRONOMY AND ASTROPHYSICS
1988 84 p
(LC-87-43333; ISBN-0-309-03875-8) Avail: NTIS HC A05/MF A01

The program of new initiatives for the era 1995 to 2015 focuses on improvements in capabilities in two areas: higher angular resolution and greater collecting areas. The expected 1995 status is outlined for radio astronomy, infrared and submillimeter astronomy, ultraviolet and optical wavelengths, X-ray astronomy, gamma-ray astronomy, cosmic-ray astronomy, astrophysics, gravitational physics, NASA operational status, and international programs. New initiatives and practical considerations (budgetary requirements, international cooperation, cost-to-weight ratio, management, facilities, and instrumentation) are reviewed. Author

N89-15846# National Academy of Sciences - National Research Council, Washington, DC. Task Group on Planetary and Lunar Exploration.
SPACE SCIENCE IN THE TWENTY-FIRST CENTURY: IMPERATIVES FOR THE DECADES 1995 TO 2015. PLANETARY AND LUNAR EXPLORATION
1988 123 p
(LC-87-43335; ISBN-0-309-03885-5) Avail: NTIS HC A06/MF A01

In the next 30 years an increase in the technical infrastructure in space should be seen. This increase should include both earth-orbital facilities for scientific investigations, and advanced capabilities for deep-space operation of scientific spacecraft. The goals of planetary exploration are achieved primarily through spacecraft missions, although various earth-based and orbital activities also serve an integral role. The recommended goals consist of completion of the reconnaissance and exploration of the solar system and intensive exploration of the planet Mars. Accomplishments of the solar system exploration from 1965 to 1995 and the expected scientific questions as of the end of that period are summarized. The program of missions for the period 1995 to 2015 are presented. Author

N89-15886*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
RESEARCH AND TECHNOLOGY 1988 Annual Report
Dec. 1988 205 p Original contains color illustrations
(NASA-TM-4078; L-16518; NAS 1.15:4078) Avail: NTIS HC A10/MF A01 CSCL 05/4

The mission of the NASA Langley Research Center is to increase the knowledge and capability of the United States in a full range of aeronautics disciplines and in selected space disciplines. The mission will be accomplished by performing innovative research relevant to national needs and Agency goals, transferring technology to users in a timely manner, and providing development support to other U.S. Government agencies, industry, and other NASA Centers. This report contains highlights of the major accomplishments and applications made during the past year. The highlights illustrate both the broad range of the research and technology activities at NASA Langley and the contributions of this work toward maintaining U.S. leadership in aeronautics and space research. Author

N89-15895*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURAL DYNAMICS DIVISION RESEARCH AND TECHNOLOGY ACCOMPLISHMENTS FOR FY 1988 AND PLANS FOR FY 1989
JAMES E. GARDNER Jan. 1989 197 p
(NASA-TM-101543; NAS 1.15:101543) Avail: NTIS HC A09/MF A01 CSCL 20/4

The purpose of this paper is to present the Structural Dynamics Division's research accomplishments for FY 1988 and research plans for FY 1989. The work under each Branch (technical area) is described in terms of highlights of accomplishments during the past year and plans for the current year as they relate to five-year plans for each area. This information will be useful in program coordination with other government organizations and industry in areas of mutual interest. Author

N89-15913*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NASA ADVANCED PROPELLER RESEARCH
JOHN F. GROENEWEG and LAWRENCE J. BOBER 30 Sep. 1988 34 p Presented at the Advanced Propellers and Their Installation on Aircraft, Cranfield, England, 26-27 Sep. 1988; sponsored in part by Royal Aeronautical Society
(NASA-TM-101361; E-4393; NAS 1.15:101361) Avail: NTIS HC A03/MF A01 CSCL 21/5

Acoustic and aerodynamic research at NASA Lewis Research Center on advanced propellers is reviewed including analytical and experimental results on both single and counterrotation. Computational tools used to calculate the detailed flow and acoustic fields are described along with wind tunnel tests to obtain data for code verification. Results from two kinds of experiments are reviewed: (1) performance and near field noise at cruise conditions as measured in the NASA Lewis 8- by 6-foot Wind Tunnel; and (2) far field noise and performance for takeoff/approach conditions as measured in the NASA Lewis 9- by 15-foot Anechoic Wind Tunnel. Detailed measurements of steady blade surface pressures are described along with vortex flow phenomena at off-design conditions. Near field noise at cruise is shown to level out or decrease as tip relative Mach number is increased beyond 1.15. Counterrotation interaction noise is shown to be a dominant source at takeoff but a secondary source at cruise. Effects of unequal rotor diameters and rotor-to-rotor spacing on interaction noise are

also illustrated. Comparisons of wind tunnel acoustic measurements to flight results are made. Finally, some future directions in advanced propeller research such as swirl recovery vanes, higher sweep, forward sweep, and ducted propellers are discussed.
Author

N89-16208# Geological Survey, Reston, VA. National Mapping Div.
RESEARCH, INVESTIGATIONS AND TECHNICAL DEVELOPMENTS. NATIONAL MAPPING PROGRAM, 1985-1986
SHEILA E. MARTIN, CYNTHIA L. CUNNINGHAM, and MARY E. GRAZIANI 1988 149 p
(USGS-OPEN-FILE-REPT-87-315) Avail: NTIS HC A07/MF A01

This report provides general information on the research, investigations, and technical developments conducted by the U.S. Geological Survey's National Mapping Division. The Division collects, processes, and disseminates geographic, cartographic, and remote sensing information, digital data, and maps for the Nation. It also provides scientific and technical assistance and conducts research in the disciplines of cartography, geography, photogrammetry, remote sensing, surveying, and geodesy. Summaries of selected R and D projects conducted in the Survey's National Mapping Division during 1985 and 1986 are contained in this report, and several longer term research projects reported in the 1983 and 1984 report are brought up to date. The selected bibliography includes citations of papers and reports produced during 1985 and 1986 Primary responsibility for the generation of this report was undertaken by the Office of Research. The report is organized into major subject areas of digital cartography, geodetic surveys, image mapping, image processing, remote sensing, and geographic information systems. It has become evident that the application of digital cartographic concepts leads not only to automated map production, but to the merging and analysis of cartographic and other earth science data in digital form -- the essence of modern geographic information systems. F.M.R.

N89-16249# Virginia Univ., Charlottesville.
PROCEEDINGS OF THE FIRST MEETING OF THE SOCIETY FOR RESEARCH ON BIOLOGICAL RHYTHMS, CHARLESTON, SOUTH CAROLINA Final Report, 1 May - 10 Aug. 1988
FRED W. TUREK 10 Aug. 1988 96 p Proceedings held in Charleston, SC, 11-14 May 1988
(Contract AF-AFOSR-0133-88; AF PROJ. 2312)
(AD-A200134; AFOSR-88-1005TR) Avail: NTIS HC A05/MF A01 CSCL 06/4

Partial contents of the conference report on biorhythms are as follows: Organization of Animal Circadian Systems; Pulsatile Rhythms of Neuroendocrine Function; Neural Transplants and Restoration of Circadian Function; Stabilization of Periodic Processes Through Coupling of Oscillators; Photic Effects on Pacemakers; Pineal and Retinal Oscillators In Vitro; Computerized Data Acquisition; Involvement of Protein Synthesis in Circadian Rhythm Generation; Mechanisms of Vertebrate Pacemakers; Photoperiodism and Seasonal Rhythms; Human Rhythms and Sleep; Pharmacological Manipulation of Rhythms; Cellular, Molecular and Genetic Dissection of Clocks; Interaction Between Sleep and the Circadian System; Entraining Effects of Melatonin; Use of Periodogram Analysis and Related Procedures in Biological Rhythms Studies; Use of In Vitro Brain Slices in Studies of Circadian Function; Modulation and Control of Neural Oscillators; Chronobiology of Depression; Cellular and Molecular Basis of Rhythmicity; and Comparative Analysis of Rhythms. GRA

N89-16467# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
FLAT-PLATE SOLAR ARRAY PROJECT: GOVERNMENT AND INDUSTRY RESPONDING TO NATIONAL NEEDS
J. PATRICK ADCOCK and ROBERT D. KNECHT Sep. 1988 53 p Prepared in cooperation with Jet Propulsion Lab., Pasadena, CA
(Contract DE-AC02-83CH-10093)
(DE88-001185; SERI/SP-320-3382) Avail: NTIS HC A04/MF A01

This document recounts the accomplishments of the 11-year Flat-Plate Solar Array Project, which is recognized as one of the most successful and comprehensive technology-transfer efforts ever achieved through government-sponsored research and development. Few Federal research projects can claim the degree of industry involvement that was a fundamental aspect of the FSA Project. This philosophy in turn led to an extraordinary transfer of technology to the private sector, and assured that a maximum amount of the taxpayers' dollars were devoted to research of primary importance to the technology's commercialization. DOE

N89-16544*# National Aeronautics and Space Administration, Washington, DC.
NASA FUTURE MISSIONS
CHARLES J. PELLERIN and ROBERT V. STACHNIK *In* ESA, Proceedings of the Celebratory Symposium on a Decade of UV Astronomy with the IUE Satellite, Volume 2 p 77-84 Jun. 1988
Copyright Avail: NTIS HC A19/MF A01

The NASA astrophysics programs are outlined. The Hubble Space Telescope; the infrared background explorer, COBE; the Shuttle-based Astro-1/BBXRT UV and X-ray experiments; the extreme ultraviolet explorer, EUVE, the diffuse X-ray experiment, DXS, and the Gamma Ray Observatory, are described, and NASA involvement in ROSAT, exploring the X-ray sky, and ORFEUS, exploring the UV sky, is shown; SCOUT-class explorers are mentioned. Suborbital science obtained from aircraft and rockets will continue and expand; supporting research and technology will also continue and substantial effort will be expended on improvement of data systems to promote data accessibility and ease of use. ESA

N89-16706*# National Aeronautics and Space Administration, Washington, DC.
EXPLORATION STUDIES TECHNICAL REPORT, FY1988 STATUS. VOLUME 1: TECHNICAL SUMMARY
Dec. 1988 49 p
(NASA-TM-4075-VOL-1; NAS 1.15:4075-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 03/2

The Office of Exploration (OEXP) at NASA Headquarters has been tasked with defining and recommending alternatives for an early 1990's nationaL decision on a focused program of human exploration of the solar system. The Mission Analysis and System Engineering (MASE) group, which is managed by the Exploration Studies Office at the Lyndon B. Johnson Space Center, is responsible for coordinating the technical studies necessary for accomplishing such a task. This technical report, produced by the MASE, describes the process that has been developed in a case study approach. The four case studies developed in FY88 include: (1) Human Expedition to Phobos; (2) Human Expedition to Mars; (3) Lunar Observatory; and (4) Lunar Outpost to Early Mars Evolution. The final outcome of this effort is a set of programmatic and technical conclusions and recommendations for the following year's work. Author

N89-16707*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
OFFICE OF EXPLORATION: EXPLORATION STUDIES TECHNICAL REPORT. VOLUME 2: STUDIES APPROACH AND RESULTS Status Report, FY 1988
BARNEY B. ROBERTS and DAN BLAND Dec. 1988 356 p
(NASA-TM-4075-VOL-2; NAS 1.15:4075-VOL-2) Avail: NTIS HC A16/MF A01 CSCL 03/2

The NASA Office of Exploration has been tasked with defining and recommending alternatives for an early 1990's national decision on a focused program of human exploration of the solar system. The Mission Analysis and System Engineering (MASE) group, which is managed by the Exploration Studies Office at the Johnson Space Center, is responsible for coordinating the technical studies necessary for accomplishing such a task. This technical report describes the process that has been developed in a case study approach. The four case studies that were developed in FY88 include: (1) human expedition to Phobos; (2) human expeditions to Mars; (3) lunar observatory; and (4) lunar outpost

to early Mars evolution. The final outcome of this effort is a set of programmatic and technical conclusions and recommendations for the following year's work. Volume 2 describes the case study process, the technical results of each of the case studies, and opportunities for additional study. Included in the discussion of each case study is a description of the mission key features and profile. Mission definition and manifesting are detailed, followed by a description of the mission architecture and infrastructure. Systems concepts for the required orbital nodes, transportation systems, and planetary surface systems are discussed. Prerequisite implementation plans resulting from the synthesized case studies are described and in-depth assessments are presented. Author

N89-16717*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
RESEARCH AND TECHNOLOGY Annual Report
Dec. 1988 109 p
(NASA-TM-100986; NAS 1.15:100986) Avail: NTIS HC A06/MF A01 CSCL 05/2

As the NASA Center responsible for assembly, checkout, servicing, launch, recovery and operational support of Space Transportation System elements and payloads, Kennedy Space Center is placing emphasis on its research and technology program. In addition to strengthening those areas of engineering and operations technology that contribute to safer, more efficient, and more economical execution of our current mission, we are developing the technological tools needed to execute the Center's mission relative to future programs. The Engineering Development Directorate encompasses most of the laboratories and other Center resources that are key elements of research and technology program implementation, and is responsible for implementation of the majority of the projects in this Kennedy Space Center 1988 Annual Report. Author

N89-16917*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NASA PHOTOVOLTAIC RESEARCH AND TECHNOLOGY
DENNIS J. FLOOD Dec. 1988 12 p Prepared for the Annual Meeting of the American Institute of Chemical Engineers, Washington, DC, 28 Nov. - 2 Dec. 1988
(NASA-TM-101422; E-4522; NAS 1.15:101422) Avail: NTIS HC A03/MF A01 CSCL 10/2

NASA photovoltaic R and D efforts address future Agency space mission needs through a comprehensive, integrated program. Activities range from fundamental studies of materials and devices to technology demonstrations of prototype hardware. The program aims to develop and apply an improved understanding of photovoltaic energy conversion devices and systems that will increase the performance, reduce the mass, and extend the lifetime of photovoltaic arrays for use in space. To that end, there are efforts aimed at improving cell efficiency, reducing the effects of space particulate radiation damage (primarily electrons and protons), developing ultralightweight cells, and developing advanced ray component technology for high efficiency concentrator arrays and high performance, ultralightweight arrays. Current goals that have been quantified for the program are to develop cell and array technology capable of achieving 300 watts/kg for future missions for which mass is a critical factor, or 300 watts/sq m for future missions for which array size is a major driver (i.e., Space Station). A third important goal is to develop cell and array technology which will survive the GEO space radiation environment for at least 10 years. Author

N89-17022# National Space Development Agency, Tokyo (Japan). Space Experiment Group.
SPACE UTILIZATION PROMOTION PROGRAM OF NASDA
K. YANAGAWA, R. KANKI, T. AMAIKE, and N. TAKEDA *In* National Research Council of Canada, Workshop on Microgravity Experimentation in Aircraft and Rockets p 17-23 1988
Avail: NTIS HC A07/MF A01; also available from Publication Sales and Distribution, National Research Council of Canada, Ottawa, ON, Canada K1A OR6

Current space research and development trends in Japan include: (1) Expectation of environment utilization like microgravity in space besides earth observation or communication terminal point; (2) Acquisition of new knowledge from space research and development; (3) Contribution to global social and economical development through the advancement of science and technology; (4) International cooperation based on peaceful purposes; and (5) Development of manned space activities for the next era. Japan has decided to participate in NASA's proposed international space station program with the Japanese Experiment Module (JEM) consisting of pressurized module, exposed facility, and logistic module. Author

N89-17250# Department of Defense, Washington, DC. Heat Engine Propulsion Div.
REPORT TO CONGRESS ON THE AUTOMOTIVE TECHNOLOGY DEVELOPMENT PROGRAM Annual Report No. 10
Nov. 1988 38 p
(DE89-004977; DOE/CE-0240) Avail: NTIS HC A03/MF A01

This is the tenth annual report on the progress in implementing the Automotive Propulsion Research and Development Act of 1978 (Title 3 of Public Law 95-238). The Act provides for an expanded research and development (R and D) effort with respect to advanced automotive propulsion systems technology which would complement and stimulate corresponding efforts by the private sector. Implementation of the Act is the responsibility of the Department of Energy's (DOE) Office of Transportation Systems (OTS). The programmatic goals of OTS are to increase end-use efficiency of highway vehicles and other transportation modes and to substitute abundant domestic fuels for petroleum based fuels. The Lewis Research Center (LERC) of the National Aeronautics and Space Administration (NASA) is the Technical Project Manager for advanced materials and alternative fuels utilization R and D. The R and D projects in progress address the high-risk areas associated with the development of ceramic components for the gas turbine engine, improvement to the Stirling engine, heavy-duty adiabatic diesel engine technology, advanced materials technology, and alternative fuels utilization technology. DOE

N89-17350# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
WIND ENERGY SYSTEMS: PROGRAM SUMMARY FOR FISCAL YEARS 1986 AND 1987
Oct. 1988 103 p
(Contract DE-AC02-83CH-10093)
(DE88-001188; DOE/CH-10093/26) Avail: NTIS HC A06/MF A01

This document summarizes the research and development activities sponsored by the DOE Wind/Ocean Technologies Division during fiscal years (FY) 1986 and 1987. The summary is organized into the following sections: An introduction to the Federal Wind Energy Program, its history, and current research directions; The program's organization for FY 1986 and 1987; The program's budget; The highlighted accomplishments of DOE's field laboratories; The program's future role; An index to and summaries of individual projects and contracts managed by each laboratory; A bibliography of major publications produced by DOE and its laboratories in FY 1986 and FY 1987. DOE

N89-17547# Pacific Northwest Lab., Richland, WA.
TECHNOLOGY TRANSFER FOR THE US DEPARTMENT OF ENERGY'S ENERGY STORAGE PROGRAM. VOLUME 1: RECOMMENDATIONS
C. L. BRUNEAU and L. L. FASSBENDER Oct. 1988 40 p
(Contract DE-AC06-76RL-01830)
(DE89-002806; PNL-6484-VOL-1) Avail: NTIS HC A03/MF A01

Technologies developed by the U.S. Department of Energy's (DOE) Energy Storage (STOR) Program must be converted into products, processes, or services that benefit the private sector. The process of technology transfer is the primary means of accomplishing this. The purpose of this report is to examine the technology transfer activities of the STOR Program and suggest mechanisms that might make the transfer of technologies from

national laboratories and universities to the private sector more effective. A brief summary of recommendations that would improve the effectiveness of the transfer of energy storage technologies from the national laboratories to the private sector is discussed.
DOE

N89-17592*# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
ADVANCED ENGINEERING DESIGN PROGRAM AT THE UNIVERSITY OF ILLINOIS FOR THE 1987-1988 ACADEMIC YEAR Final Report
KENNETH R. SIVIER and MICHAEL F. LEMBECK 15 Jun. 1988 33 p
(Contract NGT-21-002-080)
(NASA-CR-184744; NAS 1.26:184744) Avail: NTIS HC A03/MF A01 CSCL 01/3

The participation of the University of Illinois at Urbana-Champaign in the NASA/USRA Universities Advanced Engineering Design Program (Space) is reviewed for the 1987 to 88 academic year. The University's design project was the Manned Marsplane and Delivery System. In the spring of 1988 semester, 107 students were enrolled in the Aeronautical and Astronautical Engineering Departments' undergraduate Aerospace Vehicle Design course. These students were divided into an aircraft section (responsible for the Marsplane design), and a spacecraft section (responsible for the Delivery System Design). The design results are presented in Final Design Reports, copies of which are attached. In addition, five students presented a summary of the design results at the Program's Summer Conference. Author

N89-17595# Defense Science Board, Washington, DC.
REPORT OF THE DEFENSE SCIENCE BOARD TASK FORCE ON THE NATIONAL AEROSPACE PLANE (NASP) Final Report
Sep. 1988 90 p
(AD-A201124) Avail: NTIS HC A05/MF A01 CSCL 01/3

The NASP started in 1984 as a program to explore hypersonic air breathing propulsion. It transitioned during 1985 to a program with the dual goals of demonstrating single stage to orbit and hypersonic cruise with the same vehicle. DSB Task Force conclusions include: (1) The NASP program goals are valid. The NASP technologies will make significant contributions to our national military and space capabilities and our civilian economy as we enter the 21st century. (2) The NASP is truly an X-Vehicle. Expectations of short term operational utility should not be raised. (3) Technical uncertainties in all critical disciplines must be narrowed before detailed design is initiated. Uncertainties are too large to estimate with any degree of accuracy the cost, schedule or performance which can be achieved in Phase 3. (4) Readjust the program funding priorities to favor the Technology Maturation effort, while retaining sufficient effort in definition airframe and propulsion configuration to provide focus for the technology work. (5) An experimental program of this type should be event driven, not schedule driven. Demonstration of quantitative technical milestones in all critical disciplines should pace the program.
GRA

N89-17682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MICROGRAVITY COMBUSTION DIAGNOSTICS WORKSHOP
GILBERT J. SANTORO, ed., PAUL S. GREENBERG, ed., and NANCY D. PILTCH, ed. 1988 47 p Workshop held in Cleveland, OH, 28-29 Jul. 1987
(NASA-CP-10017; E-4213; NAS 1.55:10017) Avail: NTIS HC A03/MF A01 CSCL 22/1

Through the Microgravity Science and Applications Division (MSAD) of the Office of Space Science and Applications (OSSA) at NASA Headquarters, a program entitled, Advanced Technology Development (ATD) was promulgated with the objective of providing advanced technologies that will enable the development of future microgravity science and applications experimental flight hardware. Among the ATD projects one, Microgravity Combustion Diagnostics (MCD), has the objective of developing advanced diagnostic techniques and technologies to provide nonperturbing measurements of combustion characteristics and parameters that will enhance the scientific integrity and quality of microgravity combustion experiments. As part of the approach to this project, a workshop was held on July 28 and 29, 1987, at the NASA Lewis Research Center. A small group of laser combustion diagnosticians met with a group of microgravity combustion experimenters to discuss the science requirements, the state-of-the-art of laser diagnostic technology, and plan the direction for near-, intermediate-, and long-term programs. This publication describes the proceedings of that workshop. Author

N89-18045*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SYSTEMS AUTONOMY TECHNOLOGY: EXECUTIVE SUMMARY AND PROGRAM PLAN
JOHN S BULL, ed. Dec. 1987 167 p Prepared in cooperation with NASA. Goddard Space Flight Center, Greenbelt, MD; JPL, Calif., Inst. of Tech., Pasadena; Johnson Space Center; Kennedy Space Center; Langley Research Center; Lewis Research Center and Marshall Space Flight Center
(NASA-TM-100999; A-88174; NAS 1.15:100999) Avail: NTIS HC A08/MF A01 CSCL 09/2

The National Space Strategy approved by the President and Congress in 1984 sets for NASA a major goal of conducting effective and productive space applications and technology programs which contribute materially toward United States leadership and security. To contribute to this goal, OAST supports the Nation's civil and defense space programs and overall economic growth. OAST objectives are to ensure timely provision of new concepts and advanced technologies, to support both the development of NASA missions in space and the space activities of industry and other organizations, to utilize the strengths of universities in conducting the NASA space research and technology program, and to maintain the NASA centers in positions of strength in critical space technology areas. In line with these objectives, NASA has established a new program in space automation and robotics that will result in the development and transfer and automation technology to increase the capabilities, productivity, and safety of NASA space programs including the Space Station, automated space platforms, lunar bases, Mars missions, and other deep space ventures. The NASA/OAST Automation and Robotics program is divided into two parts. Ames Research Center has the lead role in developing and demonstrating System Autonomy capabilities for space systems that need to make their own decisions and do their own planning. The Jet Propulsion Laboratory has the lead role for Telerobotics (that portion of the program that has a strong human operator component in the control loop and some remote handling requirement in space). This program is intended to be a working document for NASA Headquarters, Program Offices, and implementing Project Management. Author

N89-18057*# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
SPACE-BORNE COMPUTING FOR THE YEAR 2000 AND BEYOND
RAVI K. IYER and PRITH BANERJEE Dec. 1988 40 p
(Contract NAG1-613)
(NASA-CR-184779; NAS 1.26:184779; UILU-ENG-88-2265; CSG-95) Avail: NTIS HC A03/MF A01 CSCL 09/2

The influence and utilization of computers in space science investigations greatly enhances the ability to address difficult and complicated questions about the Universe. Space Science is wholly dependent on computers because the data acquired from instruments on the spacecraft are not only complicated in form but also voluminous. Athough a great deal of attention has been paid to develop efficient and powerful computing systems on-ground, research in the area of spaceborne computing is far from satisfactory. On-board processing of data will be important in future planetary missions where telemetry rates constrain the total amount of data which can be returned and decisions may have to be made in real time. Little thought has been given to a dynamic man-machine interface with regard to scientific real-time interactive control of flight experiments. Careful thinking is therefore

essential to define appropriate spaceborne computing requirements for the future. It is imperative that powerful multiprocessing systems for on-board processing be experimentally impleneted and evaluated in selected application missions. The presentation addresses key issues and attempts to define the requirements for such processing with some of NASA's future missions in perspective. The resulting architectural and performance issues and possible developments are also addressed. Author

N89-18070# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SOFTWARE ENGINEERING EDUCATION DIRECTORY Final Technical Report
ALBERT L. JOHNSON Jan. 1988 92 p
(Contract F19628-85-C-0003)
(AD-A200630; CMU/SEI-88-TR-2; ESD-TR-88-003) Avail: NTIS HC A05/MF A01 CSCL 12/5

The Software Engineering Institute (SEI) is a Federally funded research and development center, sponsored by the Department of Defense and operated by Carnegie Mellon University. The mission of the SEI is to serve the public interest by establishing the standard of excellence for the art and practice of software engineering and by accelerating the transition of software technology. This directory has been compiled to provide information that will help students and their advisors make appropriate educational choices. It contains a detailed listing of available software engineering course and software engineering degree programs. In the future editions of this directory, the publishers plan to provide indices and cross tabulations showing a profile of ongoing software engineering education efforts. GRA

N89-18071# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
SUMMARY OF SEI (SOFTWARE ENGINEERING INSTITUTE) TECHNICAL OPERATIONS: 1987 Final Technical Report, Jan. - Dec. 1987
Jan. 1988 78 p
(Contract F19628-85-C-0003)
(AD-A200631; CMU/SEI-88-TR-1; ESD-TR-88-002) Avail: NTIS HC A05/MF A01 CSCL 06/1

The Software Engineering Institute (SEI) is a Federally funded research and development center sponsored by the Department of Defense (DOD). It was chartered by the Undersecretary of Defense for Research and Engineering on June 15, 1984. The SEI was established and is operated by Carnegie Mellon University (CMU) under contract F19628-85-C-0003, which was competitively awarded on December 28, 1984, by the Air Force Electronic System Division. The mission of the SEI is to provide the means to bring the ablest minds and the most effective technology to bear on the rapid improvement of the quality of operational software in mission-critical computer systems; to accelerate the reduction to practice of modern software engineering techniques and methods; to promulgate the use of modern techniques and methods throughout the mission-critical systems community; and to establish standards of excellence for the practice of software engineering. This report provides a summary of the programs and projects, staff, facilities, and service accomplishments of the Software Engineering Institute during 1987. GRA

N89-18177# Department of Energy, Washington, DC. Office of Nuclear Energy.
IMPORTANT TECHNOLOGY CONSIDERATIONS FOR SPACE NUCLEAR POWER SYSTEMS
JOHN P. KUSPA, EARL J. WAHLQUIST, and DENNIS A. BITZ Mar. 1988 28 p
(DE89-004005; DOE/NE-0093) Avail: NTIS HC A03/MF A01

This paper discusses the technology considerations that guide the development of space nuclear power sources (NPS) by the Department of Energy (DOE) to meet a wide variety of applications. The Department and its predecessor agencies have been developing NPS since the 1950s and producing NPS for spacecraft for the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) since the early 1960s. No one nuclear power type, isotope or reactor, will suffice over the entire range of mission power required. Nor is one type of power conversion system, be it static or dynamic, the optimum choice of all space nuclear power system applications. There is a need for DOE, in partnership with its users, NASA and DOD, to develop a variety of types of space nuclear power sources - isotope-static, isotope-dynamic, reactor-static, and reactor-dynamic - to meet mission requirements well into the next century. DOE

N89-18202# Argonne National Lab., Idaho Falls, ID. Energy and Environmental Systems Div.
POTENTIAL BENEFITS OF SUPERCONDUCTIVITY TO TRANSPORTATION IN THE UNITED STATES
DONALD M. ROTE and LARRY R. JOHNSON 1988 7 p Presented at the First International Symposium on Superconductivity, Nagoya, Japan, 29 Aug. 1988 Sponsored in part by EPRI
(Contract W-31-109-ENG-38)
(DE89-003957; CONF-880842-1) Avail: NTIS HC A02/MF A01

Research in U.S. transportation applications of superconductors is strongly motivated by a number of potential national benefits. These include the reduction of dependence on petroleum-based fuels, energy savings, substantially reduced air and noise pollution, increased customer convenience, and reduced maintenance costs. Current transportation technology offers little flexibility to switch to alternative fuels, and efforts to achieve the other benefits are confounded by growing congestion at airports and on urban roadways. A program has been undertaken to identify possible applications of the emerging superconducting applications to transportation and to evaluate potential national benefits. The current phase of the program will select the most promising applications for a more detailed subsequent study. Transportation modes being examined include highway and industrial vehicles, as well as rail, sea, air transport and pipelines. Three strategies are being considered: (1) replacing present components with those employing superconductors, (2) substituting new combinations of components or systems for present systems, and (3) developing completely new technologies. Distinctions are made between low-, medium-, and near-room-temperature superconductors. The most promising applications include magnetically levitated passenger and freight vehicles; replacement of drive systems in locomotives, self-propelled rail cars, and ships; and electric vehicles inductively coupled to electrified roadways. DOE

N89-18250# Office of Technology Assessment, Washington, DC.
BOOK PRESERVATION TECHNOLOGIES
May 1988 125 p
(PB88-212410; OTA-O-375) Avail: NTIS HC A05/MF A01; also available SOD HC $5.00 as 052-003-01103-4 CSCL 05/2

The problem of acid deterioration of books is analyzed along with the program under way at the Library of Congress. The program at the Library involves the chemical treatment of books in a unique and effective process that, however, also presents some new engineering and safety concerns. Because of these concerns, the House of Representatives Committee on Appropriations requested this independent review of the Library's system and other available or potential processes. OTA has evaluated the Library's process and program with a focus on effectiveness and safety, and compared it to available alternatives. OTA has also developed information and analyses useful to other major libraries in the Nation that are faced with the same problem of perserving valuable books and papers. Author

N89-18253*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FY 1988 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS AND PRESENTATIONS
JOYCE E. TURNER, comp. Oct. 1988 67 p
(NASA-TM-100346; NAS 1.15:100346) Avail: NTIS HC A04/MF A01 CSCL 05/2

This document presents formal NASA technical reports, papers published in technical journals, and presentations by MSFC

personnel in FY 88. It also includes papers of MSFC contractors. After being announced in STAR, all of the NASA series reports may be obtained from the NationaL Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The information in this report may be of value to the scientific and engineering community in determining what information has been published and what is available. Author

N89-18262# Committee on Appropriations (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. ADVANCED SOLID ROCKET MOTOR PROGRAM
In its Department of Housing and Urban Development and Certain Independent Agencies Appropriations for Fiscal Year 1989, Part 2 p 1139-1170 1988
Avail: Committee on Appropriations, Senate, Washington, DC 20515 HC free; SOD HC $19.00 as 552-070-05046-1

Hearings before a subcommittee of the Senate Committee on Appropriations are presented. Justifications for upgrading the solid rocket motor boosters for the shuttle systems are examined. All written testimony and submittals for the record are also included. B.G.

N89-18528*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MATERIALS DIVISION RESEARCH AND TECHNOLOGY ACCOMPLISHMENTS FOR FY 87 AND PLANS FOR FY 88
KAY L. BRINKLEY Dec. 1988 134 p
(NASA-TM-101506; NAS 1.15:101506) Avail: NTIS HC A07/MF A01 CSCL 07/1

The research program of the Materials Division is presented as FY 87 accomplishments and FY 88 plans. The accomplishments for each Branch are highlighted and plans are outlined. Publications of the Division are included by Branch. This material will be useful in program coordination with other government organizations, universities, and industries in areas of mutual interest. Author

N89-18564*# National Aeronautics and Space Administration, Washington, DC.
ACCESSING SPACE: A CATALOGUE OF PROCESS, EQUIPMENT AND RESOURCES FOR COMMERCIAL USERS
Sep. 1988 192 p
(NASA-NP-118; NAS 1.83:118) Avail: NTIS HC A09/MF A01 CSCL 13/2

This catalogue, produced by NASA's Office of Commercial Programs, provides a broad source of information for the commercial developer interested in the areas of microgravity research and remote sensing. Methods for accessing space for research are reviewed including the shuttle, expendable launch vehicles, suborbital sounding rockets, experimental aircraft, and drop towers and other ground-based facilities. Procedures for using these vehicles and facilities are described along with funding options to pay for their use. Experiment apparatus and carriers for microgravity research are also described. A separate directory of resources and services is also included which contains a listing of transportation products and services, a listing of businesses and industries which provide space-related services and products, and a listing of the NASA and CCDS (Center for the Commercial Development of Space) points of contact. M.G.

N89-18703# Department of Energy, Washington, DC. Engineering and Geosciences Div.
SUMMARIES OF PHYSICAL RESEARCH IN THE GEOSCIENCES
Dec. 1988 142 p
(DE89-005499; DOE/ER-0397) Avail: NTIS HC A07/MF A01

The Department of Energy supports research in the geosciences in order to provide a sound foundation of fundamental knowledge in those areas of the geosciences which are germane to the Department of Energy's many missions. The Division of Engineering and Geosciences, part of the Office of Basic Energy Sciences of the Office of Energy Research, supports the Geosciences Research Program. The participants in this program include Department of Energy laboratories, industry, universities, and other governmental agencies. These activities are formalized by a contract or grant between the Department of Energy and the organization performing the work, providing funds for salaries, equipment, research minerals, and overhead. The summaries in this document, prepared by the investigators, describe the scope of the individual programs. The Geoscience Research Program includes research in geology, petrology, geophysics, geochemistry, solar physics, solar-terrestrial relationships, aeronomy, seismology, and natural resource modeling and analysis, including their various subdivisions and interdisciplinary areas. All such research is related either directly or indirectly to the Department of Energy's long-range technological needs. DOE

N89-18749# Florida International Univ., Miami.
TECHNOLOGY TRANSFER FOR DEVELOPMENT OF COASTAL ZONE RESOURCES: CARIBBEAN EXPERTS EXAMINE CRITICAL ISSUES
C. SPECTER and D. GAYLE *In* ESA, Proceedings of the 1988 International Geoscience and Remote Sensing Symposium (IGARSS) '88 on Remote Sensing: Moving Towards the 21st Century, Volume 3 p 1449-1452 Aug. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Division, ESTEC, Noordwijk, Netherlands, $120 US or 250 Dutch guilders

Remote sensing utilization by developing countries for the exploration, development, and conservation of their marine/coastal zone resources is discussed. This technology is not being applied to development activities to the extent that it could be. Technological factors, as well as other significant factors in the transfer process, such as political and economic constraints, that hinder the flow of technology to the Caribbean area are assessed. Recommendations that may be useful to policy-makers and managers concerned with this technology transfer problem are considered. ESA

N89-19125# Boston Univ., MA. Center for Adaptive Systems.
THE COGNITIVE, PERCEPTUAL, AND NEURAL BASES OF SKILLED PERFORMANCE Annual Report, 1 Oct. 1987 - 30 Sep 1988
STEPHEN GROSSBERG Sep. 1988 36 p
(Contract F49620-87-C-0018)
(AD-A201446; AFOSR-88-1275TR) Avail: NTIS HC A03/MF A01 CSCL 06/4

The enclosed summaries provide an outline of some of the URI research projects. In addition to these activities, a scientific meeting combining URI scientists and other distinguished vision researchers in the USA and Canada was organized and held at Boston University in Mar 1988. Topics include: Probing cognitive processes through the structure of event-related potentials during learning; A neural network architecture for automatic trajectory formation and coordination of multiple effectors during variable-speed arm movements; Neural dynamics of planned arm movements: Emergent invariants and speed-accuracy properties during trajectory formation; Self-organizing neural architectures for eye movements, arm movements, and eye-arm coordination. GRA

N89-19216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
RESEARCH AND TECHNOLOGY 1988 Annual Report
1988 205 p Original contains color illustrations
(NASA-TM-100343; NAS 1.15:100343) Avail: NTIS HC A10/MF A01 CSCL 05/1

This report presents the on-going research activities at the NASA Marshall Space Flight Center for the year 1988. The subjects presented are space transportation systems, shuttle cargo vehicle, materials processing in space, environmental data base management, microgravity science, astronomy, astrophysics, solar physics, magnetospheric physics, aeronomy, atomic physics, rocket propulsion, materials and processes, telerobotics, and space systems. NASA

N89-19230*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
JOINT UNIVERSITY PROGRAM FOR AIR TRANSPORTATION RESEARCH, 1987
FREDERICK R. MORRELL, comp. Apr. 1989 118 p Presented at a conference held in Atlantic City, NJ, 14-15 Jan. 1988
(NASA-CP-3028; L-16547; NAS 1.55:3028) Avail: NTIS HC A06/MF A01 CSCL 01/2

The research conducted during 1987 under the NASA/FAA sponsored Joint University Program for Air Transportation Research is summarized. The Joint University Program is a coordinated set of 3 grants sponsored by NASA-Langley and the FAA, one each with the MIT, Ohio Univ., and Princeton Univ. Completed works, status reports, and annotated bibliographies are presented for research topics, which include computer science, guidance and control theory and practice, aircraft performance, flight dynamics, and applied experimental psychology. An overview of the year's activities for each university is also presented. Author

N89-19820*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A SURVEY OF PLANNING AND SCHEDULING RESEARCH AT THE NASA AMES RESEARCH CENTER
MONTE ZWEBEN *In* NASA. Lyndon B. Johnson Space Center, 2nd Annual Workshop on Space Operations Automation and Robotics (SOAR 1988) p 15-20 Nov. 1988
Avail: NTIS HC A22/MF A01 CSCL 05/1

NASA Ames Research Center has a diverse program in planning and scheduling. This paper highlights some of our research projects as well as some of our applications. Topics addressed include machine learning techniques, action representations and constraint-based scheduling systems. The applications discussed are planetary rovers, Hubble Space Telescope scheduling, and Pioneer Venus orbit scheduling. Author

N89-19926# Joint Publications Research Service, Arlington, VA.
EVALUATION SUPPORT SYSTEM FOR MULTIPLE R AND D PROJECTS
YOSHINORI KATAYAMA and MITSUHIKO TODA *In its* JPRS Report: Science and Technology. Japan: 7th Artificial Intelligence Symposium p 27-40 14 Sep. 1988 Transl. into ENGLISH of paper presented at Dainanakai Chishiki Kogaku Symposium, Tokyo, Japan, 1988 p 31-36
Avail: NTIS HC A04/MF A01

The evaluation of groups of research and development (R and D) projects largely depends on the experiential judgment of experts. A method is proposed for the total evaluation by experts of groups of projects and supporting decisionmaking based on it, focusing on engineering repercussion effects of project information. The basic framework of the support method involves knowledge of rules to deduce engineering impact relationships and relevant knowledge to expand the applicability of knowledge of these rules. An evaluation support system utilizes these rules as a knowledge base and supports experts' evaluation activities for multiple R and D projects. Examples are cited of groups of R and D projects that saved energy as application examples of this evaluation support system and results of their evaluations are shown. Author

N89-20031# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION
Washington GPO 1988 101 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 10 Mar. 1988, part 2
(S-HRG-100-579-PT-2; GPO-84-990) Avail: Subcommittee on Science, Technology and Space

Hearings before a subcommittee of the Senate on How the U.S. equips itself to be competitive in space in the 21st century: Maintaining momentum in high technology research and develop are presented. The statements of various NASA officials as well as those of university and aerospace industry are also presented. E.R.

N89-20122*# Illinois Univ., Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
AEROSPACE VEHICLE DESIGN, SPACECRAFT SECTION FINAL PROJECT REPORTS
May 1988 354 p
(Contract NGT-21-002-080)
(NASA-CR-184742; NAS 1.26:184742; AAE-241-VOL-2) Avail: NTIS HC A16/MF A01 CSCL 01/3

The next major step in the evolution of the space program is the exploration of the planet Mars. In preparation for this, much research is needed on the problem of surveying the planet surface. An aircraft appears to be a viable solution because it can carry men and equipment large distances in a short period of time as compared with ground transportation. The problems and design of an aircraft which would be able to survey the planet Mars are examined. Author

N89-20176*# Virginia Univ., Charlottesville. WWSR, Inc.
TWO DESIGNS FOR AN ORBITAL TRANSFER VEHICLE. PROJECT ORION: A PROPOSAL FOR A MANNED ORBITAL TRANSFER VEHICLE FOR THE 21ST CENTURY
1988 129 p Presented at the NASA/USRA Advanced Design Program Summer Conference, Jun. 1988
(Contract NGT-21-002-080)
(NASA-CR-184697; NAS 1.26:184697; REPT-2) Avail: NTIS HC A07/MF A01 CSCL 22/2

The most optimal design for a chemical propellant, manned OTV that fulfills the described constraints is presented. The design of the Project Orion OTV and its subsystems are examined. B.G.

N89-20192*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ADVANCED TECHNOLOGY FOR FUTURE SPACE PROPULSION SYSTEMS
LARRY A. DIEHL Mar. 1989 24 p Presented at a Symposium on Space Commercialization: Roles of Developing Countries, Nashville, TN, 5-10 Mar. 1989; sponsored in part by Tennessee Univ. Space Inst.; AIAA and IAA
(NASA-TM-101951; E-4646; NAS 1.15:101951) Avail: NTIS HC A03/MF A01 CSCL 21/8

The NASA Project Pathfinder contains programs to provide technologies for future transfer vehicles including those powered by both advanced chemical and electric propulsion rockets. This paper discusses the Chemical Transfer Propulsion and Cargo Vehicle Propulsion elements of Pathfinder. The program requirements and goals for both elements are discussed, and technical activities which are planned or underway are summarized. Recent progress in programs which support or proceed the Pathfinder activities is detailed. In particular, the NASA Program for Advanced Orbital Transfer Vehicle Propulsion, which acted as the precursor for the Chemical Transfer Propulsion element of Pathfinder is summarized. Author

N89-20546# National Inst. of Standards and Technology, Gaithersburg, MD.
ENERGY RELATED INVENTIONS PROGRAM: A JOINT PROGRAM OF THE DEPARTMENT OF ENERGY AND THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Status Report
F. L. HART Oct. 1988 308 p Sponsored in part by DOE, Washington, DC
(PB89-141154; NISTIR-88/4005) Avail: NTIS HC A14/MF A01 CSCL 10/1

A brief description of the Energy Related Inventions Program and of all inventions recommended by the National Institute of Standards and Technology (formerly the National Bureau of Standards) to the Department of Energy since the inception of

the program, including a brief summary of the current status of each are discussed. Author

N89-20862# National Technical Information Service, Springfield, VA.
SUPPLY AND USE OF JAPANESE TECHNICAL LITERATURE IN THE UNITED STATES
DAVID B. SHONYO and JANET H. GEFFNER Feb. 1988 33 p Presented at the American Association for the Advancement of Science Annual Meeting, Boston, MA, Feb. 1988
(PB88-230842) Avail: NTIS HC A03/MF A01 CSCL 05/2

Some of the barriers to easy access to scientific and technical information (STI) that originates in Japan are considered, along with some to the ways that researchers can gain an entry to this body of literature. Examples are quoted from a series of case studies of information centers in the U.S. which have been reasonably successful in providing their clients with Japanese STI. It is shown that, although there has been a great deal of interest in Japanese STI in the West, the actual demand for this kind of information has not been great, especially as measured in commercial terms. Some possible reasons for this are discussed. Finally, the results of a series of interviews with end users of Japanese STI are summarized. Author

N89-20863# Commerce Dept., Washington, DC. Office of japanese Technical Literature.
CURRENT STATUS OF JAPANESE TO ENGLISH MACHINE TRANSLATION: REPORT TO CONGRESS
TAMAMI KUSUDA Jul. 1988 18 p
(PB89-128276) Avail: NTIS HC A03/MF A01 CSCL 05/2

The primary obstacle to access to the Japanese technical literature is the Japanese language. Manual translation of Japanese technical material tends to be very expensive and, especially in specialized technical fields, is often inaccurate. Machine-aided Translation (MT) offers the hope of eventually gaining a much broader access to Japanese scientific and technical literature. The report to the US Congress assesses the present state of Japanese-to-English MT. Consideration is given to the MT process itself, and to current activities in the U.S., Japan, and Europe. Attention is also given to the status of optical Japanese character recognition devices as an input method for MT systems. GRA

N89-20873# Committee on Commerce, Science, and Transportation (U.S. Senate).
NASA AUTHORIZATION
1988 103 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d session, part 1
(S-HRG-100-579; GPO-83-952) Avail: Subcommittee on Science, Technology and Space, Senate, Washington, DC 20510 HC free

Hearings before the Science, Technology, and Space Subcommittee of the Senate are presented. The scope and direction, the health and well-being of the nation's Space and Technology Program are discussed. All written testimony and submittals for the record are included. B.G.

N89-20874# General Accounting Office, Washington, DC.
TECHNOLOGY TRANSFER: CONSTRAINTS PERCEIVED BY FEDERAL LABORATORY AND AGENCY OFFICIALS
Mar. 1988 25 p
(GAO/RCED-88-116BR) Avail: NTIS HC A03/MF A01

Federal laboratory and agency officials were interviewed to identify constraints to transferring technology from Federal labs to U.S. businesses. Following are four major constraints which were identified by several labs: (1) while recent changes in the law allow Federal labs to patent and exclusively license inventions, Federal computer software is publicly disseminated, thus businesses do not have an incentive to fully develop and market it; (2) because Federal labs generally cannot conduct proprietary research and therefore competitors can obtain access to research results, businesses are less inclined to enter into collaborative research efforts; (3) the requirement that several of the DOE's contractor operated labs must request the Department to waive its title rights to inventions that they make causes uncertainty and delay and reduces industry interest in getting involved; and (4) Federal labs, in their efforts to be fair in providing businesses opportunities to collaborate on research, may institute burdensome and time consuming procedures that inhibit industry participation. Author

N89-20881# General Accounting Office, Washington, DC.
SPACE SCIENCE: STATUS OF THE HUBBLE SPACE TELESCOPE PROGRAM
May 1988 31 p
(GAO/NSIAD-88-118BR) Avail: NTIS HC A03/MF A01

The current status of the NASA's Hubble Space Telescope (HST) program is reviewed. The following questions are addressed: (1) what is the current status of the program with respect to cost, schedule, and performance; (2) what is the role of the Space Telescope Institute; and (3) what are NASA's plans for providing on-orbit maintenance to the space telescope. The objectives, scope, and methodology are discussed and summarized. E.R.

N89-20918*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RESEARCH AND TECHNOLOGY OF THE LYNDON JOHNSON SPACE CENTER Annual Report, 1988
Mar. 1989 169 p
(NASA-TM-100473; S-590; NAS 1.15:100473) Avail: NTIS HC A08/MF A01 CSCL 05/4

Johnson Space Center accomplishments in new and advanced concepts during 1988 are highlighted. This year, reports are grouped in sections Space System Technology, Solar System Sciences, Space Transportation Technology, and Medical Sciences. Summary sections describing the role of Johnson Space Center in each program are followed by descriptions of significant tasks. Descriptions are suitable for external consumption, free of technical jargon, and illustrated to increase ease of comprehension. Author

N89-20927*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
FLIGHT RESEARCH AND TESTING
TERRILL W. PUTNAM and THEODORE G. AYERS *In* NASA, Langley Research Center, Transonic Symposium: Theory, Application, and Experiment, Volume 1, Part 1 p 33-59 Mar. 1989 Previously announced as N88-26361
Avail: NTIS HC A18/MF A01 CSCL 01/1

Flight research and testing form a critical link in the aeronautic research and development chain. Brilliant concepts, elegant theories, and even sophisticated ground tests of flight vehicles are not sufficient to prove beyond a doubt that an unproven aeronautical concept will actually perform as predicted. Flight research and testing provide the ultimate proof that an idea or concept performs as expected. Ever since the Wright brothers, flight research and testing were the crucible in which aeronautical concepts were advanced and proven to the point that engineers and companies are willing to stake their future to produce and design aircraft. This is still true today, as shown by the development of the experimental X-30 aerospace plane. The Dryden Flight Research Center (Ames-Dryden) continues to be involved in a number of flight research programs that require understanding and characterization of the total airplane in all the aeronautical disciplines, for example the X-29. Other programs such as the F-14 variable-sweep transition flight experiment have focused on a single concept or discipline. Ames-Dryden also continues to conduct flight and ground based experiments to improve and expand the ability to test and evaluate advanced aeronautical concepts. A review of significant aeronautical flight research programs and experiments is presented to illustrate both the progress being made and the challenges to come. Author

N89-21013# Fish and Wildlife Service, Fairbanks, AK.
SATELLITE TELEMETRY: A NEW TOOL FOR WILDLIFE RESEARCH AND MANAGEMENT

STEVE G. FANCY, LARRY F. PANK, DAVID C. DOUGLAS, CATHERINE H. CURBY, GERALD W. GARNER, STEVEN E. AMSTRUP, and WAYNE L. REGELIN (Alaska Dept. of Fish and Game, Fairbanks.) 1988 61 p
(PB88-249255; RESOURCE-PUB-172; LC-88-600161) Avail: NTIS HC A04/MF A01 CSCL 08/2

The Argos Data Collection and Location System can be used to systematically acquire detailed locational and behavioral data from animals via satellite. System components, applications of satellite technology to wildlife research and management, and use of geographic information systems are described. A computer software package for analyzing satellite telemetry data is presented. GRA

N89-21026*# National Aeronautics and Space Administration, Washington, DC.
NASA DIRECTIONS IN SPACE PROPULSION FOR 2000 AND BEYOND
GREGORY M. RECK 1989 12 p Presented at the Symposium on Space Commercialization: Roles of Developing Countries, Nashville, TN, 5-10 Mar. 1989
(NASA-TM-102281; NAS 1.15:102281) Avail: NTIS HC A03/MF A01 CSCL 21/8

In his National Space Policy of 1988, President Reagan committed to a goal of expanding human presence and activity in the solar system. This goal has provided the impetus for a resurgence of activity in a broad range of space technology efforts in general and for a number of propulsion technology programs in particular. Building on recommendations from several detailed studies of the U.S. space program, NASA has increased the level of investment in propulsion technology development. The Civil Space Technology Initiative is developing propulsion technology in support of near-Earth operations. These efforts are focused on both main and booster engines and seek to provide design methods and databases to support future developments of low cost, reliable transportation systems. Program elements include turbomachinery, combustion systems, and condition monitoring and diagnostics, and the design methodology developed at component levels will be verified in large scale systems. The Pathfinder program is developing a suite of technologies to enable a broad range of manned and unmanned missions beyond Earth's orbit. These include both chemical and electric propulsion technologies to support potential missions to the moon and Mars. Author

N89-21031# Lawrence Livermore National Lab., CA.
INITIATIVE FOR THE 21ST CENTURY: ADVANCED SPACE POWER AND PROPULSION BASED ON LASERS
B. G. LOGAN 1 Feb. 1989 25 p Presented at the Initiative for the 21st Century: Advanced Space Power and Propulsion Based on Lasers, Cleveland, OH, 25 Apr. 1988
(Contract W-7405-ENG-48)
(DE89-008034; UCRL-98520; CONF-8804249-1) Avail: NTIS HC A03/MF A01

This paper discusses the use of lasers in spacecraft propulsion systems. Cost, efficiencies and comparisons with other propulsion systems are discussed. DOE

N89-21418# Department of Energy, Washington, DC. Office of Energy Storage and Distribution.
ELECTRIC ENERGY SYSTEMS ENERGY STORAGE
Feb. 1988 303 p
(DE88-007217; DOE/CE-30844/T1) Avail: NTIS HC A14/MF A01

The mission of the Office of Energy Storage and Distribution (OESD) is to lead a national research and development (R and D) effort to provide the basis for a range of technological options in energy storage, control, and delivery. These technology options will find application throughout the nation's electric utility, industrial, commercial, residential, and transportation sectors. Further, these technologies have strong ties to both renewable and conservation options which will play important roles in the future energy profile of the nation. The OESD research and technology development efforts are organized into programs in Electric Energy Systems and Energy Storage. The first two sections introduce the objectives of these two programs followed by project summaries for each program. Each of the two major programs is further organized into four major research areas. Each area is introduced separately and has a table of contents listing each project. Additionally, a section on Research Support and Integration lists and discusses projects necessary for overall support of program activities. Each project or task is presented as a separate entity. The project title is given first in the heading, followed by the name and location of the performing institution, the name(s) of the principal investigator(s), and the project or contract number. The text associated with each entry gives the formal objectives of the project, its current status with respect to those objectives, and relevant publications or sources of additional information. Author

N89-21422# Department of Energy, Washington, DC. Geothermal Technology Div.
GEOTHERMAL ENERGY PROGRAM SUMMARY: VOLUME 1: OVERVIEW FISCAL YEAR 1988
Feb. 1989 27 p
(Contract DE-AC02-83CH-10093)
(DE89-000864; DOE/CH-10093/49) Avail: NTIS HC A03/MF A01

Geothermal energy is a here-and-now technology for use with dry steam resources and high-quality hydrothermal liquids. These resources are supplying about 6 percent of all electricity used in California. However, the competitiveness of power generation using lower quality hydrothermal fluids, geopressured brines, hot dry rock, and magma still depends on the technology improvements sought by the DOE Geothermal Energy R and D Program. The successful outcome of the R and D initiatives will serve to benefit the U.S. public in a number of ways. First, if a substantial portion of our geothermal resources can be used economically, they will add a very large source of secure, indigenous energy to the nation's energy supply. In addition, geothermal plants can be brought on line quickly in case of a national energy emergency. Geothermal energy is also a highly reliable resource, with very high plant availability. For example, new dry steam plants at The Geysers are operable over 99 percent of the time, and the small flash plant in Hawaii, only the second in the United States, has an availability factor of 98 percent. Geothermal plants also offer a viable baseload alternative to fossil and nuclear plants -- they are on line 24 hours a day, unaffected by diurnal or seasonal variations. The hydrothermal power plants with modern emission control technology have proved to have minimal environmental impact. The results to date with geopressured and hot dry rock resources suggest that they, too, can be operated so as to reduce environmental effects to well within the limits of acceptability. Preliminary studies on magma are also encouraging. In summary, the character and potential of geothermal energy, together with the accomplishments of DOE's Geothermal R and D Program, ensure that this huge energy resource will play a major role in future U.S. energy markets. DOE

N89-21545# Essex Corp., Orlando, FL.
EMPIRICAL DEMONSTRATION OF ISOPERFORMANCE METHODOLOGY PREPARATORY OF AN INTERACTIVE EXPERT COMPUTERIZED DECISION AID Final Report, Aug. 1987 - Feb. 1988
ROBERT S. KENNEDY, MARSHALL B. JONES, and DENNIS R. BALTZLEY Nov. 1988 44 p
(Contract MDA903-87-C-0603; DA PROJ. 2Q6-65502-M-770)
(AD-A202439; ARI-RN-88-93) Avail: NTIS HC A03/MF A01 CSCL 23/2

This research note reports on the increasing need within the Department of Defense to improve systems performance through better integration of men and women into military systems. This underlying theme of the Research Note is that once the level of operational performance is settled upon, trade-offs among available resources can and should be made. Formal methodologies are proposed which permit mixtures of training, equipment, and individual differences to be traded off to arrive at a prescribed

level of systems performance. This approach is called isoperformance. GRA

N89-21617# Air War Coll., Maxwell AFB, AL.
SDI (STRATEGIC DEFENSE INITIATIVE) AND NATIONAL SECURITY POLICY
RICHARD W. DAVIS Apr. 1988 109 p
(AD-A202730) Avail: NTIS HC A06/MF A01 CSCL 15/3

The paper attempts to answer the fundamental question of, Can SDI make a significant contribution to U.S. national security. It uses as its evaluation criteria historical arms control measurements of stability, reduction in the probability of war, reduction in the consequences of war, economic benefits, and political benefits. A historical discussion of U.S. nuclear strategy development along with Soviet thinking is provided as a backdrop to set the stage for an analysis of the reasons for President Reagan's March 1983 speech. The objectives of SDI are discussed along with the major concerns expressed by the program critics. Using the evaluation criteria defined above, the author analyzes SDI potential position in a long-term integrated national strategy that includes arms control and competitive strategies. GRA

N89-21619# Arms Control and Disarmament Agency, Washington, DC.
STRATEGIC DEFENSE INITIATIVE: A CHRONOLOGY, 1983 - 1988
1988 10 p
(AD-A203576) Avail: NTIS HC A02/MF A01 CSCL 15/3

Since President Reagan announced his commitment to explore intensively the promise of new technologies for defense against ballistic missile attack, the Strategic Defense Initiative has evolved into a vigorous Research and Development program involving a number of U.S. allies. The objective of SDI is to strengthen U.S. and allied security and enhance long term strategic stability. SDI is an integral part of U.S. and Soviet nuclear arsenals. It also has important potential benefits for spinoffs to other defense programs and for the development of technologies with potentially far reaching applications in the civilian sector. This report provides a chronology which highlights key points in the evolution of U.S. strategic defense policy since March 1983. GRA

N89-21659# Lawrence Livermore National Lab., CA.
FUSION: A NECESSARY COMPONENT OF US ENERGY POLICY
DONALD L. CORRELL, JR. 11 Jan. 1989 24 p Presented at the McGraw-Hill Nuclear Publication's Forum on US Energy Policy and Nuclear Option, Washington, DC, 31 Jan. 1989
(Contract W-7405-ENG-48)
(DE89-006234; UCRL-100194; CONF-890182-1) Avail: NTIS HC A03/MF A01

U.S. energy policy must ensure that its security, its economy, or its world leadership in technology development are not compromised by failure to meet the nation's electrical energy needs. Increased concerns over the greenhouse effect from fossil-fuel combustion mean that U.S. energy policy must consider how electrical energy dependence on oil and coal can be lessened by conservation, renewable energy sources, and advanced energy options (nuclear fission, solar energy, and thermonuclear fusion). In determining how U.S. energy policy is to respond to these issues, it will be necessary to consider what role each of the three advanced energy options might play, and to determine how these options can complement one another. This paper reviews and comments on the principal U.S. studies and legislation that have addressed fusion since 1980, and then suggests a research, development, and demonstration program that is consistent with the conclusions of those prior authorities and that will allow us to determine how fusion technology can fit into a U.S. energy policy that takes a balanced, long term view of U.S. needs. DOE

N89-21670# Universal Energy Systems, Inc., Dayton, OH.
CONTRIBUTIVE RESEARCH IN COMPOUND SEMICONDUCTOR MATERIAL AND RELATED DEVICES Final Technical Report, Oct. 1981 - Sep. 1987
JAMES R. TWIST May 1988 38 p
(Contract F33615-82-C-1716)
(AD-A202586; AFWAL-TR-88-1037) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objective of this program was to provide the Electronic Device Branch (AFWAL/AADR) with the support needed to perform state of the art electronic device research. In the process of managing and performing on the project, UES has provided a wide variety of scientific and engineering talent who worked in-house for the Avionics Laboratory. These personnel worked on many different types of research programs from gas phase microwave driven lasers, CVD and MOCVD of electronic materials to Electronic Device Technology for new devices. The fields of research included MBE and theoretical research in this novel growth technique. Much of the work was slanted towards the rapidly developing technology of GaAs and the general thrust of the research that these tasks started has remained constant. This work was started because the Avionics Laboratory saw a chance to advance the knowledge and level of the current device technology by working in the compounds semiconductor field. UES is pleased to have had the opportunity to perform on this program and is looking forward to future efforts with the Avionics Laboratory. GRA

N89-21696# System Planning Corp., Arlington, VA.
SYSTEMS ENGINEERING AND TECHNICAL ASSISTANCE Final Report, 5 Dec. 1987 - 31 Oct. 1988
RUTH ROSATI Nov. 1988 9 p
(Contract MDA972-88-C-0004; ARPA ORDER 7272)
(AD-A203479; SPC-88-2949) Avail: NTIS HC A02/MF A01 CSCL 05/2

This final technical report on the Systems Engineering and Technical Assistance contract to the Materials Sciences Division of the Defense Sciences Office of DARPA depicts those activities SPC performed to support the statement of work task objectives. Specifically, SPC provided: (1) evaluation support, (2) library support, (3) technical documentation, (4) conference support, (5) engineering analysis services, and (6) management support services. GRA

N89-21697# Air Force Systems Command Liason Office, Ottawa (Ontario).
GUIDE TO CANADIAN AEROSPACE RELATED INDUSTRIES
DONALD J. PEARSON and JOHN R. NILES 1 Aug. 1988 157 p
(AD-A203738; AFSC-TR-88-06) Avail: NTIS HC A08/MF A01 CSCL 01/3

This Guide to Canadian Aerospace Related Industries presents a compilation of descriptive data on 236 companies located in Canada that have expressed interest in doing business with the United States Air Force. This Guide has been prepared with three main objectives in mind: to encourage Air Force Systems Command Project Officers to take advantage of industrial capability of Canada; to engender interest within AFSC for participating in the U.S./Canada Defense Production and Development Sharing Programs, and to encourage Canadian aerospace industry to take a more active role in presenting their capabilities to the USAF. Th companies profiled in this Guide represent a cross-section of Canadian industry and research facilities with capabilities that may be of interest to the USAF research and development and logistics communities. GRA

N89-21761*# National Aeronautics and Space Administration, Washington, DC.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY, FISCAL YEAR 1987
Jan. 1987 143 p
(NASA-TM-89241; NAS 1.15:89241) Avail: NTIS HC A07/MF A01 CSCL 05/4

This publication represents the NASA research and technology program for FY87. It is a compilation of the Summary portions of each of the RTOPs (Research and Technology Objectives and Plans) used for management review and control of research

currently in progress throughout NASA. The RTOP Summary is designed to facilitate communication and coordination among concerned technical personnel in government, in industry, and in universities. The first section containing citations and abstracts of the RTOPs is followed by four indexes: Subject, Technical Monitor, Responsible NASA Organization, and RTOP Number. Author

N89-21812# Federal Aviation Administration, Washington, DC. Office of Airport Planning and Programming.
ELIGIBILITY OF NOISE ABATEMENT PROPOSALS FOR GRANTS-IN-AID UNDER THE AIRPORT IMPROVEMENT PROGRAM
ELLIS OHNSTAD Jan. 1989 26 p
(AD-A204724; DOT/FAA/PP-89/2) Avail: NTIS HC A03/MF A01 CSCL 14/2

This report summarizes the provisions of existing Federal laws, regulations, administrative policies and grant program procedures which relate to funding of noise abatement projects. The report also presents historical data on Federally assisted noise compatibility projects and funding levels in fiscal years 1982 to 1987. A literature search was conducted and parties involved with airport noise compatibility planning and project implementation were consulted to identify proposals which are currently not eligible for grant assistance and the reasons for their ineligibility. The report concludes with recommendations to make eligibility criteria more flexible and to provide clearer guidance to parties involved with noise compatibility project formulation, evaluation and implementation. GRA

N89-21846# Clemson Univ., SC. Dept. of Mechanical Engineering.
RELATIONSHIP OF PROCESSING TO MICROSTRUCTURE AND MECHANICAL PROPERTIES IN METAL MATRIX COMPOSITES Final Report, 1 Nov. 1986 - 31 Oct. 1988
H. J. RACK 1 Dec. 1988 8 p
(Contract AF-AFOSR-0086-87; AF PROJ. 2917)
(AD-A204158; AFOSR-89-0085TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

Historically, research designed to elucidate the fundamental mechanisms controlling the physical and mechanical response of advanced materials, for example, metal and ceramic matrix composites, has been severely hindered by the investigator's inability to procure experimental materials whose prior thermomechanical history is known and well characterized. Conflicting and apparently irreproducible results could, in many instances, have been directly ascribed to a lack of prior processing information. The laboratory facilities established utilizing equipment procured under the subject grant were designed to minimize this obvious shortcoming. In addition, the equipment purchased has been, and continues to be utilized to support a number of research programs of immediate and potential future DOD interest. GRA

N89-22522# Air Force Human Resources Lab., Brooks AFB, TX.
PRIORITIZING RESEARCH AND DEVELOPMENT PROJECTS OF THE AIR FORCE HUMAN RESOURCES LABORATORY Final Technical Paper, Mar. - Sep. 1988
HERBERT J. CLARK and JANOS B. KOPLYAY Feb. 1989 14 p
(AD-A204391; AFHRL-TP-88-51) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study assessed the possibility of obtaining ranking of 12 research and development projects which could be used as reference in allocating resources to those projects. Seven judges ranked the projects on six factors. Interjudge agreement in ranking the projects on an Overall Assessment (OA) factor was sufficiently reliable to indicate that project rankings can be used as a reference in allocating resources. Recommendations include having scientists prepare project descriptions in terms of factors on which the projects are to be ranked; using different rating procedures for new projects than for older projects; ranking projects on an OA factor only; and keeping records of project rankings for several years so that ranking validities can be assessed. GRA

N89-22615# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
VISTING CHINA'S AERODYNAMICS RESEARCH AND DEVELOPMENT CENTER
YONGDAI HU and YAPING LI 5 Jan. 1989 12 p Transl. into ENGLISH from Sichuan Huabao (People's Republic of China), no. 5, Iss. 53, Sep. 1987 p 7-9
(AD-A203980; FTD-ID(RS)T-0639-88) Avail: NTIS HC A03/MF A01 CSCL 14/2

A visit ot the reseach and development facility is detailed. The facility was developed to meet the needs of China's aviation and space industry and it's peoples' economic development. One highlight of the visit was the wind tunnel. Photographs are presented. E.R.

N89-22645# Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.). Main Dept. for Advanced Launcher Systems.
ARIANE 5 TRANSFER VEHICLE (ATV) Final Report
N. DEUTSCHER and C. COUGNET (MATRA Espace, Toulouse, France) Paris, France ESA Jul. 1988 97 p Prepared in cooperation with SAAB-Space AB, Goteborg, Sweden
(Contract ESTEC-7357/87/NL/MA(SC))
(REPT-OX-1-005; ESA-CR(P)-2735; ETN-89-94461) Avail: NTIS HC A05/MF A01

An Ariane Transfer Vehicle (ATV), an unmanned liquid propulsion Ariane 5 upper stage (L5) plus an enhanced Vehicle Equipment Bay (VEB), equipped with all needed subsystems, namely with Rendezvous and Docking (RVD) capability, to perform logistics supply missions to the International Space Station (ISS) is described. The ATV is an L5/VEB derivate and fits into the family of Ariane 5 upper stages. The ATV is a flexible intelligent basis on which to build a logistic vehicle by adaption of payload modules. It is a low-cost vehicle because it reuses to a maximum extent existing hardware and software from other ESA programs like AR5, Hermes and Columbus. Analysis shows the feasibility of the ATV, establishes the requirements, defines the hardware and dynamical configuration and the needed L5/VEB upgrades. A development plan which shows the coherence with the other space programs is given. ESA

N89-22811# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
ASSESSMENT OF EV BATTERIES AND APPLICATION TO R AND D PLANNING
GARY L. HENRIKSEN, PANDIT G. PATIL, ELLIOT Z. RATNER, and CHARLES J. WARDE (Warde Associates, Inc., Greensboro, NC.) 1989 8 p Presented at the Society of Automotive Engineers International Congress and Exposition, Detroit, MI, 27 Feb. 1989
(Contract DE-AC07-76ID-01570)
(DE89-009720; EGG-M-88460; CONF-890240-2) Avail: NTIS HC A02/MF A01

To guide future EV battery R and D programs, the U.S. Department of Energy (DOE) commissioned a comprehensive assessment of secondary battery technologies. A total of 67 battery developers---from the United States, Canada, Europe, Asia, and Africa---were solicited to submit battery design concepts for an Improved Dual-Shaft Electric Propulsion (IDSEP) van. A team of 10 consultants and 7 representatives from DOE laboratories evaluated 42 developer responses and consultant-prepared designs. Using six criteria---five technical/economic criteria and a maturity/technical barriers criterion---the assessment identified 12 most-promising batteries. Employing a generic EV-battery development-system framework, the assessment results are being used to formulate multi-year R and D plans and schedules for the most-promising developmental batteries. DOE

N89-23020# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
SOLAR THERMAL PROGRAM SUMMARY. VOLUME 1: OVERVIEW, FISCAL YEAR 1988
Feb. 1989 22 p

(Contract DE-AC02-83CH-10093)
(DE89-000860; DOE/CH-10093/45-VOL-1) Avail: NTIS HC A03/MF A01

The goal of the solar thermal program is to improve overall solar thermal systems performance and provide cost-effective energy options that are strategically secure and environmentally benign. Major research activities include energy collection technology, energy conversion technology, and systems and applications technology for both CR and DR systems. This research is being conducted through research laboratories in close coordination with the solar thermal industry, utilities companies, and universities. The Solar Thermal Technology Program is pursuing the development of critical components and subsystems for improved energy collection and conversion devices. This development follows two basic paths: for CR systems, critical components include stretched membrane heliostats, direct absorption receivers (DARs), and transport subsystems for molten salt heat transfer fluids. These components offer the potential for a significant reduction in system costs; and for DR systems, critical components include stretched membrane dishes, reflux receivers, and Stirling engines. These components will significantly increase system reliability and efficiency, which will reduce costs. The major thrust of the program is to provide electric power. However, there is an increasing interest in the use of concentrated solar energy for applications such as detoxifying hazardous wastes and developing high-value transportable fuels. These potential uses of highly concentrated solar energy still require additional experiments to prove concept feasibility. The program goal of economically competitive energy reduction from solar thermal systems is being cooperatively addressed by industry and government. DOE

N89-23366# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).
SOURCES OF INFORMATION
B. H. A. ZIJLSTRA *In* AGARD, The Organisation and Functions of Documentation and Information Centres in Defence and Aerospace Environments 14 p Mar. 1989
Copyright Avail: NTIS HC A06/MF A01

The Scientific and Technical Documentation and Information Centre of the Armed Forces (TDCK) publishes monthly abstract bulletins concerning 15 subject areas, each bulletin containing 50 to 100 abstracts of maximum 200 words concerning scientific or technical reports and articles. Details are given about the information sources from which the reports and articles are selected and deals with external on-line or on-disc data bases that are used. The TDCK also publishes the monthly acquisitions list of the Central Military Catalogue (CMC) and coordinates the production of the automated cumulative catalog of books. Details are given about the information sources (books, reference works, and encyclopedia) that are present in major Defense libraries. Attention is given to other information sources such as standards, manuals, loose leaf publications, videotapes, and to information guides and registries. Author

N89-23376# GMD-German National Research Center for Computer Science, Washington, DC.
GERMANY: FOCUS ON SCIENTIFIC AND TECHNICAL INFORMATION, VOLUME 4, NUMBER 1, APRIL 1988
Apr. 1988 16 p
(AD-A204054) Avail: NTIS HC A03/MF A01 CSCL 05/1

The report is a quarterly newsletter edited in Washington, D.C. by the office of the GMD (German National Research Center for Computer Science). Some of the news topics covered include: R&D Programs and Funding; Information Technology - Industrial Outlook for Germany; Telecommunication Issues; Information Technology for Education and Research; News from German Online Vendors; Rewards for Outstanding Achievements in Information and Technology; A Glance at Selected GMD Research Results; International Cooperation. GRA

N89-23380# Los Alamos National Lab., NM.
RELEVANCE OF INTERNATIONAL RESEARCH FACILITIES TO INTERNATIONAL STABILITY
LOUIS ROSEN 20 Mar. 1989 14 p Presented at the 4th European Physical Society Seminar on International Research Facilities, Zagreb, Yugoslavia, 17 Mar. 1989
(Contract W-7405-ENG-36)
(DE89-009400; LA-UR-89-813; CONF-890388-1) Avail: NTIS HC A03/MF A01

International Facilities have played an important play in expanding and keeping open a dialog between east and west. The advent of glasnost has dramatically reduced inhibitions on communications and opened new opportunities for international facilities to facilitate the understanding and appreciation of common goals and common threats. This is accomplished through frank discussions in which real problems are identified and assessed while fictitious ones are laid to rest. DOE

N89-23381# New Mexico Technet, Inc., Albuquerque.
TECHNOLOGY TRANSFER REPORT Final Report
15 Jun. 1988 19 p
(Contract DE-FG04-84AL-26034)
(DE89-009044; DOE/AL-26034/T6) Avail: NTIS HC A03/MF A01

For the past year New Mexico Technet, Inc. (Technet), has been working with the national laboratories, the universities and private industry to develop ways in which Technet can be used to provide and enhance technology transfer. This final report will track our progress toward creating a technology transfer data base, establishing industry-laboratory pilot projects and identifying other types of assistance Technet can provide industry and state government. This report will follow the outline of the Scope of Work set forth in our contract with the Department of Energy. A chronology of progress is included, as well as written documentation of requests Technet has made to the laboratories and meetings Technet staff has held with industries, laboratories and universities. Following our discussion of the work undertaken this year, Technet will provide its conclusions on the strengths and weaknesses of the project, how we feel its mission can be continued, and suggestions the Department of Energy might make to its laboratories in the area of technology transfer through the new tools available in various states, including communications networks and technology foundations, such as Riotech. DOE

N89-23746*# National Academy of Sciences - National Research Council, Washington, DC. Space Applications Board.
NASA SPACE COMMUNICATIONS R AND D (RESEARCH AND DEVELOPMENT): ISSUES, DERIVED BENEFITS, AND FUTURE DIRECTIONS
Feb. 1989 73 p
(Contract NASW-4154)
(NASA-CR-184831; NAS 1.26:184831) Avail: NTIS HC A04/MF A01 CSCL 17/2

Space communication is making immense strides since ECHO was launched in 1962. It was a simple passive reflector of signals that demonstrated the concept. Today, satellites incorporating transponders, sophisticated high-gain antennas, and stabilization systems provide voice, video, and data communications to millions of people nationally and worldwide. Applications of emerging technology, typified by NASA's Advanced Communications Technology Satellite (ACTS) to be launched in 1992, will use newer portions of the frequency spectrum (the Ka-band at 30/20 GHz), along with antennas and signal-processing that could open yet new markets and services. Government programs, directly or indirectly, are responsible for many space communications accomplishments. They are sponsored and funded in part by NASA and the U.S. Department of Defense since the early 1950s. The industry is growing rapidly and is achieving international preeminence under joint private and government sponsorship. Now, however, the U.S. space communications industry - satellite manufacturers and users, launch services providers, and communications services companies - are being forced to adapt to a different environment. International competition is growing, and terrestrial technologies such as fiber optics are claiming markets until recently dominated by satellites. At the same time, advancing technology is opening up opportunities for new

applications and new markets in space exploration, for defense, and for commercial applications of several types. Space communications research, development, and applications (RD and A) programs need to adjust to these realities, be better coordinated and more efficient, and be more closely attuned to commercial markets. The programs must take advantage of RD and A results in other agencies - and in other nations. Author

N89-23879# Department of Energy, Washington, DC.
ELECTRIC AND HYBRID VEHICLES PROGRAM: REPORT TO CONGRESS Annual Report No. 12, fiscal year 1988
Feb. 1989 39 p
(DE89-008988; DOE/CE-0247) Avail: NTIS HC A03/MF A01

This twelfth annual report on the implementation of the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 (Public Law 94-413, as amended by Public Law 95-238, and Public Law 96-185), referred to as the Act, complies with the reporting requirements established in Section 14 of the Act. In addition to informing Congress of the progress and plans of the Department of Energy's Electric and Hybrid Vehicles Program, this report is intended to serve as a communication link between the Department and all of the public and private interests involved in making the program a success. During FY88, significant progress was made toward fulfilling the intent of the Congress in the Act. There has been continuing interest shown by both the automobile manufacturing and supply sectors of our economy in electric and hybrid vehicles. The three major domestic automobile manufacturers are all devoting some effort towards electric vehicles. Their participation includes cost-shared contracts with the Department of Energy and the Electric Power Research Institute as well as independently funded activities. Research and development efforts in batteries and propulsion components continue to achieve significant progress in providing industry with technology options that will result in vehicles that will be more economically competitive and more acceptable. DOE

N89-23893*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE EVOLUTION OF SPACE MECHANISMS IN THE ESA R AND D PROGRAM
D. WYN-ROBERTS *In* NASA, Marshall Space Flight Center, The 23rd Aerospace Mechanisms Symposiums p 1-16 Mar. 1989
Avail: NTIS HC A15/MF A01 CSCL 13/9

The status of recently completed and already ongoing technology developments, as well as some of the most important future developments of the European Space Agency are discussed. Among the subjects considered are Scientific Satellites, Columbus space station development, applications spacecraft for communications, Earth observation and meteorology, and the Ariane V and Hermes space transportation systems. Author

N89-24217# Air Force Office of Scientific Research, Bolling AFB, Washington, DC.
US AIR FORCE RESEARCH TECHNOLOGY AREA PLAN, FY 1989 Final Report
Sep. 1988 109 p
(AD-A205304; AFOSR-89-0262TR) Avail: NTIS HC A06/MF A01 CSCL 05/1

The Research Technology Area Plan (TAP) describes the activities funded under the Defence Research Science Program. Thirteen projects are listed and briefly described. E.R.

N89-24228# Pacific Northwest Lab., Richland, WA.
PUTTING SCIENCE AND TECHNOLOGY TO WORK: A CASEBOOK OF TRANSFERRED TECHNOLOGIES
Oct. 1988 20 p
(Contract DE-AC06-76RL-01830)
(DE89-009158; PNL-SA-16279) Avail: NTIS HC A03/MF A01

New knowledge, processes, and products regularly emerge from federally funded research and development programs such as those at Pacific Northwest Laboratory (PNL). Through technology transfer, PNL shares the benefits of national investments in scientific progress with all segments of society. Technologies and technical capabilities developed for the U.S. Department of Energy and other Federal agencies are then put to work, applied to the needs of business, industry, and state and local government. GRA

N89-24229# Lawrence Livermore National Lab., CA.
ENGINEERING THRUST AREAS, 1989
1989 31 p
(Contract W-7405-ENG-48)
(DE89-009009; UCID-20366-89) Avail: NTIS HC A03/MF A01

The mission of the Engineering Research Program is to develop the tools and technology needed to support current and future Laboratory programs. To accomplish this mission Engineering Research has two important goals - to identify key technology areas important to the Laboratory and to conduct high quality research and development in support of Engineering's and the Laboratory's mission. To help focus our efforts in achieving our goals we identify key technologies called thrust areas and select technical leaders in these technologies to lead each area. The thrust areas are an integrated Engineering activity and, rather than being primarily discipline based, are staffed by the research engineers from EE and ME and from other Laboratory organizations as appropriate. The thrust area leaders are accountable to me for the quality and progress of their research activities but have significant latitude to manage the resources allocated to their thrust area. They are expected to establish strong links to the Laboratory program leaders, to use outside as well as inside experts to review the quality and direction of the research, to use university contacts to supplement and complement their efforts, and to be certain that we are not duplicating the work of others. The thrust area leader is also responsible for carrying out the development work that follows from the Research program so that the results of the research can be applied as early as possible to the needs of the programs. This booklet contains capsule descriptions of the activities of each thrust area and illustrates how thrust area activities and technologies support Laboratory programs. DOE

N89-24341# European Space Agency, Paris (France).
OVERALL COHERENCE OF THE EUROPEAN PROGRAMS WITHIN A LONG-TERM SPACE POLICY
G. VANREETH *In its* International Symposium on Europe in Space: The Manned Space System p 71-73 Oct. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The need for coherence between the elements of ESA's long term space programs is stressed. Economic and technical aspects linked to the development of the in-orbit infrastructure, user programs, and ground elements are mentioned. ESA

N89-24394# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.).
THE MICROGRAVITY USER SUPPORT CENTER (MUSC)
K. WITTMANN, H. P. SCHMIDT, D. PADEKEN, B. HILDMANN, E. BENNETT, and B. FEUERBACHER *In* ESA, International Symposium on Europe in Space: The Manned Space System p 525-530 Oct. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Function and objectives of user support in the ESA Microgravity User Support Center (MUSC) are summarized. The MUSC functions include user information services; ground support; mission support; and scientific support. ESA

N89-24409*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE PATHFINDER CHEMICAL TRANSFER PROPULSION PROGRAM
NED P. HANNUM, FRANK D. BERKOPEC, and ROBERT L. ZURAWSKI (National Aeronautics and Space Administration, Washington, DC.) May 1989 11 p Presented at the JANNAF Propulsion Meeting, Cleveland, OH, 23-25 May 1989

(NASA-TM-102084; E-4847; NAS 1.15:102084) Avail: NTIS HC A03/MF A01 CSCL 13/2

Pathfinder is a research and technology initiative by the National Aeronautics and Space Administration (NASA) intended to strengthen the technology base of the United States civil space program in preparation for future space exploration missions. Pathfinder begins in FY-89. One of the four major thrusts of Pathfinder is Space Transfer technology. A key element of this thrust is the Chemical Transfer Propulsion program which will provide the propulsion technology for high performance, liquid oxygen/liquid hydrogen expander cycle engines which are expected to be operated and maintained in space. These advanced engines will enhance or enable a variety of future space exploration missions. This paper describes the goals and objectives, management, technical plan, and technology transfer for the Chemical Transfer Propulsion element of Pathfinder. Author

N89-24417*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION: A STEP INTO THE FUTURE
ANDREW J. STOFAN 1989 9 p
(NASA-PAM-510/11-87; NAS 1.75:510/11-87) Avail: NTIS HC A02/MF A01 CSCL 22/2

The Space Station is an essential element of NASA's ongoing program to recover from the loss of the Challenger and to regain for the United States its position of leadership in space. The Space Station Program has made substantial progress and some of the major efforts undertaken are discussed briefly. A few of the Space Station policies which have shaped the program are reviewed. NASA is dedicated to building a Station that, in serving science, technology, and commerce assured the United States a future in space as exciting and rewarding as the past. In cooperation with partners in the industry and abroad, the intent is to develop a Space Station that is intellectually productive, technically demanding, and genuinely useful. B.G.

N89-24690# Laboratoire de Meteorologie Dynamique du CNRS, Palaiseau (France).
ON THE FUTURE DEVELOPMENT AND MANAGEMENT OF SPECTROSCOPIC DATABASE FOR RADIATIVE TRANSFER FROM THE ISSUES OF RECENT RELATED WORKSHOPS
N. HUSSON and A. CHEDIN 1988 3 p Presented at the International Radiation Symposium, Lille, France, 18-24 Aug. 1988
(ETN-89-94530) Avail: NTIS HC A02/MF A01

Computer accessible compilations of spectroscopic line parameters, in the infrared to microwave spectral region, are made available in data bases, for molecules of interest in remote sensing or climatic studies. The necessity to create these data bases is summarized as an introduction to future development and management of spectroscopic data bases. ESA

N89-24743# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
PHOTOVOLTAIC ADVANCED RESEARCH AND DEVELOPMENT PROJECT: SOLAR RADIATION RESEARCH Annual Report, 1 Oct. 1987 - 30 Sep. 1988
C. J. RIORDAN, R. L. HULSTROM, T. W. CANNON, T. L. STOFFEL, and D. R. MYERS Feb. 1989 26 p
(Contract DE-AC02-83CH-10093)
(DE89-000884; SERI/PR-215-3445) Avail: NTIS HC A03/MF A01

This report summarizes work performed in FY 1988 by the Solar Energy Research Institute's Resource Assessment and Instrumentation Branch, Solar Electric Research Division, under the Solar Radiation Research Task of the SERI Photovoltaic Advanced Research and Development Project. The objectives of this task are to implement improved solar radiation models and data bases and to develop specialized instrumentation and measurement techniques needed to help develop a technical understanding of the relationships between photovoltaic device performance and variations in outdoor solar radiation. DOE

N89-24745# Pacific Northwest Lab., Richland, WA.
US FUEL CELL RESEARCH AND APPLICATIONS, 1960--1989
B. R. KINZEY and R. K. SEN Apr. 1989 44 p
(Contract DE-AC06-76RL-01830)
(DE89-012244; PNL-6892) Avail: NTIS HC A03/MF A01

This paper provides an overview of the major fuel cell Research and Development (R and D) programs funded by the US government and the private sector, with a particular focus on terrestrial applications. Included in this overview is information on funding levels, project descriptions and goals, and selected accomplishments. Brief assessments as to the proximity of commercialization for each of the primary types of fuel cells are also furnished. DOE

N89-25076*# Research Triangle Inst., Research Triangle Park, NC. Technology Applications Team.
APPLICATIONS OF AEROSPACE TECHNOLOGY Annual Report, 1 Oct. 1986 - 30 Sep. 1987
D. J. ROUSE, J. N. BROWN, JR., JOHN CLELAND, STEPHEN LEHRMAN, LAWRENCE TRACHTMAN, ROBERT WALLACE, DANIEL WINFIELD, NANCY COURT, BERNARD MAGGIN, REED BARNETT et al. 30 Sep. 1987 190 p
(Contract NASW-3841)
(NASA-CR-181536; NAS 1.26:181536; RTI/2736/00-12F) Avail: NTIS HC A09/MF A01 CSCL 22/1

Highlights are presented for the Research Triangle Institute (RTI) Applications Team activities over the past quarter. Progress in fulfilling the requirements of the contract is summarized, along with the status of the eight add-on tasks. New problem statements are presented. Transfer activities for ongoing projects with the NASA Centers are included. B.G.

N89-25109*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
RESEARCH AND TECHNOLOGY, 1988 Annual Report
1988 300 p Original contains color illustrations
(NASA-TM-101246; NAS 1.15:101246) Avail: NTIS HC A13/MF A01 CSCL 05/4

Flight projects and mission definition studies for 1988 are briefly described. Technology research is presented in the following areas: sensors and space technology; space communication systems; system and software engineering; user space data systems; and techniques. Studies are presented for the following space and Earth science areas: atmospheres, SN 1987A, astronomy, high energy astrophysics, land and climate, solar systems, and oceans. B.G.

N89-25112*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LANGLEY AEROSPACE TEST HIGHLIGHTS, 1988
May 1989 166 p
(NASA-TM-101579; NAS 1.15:101579) Avail: NTIS HC A08/MF A01 CSCL 05/4

The role of the Langley Research Center is to perform basic and applied research necessary for the advancement of aeronautics and space flight, to generate new and advanced concepts for the accomplishment of related national goals, and to provide research advice, technological support, and assistance to other NASA installations, other government agencies, and industry. Some of the significant tests which were performed during calendar year 1988 in Langley test facilities, a number of which are unique in the world are highlighted. Both the broad range of the research and technology activities at the Langley Research Center and the contributions of this work toward maintaining United States leadership in aeronautics and space research are illustrated. Author

N89-25247*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION OPERATIONS TASK FORCE. PANEL 4 REPORT: MANAGEMENT INTEGRATION
Dec. 1987 213 p

(NASA-TM-101819; NAS 1.15:101819) Avail: NTIS HC A10/MF A01 CSCL 22/1

The Management Integration Panel of the Space Station Operations Task Force was chartered to provide a structure and ground rules for integrating the efforts of the other three panels and to address a number of cross cutting issues that affect all areas of space station operations. Issues addressed include operations concept implementation, alternatives development and integration process, strategic policy issues and options, and program management emphasis areas. A.D.

N89-25258*# Massachusetts Inst. of Tech., Cambridge.
MIDDECK ACTIVE CONTROL EXPERIMENT (MACE), PHASE A Final Report
EDWARD F. CRAWLEY, JAVIER DELUIS, and DAVID W. MILLER Jun. 1989 194 p
(Contract NAG1-915)
(NASA-CR-185331; NAS 1.26:185331) Avail: NTIS HC A09/MF A01 CSCL 22/2

A rationale to determine which structural experiments are sufficient to verify the design of structures employing Controlled Structures Technology was derived. A survey of proposed NASA missions was undertaken to identify candidate test articles for use in the Middeck Active Control Experiment (MACE). The survey revealed that potential test articles could be classified into one of three roles: development, demonstration, and qualification, depending on the maturity of the technology and the mission the structure must fulfill. A set of criteria was derived that allowed determination of which role a potential test article must fulfill. A review of the capabilities and limitations of the STS middeck was conducted. A reference design for the MACE test article was presented. Computing requirements for running typical closed-loop controllers was determined, and various computer configurations were studied. The various components required to manufacture the structure were identified. A management plan was established for the remainder of the program experiment development, flight and ground systems development, and integration to the carrier. Procedures for configuration control, fiscal control, and safety, reliabilty, and quality assurance were developed. B.G.

N89-25388# Eaton Corp., Southfield, MI.
ADVANCED DUAL-SHAFT ELECTRIC PROPULSION SYSTEM TECHNOLOGY DEVELOPMENT PROGRAM Annual Report No. 4
I. KALNS Oct. 1988 33 p
(Contract DE-AC07-84NV-10366)
(DE89-010008; DOE/NV-10366/6) Avail: NTIS HC A03/MF A01

This fourth annual report of the DSEP program summarizes all program activities from September 1987 through August 1988. These activities comprise: (1) Successful completion of the first test-bed, proof-of-concept vehicle (TB-1) tests, achieving performance comparable to that of IC engine powered vehicles. Results are in good (+ or - 8 percent) agreement with those obtained by EG and G, Idaho in simulated dyno tests. (2) Completion of conversion of the second test-bed, durability test vehicle (NVH), dying tests of its powertrain, vehicle installation of the powertrain, shakedown tests of the complete system, and problems encountered in the process. A revision in DSEP program scope is in process that designates this vehicle as a deliverable to DOE and reduces the extent of its durability testing. (3) Completion of conversion and start of subsystem installation of the third complete vehicle (TB-2) to be constructed on the DSEP program: it is a deliverable to DOE. (4) Battery life test results to date, battery performance in the TB-1 vehicle, and an assessment of battery system status. (5) Analysis of the DSEP vehicle/propulsion system manufacturing cost and life cycle cost, and the start of future planning. (6) Program administration and management. DOE

N89-25509# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
GEOTHERMAL ENERGY PROGRAM SUMMARY. VOLUME 2: RESEARCH SUMMARIES, FISCAL YEAR 1988
Mar. 1989 76 p
(Contract DE-AC02-83CH-10093)
(DE89-000865; DOE/CH-10093/50-VOL-2) Avail: NTIS HC A05/MF A01

The Geothermal Technology Division (GTD) of the U.S. Department of Energy (DOE) is charged with the lead Federal role in the research and development (R and D) of technologies that will assist industry in economically exploiting the nation's vast geothermal resources. The GTD R and D program represents a comprehensive, balanced approach to establishing all forms of geothermal energy as significant contributors to the nation's energy supply. It is structured both to maintain momentum in the growth of the existing hydrothermal industry and to develop long-term options offering the greatest promise for practical applications. The Geothermal Energy Program Summary for Fiscal Year 1988 is a two-volume set designed to be an easily accessible reference to inform the U.S. geothermal industry and other interested parties of the technological advances and progress achieved in the DOE geothermal program as well as to describe the thrust of the current R and D effort and future R and D directions. This volume, Volume 2, contains a detailed compilation of each GTD-funded R and D activity performed by national laboratories or under contract to industrial, academic, and nonprofit research institutions. The Program Summary is intended as an important technology transfer vehicle to assure the wide and timely dissemination of information concerning the department's geothermal research. DOE

N89-25516# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
FOCUSING ON THE FUTURE: SOLAR THERMAL ENERGY SYSTEMS EMERGE AS COMPETITIVE TECHNOLOGIES WITH MAJOR ECONOMIC POTENTIAL
Mar. 1989 16 p
(Contract DE-AC02-83CH-10093)
(DE89-000851; SERI/SP-220-3458) Avail: NTIS HC A03

Hundreds of thousands of U.S. citizens are now receiving a portion of their daily demand for electricity from large-scale solar thermal electric generating stations-power plants that use concentrated solar energy to drive electric power generators. Just as with coal, fuel oil, natural gas, and nuclear energy, concentrated solar energy can create working temperatures of around 600C and much higher. Also, solar power plants contribute almost nothing to the atmospheric greenhouse effect and pose few, if any, of the other environmental problems associated with conventional energy sources. As a result of research and development within the national Solar Thermal Technology Program of the U.S. Department of Energy (DOE), solar thermal energy is on the threshold of competing economically with conventional power plants and is now viable for international markets. Its potential for spurring American economic growth and exports is significant. DOE

N89-25763*# RMS Technologies, Inc., Landover, MD.
MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE'S OPERATIONAL/DEVELOPMENT NETWORK (MODNET) AT GODDARD SPACE FLIGHT CENTER Final Report
31 Oct. 1988 47 p
(Contract NAS5-30168)
(NASA-CR-183426; NAS 1.26:183426; REPT-16) Avail: NTIS HC A03/MF A01 CSCL 05/1

A brief, informal narrative is provided that summarizes the results of all work accomplished during the period of the contract; June 1, 1987 through September 30, 1988; in support of Mission Operations and Data Systems Directorate's Operational Development Network (MODNET). It includes descriptions of work performed in each functional area and recommendations and conclusions based on the experience and results obtained. Author

N89-25765# Oak Ridge National Lab., TN.
SYSTEMS APPROACH TO PROJECT MANAGEMENT
LARRY G. MEDLEY, SR. Feb. 1989 22 p Presented at the 33rd Annual Meeting of the American Association of Cost

Engineers, San Diego, CA, 25 Jun. 1989
(Contract DE-AC05-84OR-21400)
(DE89-008741; CONF-890657-2) Avail: NTIS HC A03/MF A01

In 1979, UCC-ND Engineering management decided to study the overall engineering process in light of new methodologies and management techniques to determine how it could be improved and made more uniform. The system had evolved piecemeal over a period of 36 years. A prime objective was to provide a common framework for understanding the project management process. Systems methodology was chosen as the means for analyzing and integrating a wide variety of activities required for successful project management. This application is very effective and resulted in the creation of a model that serves as the desired framework for understanding project management. Other benefits include improvements to the Engineering Procedures Manual, additional reference material, and enhanced use of a variety of management tools. DOE

N89-25947*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SPACE DIRECTORATE RESEARCH AND TECHNOLOGY ACCOMPLISHMENTS FOR FY 1988
DON E. AVERY, comp. Apr. 1989 162 p
(NASA-TM-101597; NAS 1.15:101597) Avail: NTIS HC A08/MF A01 CSCL 05/4

The major accomplishments and test highlights for FY 1988 that occurred in the Space Dirctorate are given. Accomplishments and test highlights are presented by Division and Branch. The presented information will be useful in program coordination with government organizations, universities, and industry in areas of mutual interest. Author

N89-26050*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MATERIALS DIVISION RESEARCH AND TECHNICAL ACCOMPLISHMENTS FOR FY 1988 AND PLANS FOR FY 1989
KAY L. BRINKLEY Apr. 1989 126 p
(NASA-TM-101593; NAS 1.15:101593) Avail: NTIS HC A07/MF A01 CSCL 11/4

The research program of the Materials Division is presented as FY-88 accomplishments and FY-89 plans. The accomplishments for each Branch are highlighted and plans are outlined. Publications of the Division are included by Branch. This material is useful in program coordination with other government organizations, universities, and industry in areas of mutual interest. Author

N89-26460*# California Inst. of Tech., Pasadena.
SYSTEM ENGINEERING TECHNIQUES FOR ESTABLISHING BALANCED DESIGN AND PERFORMANCE GUIDELINES FOR THE ADVANCED TELEROBOTIC TESTBED
W. F. ZIMMERMAN and J. R. MATIJEVIC *In* Jet Propulsion Lab., California Inst. of Tech., Proceedings of the Workshop on Space Telerobotics, Volume 1 p 67-73 1 Jul. 1987
Avail: NTIS HC A16/MF A01 CSCL 14/2

Novel system engineering techniques have been developed and applied to establishing structured design and performance objectives for the Telerobotics Testbed that reduce technical risk while still allowing the testbed to demonstrate an advancement in state-of-the-art robotic technologies. To estblish the appropriate tradeoff structure and balance of technology performance against technical risk, an analytical data base was developed which drew on: (1) automation/robot-technology availability projections, (2) typical or potential application mission task sets, (3) performance simulations, (4) project schedule constraints, and (5) project funding constraints. Design tradeoffs and configuration/performance iterations were conducted by comparing feasible technology/task set configurations against schedule/budget constraints as well as original program target technology objectives. The final system configuration, task set, and technology set reflected a balanced advancement in state-of-the-art robotic technologies, while meeting programmatic objectives and schedule/cost constraints. Author

N89-26466*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COMMERCIAL USERS PANEL
JOSEPH S. BYRD, CARL FLATAU, DAVID C. HODGE, RALPH HOLLIS, EUGENE F. LEACH, RAY GILBERT, JOHN CLELAND, LARRY LEIFER, JOSEPH NASER (Electric Power Research Inst., Palo Alto, CA.), SAMSON D. SCHMUTER et al. *In* Jet Propulsion Lab., California Inst. of Tech., Proceedings of the Workshop on Space Telerobotics, Volume 1 p 113-123 1 Jul. 1987 Prepared in cooperation with Bureau of Mines, Pittsburgh, PA; Perry Offshore, Riviera Beach, FL; and Ford Motor Co., Detroit, MI
Avail: NTIS HC A16/MF A01 CSCL 05/1

The discussions of motives and requirements for telerobotics application demonstrated that, in many cases, lack of progress was a result not of limited opportunities but of inadequate mechanisms and resources for promoting opportunities. Support for this conclusion came from Telerobotics, Inc., one of the few companies devoted primarily to telerobot systems. They have produced units for such diverse applications as nuclear fusion research, particle accelerators, cryogenics, firefighting, marine biology/undersea systems and nuclear mobile robotics. Mr. Flatau offered evidence that telerobotics research is only rarely supported by the private sector and that it often presents a difficult market. Questions on the mechanisms contained within the NASA technology transfer process for promoting commercial opportunities were fielded by Ray Gilbert and Tom Walters. A few points deserve emphasis: (1) NASA/industry technology transfer occurs in both directions and NASA recognizes the opportunity to learn a great deal from industry in the fields of automation and robotics; (2) promotion of technology transfer projects takes a demand side approach, with requests to industry for specific problem identification. NASA then proposes possible solutions; and (3) comittment ofmotivated and technically qualified people on each end of a technology transfer is essential. Author

N89-26769# Air Force Office of Scientific Research, Bolling AFB, Washington, DC.
RESEARCH PROPOSAL QUARTERLY STATUS REPORT FOR JULY-SEPTEMBER 1988
DEBRA TYRRELL Oct. 1988 67 p
(AD-A206810; AFOSR-89-0390TR) Avail: NTIS HC A04/MF A01 CSCL 05/1

This Research Proposal Status Report is published quarterly as of March, June, September, and December of each year. It lists all the research proposals received by the Air Force Office of Scientific Research (AFOSR) in the six month period prior to the date of this report. Normally, decisions and actions are made within six months after receiving a research proposal. The action taken (i.e. initiated, declined, or withdrawn) will be listed in this report. The report is divided into two parts: Part I is the Institution Index which lists the proposals received, alphabetically by institution. Part II is the AFOSR Directorate Index in which the proposals received are listed alphabetically by Directorate and alphabetically by AFOSR Program Manager within the Directorate. The purpose of the quarterly report is to inform other Government sponsoring agencies of the proposals received by the AFOSR and the action taken on these proposals. GRA

N89-26805*# National Aeronautics and Space Administration, Washington, DC.
ORDERS OF MAGNITUDE: A HISTORY OF THE NACA AND NASA, 1915-1990
ROGER E. BILSTEIN Jul. 1989 171 p ERRATUM: Coauthored by Frank W. Anderson, Jr.
(NASA-SP-4406; NAS 1.21:4406) Avail: NTIS HC A08/MF A01 CSCL 05/4

This edition brings up to date the history of U.S. agencies for space exploration, the NACA and NASA, from 1915 through 1990. Early aviation and aeronautics research are described, with particular emphasis on the impact of the two world wars on aeronautics development and the postwar exploitation of those technologies. The reorganization and expansion of the NACA into NASA is described in detail as well as NASA's relationship with

industry, the university system, and international space agencies such as the ESA. The dramatic space race of the 1950 and 1960s is recounted through a detailed histroy of the Gemini and Apollo programs and followed by a discussion of the many valuable social/scientific application of aeronautics technologies, many of which were realized through the launching of successful satellite projects. The further solar system explorations of the Voyager missions are described, as it the Challenger tragedy and the 1988 return to space of the Shuttle program. Future plans are outlined for a cooperatively funded international space station to foster the ongoing study of space science. Author

N89-26806# Office of the Deputy Under Secretary of Defense for Research and Development (Research and Advanced Technology), Washington, DC.
DEPARTMENT OF DEFENSE STATEMENT ON SCIENCE AND TECHNOLOGY TO THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT OF THE COMMITTEE ON ARMED SERVICES, UNITED STATES HOUSE OF REPRESENTATIVES, 101ST CONGRESS, FIRST SESSION
GEORGE P. MILLBURN 23 Mar. 1989 36 p
(AD-A206584) Avail: NTIS HC A03/MF A01 CSCL 05/1

This statement describes the need for the DoD Science and Technology Program and management aspects such as the balanced technology initiative, the university research initiative, independent research and development, transferring technology to deployed systems, investment strategy and critical technologies. Also covered are the technology programs concerning research, weapons, technology, vehicular mobility technology, electronics technology, environmental and life sciences, support technology, and software and computer technology. GRA

N89-27078# National Inst. of Standards and Technology, Gaithersburg, MD. Center for Electronics and Electrical Engineering.
EMERGING TECHNOLOGIES IN ELECTRONICS AND THEIR MEASUREMENT NEEDS
Mar. 1989 79 p
(PB89-189245; NISTIR-89/4057) Avail: NTIS HC A05/MF A01 CSCL 09/3

Emerging technologies are identified in electronics that the Center for Electronics and Electrical Engineering (CEEE) believes will require increased measurement support from CEEE in coming years. The emerging technologies described here are new to the marketplace or are experiencing major technological advances. The document is designed to stimulate feedback that CEEE needs to refine its plans for developing measurement capability to support emerging electronic technologies that are important to the national interest. GRA

N89-27182# National Inst. of Standards and Technology, Gaithersburg, MD. National Engineering Lab.
INTERACTIONS BETWEEN THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY AND THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS Report, 1982 - 1989
GAIL K. EHRLICH Feb. 1989 32 p
(PB89-172563; NISTIR-89/4038) Avail: NTIS HC A03/MF A01 CSCL 13/2

Examples of interactions between the National Institute of Standards and Technology (NIST) and the American Society of Mechanical Engineers (ASME) over the past several years are highlighted. It is meant to be representative, not all-inclusive. The interactions are organized by discipline in the following categories: conferences, committee memberships and contribution to standards, editors, publications which are designed to disseminate NIST's most recent technical advances and to learn of the technical challenges facing engineers in industry. GRA

N89-27603# Office of Technology Assessment, Washington, DC.
REPORT TO THE CONGRESS Annual Report, Fiscal Year 1988
Mar. 1989 137 p
(PB89-195408; OTA-A-411) Avail: NTIS HC A07/MF A01 CSCL 05/1

(Public Law 92-484) to provide the Congress with the new effective means for securing competent, unbiased information concerning the physical, biological, economic, social and political effects of technological applications. The activities of OTA for the calendar year 1988 are summarized. Included are discussions of its organization and operation, summaries of assessments completed during 1986, descriptions of work in progress, and a list of staff members, advisors, and panel members. A copy of the Technology Assessment Act of 1972 is also included. GRA

N89-27652# Westinghouse Electric Corp., Baltimore, MD.
AVIONIC SYSTEM REQUIREMENTS
HARVEY M. PASKIN *In* AGARD, Systems Engineering 6 p May 1989
Copyright Avail: NTIS HC A07/MF A01

Avionics system requirements are addressed at the conceptual level in light of changing threats, acquisition strategies, technology, and business environments. The objective is to provide a perspective of total integrated avionics system performance which illuminates broad requirement issues rather than specific subsystem specifications. The fundamental tenet is that although parametric and functional avionic system requirements can be related intuitively to mission related activities, a more global view is necessary to ensure that system requirements aptly address the gamut of factors which relentlessly bear on the ultimate system design, development, production, and support. The premise is that avionics requirements are driven by four factors: information and data sources, control opportunities and information needs; concepts and algorithmic techniques; and realization technologies. These four factors are set in a generic systems structure which shows their interrelationships and provides the framework for conceptualizing avionic system solutions to meet particular mission needs. The structure focuses on the role of avionics in providing situation assessment, response selection, response implementation, and communications. With this structures in place, avionic system requirements are then examined within the context of architecture, techniques, technology, producibility, and supportability. Author

N89-27653# British Aircraft Corp., Preston (England).
A STRUCTURED APPROACH TO WEAPON SYSTEM DESIGN
J. D. ROWLEY *In* AGARD, Systems Engineering 7 p May 1989
Copyright Avail: NTIS HC A07/MF A01

A structured approach is described for the design of a weapon system which British Aerospace (BAe) was able to develop and prove during the design of the avionics system for the Experimental Aircraft Program (EAP) demonstrator aircraft. Brief descriptions are given of the EAP avionics system, the main system design tools used, the activities carried out during the systems design process, and the management and control procedures adopted. In addition a series of observations highlighting some of the findings of the project and providing pointers to the design of future weapon systems are given. Author

N89-27656# GEC Avionics Ltd., Rochester (England).
AVIONIC SYSTEM DESIGN METHODOLOGY
M. J. TOOZE *In* AGARD, Systems Engineering 9 p May 1989
Copyright Avail: NTIS HC A07/MF A01

An approach is described for an avionic system design and its application to modular avionic architecture. The approach is to test various candidate architectures using a common functional requirement. The method commences with a requirement analysis carried out in a top-down fashion to arrive at a full functional description. A parallel phase determines the technological base and defines a number of candidate architectures and corresponding component sets (module sets in the case of modular architecture). Thus technological performance and in-place equipment limitations are included at an early stage independent of the requirement. Hence top-down means bottom-up, by taking various architecture candidates and corresponding modular sets and applying the

functional description of the requirement, so each architecture may be investigated for its capability to cope with the trial or application system. Assessment of reliability and performance objectives is discussed. Also included is reference to the areas of operating systems and BITE which may form part of the system but are not necessarily directly represented at the boundaries of the system. The philosophy of the approach is evaluated and does not extend to application of the various CASE design tools which exist (or may be specified) in order to carry out such a project in practice. Author

N89-27687*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NASA IN-HOUSE COMMERCIALLY DEVELOPED SPACE FACILITY (CDSF) STUDY REPORT. VOLUME 1: CONCEPT CONFIGURATION DEFINITION
L. J. DERYDER, H. D. CHIGER, D. D. DERYDER, K. N. DETWEILER, R. L. DUPREE, V. P. GILLESPIE, J. B. HALL, M. L. HECK, D. C. HERRICK, S. J. KATZBERG et al. 28 Apr. 1989 738 p
(NASA-TM-101586-VOL-1; NAS 1.15:101586-VOL-1) Avail: NTIS HC A99/MF E03 CSCL 22/2

The results of a NASA in-house team effort to develop a concept definition for a Commercially Developed Space Facility (CDSF) are presented. Science mission utilization definition scenarios are documented, the conceptual configuration definition system performance parameters qualified, benchmark operational scenarios developed, space shuttle interface descriptions provided, and development schedule activity was assessed with respect to the establishment of a proposed launch date. Author

N89-28023# Illinois Univ., Chicago. Dept. of Mathematics Statistics and Computer Science.
DESIGN OF EXPERIMENTS AND RELIABILITY MODELS Final Report, 1 Aug. 1985 - 31 Oct. 1988
A. S. HEDAYAT and E. EL-NEWEIHI 1 May 1989 51 p
(Contract AF-AFOSR-0320-85; AF PROJ. 2304)
(AD-A209880; AFOSR-89-0772TR) Avail: NTIS HC A04/MF A01 CSCL 14/2

The research in design of experiments included the following areas: (1) efficient designs for experiments involving several factors; (2) efficient designs for repeated measurements models; (3) trade off in designs; (4) flexible orthogonal arrays; (5) efficient designs for comparing test treatments with controls; and (6) designs for collecting data through sampling. The research in reliability was mainly directed to the following areas: multistate reliability models; optimal assembly of coherent systems (both in the binary and multistate cases); redundancy importance and allocation of spares in coherent systems; closure properties of classes of life distributions; and optimal inspection policies. GRA

N89-28099# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
PHOTOVOLTAIC PROGRAM BRANCH ANNUAL REPORT, FY 1988
Mar. 1989 303 p
(Contract DE-AC02-83CH-10093)
(DE89-000898; SERI/PR-211-3483) Avail: NTIS HC A14/MF A01

This report summarizes the progress of the Photovoltaic (PV) Program Branch of the Solar Energy Research Institute (SERI) from October 1, 1987 through September 30, 1988. The branch is responsible for the management of the subcontracted portion of SERI's PV Advanced Research and Development Project. In fiscal year 1988, this included more than 55 subcontracts with a total annualized funding of approximately $13.5 million. Approximately two-thirds of the subcontracts were with universities at a total funding of nearly $4.7 million. The six technical sections of the report cover the main areas of the subcontracted program: the Amorphous Silicon Research Project, Polycrystalline Thin Films, Crystalline Silicon Materials Research, High-Efficiency Concepts, the New Ideas Program, and the University Participation Program. Technical summaries of each of the subcontracted programs provide a discussion of approaches, major accomplishments in FY 1988, and future research directions. DOE

N89-28368# Strategic Defense Initiative Organization, Washington, DC.
THE 1989 REPORT TO THE CONGRESS ON THE STRATEGIC DEFENSE INITIATIVE
13 Mar. 1989 358 p
(PB89-196661) Avail: NTIS HC A16/MF A01 CSCL 12/2

A summary of the Strategic Defense Initiative (SDI) legacy is presented. The best current program for the resolution of remaining technical issues, the validation of technologies, and the demonstration of the ability to integrate them is assessed in detail. The program of research, development and testing would, if adequately funded, support a fully informed decision by the President and Congress in the future on whether to deploy a strategic defense of the United States. Such defenses could enhance deterrence and increase stability. GRA

N89-28534# Army War Coll., Carlisle Barracks, PA.
US ARMY ROLE IN SPACE Study Project
JOSEPH R. NOWLAND 12 Apr. 1989 36 p
(AD-A209178) Avail: NTIS HC A03/MF A01 CSCL 22/1

The future battlefield has been described as non-linear, chaotic, intense and highly lethal. To fight and win in this environment, the Army has developed the AirLand Battle Doctrine, which relies heavily on the fundamental tenets of initiative, agility, depth, and synchronization as it fights the close, deep and rear battle. Our current terrestrial intelligence and communications systems alone do not provide the sufficiency of connectivity, reliability and capacity to meet the demands of this new doctrine. These systems also suffer from electronic jamming, frequency detection and coverage limitations. New battlefield surveillance and communications systems offer increased day/night, all-weather capability to see deep behind enemy lines, but will be limited because of stand-off positioning limitations and air platform flight-time restrictions. Space-based systems cannot totally replace terrestrial and airborne systems but offer enhanced capabilities that provide timely, reliable information in a ready-to-use form necessary to fight the deep-attack doctrine. This paper will review current military uses of space and suggest several roles and missions for the Army in space as it moves into the 21st century and attempts to meet the demands of the AirLand Battle 2004 Doctrine. GRA

N89-28573# Rockwell International Corp., Golden, CO.
A COMPREHENSIVE GUIDE TO THE LITERATURE ON ACOUSTIC EMISSION FROM COMPOSITES, SUPPLEMENT 2
THOMAS F. DROUILLARD 25 Apr. 1989 22 p Presented at the 3rd International Symposium on Acoustic Emission From Reinforced Composites, Paris, France, 17-21 Jul. 1989 Submitted for publication
(Contract DE-AC04-76DP-03533)
(DE89-013524; RFP-4297-SUPP-2; CONF-890789-1-SUPP-2)
Avail: NTIS HC A03/MF A01

Comprehensive bibliographies on the subject of Acoustic Emission (AE) from composites were compiled for the First and Second International Symposiums on Acoustic Emission from Reinforced Composites. The current bibliography is the third in the series. It presents 212 references of new material. The material is presented in the same format as previously used, which consists of a bibliographic section, an author index, and a subject index. Although not all-inclusive, this series of bibliographies presents a compilation of the bulk of world literature published on the subject of acoustic emission from composites. DOE

N89-28922# Analytic Sciences Corp., Reading, MA.
STUDY OF AN ADVANCED CIVIL EARTH REMOTE SENSING SYSTEM: EXECUTIVE SUMMARY
ARTHUR BASS, STEVEN BERNER, ALLEN COBURN, AL. GARGIULO, BRAD MESLIN, MARK ODERMAN, and MARC VAUCHER 12 Aug. 1988 22 p

(Contract MANE-8-4002)
(PB89-163208; TR-5629-1-ES; NOAA-NESDIS-89/01) Avail: NTIS HC A03/MF A01 CSCL 08/2

The present and foreseeable trends in the domestic and international markets for earth remotely sensed data and value-added information products were examined. Other topics studied were 1990's technology projections for spacecraft, sensors, data management, and communications and options for substantial private investment. Two study elements examined were Market Survey and Data Processing Technology. The goal was to evaluate technical, financial and organizational options which could maximize the role of the private sector in all aspects of the development and operation of a Civil Earth Remote Sensing System (CERSS), while progressively minimizing Government support. Author

N89-28947# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
SOLAR THERMAL PROGRAM SUMMARY. VOLUME 2: RESEARCH SUMMARIES, FISCAL YEAR 1988
May 1989 84 p
(Contract DE-AC02-83CH-10093)
(DE89-000861; DOE/CH-10093/46) Avail: NTIS HC A04/MF A01

The Solar Thermal Program Summary for Fiscal Year 1988 is a two-volume reference set describing the technological advances and future research and development (R and D) direction of the Solar Thermal Technology Program. Volume 1 contains capsule descriptions of the various activities undertaken in the year, a brief history of the program, and the significant accomplishments realized. It also describes the management framework for the program and sets forth the FY-88 budget. Volume 2 consists mainly of a compilation of detailed descriptions of the various research and development activities performed by the national laboratories and their subcontractors from industry, academia, and nonprofit research institutions. It also contains a bibliography of the various publications produced under the program in recent years. DOE

N89-28994# World Meteorological Organization, Geneva (Switzerland).
THE WMO LONG-TERM PLAN OVERALL POLICY AND STRATEGY 1988-1997: SECOND WMO LONG-TERM PLAN, PART 1
1987 102 p
(WMO-690-PT-1; ISBN-92-63-10690-8; ETN-89-94929) Copyright Avail: NTIS MF A01; print copy available from World Meteorological Organization, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

The members of the World Meteorological Organization (WMO) define the overall policy and strategy of the organization and outline the main long term objectives of WMO programs for the coming decade, including, world weather watch, world climate, applications of meteorology, hydrology and water resources, education and training, and technical cooperation. ESA

N89-28995# World Meteorological Organization, Geneva (Switzerland).
THE WORLD WEATHER WATCH PROGRAM 1988-1997: SECOND WMO LONG-TERM PLAN, PART 2, VOLUME 1
1987 240 p
(WMO-691-PT-2-VOL-1; ISBN-92-63-10691-6; ETN-89-94930) Copyright Avail: NTIS MF A01; print copy available from World Meteorological Organization, Case Postale No.5, CH-1211 Geneva 20, Switzerland

The members of the World Meteorological Organization (WMO) define the overall policy and strategy of the organization and outline the main long term objectives of WMO programs for the coming decade. Details of the world weather watch program are given, including descriptions of the global data processing system, the global observing system, the global telecommunication system, data management, support activities, and coordination. ESA

N89-28996# World Meteorological Organization, Geneva (Switzerland).
THE WORLD CLIMATE PROGRAM 1988-1997: SECOND WMO LONG-TERM PLAN, PART 2, VOLUME 2
1987 83 p
(WMO-692-PT-2-VOL-2; ISBN-92-63-10692-4; ETN-89-94931) Copyright Avail: NTIS MF A01; print copy available from World Meteorological Organization, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

The members of the World Meteorological Organization (WMO) define the overall policy and strategy of the organization and outline the main long term objectives of WMO programs for the coming decade. Details of the world climate program are given, including descriptions of the objectives, the climate applications program, the climate impact studies program and the world climate research program. ESA

N89-28997# World Meteorological Organization, Geneva (Switzerland).
THE WMO RESEARCH AND DEVELOPMENT PROGRAM 1988-1997: SECOND WMO LONG-TERM PLAN, PART 2, VOLUME 3
1987 51 p
(WMO-693-PT-2-VOL-3; ISBN-92-63-10693-2; ETN-89-94932) Copyright Avail: NTIS MF A01; print copy available from World Meteorological Organization, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

The member of the World Meteorological Organization (WMO) define the overall policy and strategy of the organization and outline the main long term objectives of WMO programs for the coming decade. Details of research and development program are given, including descriptions of specific programs on weather prediction research, long range forecasting, tropical meteorology research, environmental pollution and cloud physics. ESA

N89-28998# World Meteorological Organization, Geneva (Switzerland).
THE WMO APPLICATIONS OF METEOROLOGY PROGRAM 1988-1997: SECOND WMO LONG-TERM PLAN, PART 2, VOLUME 4
1987 115 p
(WMO-694-PT-2-VOL-4; ISBN-92-63-10694-0; ETN-89-94933) Copyright Avail: NTIS MF A01; print copy available from World Meteorological Organization, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

The members of the World Meteorological Organization (WMO) define the overall policy and strategy of the organization and outline the main long term objectives of WMO programs for the coming decade. The detailed plans for applications of meteorology programs are presented, including the agricultural meteorology program, the aeronautical program, and the marine meteorology and associated oceanographic programs. ESA

N89-29274# Army War Coll., Carlisle Barracks, PA.
INTERNATIONAL TECHNOLOGY TRANSFER AS PRACTICED BY THE U.S.S.R.: IMPLICATIONS FOR US NATIONAL SECURITY
MARVIN D. REDD, SR. 12 Feb. 1989 28 p
(AD-A208010) Avail: NTIS HC A03/MF A01 CSCL 05/1

In its broadest sense, technology transfer encompasses the collection, documentation and dissemination of scientific and technical information, including data on the performance and costs of using the technology; the transformation of research and technology into processes, products, and services that can be applied to public or private needs; and the secondary application of research or technology developed for a particular mission that fills a need in another environment. The above perspective of technology transfer is a benign one; one which takes place among and between amicable and cooperating sociopolitical, cultural and/or national friends. The following paper examines the more notorious side of the technology transfer issue, with especial emphasis on its practice by the Soviet Union, who through copying, espionage, and blatant thievery, sooner or later acquire western

technology for themselves and Warsaw Pact nations. Forms of technology transfer are scrutinized through the use of several case studies and finally the efforts used by the U.S. at deterring this leaching away of one of the bulwarks of western-nation national security are surveyed. GRA

N89-29487# NSI Technology Services Corp., Dayton, OH.
CONFERENCE ON OCCUPATIONAL HEALTH ASPECTS OF ADVANCED COMPOSITE TECHNOLOGY IN THE AEROSPACE INDUSTRY. VOLUME 2: PROCEEDINGS
Mar. 1989 408 p Conference held in Dayton, OH, 6-9 Feb. 1989
(Contract F33615-85-C-0532)
(AD-A209026; AAMRL-TR-89-008-VOL-2) Avail: NTIS HC A18/MF A01 CSCL 11/4

The U.S. Air Force sponsored a national conference on the Occupational Health Aspects of Advanced Composite Materials in the Aerospace Industry. The conference was developed in cooperation with the Suppliers of Advanced Composite Materials Association (SACMA) and the Aerospace Industries Association (AIA). It was attended by over 230 representatives from the Department of Defense and the Service Components, industry, labor, and other Federal agencies. The goals of the conference were to promote technology transfer and to provide a forum for discussion to determine: what is known and, possibly more importantly, what is not known about the health effects of composites; availability and effectiveness of current controls in preventing worker illness; the need for epidemiologic studies on the health effects of composite materials; and the availability of health information to the worker in the form of training and hazard communication. The overall conclusion is that while there are some health problems associated with the use of these materials, the problems are neither unique to these materials nor the aerospace industry, and the problems are solvable with current technology. The report on the conference is provided in two volumes. Volume 2 presents the proceedings which provides the full text of the presentations. GRA

N89-29603# European Space Agency, Paris (France).
THE OLYMPUS UTILIZATION PROGRAM
PIERRE BARTHOLOME *In its* Olympus Utilization Conference p xxxxi-xxxxii May 1989
Copyright Avail: NTIS HC A23/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Guidelines to improve the coordination of experimentation, television broadcasting and data transmission of the Olympus satellite are outlined. Availability of the satellite to different user groups is explained. Problems concerning the need for standardization in broadcasting and conditional access are addressed. ESA

N89-30019# Department of National Education, Pretoria (South Africa). Chief Directorate Science Planning.
NATIONAL REGISTER OF RESEARCH PROJECTS, 1986/87. PART 4: HUMAN SCIENCES. ECONOMIC, POLITICAL, LANGUAGE, ART AND OTHER SCIENCES
Aug. 1988 129 p In AFRIKAANS and ENGLISH
(DE89-015035; DNE-9015035-PT-4) Avail: NTIS (US Sales Only) HC A07/MF A01

This Register is intended to serve as a source of information on research which is being conducted in all fields (both natural and human sciences) in the Republic of South Africa. New and current research projects that were commenced or modified during 1986 and 1987, on which information was received by the compilers until January 1988, are included, with the exception of confidential projects. Project titles and keywords are presented in the language as supplied, and the classifications are based on those provided by the primary sources. DOE

N89-30122# Department of Defense, Washington, DC.
DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR). VOLUME 1: ARMY ABSTRACTS OF PHASE 1 AWARDS FROM FY 1988 SBIR SOLICITATION
May 1989 137 p
(AD-A210041) Avail: NTIS HC A07/MF A01 CSCL 05/1

On September 1, 1988 Secretary of Defense Frank C. Carlucci announced the selection of small business firms proposals under Phase 1 of the fiscal year (FY) 1988 Department of Defense (DOD) Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations. The selection of proposals for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) in response to the FY 1988 solicitation distributed on October 1, 1987 with a closing date of January 8, 1988. In order to make information available on the technical content of the Phase 1 projects supported by the Department of Defense SBIR Program, this report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards. This is Volume 1 which contains abstracts and contacts for the 214 Phase 1 projects funded by the Army from the FY 1988 SBIR solicitation. GRA

N89-30123# Department of Defense, Washington, DC.
DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR). VOLUME 2: NAVY ABSTRACTS OF PHASE 1 AWARDS FROM FY 1988 SBIR SOLICITATION
May 1989 175 p
(AD-A210042) Avail: NTIS HC A08/MF A01 CSCL 05/1

On September 1, 1988 Secretary of Defense Frank C. Carlucci announced the selection of small business firms proposals under Phase 1 of the fiscal year (FY) 1988 Department of Defense (DOD) Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations. The selection of proposals for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) in response to the FY 1988 solicitation distributed on October 1, 1987 with a closing date of January 8, 1988. In order to make information available on the technical content of the Phase 1 projects supported by the Department of Defense SBIR Program, this report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards. This is Volume 2 which contains abstracts and contacts for the 249 Phase 1 projects funded by the Navy from the FY 1988 SBIR solicitation. GRA

N89-30124# Department of Defense, Washington, DC.
DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR). VOLUME 3: AIR FORCE ABSTRACTS OF PHASE 1 AWARDS FROM FY 1988 SBIR SOLICITATION
May 1989 340 p
(AD-A210043) Avail: NTIS HC A15/MF A01 CSCL 05/1

On September 1, 1988 Secretary of Defense Frank C. Carlucci announced the selection of small business firms proposals under Phase 1 of the fiscal year (FY) 1988 Department of Defense (DOD) Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations. The selection of proposal for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO), in response to the FY 1988 solicitation distributed in October 1, 1987 with a closing date of January 8, 1988. In order to make information available on the technical content of the Phase 1 projects supported by the Department of Defense SBIR Program, this Report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards. This is Volume 3 which contains abstracts and contacts for the 375 Phase 1 projects funded by the Air Force from the FY 1988 SBIR solicitation. GRA

N89-30125# Department of Defense, Washington, DC.
DEFENSE SMALL BUSINESS INNOVATION RESEARCH PROGRAM (SBIR). VOLUME 4: DEFENSE AGENCIES ABSTRACTS OF PHASE 1 AWARDS FROM FY 1988 SBIR SOLICITATION
May 1989 255 p
(AD-A210044) Avail: NTIS HC A12/MF A01 CSCL 05/1

On September 1, 1988 Secretary of Defense Frank C. Carlucci announced the selection of small business firms proposals under Phase 1 of the fiscal year (FY) 1988 Department of Defense (DOD) Small Business Innovation Research (SBIR) Program to be funded upon successful completion of contract negotiations. The selection of proposals for funding was made from proposals received by the Military Departments, the Defense Advanced Research Projects Agency (DARPA), the Defense Nuclear Agency (DNA), and the Strategic Defense Initiative Organization (SDIO) in response to the FY 1988 solicitation distributed on October 1, 1987 with a closing date of January 8, 1988. In order to make information available on the technical content of the Phase 1 projects supported by the Department of Defense SBIR Program, this report presents, in four volumes, the abstracts of those proposals which have resulted in contract awards. This is Volume 4 which contains abstracts and contacts for the 218 Phase 1 projects funded by the three participating Defense Agencies (61 DARPA projects, 19 DNA projects and 138 SDIO projects). GRA

N89-30138# Gas Research Inst., Chicago, IL.
PUTTING R AND D (RESEARCH AND DEVELOPMENT) RESULTS TO WORK: THE ROLE OF TECHNOLOGY TRANSFER Annual Report
MARY D. FARRELL Mar. 1989 48 p Presented at the 9th Annual GRI Energy Seminar, Hilton Head, SC, 8-10 Aug. 1988
(PB89-204580; GRI-88/0363) Avail: NTIS HC A03/MF A01 CSCL 05/1

The seminar focused on the ways in which the products of successful R and D make it to the marketplace, including discussion of how Gas Research Institute (GRI) accomplishes this transfer of technology in an environment of increasing competition among energy forms and services. The formal presentations outlined GRI's approach and experience, the challenges of technology transfer arising from market factors and policy constraints, and the experience of other organizations. Seminar participants agreed on the continued need for a robust technology transfer process at GRI that includes early commitment and participation from a commercializing partner. Gas industry involvement in the form of project participation or strategic alliances to further the development and market introduction of a new product is also needed. Participants suggested that GRI look at ways to provide more flexibility in project planning and execution to allow for scientific invention and innovation along the development path as well as to tailor the end product to ensure commercializing partners, product advocates, and marketplace acceptance. Author

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ECONOMICS, COSTS AND MARKETS

Includes Costs and Cost Analysis, Cost Control and Cost Effectiveness, Productivity and Efficiency, Economics and Trade, Financial Management and Finance, Investments, Value and Risk (Monetary), Budgets and Budgeting, Marketing and Market Research, Consumerism, Purchasing, Sales, Commercialization, Competition, Accounting.

A89-11560
NASA, PENTAGON URGED TO FOCUS ON CUTTING LAUNCH OPERATION COSTS
MICHAEL MECHAM Aviation Week and Space Technology (ISSN 0005-2175), vol. 129, Oct. 3, 1988, p. 39, 41, 44.
Copyright

According to a study by the congressional Office of Technology Assessment (OTA), the U.S. should be more concerned with launch and mission operation costs if it wants to reduce the overall costs of space transportation. The OTA study suggests that inserting the Shuttle-C into the Shuttle processing flow could increase the costs for launching the orbiter because of the risk of slipping Shuttle-C schedules. According to the OTA, system reliability is a significant factor in operation costs because the cost of a payload may be worth eight times the cost of launch services. K.K.

A89-12322* National Aeronautics and Space Administration, Washington, DC.
THE WINNING EDGE
CECIL C. ROSEN, III and LOUIS J. WILLIAMS (NASA, Washington, DC) SAE, Aerospace Vehicle Conference, Annapolis, MD, Apr. 18-20, 1988. 13 p.
(SAE PAPER 880945) Copyright

Aeronautics research at NASA is reviewed, stressing NASA's leading role in the development of technological advances. The Aircraft Energy Efficiency program for improving transport aircraft and the Natioanl Aerospace Plane program are examined. NASA research facilities and wind tunnels, and research in materials and structures and aviation safety and automation are discussed. R.B.

A89-13418
COST MODELLING FOR SPACE PROGRAMMES - THE COLUMBUS POLAR PLATFORM
H. C. LEESON (Logica Space and Defence Systems, Ltd., London, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 41, Oct. 1988, p. 477-482.
Copyright

As the cost of space projects continues to increase, a need has developed to examine proposed programs from a more critical economic stance. Late in 1987 the design and operational strategy of the polar platform element of the Columbus program was changed in response to a variety of technical, political and economic factors. One of a variety of sources of information which contributed to this change was a parametric life-cycle cost analysis carried out by a consortium of British companies, led by Logica of BNSC. This paper describes the stages through which the study progressed, from an initial definition of the baseline platform, through to a final analysis of the life-cycle cost trade-off between the different options under consideration. Author

A89-13597#
THE DESIGNER'S IMPACT ON COMMERCIAL AIRCRAFT ECONOMICS
A. L. JACOBSON and D. G. MURPHY (Douglas Aircraft Co., Long Beach, CA) IN: ICAS, Congress, 16th, Jerusalem, Israel, Aug. 28-Sept. 2, 1988, Proceedings. Volume 2. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 946-952.
Copyright

The engineer/designer has a powerful influence not only on the technical quality of the design but also on its economic feasibility. A commercial aircraft program involves the expenditure of large resources and produces an aircraft that must be price competitive and meet airline requirements. The designer uses trade studies and preliminary cost analyses to ensure that the selected design will be the best practical compromise between product quality, production costs, and operating costs. Author

A89-17858#
SPACE SYSTEMS AND THEIR RUNNING COSTS
J. MAJUS, P. KLEBER, R. SCHMID (DFVLR, Cologne, Federal Republic of Germany), and G. P. SEIDEL (MST, Munich, Federal Republic of Germany) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 13 p.
(Contract BMFT-01-QV-8798)
(IAF PAPER 88-571) Copyright

The follow-on (running) costs of a variety of space systems are studied and an approach for determining cost elements is

developed. The defined cost breakdown structure is used to calculate corresponding cost figures for space systems including satellites, the Space Station, and the Space Shuttle. The figures are compared to the follow-on costs of a commercial airline, an experimental airplane, and a steel plant. It is found that the follow-on cost ratios for the airline and the industrial plant are about one order of magnitude higher than those of the space systems. It is suggested that the follow-on costs for space systems are typical for research projects. R.B.

A89-17859*# NASA Space Station Program Office, Reston, VA.
SPACE STATION FREEDOM OPERATIONS COSTS
ANNE L. ACCOLA and GREGORY J. WILLIAMS (NASA, Space Station Freedom Program Office, Reston, VA) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 7 p.
(IAF PAPER 88-572) Copyright

Measures to reduce the operation costs of the Space Station which can be implemented in the design and development stages are discussed. Operational functions are described in the context of an overall operations concept. The provisions for operations cost responsibilities among the partners in the Space Station program are presented. Cost estimating methodologies and the way in which operations costs affect the design and development process are examined. R.B.

A89-19384
THE NASA PROGRAMME IN THE 1990S AND BEYOND
Space Policy (ISSN 0265-9646), vol. 4, Nov. 1988, p. 273-280.
Copyright

Economic aspects of NASA program planning are discussed, summarizing a report published by the Congressional Budget Office in May 1988. The presently proposed core program (with the Space Station as the main project and the Space Shuttle as the main STS) is shown to represent a middle path between expansive planning with significantly increased budgets (including a lunar base or manned mission to Mars by around the year 2000) and zero budget growth (forcing delay of the Space Station and more unmanned missions). Core-program funding would increase gradually, from $9 billion in 1988 to $14.4 billion (1988 dollars) in 1993 and $16.4 billion in 2000. The breakdown of expenditures in these three plans is explored in detail; the implications for U.S. space leadership are examined; and the effects of increased space commercialization are considered. T.K.

A89-20103*# National Aeronautics and Space Administration, Washington, DC.
COMMERCIALIZATION OF SPACE
JAMES T. ROSE and BARBARA A. STONE (NASA, Washington, DC) IN: EASCON '88; Proceedings of the Twenty-first Annual Electronics and Aerospace Conference, Arlington, VA, Nov. 9-11, 1988. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 11-15.

Space-commercialization activities are grouped into five categories: private sector development from existing technology for private sector use; pure privatization; private sector development for U.S. government use; private sector development from novel technology for private sector use; and, finally, full commercialization. The commercialization of space categories is defined, and the key issues in each are highlighted. A description of key NASA actions is included for each category. It is concluded that NASA and other government agency involvement is a common thread across the spectrum of space commercialization activities. I.E.

A89-21399
SMALL SPACE SERVICE FIRMS DO WELL BUT LARGE VENTURES FIND TOUGH GOING
THERESA M. FOLEY Aviation Week and Space Technology (ISSN 0005-2175), vol. 129, Dec. 19, 1988, p. 64, 65, 67.
Copyright

The space service industry is examined, focusing on two private platform companies and several small space service businesses. The economic issues related to the development of the Industrial Space Facility and the Spacehab pressurized modules, such as the problems of obtaining government contracts and international competition, are discussed. Smaller space service business are considered, including a payload processing facility, a company providing service and equipment to microgravity researchers, and businesses which lease space-based equipment. It is suggested that large space service firms cannot succeed without extensive government backing. R.B.

A89-22892
DOMESTIC AND REGIONAL SYSTEMS - CAN THEY EARN THEIR KEEP?
CHRIS BULLOCH Space Markets (ISSN 0258-4212), Winter 1988, p. 184, 187-191.
Copyright

Domestic and regional satellite communications systems are discussed. The benefits of domestic and regional systems are compared. The economic, technological, and policy considerations involved with developing a system are examined. The Intelsat system is described in detail, including the system's domestic service capability. The capabilities, technological specifications, coverage, and operation of specific regional and domestic systems are presented. R.B.

A89-23250
SOCIOECONOMIC BENEFITS CONNECTED WITH THE USE OF SPACE POWER AND ENERGY SYSTEMS
S. A. SARKISIAN, S. S. KORUNOV, I. A. STAROSTIN, A. G. GUROV, M. A. KARIMULAEV (AN SSSR, Sovet Interkosmos, Moscow, USSR) et al. Space Technology - Industrial and Commercial Applications (ISSN 0892-9270), vol. 8, no. 4, 1988, p. 351-363.
Copyright

Prospects for future developments in space technology are examined, focusing on the socioeconomic benefits of developing space energy systems. The development of space energy technology is discussed. Future energy consumption requirements are estimated. Space technologies to meet those requirements and the possible effects of space energy technology on the global economy are considered. R.B.

A89-23262
GERMANY INVESTS IN SPACE
PETER DONALDSON Space (ISSN 0267-954X), vol. 4, May-June 1988, p. 14-17.
Copyright

An evaluation is made of West Germany's contributions to ESA's space activities through the DFVLR, with a view to the anticipated technology-development and economic consequences of these efforts. Major DFVLR programs currently underway encompass the Saenger two-stage-to-orbit airbreathing launch vehicle (which is in competition with Britain's HOTOL), the Space Pallet Satellite multirole space platform, which can be deployed and retrieved by the Space Shuttle's Remote Manipulator System, and the Instrument Pointing System for the Space Shuttle. O.C.

A89-29150
ECONOMICS AND TECHNOLOGY IN U.S. SPACE POLICY
MOLLY K. MACAULEY, ED. (Resources for the Future, Inc., Washington, DC) Washington, DC, Resources for the Future, Inc., 1987, 282 p. No individual items are abstracted in this volume.
Copyright

Various papers on economics and technology in U.S. space policy are presented. Individual topics addressed include: the contribution of a partnership between economics and technology; technology, economics, and international cooperation in earth observations; perspectives on materials processing in space; space transportation; challenges ahead for the communications satellite industry; a manufacturer's view of commercial activity in space; insurance, risk sharing, and incentives for commercial use of space. Also considered are: the government's role in the commercialization of new technology; the economics of the Space Station; changes

and challenges in the global context; commercial policies and international competition in space transportation policy; natural monopoly in commercial satellite systems; and the need for rational analysis in the U.S. space program. C.D.

A89-33775* Resources for the Future, Inc., Washington, DC.
LAUNCH VOUCHERS FOR SPACE SCIENCE RESEARCH
MOLLY K. MACAULEY (Resources for the Future, Inc., Washington, DC) Research supported by NASA. Washington, DC, Resources for the Future, Inc., 1989, 54 p. refs
Copyright
Recent national space policy proposes the use of space transportation vouchers to increase opportunities for space-based science research and to support the U.S. space transportation industry. Vouchers issued and financially backed by the government would be given to researchers for redemption on any mode of space transportation. This paper examines the economic costs and benefits of vouchers; incentive-based strategies for effective program design; and areas where the voucher scheme is weak. It is concluded that, under plausible assumptions, vouchers may well be a cost-effective way to achieve near-term space transportation for space research payloads. B.J.

A89-34390
REMOTELY INCENSED - THE SEARCH FOR PROFITS
CHARLIE KNOX Ad Astra (ISSN 1041-102X), vol. 1, April 1989, p. 22-24, 26-28.
Copyright
The privatization of Landsat is discussed. The market for Landsat data, international competition in the field of remote sensing, and the status of Eosat are considered. The role of Landsat in the United Nation's 'open skies' policy is examined. The satellites in the Landsat system are described and compared with SPOT satellites. Problems associated with efforts to commercialize space-based industries are examined. R.B.

A89-34703
LANDSAT COMMERCIALIZATION - KEYS TO FUTURE SUCCESS
C. P. WILLIAMS (Earth Observation Satellite Co., Lanham, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 10, Feb. 1989, p. 265-274.
Copyright
The lessons learned over the first thirty-six months of commercialization effort on the Landsat program by Eosat have dictated a change in marketing philosophy and a dramatic rethinking of the strategies necessary to produce an economically viable commercial program. This paper presents EOSAT's philosophy and approach to the commercialization of satellite remote sensing. Author

A89-34705
SATELLITE REMOTE SENSING MARKET DEVELOPMENT - AN ALTERNATIVE SCENARIO
G. K. C. PARDOE and L. P. WHITE (General Technology Systems, Ltd., Brentford, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 10, Feb. 1989, p. 295-299.
Copyright
The establishment of fully commercial satellite remote-sensing data services does not look promising with the present very costly satellite programms attempting to provide data to a very wide range of disparate users. An alternative approach using low rate reception stations and limited capability satellites, individually targeted at a specific and limited range of customers, is technically viable at significantly lower development and implementation costs. The much smaller investment needed, with returns from user systems as well as from data sales, would make the prospect much more attractive to private investment. Author

A89-34710
COMMERCIALIZATION OF REMOTE SENSING FROM THE EURIMAGE VIEW
D. P. S. WILSON (Eurimage, Hemel Hempstead, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 10, Feb. 1989, p. 351-357.
Copyright
Eurimage, under contract to the ESA, distributes and markets Landsat data acquired at Kiruna, Fucino, and Maspalomas. The commercial aspects of such a business are very new and Eurimage faces a challenging and exciting future. This article describes a brief history of the commercialization of remote sensing data and discusses both the present operations and future plans of Eurimage. Author

A89-36035
LUNAR PROSPECTING
WILLIAM FARRAND Ad Astra (ISSN 1041-102X), vol. 1, Feb. 1989, p. 8-12.
Copyright
Missions to study the possible utilization of lunar resources are discussed. Plans for the Lunar Observer mission are described. Results are presented from a review of the feasibility of a low-cost lunar polar mission. Consideration is given to several proposals, including the Lunar Get Away Special, the Lunar Prospector, and the Japanese Muses-A mission. R.B.

A89-43638
MARS ON $800,000 A DAY
KELLY PARKS and BEVIN MCKINNEY (American Rocket Co., Camarillo, CA) Space Power (ISSN 0951-5089), vol. 7, no. 3-4, 1988, p. 327-344. refs
Copyright
Manned Mars missions are expected to cost $100 billion or more. It will be shown that, with the proper exploration strategy, not only can this cost be brought down by nearly two orders of magnitude, such that the mission could be financed by private investors, but also that a substantial profit could be made. Author

A89-43822
THE ADVENT OF COMMERCIAL SPACE - COMMENTS ON A JOINT VENTURE AGREEMENT
WILLIAM B. WIRIN (Space Commerce Corp., Houston, TX) Journal of Space Law, vol. 17, no. 1, 1989, p. 61-66.
Copyright
The joint agreement between the Soviet civil space agency, GLAVCOSMOS, and the Space Commerce Corporation (SCC) is discussed. The SCC is to market Soviet space goods and services. The capabilities of the Soviet space program are described. The proposed marketing activities of the SCC include: remote sensing, communications, material processing and scientific research, launch services, tours of Soviet space facilities, and the sale of Soviet space program memorabilia. I.F.

A89-43877
THE ART OF PINPOINTING - THE ROLE OF SATELLITES, AND INMARSAT IN NAVIGATION
JOHN DAVIDSON (International Maritime Satellite Organization, London, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 42, June 1989, p. 285-289.
Copyright
The navigation and position determination applications of satellites are discussed, focusing on the role of Inmarsat. The development of the GPS and Glonass global satellite navigation systems is considered. The operational, technical, and economic characteristics of passive, active, and hybrid radiodetermination systems are described. In addition, the development of an international civilian communication, navigation, and surveillance system and the market for satellite navigation services are considered. R.B.

A89-43879
THE INMARSAT MOBILE SATELLITE SYSTEM - AN ECONOMIC PERSPECTIVE
EUGENE STAFFA (International Maritime Satellite Organization,

London, England) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 42, June 1989, p. 297-302.
Copyright

The economic aspects of the Inmarsat satellite system are examined. The stucture of the Inmarsat system is reviewed and the financial structure of the Inmarsat organization is described. The percentage of investment by various nations in the organization and the location of the Inmarsat coast earth stations are listed. The resource costs of providing the mobile satellite service, the services offered by the system, and the market for Inmarsat services are discussed. R.B.

A89-45789* NASA Space Station Program Office, Reston, VA.
SPACE STATION - NEW VENTURE/OLD PROBLEM
JOHN T. COX (NASA, Program Utilization and Operations Group, Reston, VA) IN: Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. New York, American Society of Civil Engineers, 1988, p. 783-786.
Copyright

Four key operations-related costs are associated with the Space Station: (1) transportation, (2) data management, (3) sustaining enginenering, and (4) integrated logistics. Life cycle cost principles will be utilized by the Space Station Program to assess operating costs associated with any particular design 'improvement' opportunity. Author

A89-48430#
NOVOVIEW LCV - BALANCING PERFORMANCE AND COST FOR A 'LOW COST' VISUAL SYSTEM
JAMES L. DAVIS (Rediffusion Simulation, Ltd., Crawley, England) IN: AIAA Flight Simulation Technologies Conference and Exhibit, Boston, MA, Aug. 14-16, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 416-421.
(AIAA PAPER 89-3321) Copyright

The paper describes Novoview LCV, which is a complete visual system package comprised of a computer image generator, generic data base, one of several standardized displays, a visual control console, installation and integration support, and overall product support. It was found that the key to cost reduction lay in: (1) reducing performance to reduce cost, (2) using standardization to reduce nonrecurring costs, and (3) maintaining system flexibility to ensure economies of scale through broad applicability to a large user population. K.K.

A89-48727
SOME ASPECTS OF LCC REDUCTION FOR IN-ORBIT EXPERIMENTS
K. LOHMANN, S. HOLL (Elektronik System Gesellschaft GmbH, Munich, Federal Republic of Germany), and H. SPRENGER (Intospace GmbH, Hanover, Federal Republic of Germany) (ESA, Ministry for Science and Technology of Italy, and BMFT, Columbus Symposium, 4th, Friedrichshafen, Federal Republic of Germany, Sept. 12-15, 1988) Space Technology - Industrial and Commercial Applications (ISSN 0892-9270), vol. 9, no. 1-2, 1989, p. 167-173.
Copyright

Life Cycle Costs (LCC) related to in-orbit experimentation in the Columbus era will have a strong impact on the affordability of scientific goals obtained from low-g research. As the operating costs tend to get frozen early in the development stage of a project, it is highly desirable to know trends and tendencies of cost driving factors as soon as possible. In this paper the characteristics of selected in-orbit experiments relevant to LCC are described, putting emphasis on the pressurized Columbus elements. State-of-the-art LCC models are introduced and their suitability to represent Columbus-type experiment operations is evaluated. Taking into account costing trends already known, parametric trade-offs based on cost estimating relationships are performed. Following this, possible countermeasures regarding identified cost drivers are taken into consideration. Author

A89-48879#
BEST EFFORTS PRINCIPLE AND TERMS OF CONTRACT IN SPACE BUSINESS
BERNHARD SCHMIDT-TEDD (DLR, Cologne, Federal Republic of Germany) IN: Colloquium on the Law of Outer Space, 31st, Bangalore, India, Oct. 13, 14, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 330-340. refs
Copyright

The use of the Best Efforts Principle (BEP) in space business contracts is discussed, using the NASA Launch Service Agreements as an example. The purport and legal nature of the BEP are reviewed. Principles usually included in the BEP are examined, including waiver of guarantee/liability, enhanced promise of performance, and the legal nature/binding effect of a contract. Guidelines for preparaing a space business contract according to the BEP are given. R.B.

A89-49374
SPACE INDUSTRIALISATION - A NEW PERSPECTIVE
MARK HEMPSELL Spaceflight (ISSN 0038-6340), vol. 31, July 1989, p. 224-227. refs
Copyright

Recent studies of the long-term development of space technology suggest that the industrialization of space is far more than just another investment; it is crucial for the continued survival of technical civilization. The economic viability of a space factory is assessed with reference to the extent and efficiency of the space infrastructure in place. Currently, new space infrastructure elements are introduced every 15 to 20 years. The pace of the Western space effort needs to be accelerated to get anywhere near its target. The NASA Post-Apollo program offers a vision of lunar bases and manned flight to Mars. C.E.

A89-49415#
INTERNATIONAL COOPERATION ON EFA
ERWIN OBERMEIER (Messerschmitt-Boelkow-Blohm GmbH, Munich, Federal Republic of Germany) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 13 p.
(AIAA PAPER 89-2035) Copyright

Experience gained during the four-nation European Fighter Aircraft (EFA) program is examined. High-technology large-scale projects will be performed in the framework of international cooperation. A systematic program management is mandatory for complex projects using advanced technology under the constraint of limited budgets. Customer and contractor organizations will be equally responsible for the coordination of the program, while specialized tasks will be carried out at partner companies. Cost estimates require international harmonization with consideration of possible modifications, fixed-price contract requirements, and risk. An examination of issues of industrial policy and relevance to alliances showed that the views are harmonized between the four to six European partners. C.E.

A89-49439#
KILLS, SORTIES AND DOLLARS
JIM BENNETT (McDonnell Aircraft Co., Saint Louis, MO) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 8 p. refs
(AIAA PAPER 89-2073) Copyright

The present discussion of the design-management basis of excellence in fighter aircraft proceeds from the notion of fighter effectiveness as the product of figures of relative merit among competing designs' capability, reliability, and supportability. Illustrative cases are drawn from the First World War (SPAD vs Fokker Triplane), the Battle of Britain (Spitfire vs Me1 09), the latter stages of World War II (P-51D vs FW 190), Korea (F-86 vs MiG-15) and Vietnam (F-4J vs MiG-21). System cost, system effectiveness, and effectiveness/cost evaluation criteria are compared. O.C.

A89-50833* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
COST ESTIMATING METHODS FOR ADVANCED SPACE SYSTEMS
KELLEY CYR (NASA, Johnson Space Center, Houston, TX) SAWE, Annual Conference, 47th, Plymouth, MI, May 23-25, 1988. 16 p.
(SAWE PAPER 1856) Copyright
The development of parametric cost estimating methods for advanced space systems in the conceptual design phase is discussed. The process of identifying variables which drive cost and the relationship between weight and cost are discussed. A theoretical model of cost is developed and tested using a historical data base of research and development projects. R.B.

A89-51829
SPACE COMMERCE; PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE AND EXHIBITION ON THE COMMERCIAL AND INDUSTRIAL USES OF OUTER SPACE, MONTREUX, SWITZERLAND, FEB. 21-25, 1988
New York, Gordon and Breach Science Publishers, 1988, 490 p. For individual items see A89-51830 to A89-51859.
Copyright
Papers concerning the commercial and industrial uses of outer space are presented, covering topics such as the commercial space market, satellite communications, materials processing in space, and commercial remote sensing. Consideration is given to ESA space commercialization efforts, computer mapping systems, applications for the Mir space station, power in space, European programs for space-based facilities, satellite launchers, Space Station payload accommodations, and epitaxial thin film growth in space. Other topics include contract research organizations, chemical analysis, cell biology, metallic compound manufacturing experiments during the D-1 mission, manufacturing in LEO, the economics of space business, satellite liability insurance, the export of space technology, and trends in European and Soviet space technology. R.B.

A89-51830
AN INTRODUCTION TO SPACE BUSINESS - WHAT IS ALL THE FUSS ABOUT?
JOHN J. EGAN (Egan Group, Washington, DC) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 3-18.
Copyright
This paper serves as a general introduction to space business. It attempts to place space business in both historical and industrial contexts. Four specific topics are addressed: (1) the question of what space business is and is not, (2) the impact of the loss of the Space Shuttle Challenger, (3) the requirements needed by a business to participate, and (4) the future of commercial space activity. Author

A89-51836
ESA SPACE COMMERCIALISATION EFFORT
ANNE-MARIE HIERONIMUS (ESA, Space Commercialisation Office, Paris, France) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 109-116.
Copyright
Consideration is given to four studies related to ESA space commercialization activities. The promotion of spin-off from space technology into nonspace industry and the development of applications and commercial activities in remote sensing are discussed. In addition, the promotion of the industrial use of the microgravity environment and private contributions to space programs that have possible commercial applications are examined. R.B.

A89-51847
SATELLITE LAUNCHER WORLD MARKET TO THE END OF THE CENTURY
TIM FURNISS IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 237-257.
Copyright
The status of the commercial satellite launch vehicle industry is assessed. The use of the Space Shuttle for satellite launches is reviewed. Consideration is given to the current state of the Ariane, Titan, Delta, Centaur, the Chinese Long March, and the Soviet Proton launch systems. Plans for future commercial satellite launches are discussed, including the Conestoga launcher, the Indian GEO Satellite Launch Vehicle, and the Brazilian Sonda systems. R.B.

A89-51857
THE ECONOMICS OF SPACE BUSINESS
PETER W. WOOD (ERC International, Fairfax, VA) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 395-412. refs
Copyright
Several major factors which impact the economics of typical prospective space businesses require special consideration. Among them are access to space and the cost of this access, the cost of manned presence or alternative automation, the lack of definition of projected markets and research goals, the dynamics of space technology and competing technologies, and issues of risk and insurance. Brief case studies are presented of several U.S. space businesses, addressing their economic experience and how they justify investment in the face of such economic issues. Conclusiosns are offered on conditions which can nurture the growth of space commerce. Author

A89-54353
HYPERSONIC FLIGHT - FUTURE COMMERCIAL POTENTIAL
H. ROBERT WASIUTA (North Dakota, University, Grand Forks) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 301-306. refs
Copyright
Determining what potential economic markets exist for the NASP is the central focus of this paper. The thesis of this work suggests that hypersonic aircraft will fly at Mach 25 only if there is a commercial market willing to absorb the costs of producing such a vehicle. Subsequently, this paper will outline political and economic factors that contribute to establishing the infrastructure capable of servicing commercial aviation, the space program, and the national security requirements of the nation. Author

A89-54695*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
SPACE STATION LAUNCH SITE PROCESSING
JOHN G. OERTEL (NASA, Kennedy Space Center, Cocoa Beach, FL) and JOHN W. ELBON, III (NASA, Kennedy Space Center; McDonnell Douglas Astronautics Co., Cocoa Beach, FL) IN: Aerospace Testing Seminar, 11th, Manhattan Beach, CA, Oct. 11-13, 1988, Proceedings. Mount Prospect, IL, Institute of Environmental Sciences, 1988, p. 227-235.
Planning which is underway at NASA-Kennedy toward launch site processing of Space Station elements is described. The goal is to develop cost-effective processing for each of the Program elements. Launch site receiving is discussed as well as post delivery verification, prelaunch assembly, prelaunch testing, experiment integration, and testing and servicing. K.K.

N89-10001# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Flight Mechanics Panel.
TECHNICAL EVALUATION REPORT ON THE FLIGHT MECHANICS PANEL SYMPOSIUM ON FLIGHT VEHICLE DEVELOPMENT TIME AND COST REDUCTION
GERALD G. KAYTEN (Kayten, Gerald G., Chevy Chase, Md) 1988 16 p Symposium held in Toulouse, France, 11-14 May 1987
(AGARD-AR-244; ISBN-92-835-0473-9; AD-A199742) Copyright Avail: NTIS HC A03/MF A01

There is a current perception that time and especially the cost of the new systems are increasing at an ever accelerating rate greater than that for improvement of the capabilities of the machines. The purpose of this symposium was to provide a forum to identify and discuss the elements contributing to the increased time and cost development, and to explore the question of what can be done to arrest and reverse the trend. Another aim of this symposium was to encourage others in the nontechnical area to join with the technical people in attacking these problems resolutely. It is considered that the meeting was successful in focusing attention on this situation, showing what technologies can do to reduce development time and cost growth, and by highlighting key areas that must be addressed to reverse the trend. Author

N89-10677# Commerce Dept., Washington, DC.
SPACE COMMERCE: AN INDUSTRY ASSESSMENT
May 1988 138 p
(PB88-214069) Avail: NTIS HC A07/MF A01 CSCL 05/1

Existing and potential worldwide markets are identified for space related goods and services, focusing on five major areas: (1) Space Transportation; (2) Satellite Communications; (3) Satellite Remote Sensing; (4) Space Based Industrial Facilities; and (5) Materials Research and Processing in Space. Aspects of Insurance and Finance relevant to commercial ventures in these markets are examined. Finally, assessments are presented from U.S. industry representatives on their ability to compete against foreign competition in each of the five major areas. GRA

N89-14178# Committee on Science, Space and Technology (U.S. House).
THE 1989 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION, VOLUME 1
1988 133 p Hearings before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science, Space and Technology, 100th Congress, 2d Session, No. 94, 12-13 Apr. 1988
(GPO-86-166) Avail: Subcommittee on Transportation, Aviation and Materials of the Committee on Science, Space and Technology, House of Representatives, Washington, D.C. 20515 HC free

A congressional report of authorization hearings before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science, Space, and Technology of the House of Representatives of the 100th Congress is presented. The subcommittee considers NASA fiscal year 1989 budget request for aeronautics. Two particular items of interest are the budgets for Aeronautical Research and Technology and the Transatmospheric Research and Technology, the latter item also known as the Aerospace Plane. E.R.

N89-14180# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION, PART 3
1988 148 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 22 Mar. 1988
(S-HRG-100-579-PT-3; GPO-87-269) Avail: Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, Senate, Washington, D.C. 20510 HC free; SOD SN-552-070-045-89-9 HC $4.25

Funding for the restoration of the space shuttle to safe flight; the National Space Policy; and the NASA budget are discussed. B.G.

N89-14181# Committee on Science, Space and Technology (U.S. House).
THE 1989 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION, VOLUME 2
1988 1133 p Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space and Technology, 100th Congress, 2d Session, 3; 8-10; 22-24; 29-31 Mar. 1988
(GPO-86-904) Avail: Subcommittee on Space Science and Applications of the Committee on Science, Space and Technology, House of Representatives, Washington, D.C. 20515 HC free; SOD SN-552-070-050-23-0 HC $29.00

Funding for the restoration of the space shuttles to eliminate payload backlog; restoration of the U.S. leadership in space; the space station; and continuity and advances in space science, aeronautics and space technology is discussed. B.G.

N89-15286*# Eagle Engineering, Inc., Houston, TX.
LUNAR BASE SCENARIO COST ESTIMATES: LUNAR BASE SYSTEMS STUDY TASK 6.1
31 Oct. 1988 294 p
(Contract NAS9-17878)
(NASA-CR-172103; NAS 1.26:172103; EEI-88-211) Avail: NTIS HC A13/MF A01 CSCL 13/2

The projected development and production costs of each of the Lunar Base's systems are described and unit costs are estimated for transporting the systems to the lunar surface and for setting up the system. Author

N89-17546# Oak Ridge National Lab., TN.
OPTICAL STORAGE: FINANCIAL MANAGEMENT AND BUDGET APPLICATIONS
JOHN D. MORRIS and M. L. EMRICH Oct. 1988 12 p Presented at the National Governor's Association Meeting: Finding the Future Conference, Washington, DC, 12 Dec. 1988
(Contract DE-AC05-84OR-21400)
(DE89-004916; CONF-881249-1) Avail: NTIS HC A03/MF A01

Recent optical storage technology advances have improved the micro-computer's ability to handle large quantities of data. This paper will explain the evolution of this technology including the state of the art. The factors involved in this evolution will be described, namely the division of research into three distinct areas: Compact Disk Read Only Memory (CD-ROM); Write Once Read Many (WORM); and Erasable Optical Storage (EOS). The future implications of these areas will be reported. In addition, practical applications that utilize optical media in the financial environment will be highlighted. DOE

N89-19325# Committee on Commerce, Science, and Transportation (U.S. Senate).
COMMERCIAL EXPENDABLE LAUNCH VEHICLE LIABILITY
1988 82 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 17 May 1988
(S-HRG-100-750; GPO-87-608) Avail: Subcommittee on Science, Technology and Space, Senate, Washington DC 20510 HC free

Hearings before a subcommittee of the House Committee on Commerce, Science, and Transportation are presented. Cost and availability of insurance for commercial launch providers was discussed. The contribution of the domestic launch industry to the Space Program is examined. All written testimony and submittals for the record are also included. B.G.

N89-19829*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
CIRCA 2000 OPERATIONS CRITERIA
ARTHUR L. SCHOLZ (Boeing Aerospace Co., Kennedy Space Center, FL.) and WILLIAM J. DICKINSON *In* NASA. Lyndon B.

Johnson Space Center, 2nd Annual Workshop on Space Operations Automation and Robotics (SOAR 1988) p 81-85 Nov. 1988
Avail: NTIS HC A22/MF A01 CSCL 22/2

The current Shuttle Program was used as a working model and certified data source in the identification of Space Transportation System (STS) operational cost drivers. Changes to flight hardware, processing methodologies, and identification of automation applications that would reduce costs were derived by reference to that data. The CIRCA 2000 Criteria were developed using these critical analyses of the on-going Shuttle Program. Several innovative suggestions are reviewed. Author

N89-20188# General Accounting Office, Washington, DC.
SPACE STATION: NASA EFFORTS TO ESTABLISH A DESIGN-TO-LIFE-CYCLE COST PROCESS
May 1988 46 p
(GAO/NSIAD-88-147) Avail: NTIS HC A03/MF A01

NASA's implementation of actions regarding space station operations cost management is reviewed. Although the definition phase has been completed, NASA is still developing major portions of the operations cost management system described in its Dec. 1985 report, including a cost management policy and cost benchmarks. NASA is currently considering a draft directive to help establish a management system that would systematically consider and assess life cycle cost impacts of design proposals. E.R.

N89-20871*# Ecosystems International, Inc., Gambrills, MD.
COMMERCIAL POTENTIAL OF EUROPEAN AND JAPANESE SPACE PROGRAMS, TASK 5 Final Report
Sep. 1987 89 p
(Contract NASW-4065)
(NASA-CR-184659; NAS 1.26:184659) Avail: NTIS HC A05/MF A01 CSCL 05/3

The current and expected future competitive status in the commercialization of space of the two principal programs competitive with NASA: the European Space Agency (ESA) and the program sponsored by the Ministry of International Trade and Industry (MITI) of Japan are evaluated, quantitatively assessed, and presented in usable format. B.G.

N89-21817# Technische Univ., Berlin (Germany, F.R.). Inst. fuer Luft- und Raumfahrt.
DEVELOPMENT OF A METHODICAL APPROACH TO THE COST-RISKS ASSESSMENT OF LAUNCH VEHICLES [ENTWICKLUNG EINES METHODISCHEN ANSATZES ZUR KOSTEN-RISIKOBEWERTUNG VON TRAEGERSYSTEMEN]
RAINER W. PROTSCH 15 Aug. 1988 85 p In GERMAN; ENGLISH summary
(ILR-MITT-204; ETN-89-93787) Avail: NTIS HC A05/MF A01

A method for the assessment and documentation of cost risks in the development and operation of launch vehicles is presented. Special attention is paid to the complex logistics of modern launch vehicles, the possible reusability of launcher components, and the annual launch demand. The fundamentals of cost risk assessment for launch vehicles are summarized. The implementation of a developed stochastic simulation model on a personal computer using the FORTRAN 77 standard and the Monte Carlo technique facilitates the assessment as well as the graphical output. The possibilities of the method are demonstrated by the Space Transportation System. It turns out that the consideration of logistic relationships is of particular importance for the cost risk assessment of reusable launch vehicles. ESA

N89-22535# Committee on Science, Space and Technology (U.S. House).
NASA REPORTS REQUIRED BY CONGRESS, 1987-1988
1989 682 p Presented by the Subcommittee on Space Science and Applications to the Committee on Science, Space and Technology, 100th Congress, 1st Session, May 1989
(GPO-96-193) Avail: Subcommittee on Space Science and Applications, House of Representatives, Washington, DC 20515 HC free; SOD HC $19.00

Hearings before a subcommittee of the House Committee on Science, Space, and Technology are presented. All written testimony and submittals for the record are also included. Justifications are provided for the Space Station Development Plan and for commercial profit-making space endeavors. B.G.

N89-22637# Office of Technology Assessment, Washington, DC.
LAUNCH OPTIONS FOR THE FUTURE: SPECIAL REPORT
Jul. 1988 110 p
(PB89-114268; OTA-ISC-383; LC-88-600540) Avail: NTIS HC A06/MF A01; also available SOD HC $5.00 as 052-003-01117-4 CSCL 22/2

The range of launch systems that exist now or could be available before 2010 are described and the costs of meeting different demand levels are explored for launching humans and spacecraft to orbit. Also discussed is the importance of developing advanced technologies for space transportation. Author

N89-22943*# Deutsche Metal Components, Gardena, CA.
INCREASING MARKETABILITY AND PROFITABILITY OF PRODUCT LINE THRU PATRAN AND NASTRAN
ART HYATT *In* Computer Software Management and Information Center Seventeenth NASTRAN (R) Users' Colloquium p 102-129 Mar. 1989
Avail: NTIS HC A17/MF A01; also available from COSMIC, Athens, GA 30602 CSCL 20/11

Starting with the design objective the operational cycle life of the Swaging Tool was increased. To accomplish this increase in cycle life without increasing the size or weight of the tool would be engineering achievement. However, not only was the operational cycle life increased between 2 to 10 times but simultaneously the size and weight of the Swage Tool was decreased by about 50 percent. This accomplishment now becomes an outstanding engineering achievement. This achievement was only possible because of the computerized Patran, Nastran and Medusa programs. Author

N89-23359# Kienbaum Unternehmensberatung, Gummersbach (Germany, F.R.).
ANALYSIS OF THE PRESENT KNOWLEDGE OF COSTS AND BENEFITS OF THE GOVERNMENTAL ADVANCEMENT OF ASTRONAUTICS [ANALYSE BISHERIGER ERKENNTNISSE ZU KOSTEN UND NUTZEN DER STAATLICHEN FOERDERUNG DER RAUMFAHRT]
HANS-JUERGEN MORTSIEFER, ULRICH BENDER, and GUENTER BOEHM Oct. 1987 192 p In GERMAN Sponsored by the BMFT, Bonn, Fed. Republic of Germany
(ETN-89-93770) Avail: NTIS HC A09/MF A01

A literature study of the costs and benefits of governmental advancement of astronautics was performed. An up-to-date overview of the status and contribution of the economic sciences to the research field cost-benefit analysis and related methods is given. The cost-benefit analyses performed in the field of astronautics and analogous technology domains are reviewed and analyzed with respect to their fields of research, methods, and results. ESA

N89-23500# Office of Technology Assessment, Washington, DC.
REDUCING LAUNCH OPERATIONS COSTS: NEW TECHNOLOGIES AND PRACTICES
Sep. 1988 100 p
(PB89-136402; OTA-TM-ISC-28; LC-88-600539) Avail: NTIS HC A05/MF A01 CSCL 22/1

The report discusses the issues of launch operations and how the use of advanced technologies and improved management techniques could reduce the costs of launching payloads. Author

N89-23887# Army Missile Command, Redstone Arsenal, AL. Systems Analysis Div.
SYSTEM MEAN-TIME-BETWEEN-FAILURE VERSUS LIFE-CYCLE LOGISTICS COST SUBJECT TO THE INTRODUCTION OF LINE-REPLACEABLE-UNIT REDUNDANCY Final Report
PATRICK B. LAWLER, JR. 18 Mar. 1988 140 p
(AD-A206324; AD-E951232; AMSMI/TR-OR-SA-88-01) Avail: NTIS HC A07/MF A01 CSCL 15/5

This document presents an examination of ten alternate system designs in which redundancy is employed to achieve various values of system Mean-Time-Between-Failure (MTBF). In serial system designs where line-replaceable-units (LRU's) possess exponentially distributed times to failure, life-cycle logistics cost is inversely proportional to system MTBF. In this analysis, this phenomena was found to be contradicted. Life-cycle logistics cost is directly proportional to system MTBF, in the presents of LRU redundancy and no preventive or scheduled maintenance. GRA

N89-25077# Federal Lab. Consortium, Washington, DC.
PUTTING TECHNOLOGY TO WORK: EXAMPLES OF INDUSTRY-LABORATORY COOPERATION CONTRIBUTING TO OUR NATION'S ECONOMIC STRENGTH
Mar. 1988 155 p
(PB89-134654) Avail: NTIS HC A08/MF A01 CSCL 13/2

The Nation's Federal laboratories are proving increasingly effective in contributing to the economy through technology transfer - a term that covers a wide variety of cooperative relationships. Laboratory technologies, expertise, and mission program interests form the basis for many commercial innovations, some of which are described. A collection of examples from 31 laboratories representing 7 government agencies is discussed; it should be viewed as indicative of the full potential for industry-laboratory cooperation to contribute to the nation's economic strength. Author

N89-25248*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION OPERATIONS TASK FORCE SUMMARY REPORT
Oct. 1987 203 p Original contains color illustrations
(NASA-TM-101820; NAS 1.15:101820) Avail: NTIS HC A10/MF A01 CSCL 22/1

A companion to the Space Stations Operation Task Force Panels' Reports, this document summarizes all space station program goals, operations, and the characteristics of the expected user community. Strategies for operation and recommendations for implementation are included. A.D.

N89-25249*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION OPERATIONS TASK FORCE. EXECUTIVE SUMMARY Final Report
Oct. 1987 23 p Original contains color illustrations
(NASA-TM-101780; NAS 1.15:101780) Avail: NTIS HC A03/MF A01 CSCL 22/1

The space station program goads, operations and the characteristics of the expected user community are summarized. Strategies for operations and recommendations for implementation are included. A.D.

N89-25377# Technische Univ., Eindhoven (Netherlands). Faculty of Electrical Engineering.
THE IMPACT OF TELECOMMUNICATION ON RURAL AREAS IN DEVELOPING COUNTRIES
P. A. M. HERMANS, A. M. J. KWAKS, I. V. BRUZA, and J. DIJK Dec. 1987 92 p
(EUT-87-E-185; ISBN-9-06-144185-4; ISSN-0167-9708; ETN-89-94773) Avail: NTIS HC A05/MF A01

The economic and social impact of telecommunication in developing countries was studied. The economic impact not only depends on the direct returns of the investment, like tariffs, through the improved communication facilities, other sectors can indirectly profit from the investments too. Especially, in areas with a very low telephone density, the indirect returns of a telecommunication investment are enormous. Technical possibilities for building up transmission links in a rural network include coaxial cables, glass fibers, radio transmission, and satellite communication. In thinly populated rural areas, satellite communication with a single channel per carrier (SCPC) system is a good solution. With a SCPC system few groundstations can be used. These stations are easy to maintain, and use little power. As soon as a satellite channel and two groundstations are operational, transmission is possible, so a SCPC system can be implemented quickly. ESA

N89-25475# Lawrence Livermore National Lab., CA.
LEARNING THE VALUE OF VE
ROGER B. SPERLING 3 Mar. 1989 7 p Presented at the Society of American Value Engineers International Conference, Indianapolis, IN, 12 Jun. 1989
(Contract W-7405-ENG-48)
(DE89-008121; UCRL-100655; CONF-890691-1) Avail: NTIS HC A02/MF A01

Describing lessons learned from Value Engineers (VE) studies at a government-funded research laboratory reveals how project managers were encouraged to use VE and how their projects benefited from the VE savings. The five major lessons were: An officer of free VE is a low-risk incentive to encourage the use of VE; More costs savings can be identified by VE studies than cost reviews or design reviews; Large projects can benefit from repeat VE studies; VE teams can identify surprising savings when allowed to challenge all design criteria; VE programs can be costs effective even though return on investment may vary among projects. DOE

N89-26670# Strategic Defense Initiative Organization, Washington, DC.
REPORT TO THE CONGRESS ON THE STRATEGIC DEFENSE INITIATIVE, 1989
13 Mar. 1989 355 p
(AD-A206944) Avail: NTIS HC A16/MF A01 CSCL 15/3

This report summarizes the SDI legacy of President Reagan, who launched the initiative with his speech of March 23, 1983. It describes in detail our current assessment of the best program for the resolution of remaing technical issues, the validation of technologies, and the demonstration of our ability to integrate them. This program of research, development and testing would, if adequately funded, support a fully informed decision by the President and Congress in the future on whether to deploy a strategic defense of the United States. Such defenses could enhance deterrence and increase stability. In an effort to reduce the overall costs of a first-phase Strategic Defense System, the DOD recently completed an intensive review of the modifications made to date toward this end. The projected cost of the first phase of a Strategic Defense system has been reduced dramatically from the earlier estimate of $115 billion to $69 billion while maintaining the capability to contribute to deterrence. The review also confirmed that SDI is proceeding in the right direction toward development of a comprehensive space and ground based Strategic Defense System. GRA

N89-26809# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.
ESTIMATING AND EXPLAINING THE PRODUCTION COST OF HIGH-TECHNOLOGY SYSTEMS: THE CASE OF MILITARY AIRCRAFT
O. DOUGLAS MOSES 17 May 1989 85 p
(AD-A208391; NPS54-89-07) Avail: NTIS HC A05/MF A01 CSCL 01/3

This study tests relationships between measures of the state-of-the-art of technology and advances in technology with production cost. The analysis is conducted using a sample of military aircraft. Parametric cost estimating models are developed. Actual production costs are compared with estimated production costs predicted from the models to create measure of cost overruns and cost underruns. A set of factors that are associated with

instances of cost over/underruns are identified. These factors reflect aspects of the aircraft program, the political and economic environment at the time of commencement of production on the aircraft program, and the financial condition of the prime contractor. GRA

N89-27034*# National Academy of Sciences - National Research Council, Washington, DC. Commission on Engineering and Technical Systems.
INDUSTRIAL APPLICATIONS OF THE MICROGRAVITY ENVIRONMENT
1988 64 p
(Contract NASW-4154)
(NASA-CR-181516; NAS 1.26:181516; PB89-170559) Avail: NTIS HC A04/MF A01 CSCL 22/1

Opportunities for commercialization of the microgravity environment will depend upon the success of basic research projects performed in space. Significant demands for manufacturing opportunities are unlikely in the near term. The microgravity environment is to be considered primarily as a tool for research and secondarily as a manufacturing site. This research tool is unique, valuable, and presently available to U.S. investigators only through resources provided by NASA. The United States has an obligation to facilitate corporate research, maintain a flexible international policy, foster use of and assure access to a wide variety of facilities, and develop a posture of national and international leadership in and stewardship of research and materials processing in the microgravity environment. The National Research Council's Committee on Industrial Applications of the Microgravity Environment recommends six actions that strengthen this posture, including the formation of an authoritative organization to oversee the implementation of a program of microgravity research and its industrial applications. GRA

N89-27202# Wallace and Co., Fairborn, OH.
COST OF QUALITY EVALUATION METHODOLOGIES HANDBOOK Final Report
WILLIAM J. GRUNEWALD, DONOVAN C. WIKSTROM, ROBERT SIMON, and WILLIAM CANCE 28 Jul. 1988 233 p
(Contract F33657-86-D-0094)
(AD-A206935) Avail: NTIS HC A11/MF A01 CSCL 05/1

The purpose of the handbook is to function as an aid to the understanding of the concept of cost of quality and its value as a management tool. Individuals who are not a part of a quality assurance organization must recognize that there are activities which go on in their area of interest that are indeed part of the total cost of quality for an organization. This handbook is designed to be used by people involved with proposal evaluation, fact finding, should cost, quality audits, contractor operation reviews, source selection, pre-award surveys, or any review effort in which visibility into what the government is paying for quality would be useful. All disciplines are involved in these types of reviews and all disciplines have a share in the cost of quality. The quality representative involved in a particular review would be the focal point for overall cost of quality evaluation results. But each of the other team members must find the cost of quality in their specific area, evaluate the cost, and make input to the quality representative for consolidation. The handbook is designed to enable each participant team member to accomplish that task in support of the overall cost of quality effort. GRA

N89-27230# Egan Group, Washington, DC.
STUDY FOR ADVANCED CIVIL EARTH REMOTE SENSING SYSTEM: FOCUSED FINANCE STUDY. VOLUME 1: EXECUTIVE SUMMARY
12 Aug. 1988 10 p
(Contract MANE-8-00003)
(PB89-163224; NOAA-NESDIS-89/03-VOL-1) Avail: NTIS HC A02/MF A01 CSCL 08/2

The Egan Group was asked to study the issues and prospects for private sector financing of commercial remote sensing ventures. The report is one of three studies to evaluate options for an advanced civil earth remote sensing system to follow the recently funded LANDSAT 6 system. The executive summary presents an overview of the study scope and approach, enabling technologies, financing environment, risks, conclusions, and recommended actions which are discussed in detail in the Final Report. GRA

N89-27232# KRS Remote Sensing, Landover, MD.
STUDY FOR AN ADVANCED CIVIL EARTH REMOTE SENSING SYSTEM. VOLUME 2: MARKET AND FINANCIAL ASSESSMENT Final Report
Aug. 1988 470 p
(Contract MANE-8-00001)
(PB89-163265; NOAA-NESDIS-89/06-VOL-2) Avail: NTIS HC A20/MF A01; also available in set of 3 reports HC E99 as PB89-163240 CSCL 08/2

The results of a comprehensive study of options for an Advanced Civil Earth Remote Sensing System (ACERSS) to follow LANDSAT 6 are given. The study approach followed three basic steps: projection of worldwide market demand for raw data and value added information products; identification of technical and implementation options for satisfying this demand; and determination of the commercial viability of these options. Here, market profiles for remote sensing data are given. Author

N89-28939# DHV Raadgevend Ingenieursbureau B.V., Amersfoort (Netherlands).
MARKETING AND CASE STUDY OF SATELLITE THEMATIC MAPS AND OTHER PRODUCTS OF SATELLITE REMOTE SENSING Final Report
CENDEKIA JASA IHE Dec. 1988 27 p Prepared in cooperation with DHV Raadgevend Ingenieurs Bureau B.V., Amersfoot, Netherlands Original contains color illustrations
(Contract BCRS-PROJ-4533/TO-3.13)
(BCRS-55-16E; ETN-89-95477) Avail: NITS HC A03/MF A01

The project of marketing for satellite thematic maps in Indonesia is presented. The interest in high resolution satellite data arises from the feeling that traditional data collection systems, which are partly based on ground observations and partly on aerial photographs, are no longer satisfactory. Conclusions on the commercial and technical prospects for products derived from Tropical Earth Resources Satellite (TERS) data, are drawn. The study of the Cirebon area of West Java is reported. It was concluded that basic information on land use is lacking. It also became clear that there is limited experience and expertise in high resolution satellite image interpretation in Indonesia. The cost effectiveness of this type of mapping depends in part on the extent to which the requirements of the user are met. An efficient procedure for land use mapping may be found in a combination of satellite data, existing aerial photography and additional data collection on the ground. Not all land use information that is required by the different potential users can be obtained exclusively from remote sensing imagery. ESA

N89-29268# Naval Postgraduate School, Monterey, CA.
MOVING OPTICAL TECHNOLOGY IN-HOUSE M.S. Thesis
BRUCE E. FRANCE, SR. Mar. 1989 37 p
(AD-A207850) Avail: NTIS HC A03/MF A01 CSCL 05/2

The Navy, through a series of projects and programs, is identifying a considerable number of uses for optical technology. Key commands and Navy projects using optical technology are identified and reviewed. Currently, the Navy has no production capability for this medium nor does an optical production facility exist for classified data. The issue is whether the Navy should develop an optical technology production facility to avoid the use of outside contractors. Current costs for producing compact disk-read only memory and what cost savings might be incurred through the in-house use of this technology is examined. And if the technology were developed internally, questions such as who should manage this program and how should it be managed need to be addressed. The impact and benefits and barriers to developing an optical technology in-house capability in the Navy are summarized. GRA

N89-29273# Committee on Appropriations (U.S. House).
DEPARTMENTS OF VETERANS AFFAIRS AND HOUSING AND URBAN DEVELOPMENT AND INDEPENDENT AGENCIES APPROPRIATIONS FOR 1990. PART 6: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
1989 169 p Hearings before a Subcommittee of the Committee on Appropriations, 101st Congress, 1st Session, 25 Apr. 1989 (GPO-99-598) Avail: Subcommittee of the Committee on Appropriations, House of Representatives, Washington, D.C. 20510 HC free; SOD HC $31.00

Hearings before a subcommittee of the House Committee on Appropriations are presented along with budget estimates for the National Aeronautics and Space Administration for the fiscal year 1990. All written testimony and submittals for the record are also included. The budget estimates provide a detailed outline of budgetary information and justifications for research and development, construction of facilities, space flight and communications, and research and program management. B.G.

N89-29434# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
REVIEW OF SMALL TELECOMMUNICATIONS MISSIONS
D. BROWN and M. CLAUTRIER (Centre National d'Etudes Spatiales, Toulouse, France) *In its* First European Workshop on Flight Opportunities for Small Payloads p 15-17 May 1989
Copyright Avail: NTIS HC A09/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

A market study is carried out showing that developing countries can benefit from having a tailored domestic communication satellite system. It is concluded that the market is at an interesting size for enterprising manufacturers to design a low cost satellite which can also be launched at low cost. ESA

N89-29457# Space Services Inc. of America, Houston, TX.
RELIABLE, LOW-COST LAUNCH SERVICES
D. K. SLAYTON and P. J. ARMITAGE *In* ESA, First European Workshop on Flight Opportunities for Small Payloads p 155-160 May 1989
Copyright Avail: NTIS HC A09/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

Small payload launch services provided for a complete range of inclinations and altitudes as well as suborbital launch services for a variety of missions are described. The Conestoga family of launch vehicles has been designed using the same basic hardware in several configurations for different mission requirements. ESA

N89-29667# Eutelsat, Paris (France).
EUROPESAT, THE EUTELSAT PAN-EUROPEAN DBS SYSTEM
B. NAESLUND *In* ESA, Olympus Utilization Conference p 421-424 May 1989
Copyright Avail: NTIS HC A23/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The advantages of EUROPESAT, a pan-European (DBS) direct broadcast satellite system proposed to be established under the auspices of the European Telecommunications Satellite Organization, EUTELSAT are discussed. The main features of EUROPESAT and its financial and institutional aspects are outlined. How the experience of Olympus will be beneficial for EUROPESAT is also touched upon. Developments of high definition television standards as well as the implications of different market developments for satellite television are briefly discussed. ESA

N89-29669# Radiotelevisione Italiana, Turin (Italy).
THE RAI DBS EXPERIMENT WITH OLYMPUS
ENZO CASTELLI *In* ESA, Olympus Utilization Conference p 429-432 May 1989
Copyright Avail: NTIS HC A23/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The experimental programs of RAI (Radiotelevisione Italiana) carried out using the Olympus broadcast channel are outlined. The scheduling of these programs is explained. The uplinking of these programs is described. The use of DBS technology (Direct Broadcast Satellites) is described in terms of the program targets. Market surveys and diffusion standards are discussed. ESA

N89-29671# Eutelsat, Paris (France).
AN OVERLOOK OF THE EUROPEAN VSAT SCENE BY EUTELSAT
MICHEL CHABROL, JEAN-NOEL COLCY, and MARTINE PAPO *In* ESA, Olympus Utilization Conference p 439-445 May 1989
Copyright Avail: NTIS HC A23/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The Very Small Aperture Terminals (VSATs) networks in operation today on the EUTELSAT system, as well as those about to become operational, are described. These include: press agency information networks, meteorological forecasting, tele-education programs and a variety of other data distribution systems around Europe. The identifiable trends and perspectives of this market and its projected growth and regulatory environment are discussed. ESA

08

LOGISTICS AND OPERATIONS MANAGEMENT

Includes Inventory Management and Spare Parts, Materials Management and Handling, Resources Management, Resource Allocation, Procurement Management, Leasing, Contracting and Subcontracting, Maintenance and Repair, Transportation, Air Traffic Control, Fuel Conservation, Operations, Operational Programs.

A89-10633* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SPACE TRANSPORTATION SYSTEMS FOR THE FUTURE
T. J. LEE (NASA, Marshall Space Flight Center, Huntsville, AL) IN: International Pacific Air and Space Technology Conference, Melbourne, Australia, Nov. 13-17, 1987, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1988, p. 85-97. refs
(SAE PAPER 872407) Copyright

A summary of the potential requirements, proposed configurations, inherent development problems, and technologies to be considered for future space transportation systems is presented. Such systems will include the improved Space Shuttle, new and derivative cargo launch vehicles, new propulsion systems, orbital transfer and maneuvering vehicles, and a second-generation Space Shuttle. It is concluded that more efficient and capable systems can be developed by placing strong emphasis on high reliability, safety, and improved ground and flight operations. These improvements can result from the introduction of advanced technologies and vehicles designed for operations and maintainability with the flexibility to adapt to mission needs. B.J.

A89-10656
MAINTENANCE AND AIRLINE SAFETY
RAYMOND E. RAMAKIS (FAA, Aircraft Maintenance Div., Washington, DC) IN: International Pacific Air and Space Technology Conference, Melbourne, Australia, Nov. 13-17, 1987, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1988, p. 359-368. refs
(SAE PAPER 872443) Copyright

Aircraft certification is discussed, as well as airline certification and responsibilities and Federal Aviation Administration regulatory responsibilities. As a result of the continuing inspections of air carriers and repair stations since 1984, the industry and the FAA have worked to overcome various negative findings. Among other things, the air carriers have increased the number of mechanics on the payroll, increased their engineering staffs, and increased their inventory of spare parts. The FAA reinstituted national work program guidelines in October 1985, increased inspector staffing, and initiated a flight standards national aviation inspection program. K.K.

A89-12537
BITING THE BULLET ON AVIATION SAFETY
ROBERT L. CRANDALL (American Airlines, Inc., Dallas, TX) Issues in Science and Technology (ISSN 0748-5492), vol. 4, Winter 1988, p. 93-95.
Copyright

It is presently proposed that the U.S. Secretary of Transportation should constitute a blue-ribbon commitee, headed by the FAA and encompassing representatives from all concerned groups, to conduct a detailed study of the ATC system's current status and prospects for expansion to handle the increase to 600 million passengers, from the current 415 million passengers, expected by 1992. For the time being, the FAA is noted to be proceeding with the hiring and training of 955 more ATC operators. Difficulties are likely to emerge from the need to override environmentalist concerns and undertake the construction of additional airports, and more runways for existing airports, which will be capable of handling expanded future traffic.

A89-18289
AIAA/SOLE SPACE LOGISTICS SYMPOSIUM, 2ND, COSTA MESA, CA, OCT. 3-5, 1988, PROCEEDINGS
Symposium sponsored by the Society of Logistics Engineers and AIAA. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, 316 p. For individual items see A89-18290 to A89-18331.
Copyright

The present conference discusses topics in SDI space logistics concepts and challenges, the influence of logistical considerations on space hardware design, logistical support of ground operations, Space Shuttle logistics concepts, logistical support of orbital systems, and the AI, system-modeling, and computer aids developed for orbital system support. Attention is given to an integrated effectiveness/supportability analysis capability for SDI, new avenues in space logistics, Space Station organization, future civil space systems logistics, the Columbus logistics program, Space Station maintenance concepts, increased autonomy through satellite expert system scheduling, and applications of queuing theory to on-orbit logistics modeling. O.C.

A89-18305#
PRODUCT SUPPORT TRAINING - HOW, WHAT, WHEN, WHERE, AND WHY
RITA L. WELLS (USAF, Institute of Technology, Dayton, OH) and JOHN H. WELLS (Universal Energy Systems, Inc., Dayton, OH) IN: AIAA/SOLE Space Logistics Symposium, 2nd, Costa Mesa, CA, Oct. 3-5, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, 4 p. refs
(AIAA PAPER 88-4726) Copyright

As the horizons of logistics expand into space, training of product support personnel must keep pace with the rapid development and integration of modern systems. Timely system start-up - and ultimately mission success - makes this a critical element of the total logistics process. The wise and timely procurement of product support training can make the difference in the user's arena. Contracting for product support training has three distinctive phases - needs assessment, needs definition, and evaluation. During each phase, parameters of the training must be established in terms of who, what, when, where, and why.
Author

A89-18326#
ROGER B. CHAFFEE SPACE OPERATIONS LOGISTICS ENGINEERING RESEARCH CENTER
BRUCE A. CHUBB (Research and Technology Institute, Grand Rapids, MI) and WILLIAM C. LEWIS (Grand Valley State University, Allendale, MI) IN: AIAA/SOLE Space Logistics Symposium, 2nd, Costa Mesa, CA, Oct. 3-5, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, 6 p. refs
(AIAA PAPER 88-4751) Copyright

A consortium of university research interests has conceived a NASA organization, to be designated the 'Roger B. Chaffee Space Operations Logistics Engineering Research Center', whose initial concerns will extend to the analysis of NASA Space Station ready-spares inventory, ground repair and reconditioning systems, automated inventory and configuration management, on-orbit component-level repair, and packaging. The results of Logistics Center studies would aid equipment suppliers in the optimization of logistics requirements and in the improvement of long term space operations' cost-effectiveness. O.C.

A89-25330*# NASA Space Station Program Office, Reston, VA.
SPACE STATION OPERATIONS MANAGEMENT
KATHLEEN V. CANNON (NASA, Space Station Freedom Program Office, Reston, VA) AIAA, Aerospace Sciences Meeting, 27th, Reno, NV, Jan. 9-12, 1989. 8 p. refs
(AIAA PAPER 89-0393)

Space Station Freedom operations management concepts must be responsive to the unique challenges presented by the permanently manned international laboratory. Space Station Freedom will be assembled over a three year period where the operational environment will change as significant capability plateaus are reached. First Element Launch, Man-Tended Capability, and Permanent Manned Capability, represent milestones in operational capability that is increasing toward mature operations capability. Operations management concepts are being developed to accomodate the varying operational capabilities during assembly, as well as the mature operational environment. This paper describes operations management concepts designed to accomodate the uniqueness of Space Station Freedoom, utilizing tools and processes that seek to control operations costs.
Author

A89-28231* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SPACE STATION FREEDOM OPERATIONS PLANNING
KEVIN J. SMITH (NASA, Johnson Space Center; Barrios Technology, Inc., Houston, TX) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Oct. 3-6, 1988. 10 p.
(SAE PAPER 881493) Copyright

This paper addresses the development of new planning methodologies which will evolve to serve the Space Station Freedom program; these planning processes will focus on the complex task of effectively managing the resources provided by the Space Station Freedom and will be made available to the diverse international community of space station users in support of their ongoing investigative activities. Author

A89-35825
NEW WINGS, NEW WAYS
Flight International (ISSN 0015-3710), vol. 135, March 18, 1989, p. 26-29.
Copyright

The USSR's most recently revised unified airworthiness standards, to which such new aircraft as the four-engined, wide-body Il-96-300 airliner must adhere, follow the European safety-assessment practices developed over a decade ago. The maximum allowable probabilities of various potentially hazardous situations are determined for the aircraft as a whole, and acceptable probabilities are then derived for the failures of individual aircraft systems. Each system is, finally, assessed as a number of separate components. Efforts are also being made to reduce major maintenance for new aircraft in order to reduce the staffing levels required in heavy maintenance tasks. O.C.

A89-38269
JEM OPERATIONS CONCEPT
YASUSHI HORIKAWA and AKIRA TANAKA (National Space Development Agency of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 1783-1787.
Copyright

JEM is scheduled to be launched and attached to the U.S. Space Station core in 1996. The operations of JEM will start with

the launch site processing of the JEM system. JEM will then be launched, assembled and verified on orbit. These activities will be followed by initial and mature phase operations which include operations planning, flight control, logistics support, operations analysis, and crew training. Facilities and equipment for these operations are to be prepared at appropriate operation centers in Japan and the U.S. Author

A89-38582
AIRPORT TECHNOLOGY INTERNATIONAL 1988
MAURICE G. HUDSON, ED. London, Sterling Publications, Ltd., 1988, 252 p. No individual items are abstracted in this volume.
Copyright

The current status of airport technology is surveyed in reviews and reports by industry experts. Topics addressed include airport policy and management; the planning, design, and construction of airports; passenger handling and commercial operations; cargo handling; and ramp operations and handling. Consideration is given to problems of maintenance, airfield operations, ATC and navigation, training, and security. Extensive diagrams, drawings, graphs, and photographs are provided. T.K.

A89-39088
COMING TO TERMS WITH TCAS
JOHN BAILEY Flight International (ISSN 0015-3710), vol. 135, April 15, 1989, p. 40-42.
Copyright

The certification of the U.S. Traffic Alert and Collision-Avoidance System, or 'TCAS', is expected to occur towards the end of 1989; by January 1, 1992, every large transport aircraft operating in U.S. airspace, foreign and domestic, will have to incorporate TCAS. If the prospective collision-target aircraft has a mode S transponder with datalink capability, the TCAS computers aboard both aircraft will coordinate a complementary vertical-avoidance maneuver. Still under development is a further refinement of TCAS to yield mutual-avoidance maneuvers in the horizontal plane. Airlines with financial or cash-flow constraints may lose substantial revenue if they are unable to outfit their entire fleet with TCAS by 1992. O.C.

A89-45791* Grand Valley State Coll., Allendale, MI.
LOGISTICS SUPPORT OF SPACE FACILITIES
WILLIAM C. LEWIS (Grand Valley State University, Allendale, MI) IN: Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. New York, American Society of Civil Engineers, 1988, p. 797-808. Research supported by NASA and American Society of Engineering Educators.
Copyright

The logistic support of space facilities is described, with special attention given to the problem of sizing the inventory of ready spares kept at the space facility. Where possible, data from the Space Shuttle Orbiter is extrapolated to provide numerical estimates for space facilities. Attention is also given to repair effort estimation and long duration missions. Author

A89-47336
RESEARCH IN AUTOMATION FOR AIR TRAFFIC CONTROL - UNITED KINGDOM WORK AND ASSOCIATED EUROPEAN PROJECTS
ARTHUR G. THORNING (Civil Aviation Authority, London, England) IN: Aerospace Behavioral Technology Conference and Exposition, 7th, Anaheim, CA, Oct. 3-6, 1988, Proceedings. Warrendale, PA, Society of Automotive Engineers, Inc., 1989, p. 87-94.
(SAE PAPER 881470) Copyright

Research work in the United Kingdom aimed at developing the benefits of automation in Air Traffic Management is described. To emphasize the systematic and international nature of such work, related projects are also outlined. The paper gives a broad overview of projects in UK and Europe rather than much detail and as such is aimed at stimulating interest in and understanding of the ATC aspects of automation. Author

A89-49428#
MONITORING FLIGHT OPERATIONS USING FLIGHT RECORDED DATA
LARRY WILLIAMSON (British Airways, PLC, London, England) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 9 p.
(AIAA PAPER 89-2056) Copyright

The use of flight data recording within British Airways is described. Analog recorders were initially used, followed by digital recording systems, with the acquisition and analysis of data on a larger and more automated scale becoming a reality. SESMA Program Management meetings carried out on a day-by-day basis and semiannual meetings between Airlines, RAE, Meteorological Office, Air Traffic Control and others are considered necessary to discuss topical subjects, exchange views and perhaps initiate research projects. SESMA, part of CAADRP (Civil Aircraft Airworthiness Data Recording Programme), has as its primary objective the maintenance and improvement of safety. Some examples of information obtained from CAADRP/SESMA are presented, including turbulence analysis, vortex wake encounters, and runway roughness monitoring. C.E.

A89-49429#
THE WAYPORT CONCEPT
REM S. P. SCHUIL (Middle Tennessee State University, Murfreesboro, TN) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 8 p. refs
(AIAA PAPER 89-2057) Copyright

The 'Wayport' concept involves a system of four to six strategically located airports that will be constructed in what are currently rural, thinly populated areas of marginal economic value and low real estate costs; they will be dedicated to achieving the swiftest possible connecting operations between flights having urban points of origin and destination. Entire regions will be serviced by each of the Wayports. Development costs for the Wayports will be powerfully limited by the use of highly standardized designs for all facilities. All facilities will be designed for maximum terminal and transit system efficiency, consistently achieving 20-30-minute connections between airliners for passengers and air freight. O.C.

A89-49462#
MAINTENANCE LESSONS LEARNED - BLUE TWO VISITS
WILLIAM H. DEHLER (Boeing Military Airplanes, Wichita, KS) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 17 p.
(AIAA PAPER 89-2104) Copyright

The USAF's 'Blue Two Visits' (BTV) program invites contractor engineering personnel to visit AFBs throughout the world in order to experience the daily work of maintennance personnel by actually performing their tasks over the course of a typical week. The ultimate purpose of BTV is the identification of inadequate maintainability design features. Attention is presently given to the computer data base compiled by a major military aircraft manufacturer on the basis of its BTV experiences, using questionnaires that are filed by its employees upon their return. O.C.

A89-52702#
GROUND-HOLDING STRATEGIES FOR ATC FLOW CONTROL
MOSTAFA TERRAB, AMEDEO R. ODONI (MIT, Cambridge, MA), and OWEN L. DEUTSCH (Charles Stark Draper Laboratory, Inc., Cambridge, MA) IN: AIAA Guidance, Navigation and Control Conference, Boston, MA, Aug. 14-16, 1989, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 1635-1646. refs
(AIAA PAPER 89-3628) Copyright

One of the most important functions of any air traffic management system is the assignment of 'ground-holding' times to flights, i.e., the determination of whether and by how much the take-off of a particular aircraft headed for a congested part of the ATC system should be postponed in order to reduce the likelihood

and extent of airborne delays. An analysis is presented of the fundamental case in which flights from many destinations must be scheduled for arrival at a single congested airport. A set of approaches for addressing a deterministic and stochastic version of this problem is described. Optimal solution approaches include minimum cost flow algorithms and dynamic programming. Under a particular natural assumption regarding the functional form of delay, a very efficient algorithm can be used. This algorithm is also useful in addressing heuristically the stochastic version of the problem. Author

N89-13419# Federal Aviation Administration, Washington, DC. Office of Aviation Policy and Plans.
TERMINAL AREA FORECASTS: FISCAL YEARS 1988-2000
Mar. 1988 433 p
(AD-A198079; FAA-APO-88-3) Avail: NTIS HC A19/MF A01 CSCL 01/5

This report contains forecasts of aviation activity for 847 airports in the United States for fiscal years 1988 to 2000. These include 399 airports with FAA air traffic control towers and radar approach control service and 14 FAA contract towers. For each airport, detailed forecasts are made for the four major users of the air traffic system: air carriers, air taxi/commuters, general aviation, and military. Summary tables contain national, FAA regional, and state aviation data and other airports specific highlights. The forecasts have been prepared to meet the budget and planning needs of the constituent units of the FAA headquarters and regional offices and to provide airport-specific information that can be used by state and local aviation authorities, the aviation industry, as a whole, and the general public. GRA

N89-17564# Army Missile Command, Redstone Arsenal, AL.
REMOTELY PILOTED VEHICLE (RPV) TWO VERSUS THREE LEVEL MAINTENANCE SUPPORT CONCEPT STUDY Final Report
JOSEPH H. NORDMAN, WAYNE M. LEONARD, JR., and ADRIAN A. ABRAMS 15 Jan. 1988 67 p
(AD-A200665; AMSMI/LC-TA-88-01) Avail: NTIS HC A04/MF A01 CSCL 01/3

Two maintenance support concepts for selected RPV subsystems lifetime supply and maintenance (S and M) costs are: (1) two levels of support, organizational and depot; and (2) three levels of support, organizational, intermediate (direct support and general support) and depot. Lifetime costs applicable to current peacetime conditions are estimated through the method of the Optimum Supply and Maintenance Model (OSAMM) which uses the supply model, called Selected Essential-Item Stockage for Availability Method (SESAME), as a subroutine. The unique features of OSAMM allows it to simultaneously minimize costs, develop maintenance task distributions, and quantities and placement of test equipment and stockage while achieving a pre-stated operational availability target. Results are presented over a range of operational availability values of interest in which supply quantities are variants. It is concluded that the three level support concept is less expensive than the two level concept for every selected subsystem studied except one - that one exception has a small cost impact. Another interesting conclusion reached for the three level concept is that the operational availability can be significantly improved with small stockage cost increases. GRA

N89-18503# Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.).
STUDY OF IN-ORBIT SERVICING OF COLUMBUS ELEMENTS BY ALV, EXECUTIVE SUMMARY
Paris, France ESA Mar. 1988 86 p
(Contract ESTEC-7343/87-NL-MA(SC))
(ESA-CR(P)-2675; ETN-89-93929) Avail: NTIS HC A05/MF A01

An orbital servicing concept, especially for Columbus, based on an Ariane 5 logistics vehicle (ALV) is shown to be feasible. The ALV concept meets all the performance requirements, including safety for transporting logistics resupplies to the space station elements. Deletion of the ALV capability to perform active proximity maneuvers greatly reduces system complexity. Replacement of a large mono tank by separate tanks increases overall safety, deletes tank emptying operation, and the need for additional tanks. The separate tank concept reduces overall height of stage with associated mass savings on the interstage. The propulsion stage proposed can be used as basic stage for all Ariane 5 applications using 20 kN engine together with 2, 4, or 6 tanks for LEO-GTO missions. Attached pressurized module downloads must be returned by STS. The ALV offers very large free capacity for accommodating all types of expendable equipment, trash, waste products for atmospheric burn-up. Pressurized cargo modules were designed for worst case docking to the space station (180 days) offering pressurized storage capability, or umpressurized CM operating as tank farm. ESA

N89-20179*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EXPENDABLE LAUNCH VEHICLE TRANSPORTATION FOR THE SPACE STATION
ROBERT R. CORBAN Oct. 1988 13 p Presented at the 39th Congress of the International Astronautical Federation, Bangalore, India, 8-15 Oct. 1988 Previously announced in IAA as A89-17720
(NASA-TM-101947; E-4636; NAS 1.15:101947) Avail: NTIS HC A03/MF A01 CSCL 22/2

Logistics transportation will be a critical element in determining the Space Station Freedom's level of productivity and possible evolutionary options. The current program utilizes the Space Shuttle as the only logistics support vehicle. Augmentation of the total transportation capability by expendable launch vehicles (ELVs) may be required to meet demanding requirements and provide for enhanced manifest flexibility. The total operational concept from ground operations to final return of support hardware or its disposal is required to determine the ELV's benefits and impacts to the Space Station Freedom program. The characteristics of potential medium and large class ELVs planned to be available in the mid-1990's (both U.S. and international partners' vehicles) indicate a significant range of possible transportation systems with varying degrees of operational support capabilities. The options available for development of a support infrastructure in terms of launch vehicles, logistics carriers, transfer vehicles, and return systems is discussed. Author

N89-24220# Defense Logistics Services Center, Battle Creek, MI.
DEFENSE INTEGRATED DATA SYSTEM (DIDS) PROCEDURES MANUAL. VOLUME 8: DOCUMENT IDENTIFIER CODE (DIC) INPUT/OUTPUT (I/O) FORMATS (FIXED LENGTH), CHANGE 3
Oct. 1988 92 p Supplement to DOD-4100.39-M-Vol-8
(PB89-139414; DOD-4100.39-M-VOL-8-CHANGE-3) Avail: NTIS HC A05/MF A01 CSCL 05/2

Operating procedures for processing transactions in support of the Federal Catalog System are provided and logistics management information outlined. Procedures address major logistics areas such as supply management, item identification, Interchangeability and Substitutability (I and S), and standardization. Also included is general and administrative information. All DIC and record formats that are Input/Output to/from DLSC in fixed length format are furnished. Author

N89-24221# Defense Logistics Services Center, Battle Creek, MI.
DEFENSE INTEGRATED DATA SYSTEM (DIDS) PROCEDURES MANUAL. VOLUME 2: MULTIPLE APPLICATION PROCEDURES
Oct. 1988 132 p Supersedes PB86-237484
(PB89-139307; DOD-4100.39-M-VOL-2) Avail: NTIS HC A07/MF A01 CSCL 05/2

Operating procedures are provided for processing transactions in support of the Federal Catalog System and logistics management information is outlined. Procedures address major logistics areas such as supply management, item identification, interchangeability and substitutability, and standardization. Also included is general

and administrative information. The manual consist of 16 volumes. GRA

N89-24376# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Space Operation Center.
THE MANNED SPACE LABORATORIES CONTROL CENTER (MSCC) AT DFVLR, OBERPFAFFENHOFEN, GERMANY, F.R.
JOACHIM KEHR *In* ESA, International Symposium on Europe in Space: The Manned Space System p 379-387 Oct. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The ESA approach for operating manned space laboratories is outlined. The ground segment and operational management structure are described. The manned space laboratories control center is presented. ESA

N89-25245*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION OPERATIONS TASK FORCE. PANEL 2 REPORT: GROUND OPERATIONS AND SUPPORT SYSTEMS
Dec. 1987 569 p
(NASA-TM-101817; NAS 1.15:101817) Avail: NTIS HC A24/MF A01 CSCL 22/1

The Ground Operations Concept embodied in this report provides for safe multi-user utilization of the Space Station, eases user integration, and gives users autonomy and flexibility. It provides for meaningful multi-national participation while protecting U.S. interests. The concept also supports continued space operations technology development by maintaining NASA expertise and enabling technology evolution. Given attention here are pre/post flight operations, logistics, sustaining engineering/configuration management, transportation services/rescue, and information systems and communication. A.D.

N89-29074# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
SOLUTION OF A TINNED IRON PURCHASING PROBLEM BY LAGRANGIAN RELAXATION
B. DORHOUT Sep. 1988 19 p
(MEMO-735; ISSN-0169-2690; ETN-89-95112) Avail: NTIS HC A03/MF A01

The problem in minimizing total purchase cost of tinned iron sheets, for a tin factory with a fixed production program, and the exploitation of the price structure by the formulation of a combinatorial optimization problem are described. A combinatorial programming model of the problem is formulated and solutions to this model are obtained by Lagrangean relaxation and subgradient techniques. The principles of these methods are described and a computer program, written in TURBO PASCAL, was executed on a microcomputer, to implement them for the specific problem. Extensions, modifications, and other possible applications of the model are formulated including reduction of computation time and the purchase of arbitrary goods from various sellers on the basis of value order discounts. Technical details on the solving of knapsack problems, and the transformation of infeasible solutions to feasible, are included. ESA

N89-29352# Federal Aviation Administration, Washington, DC.
ACCOMPLISHMENTS UNDER THE AIRPORT IMPROVEMENT PROGRAM: FISCAL YEAR 1988 Annual Report No. 7, Fiscal Year ending 30 Sep. 1988
JEAN HETSKO 1988 123 p
(AD-A208200; DOT/FAA/RP-89/3) Avail: NTIS HC A06/MF A01 CSCL 14/2

Section 521 of the Airport and Airway Improvement Act of 1982 (Public Law 97-248) requires that the Secretary of Transportation submit an annual report to Congress describing the accomplishment of the Airport grant program. This report covers activities for the fiscal year ending September 30, 1988. GRA

09

RELIABILITY AND QUALITY CONTROL

Includes Fault Tolerance, Failure and Error Analysis, Reliability Engineering, Quality Assurance, Wear, Safety Management and Safety, Standards and Measurement, Tests and Testing Inspections, Specifications, Performance Tests, Certification.

A89-14260
DYNAMIC FAULT RECONFIGURATION IN A MESH-CONNECTED MIMD ENVIRONMENT
M. UMIT UYAR (AT&T Bell Laboratories, Holmdel, NJ) and ANTHONY P. REEVES (Illinois, University, Urbana) IEEE Transactions on Computers (ISSN 0018-9340), vol. 37, Oct. 1988, p. 1191-1205. refs
Copyright

The near-neighbor problem is characterized by many iterations of a parallel matrix operation in which each matrix element is recomputed as a function of itself and its immediately adjacent near neighbors. Several highly parallel computer systems have been designed with the near-neighbor class of problems as the target application. As the number of processors in evolving parallel computer systems increases, the capability of fault tolerance to processor failures becomes more important. The authors show how fault tolerance can be efficiently achieved on an MIMD (multiple-instruction, multiple-data-stream) computer system for the near-neighbor problem by task redistribution. The techniques discussed minimize the extra data transfers and/or the extra computation in the system with faulty processors and links. I.E.

A89-14535
CAUSES AND EFFECTS OF SPACECRAFT FAILURES
MYRON HECHT (SoHaR, Inc., Los Angeles, CA) and EUGENE FIORENTINO (USAF, Rome Air Development Center, Griffiss AFB, NY) Quality and Reliability Engineering International (ISSN 0748-8017), vol. 4, Jan.-Mar. 1988, p. 11-19.
Copyright

In a study conducted for the USAF Rome Air Development Center to improve reliability prediction for spacecraft approximately 2600 incident reports on 300 spacecraft (representing 100 programs) that were launched between the early 1960s and January 1984 were analyzed. The causes of the spacecraft failures and the severity of the observed effects are examined. The classification of causes is explained in detail and examples of each type of failure are provided. Differences in the relative frequency of certain causes between pre-1977 missions and later ones are analyzed and some significant trends are identified. The association of spacecraft subsystems with the major causes of failure is investigated. Finally, the severity of the failure effects due to the identified cause categories is discussed. A significant finding is that a large fraction of the incidents is due to design and environmental causes rather than to random failures. Author

A89-17680*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STANDARDS FOR EARTH OBSERVATIONS FROM SPACE
H. J. SHEETZ (AIAA, Washington, DC) and M. S. REID (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 17 p. refs
(IAF PAPER 88-107) Copyright

The development of earth observation standards and the need for cooperation between national and international earth resource organizations are discussed. Possible solutions to the problem of developing a coordinated effort in the development of observational satellite systems are given. The activities of the AIAA Earth Observation Committee on Standards are reviewed. It is suggested that earth observation organizations must combine their resources and efforts and that computer programs of earth observation organizations, their work and products, and agreements between

various organizations, should be developed. Charts of organizations addressing the problems in earth observations by satellite are presented, including descriptions of their activities. R.B.

A89-20958#
IN PROCESS FAILURE INVESTIGATIONS IN AERONAUTICS
A. K. DAS and PREM BAVEJA (Hindustan Aeronautics, Ltd., Bangalore, India) Aeronautical Society of India, Journal (ISSN 0001-9267), vol. 40, Feb. 1988, p. 63-69. Research supported by the Aeronautical Research and Development Board.

The classification of defects is discussed as well as the causes and detection of defects. Inherent defects due to casting include piping, blow holes, nonmetallic inclusions, and segregation. Primary processing defects in wrought products include seams, laminations, and cooling cracks. Secondary processing defects include heat treatment cracks, overheating, and oxidation. Nondestructive testing is considered as well as fractographic examination, mechanical tests, chemical analysis, and metallography. K.K.

A89-24493
RELIABLE FLIGHT CONTROL SYSTEMS - COMPONENTS PLACEMENT AND FEEDBACK SYNTHESIS
M. MARITON and P. BERTRAND (CNRS, Laboratoire des Signaux et Systemes, Gif-sur-Yvette, France) IN: Automatic control; Proceedings of the Tenth Triennial World Congress of IFAC, Munich, Federal Republic of Germany, July 27-31, 1987. Volume 6. Oxford, England and Elmsford, NY, Pergamon Press, 1988, p. 151-155. refs
Copyright

For modern spacecraft and aircraft, reliable flight-control systems (FCS) must be designed to provide some fault tolerance. The mission has to be carried out in the presence of failures. Jump linear-quadratic systems are proposed as a suitable mathematical model, and it is shown how control laws can be built with automatic reconfiguration and failure anticipation. A global approach to the design of reliable FCS is outlined. It incorporates into a single analytical framework the three basic steps of the design (component selection, component location and control-law synthesis) and provides a cost index that is sensitive to both reliability and performance issues. Author

A89-24844
SPACE SAFETY AND RESCUE 1986-1987
GLORIA W. HEATH, ED. (SAR-ASSIST, Greenwich, CT) San Diego, CA, Univelt, Inc. (Science and Technology Series. Volume 70), 1988, 357 p. For individual items see A89-24845 to A89-24850.
Copyright

Technological and policy aspects of space safety, space rescue, and space-based terrestrial rescue systems are discussed in reviews and reports. Topics addressed include safety and rescue (S&R) evaluations of planned space stations, human factors on the International Space Station, the decay of trackable space objects, and orbital-debris hazard mitigation using the OMV. Consideration is given to satellite communication in land disasters, S&R considerations for space biological experiments, crew rescue equipment for manned space missions, S&R planning for Hermes, and the breakup of the Cosmos 1275 satellite. T.K.

A89-28836
FORMAL VERIFICATION OF FAULT TOLERANCE USING THEOREM-PROVING TECHNIQUES
JOSEPH KLJAICH, JR. (AT&T Bell Laboratories, Naperville, IL), BRIAN T. SMITH (Argonne National Laboratory, IL), and ANTHONY S. WOJCIK (Michigan State University, East Lansing) IEEE Transactions on Computers (ISSN 0018-9340), vol. 38, March 1989, p. 366-376. refs
(Contract W-31-109-ENG-38; NSF DCR-83-17524)
Copyright

A formal verification system based on the use of automated reasoning techniques is described to validate fault tolerance. An extended Petri net representation, called a flow net, is described together with the theorem-proving implementation of a rule-based system for manipulating system descriptions. Examples taken from the literature are used to illustrate the representation and the capabilities of the formal verification system under development. I.E.

A89-30819*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PRACTICES IN ADEQUATE STRUCTURAL DESIGN
ROBERT S. RYAN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: AIAA, ASME, ASCE, AHS, and ASC, Structures, Structural Dynamics and Materials Conference, 30th, Mobile, AL, Apr. 3-5, 1989, Technical Papers. Part 4. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 1612-1622. refs
(AIAA PAPER 89-1344)

An account is given of the guidelines for safe and reliable space vehicle design, especially in the structural engineering area, which have been formulated by NASA in the aftermath of the Space Shuttle Challenger accident in 1986. Illustrative examples are presented from state-of-the-art, performance-driven hardware whose design ineluctably gives rise to a high sensitivity to small variations and uncertainties. It is recommended that such hardware be designed with a view to easy inspectability and manufacturability, with emphasis on the role played in system structures by fracture mechanics. Static and dynamic coupling effects must be precluded wherever possible. O.C.

A89-37256
A CLASS OF FAULT-TOLERANT MULTIPROCESSOR NETWORKS
ARIF GHAFOOR (Syracuse University, NY) IEEE Transactions on Reliability (ISSN 0018-9529), vol. 38, April 1989, p. 5-15. refs
Copyright

A class of efficient interconnection networks for large multiprocessor systems is introduced. The important characteristics of these networks are their capability of maximal fault-tolerance, higher density, admitting simple distributed-routing algorithms both for the faulty and fault-free network, and ease of self-diagnosis. The fault-tolerant routing is fully distributed and does not require any topological table. The self-diagnostic algorithm is semi-distributed, and is based on a combinatorial structure known as the Hadamard matrix. The diagnostic scheme has high degree of fault-tolerance, which asymptotically approaches to a level of 100 percent. The scheme can be made more secure and fault-tolerant by using various forms of Hadamard matrix. I.E.

A89-38271
JEM INTEGRATED CONTROL AND MANAGEMENT SYSTEM
MASAO HATADA, TETSUROU YOKOYAMA, TAKEYASU YOSHIOKA (National Space Development Agency of Japan, Tokyo), MASAOKI KUZUMAKI (Mitsubishi Heavy Industries, Ltd., Nagoya, Japan), HIDEO KOIZUMI (Mitsubishi Heavy Industries, Ltd., Tobishima, Japan) et al. IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 1795-1800.
Copyright

To assure adequate safety, reliability and maintainability of JEM (The Japanese Experiment Module), the concept of an 'Integrated Control and Management System' was studied. As the result of the study: (1) the control and management structure, (2) functional requirements, and (3) software methodologies were clarified. Author

A89-38524
ENVIRONMENTAL STRESS SCREENING - AN INTEGRATION OF DISCIPLINES
HENRY CARUSO (Westinghouse Electric Corp., Baltimore, MD) Journal of Environmental Sciences (ISSN 0022-0906), vol. 32, Mar.-Apr. 1989, p. 29-34. refs
Copyright

This article provides guidelines for developing consistent and effective environmental stress screening (ESS) programs for electronic assemblies and systems. Emphasis is on the timely

coordination of all concerned technical disciplines to ensure that a complete and unbiased information base is available to program management for decision making. The technical disciplines involved include design, reliability, environmental, quality, test, and field engineering. The ESS development program is characterized by three phases: conceptual definition, implementation, and effectiveness review. Throughout this process, integration of technical and administrative concerns is essential. Author

A89-40840
ALGORITHMIC FAULT TOLERANCE FOR MATRIX OPERATIONS ON TRIANGULAR ARRAYS
G. M. MEGSON and D. J. EVANS (Loughborough University of Technology, England) Parallel Computing (ISSN 0167-8191), vol. 10, April 1989, p. 207-219. refs
Copyright

In this paper the technique of algorithm-based fault tolerance which is used to detect and correct transient or permanent hardware faults by checksum matrices is reconsidered for triangular systolic arrays. Linear error detecting arrays are developed for both matrix product and triangular factorization and are shown to interface neatly with triangular schemes. The overheads associated with error detecting redundancy is offset by hardware reduction due to the folding of the array to produce triangular rather than the standard hex connected arrays. The result is shown to be improved efficiency and area efficient fault tolerant arrays. Author

A89-43049#
SEQUENTIAL TESTING FOR FAULT DETECTION IN MULTIPLY-REDUNDANT SYSTEMS
ASOK RAY (Pennsylvania State University, University Park) ASME, Transactions, Journal of Dynamic Systems, Measurement, and Control (ISSN 0022-0434), vol. 111, June 1989, p. 329-332. refs
Copyright

The paper presents the theory and application of a sequential test procedure for fault detection and isolation (FDI). The test procedure is suited for development of intelligent instrumentation in strategic processes like aircraft and nuclear plants where redundant measurements are usually available for individual critical variables. The algorithm of the test procedure is formulated by use of (1) a generic redundancy management procedure which is essentially independent of the fault detection strategy and measurement noise statistics, and (2) a modified version of sequential probability ratio test (SPRT) algorithm for fault detection and isolation, which functions within the framework of the aforesaid redundancy management procedure. The sequential test procedure is suitable for real-time applications using commercially available microcomputers and its efficacy has been verified by on-line fault detection in an operating nuclear reactor. Author

A89-44425* Draper (Charles Stark) Lab., Inc., Boston, MA.
HARDWARE AND SOFTWARE FAULT TOLERANCE - A UNIFIED ARCHITECTURAL APPROACH
JAYNARAYAN H. LALA and LINDA S. ALGER (Charles Stark Draper Laboratory, Inc., Cambridge, MA) IN: FTCS-18; International Symposium on Fault-Tolerant Computing, 18th, Tokyo, Japan, June 27-30, 1988, Digest of Papers. Washington, DC, Computer Society Press, 1988, p. 240-245. refs
(Contract NAS1-18061)
Copyright

The loss of hardware fault tolerance which often arises when design diversity is used to improve the fault tolerance of computer software is considered analytically, and a unified design approach is proposed to avoid the problem. The fundamental theory of fault-tolerant (FT) architectures is reviewed; the current status of design-diversity software development is surveyed; and the FT-processor/attached-processor (FTP/AP) architecture developed by Lala et al. (1986) is described in detail and illustrated with diagrams. FTP/AP is shown to permit efficient implementation of N-version FT software while still tolerating random hardware failures with very high coverage; the reliability is found to be significantly higher than that of conventional majority-vote N-version software. T.K.

A89-46484
LOST OPPORTUNITIES - RELIABILITY AND MAINTAINABILITY CAN ENHANCE PRODUCTIVITY
OTTO H. FEDOR IN: Annual Reliability and Maintainability Symposium, Atlanta, GA, Jan. 24-26, 1989, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 248-251. refs
Copyright

Lost opportunities using reliability practice to improve productivity are discussed. Recommendations are made based on proven techniques and results. The NASA-developed systems assurance analysis (SAA) is presented as a tool to avoid failures and reduce operational risks. I.E.

A89-47550
FAULT TOLERANCE ANALYSIS OF THE CLASS OF REARRANGEABLE INTERCONNECTION NETWORKS
S. PAKZAD (Pennsylvania State University, University Park) Journal of Parallel and Distributed Computing (ISSN 0743-7315), vol. 7, Aug. 1989, p. 148-164. refs
Copyright

The Shen and Hays (1984) theoretical framework subsequently extended by Pakzad and Lakshmivarahan (1988) into a framework for the analysis of interconnection-network fault tolerance behavior in a multicomputer environment is presently used to analyze the fault tolerance characteristics of a range of rearrangeable beta-networks, namely those of Benes (1965), Waksman (1968), and Joel (1968), as well as the serial network. A comparative analysis is also undertaken of these networks with a view to their hardware cost, performance, and degree of fault tolerance. O.C.

A89-50401
ON FAULT-TOLERANT STRUCTURE, DISTRIBUTED FAULT-DIAGNOSIS, RECONFIGURATION, AND RECOVERY OF THE ARRAY PROCESSORS
SEYED H. HOSSEINI (Wisconsin, University, Milwaukee) IEEE Transactions on Computers (ISSN 0018-9340), vol. 38, July 1989, p. 932-942. refs
Copyright

A study is made of the design of fault-tolerant array processors. It is shown how hardware redundancy can be used in the existing structures in order to make them capable of withstanding the failure of some of the array links and processors. Distributed fault-tolerance schemes are introduced for the diagnosis of the faulty elements, reconfiguration, and recovery of the array. Fault tolerance is maintained by the cooperation of processors in a decentralized form of control without the participation of any type of hardcore or fault-free central controller such as a host computer. Time redundancy is utilized by assigning the functions of the failed processors to fault-free processors. I.E.

A89-50464
PERFORMANCE OF FAULT-TOLERANT DIAGNOSTICS IN THE HYPERCUBE SYSTEMS
ARIF GHAFOOR and PATRICK SOLE (Syracuse University, NY) IEEE Transactions on Computers (ISSN 0018-9340), vol. 38, Aug. 1989, p. 1164-1172. refs
Copyright

The concept of fault-tolerant self-diagnostics is introduced for distributed systems, and it is shown that there exists a performance tradeoff between the complexity of a self-diagnostic algorithm and the level of fault tolerance inherited by the algorithm. Hypercube systems are selected, and it is shown that designing an optimal algorithm for such systems has an equivalent coding theory formulation which belongs to the class of NP-hard problems. An efficient diagnostic scheme is proposed for these systems, and the performance tradeoff of the proposed algorithm, which is based on a combinatorial structure called the Hadamard matrix, is studied. The tradeoff between the fault tolerance and traffic complexity of

the proposed diagnostic algorithm for hypercubes of small size is evaluated. An interesting compromise is exhibited for the hypercube with an arbitrary size. I.E.

A89-52168
PERFORMANCE ANALYSIS OF VOTING STRATEGIES FOR A FLY-BY-WIRE SYSTEM OF A FIGHTER AIRCRAFT
C. SUBRAMANIAN and D. K. SUBRAMANIAN (Indian Institute of Science, Bangalore, India) IEEE Transactions on Automatic Control (ISSN 0018-9286), vol. 34, Sept. 1989, p. 1018-1021. refs
Copyright

Findings of studies on processing data from a digital fly-by-wire system of a fighter aircraft are presented. The objectives are to select a suitable software structure complying with reliability and fault-tolerance requirements and to assess its computational load. Ramp and constant input signals with noise are studied using on Monte Carlo methods. Voting strategies studied and compared include lower median, upper median, and weighted average. Execution times and memory requirements of each strategy are also assessed. I.E.

A89-52717#
PERFORMANCE TEST RESULTS OF A MULTI-FUNCTION FAULT-TOLERANT RLG SYSTEM
MAHESH K. JEERAGE (Honeywell Systems and Research Center, Minneapolis, MN) AIAA, Guidance, Navigation and Control Conference, Boston, MA, Aug. 14-16, 1989. 11 p.
(AIAA PAPER 89-3584) Copyright

This paper presents the performance test results of a fault-tolerant RLG system featuring skewed axis inertial sensors, sensor redundancy management scheme, and fault-tolerant electronics. This system, built by Honeywell's Commercial Flight Systems Group, was calibrated and tested in the laboratory by Honeywell's Systems and Research Center. This system is currently being flight tested by Boeing Commercial Airplane Company. A brief description of the system is presented in the paper with emphasis on the fault-tolerant aspects. The performance test results presented include nominal navigation performance and navigation performance under sensor failures. Performance of the failure detection and isolation scheme is also presented. Author

N89-10111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
FIRE BEHAVIOR AND RISK ANALYSIS IN SPACECRAFT
ROBERT FRIEDMAN and KURT R. SACKSTEDER 1988 14 p Prepared for presentation at the Winter Annual Meeting of the American Society of Mechanical Engineers, Chicago, Ill., 28 Nov. - 3 Dec. 1988
(NASA-TM-100944; E-4232; NAS 1.15:100944) Avail: NTIS HC A03/MF A01 CSCL 22/2

Practical risk management for present and future spacecraft, including space stations, involves the optimization of residual risks balanced by the spacecraft operational, technological, and economic limitations. Spacecraft fire safety is approached through three strategies, in order of risk: (1) control of fire-causing elements, through exclusion of flammable materials for example; (2) response to incipient fires through detection and alarm; and (3) recovery of normal conditions through extinguishment and cleanup. Present understanding of combustion in low gravity is that, compared to normal gravity behavior, fire hazards may be reduced by the absence of buoyant gas flows yet at the same time increased by ventilation flows and hot particle expulsion. This paper discusses the application of low-gravity combustion knowledge and appropriate aircraft analogies to fire detection, fire fighting, and fire-safety decisions for eventual fire-risk management and optimization in spacecraft. Author

N89-14000# Maryland Univ., College Park. Systems Design and Analysis Group.
ALLOCATION OF REAL-TIME COMPUTATIONS UNDER FAULT TOLERANCE CONSTRAINTS
SHEM-TOV LEVI, DANIEL MOSSE, and ASKOK K. AGRAWALA 3 May 1988 46 p
(Contract N00014-87-K-0241; DASG60-87-C-0066)
(AD-A198863; UMIACS-TR-88-32; CS-TR-2018) Avail: NTIS HC A03/MF A01 CSCL 12/5

Allocation of resources in next generation real time operating systems requires some important features in addition to those demonstrated by current systems, resulting in an increased complexity of each system. The allocation is closely related to the scheduling, and the two are based on time considerations, rather then on a static priority scheme. The allocation is fault tolerance motivated, to cope with the application's reliability goals. Distributed system issues and adaptive behavior requirements increase the complexity and significance of the allocation approach. The allocation scheme proposed here accomplishes the hard real time goal of guaranteeing a deadline satisfaction in case the job is accepted. In addition, this allocation scheme supports fault tolerance objectives in both damage containment and resiliency requirements. It does this in cooperation with a schedulability verification mechanism, and with an object architecture in which for each object there exists a calendar that maintains the time of its execution. A nice feature of this scheme is the way in which it can be used for reallocation while increasing the resiliency. GRA

N89-15416# Pratt and Whitney Aircraft, West Palm Beach, FL.
RELIABILITY, MAINTAINABILITY, AND SAFETY: BIBLIOGRAPHY
7 Apr. 1988 58 p
Avail: NTIS HC A04/MF A01 CSCL 14/4

This bibliography includes information given at AIAA SESTC technical meetings since 1982. B.G.

N89-17262# Grumman Aerospace Corp., Bethpage, NY. Aircraft Systems Div.
R/M/T (RELIABILITY/MAINTAINABILITY/TESTABILITY) DESIGN FOR FAULT TOLERANCE. VOLUME 1: PROGRAM MANAGER'S GUIDE Final Report, Oct. 1985 - May 1986
DAVID J. CONROE and STANLEY J. MURN, JR. Mar. 1988 153 p
(Contract F30602-85-C-0161)
(AD-A200204; RADC-TR-88-69-VOL-1) Avail: NTIS HC A08/MF A01 CSCL 13/8

Fault tolerance has come into almost universal use in modern day systems of all types. This report contains design guidance and general information for Air Force and contractor program managers with respect to the nature and form of Reliability/Maintainability/Testability (R/M/T) tasks needed in the development of fault tolerant systems. This program managers guide contains instructions for tailoring the R/M/T programmatic standards (MIL-STDs 785, 470 and 2165) for fault tolerant systems development. Important fault tolerance design options and tradeoff analysis methods are discussed to aid the program manager in understanding and overseeing the entire fault tolerant system design process. This report is Volume 1 of 2. Volume 2 will be an R/M/T Fault Tolerant Design Implementation Guide available at a later date. GRA

N89-20698*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
FAULT-TOLERANCE OF A NEURAL NETWORK SOLVING THE TRAVELING SALESMAN PROBLEM Final Report
P. PROTZEL, D. PALUMBO, and M. ARRAS (College of William and Mary, Williamsburg, VA.) Feb. 1989 15 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-181798; ICASE-89-12; NAS 1.26:181798) Avail: NTIS HC A03/MF A01 CSCL 09/2

This study presents the results of a fault-injection experiment that stimulates a neural network solving the Traveling Salesman Problem (TSP). The network is based on a modified version of Hopfield's and Tank's original method. We define a performance characteristic for the TSP that allows an overall assessment of the solution quality for different city-distributions and problem sizes. Five different 10-, 20-, and 30- city cases are sued for the injection

of up to 13 simultaneous stuck-at-0 and stuck-at-1 faults. The results of more than 4000 simulation-runs show the extreme fault-tolerance of the network, especially with respect to stuck-at-0 faults. One possible explanation for the overall surprising result is the redundancy of the problem representation. Author

N89-21754*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
SOFTWARE SYSTEM SAFETY
JAMES G. UBER *In* Alabama Univ., Research Reports: 1988 NASA/ASEE Summer Faculty Fellowship Program 28 p Dec. 1988
Avail: NTIS HC A99/MF E03 CSCL 09/2

Software itself is not hazardous, but since software and hardware share common interfaces there is an opportunity for software to create hazards. Further, these software systems are complex, and proven methods for the design, analysis, and measurement of software safety are not yet available. Some past software failures, future NASA software trends, software engineering methods, and tools and techniques for various software safety analyses are reviewed. Recommendations to NASA are made based on this review. Author

N89-22295# Pacific Northwest Lab., Richland, WA.
HANFORD METEOROLOGICAL STATION COMPUTER CODES. VOLUME 9: THE QUALITY ASSURANCE COMPUTER CODES
K. W. BURK and G. L. ANDREWS Feb. 1989 171 p
(Contract DE-AC06-76RL-01830)
(DE89-008414; PNL-6279-VOL-9) Avail: NTIS HC A08/MF A01

The Hanford Meteorological Station (HMS) was established in 1944 on the Hanford Site to collect and archive meteorological data and provide weather forecasts and related services for Hanford Site approximately 1/2 mile east of the 200 West Area and is operated by PNL for the U.S. Department of Energy. Meteorological data are collected from various sensors and equipment located on and off the Hanford Site. These data are stored in data bases on the Digital Equipment Corporation (DEC) VAX 11/750 at the HMS (hereafter referred to as the HMS computer). Files from those data bases are routinely transferred to the Emergency Management System (EMS) computer at the Unified Dose Assessment Center (UDAC). To ensure the quality and integrity of the HMS data, a set of Quality Assurance (QA) computer codes has been written. The codes will be routinely used by the HMS system manager or the data base custodian. The QA codes provide detailed output files that will be used in correcting erroneous data. The following sections in this volume describe the implementation and operation of QA computer codes. The appendices contain detailed descriptions, flow charts, and source code listings of each computer code. DOE

N89-22591# Office of Technology Assessment, Washington, DC.
SAFE SKIES FOR TOMORROW: AVIATION SAFETY IN A COMPETITIVE ENVIRONMENT
Jul. 1988 194 p
(PB89-114318; OTA-SET-381; LC-88-600550) Avail: NTIS HC A09/MF A01; also available SOD HC $8.50 as 052-003-01126-3 CSCL 01/3

How well existing safety policies, regulations and technologies meet the government's responsibility for ensuring safety in commercial aviation are assessed and the role and capability of FAA to carry out its function are reviewed. Author

N89-24368# European Space Agency, Paris (France). Columbus System Engineering and Integration.
COLUMBUS SAFETY AND RELIABILITY
F. LONGHURST and H. WESSELS *In its* International Symposium on Europe in Space: The Manned Space System p 281-290 Oct. 1988
Copyright Avail: NTIS HC A99/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

Analyses carried out to ensure Columbus reliability, availability, and maintainability, and operational and design safety are summarized. Failure modes/effects/criticality is the main qualitative tool used. The main aspects studied are fault tolerance, hazard consequence control, risk minimization, human error effects, restorability, and safe-life design. ESA

N89-24817* Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Electrical and Computer Engineering.
PREDEPLOYMENT VALIDATION OF FAULT-TOLERANT SYSTEMS THROUGH SOFTWARE-IMPLEMENTED FAULT INSERTION Final Report, Nov. 1987 - Nov. 1988
EDWARD W. CZECK, DANIEL P. SIEWIOREK, and ZARY Z. SEGALL Washington Jul. 1989 47 p
(Contract NAG1-190)
(NASA-CR-4244; NAS 1.26:4244) Avail: NTIS HC A03/MF A01 CSCL 09/2

Fault injection-based automated testing (FIAT) environment, which can be used to experimentally characterize and evaluate distributed realtime systems under fault-free and faulted conditions is described. A survey is presented of validation methodologies. The need for fault insertion based on validation methodologies is demonstrated. The origins and models of faults, and motivation for the FIAT concept are reviewed. FIAT employs a validation methodology which builds confidence in the system through first providing a baseline of fault-free performance data and then characterizing the behavior of the system with faults present. Fault insertion is accomplished through software and allows faults or the manifestation of faults to be inserted by either seeding faults into memory or triggering error detection mechanisms. FIAT is capable of emulating a variety of fault-tolerant strategies and architectures, can monitor system activity, and can automatically orchestrate experiments involving insertion of faults. There is a common system interface which allows ease of use to decrease experiment development and run time. Fault models chosen for experiments on FIAT have generated system responses which parallel those observed in real systems under faulty conditions. These capabilities are shown by two example experiments each using a different fault-tolerance strategy. Author

N89-26247# Missouri Univ., Columbia. Dept. of Statistics.
INTERNATIONAL RESEARCH CONFERENCE ON RELIABILITY Final Report, 1 Apr. - 30 Sep. 1988
ASIT P. BASU 10 Nov. 1988 8 p
(Contract AF-AFOSR-0144-88; AF PROJ. 2304)
(AD-A207001; AFOSR-89-0377TR) Avail: NTIS HC A02/MF A01 CSCL 12/3

An international research conference on reliability was held at the University of Missouri-Columbia, Missouri, May 17-19, 1988. The primary purpose of the conference is to bring together researchers from industry, government and universities so that they may exchange ideas to identify directions for future relevant research in reliability. Here reliability is interpreted in its broadest sense. The conference is planned by the Research Subcommittee of the American Statistical Association Productivity and Quality Committee and is sponsored by the University of Missouri. Other organizations are also expected to sponsor the conference. The program will consist of invited and contributed papers on a broad spectrum of topics. Among proposed topics are: Accelerated Tests, Artificial Intelligence and Expert Systems, Automatic Diagnostics of Complex Systems, Bayesian Reliability, DataBase Analysis; Network Reliability; Government Documents on Reliability; Reliability Growth; Reliability Management; Repairable Systems; and Software Reliability. GRA

N89-27096# Syracuse Univ., NY. Dept. of Computer and Information Sciences.
FAULT TOLERANT VLSI (VERY LARGE-SCALE INTEGRATION) DESIGN USING ERROR CORRECTING CODES Final Technical Report, Mar. 1987 - Mar. 1988
C. R. HARTMANN, P. K. LALA, A. M. ALI, S. GANGULY, and G. S. VISWESWARAN Feb. 1989 67 p
(Contract F30602-81-C-0169; AF PROJ. 2338)
(AD-A208337; RADC-TR-88-321) Avail: NTIS HC A04/MF A01 CSCL 09/1

Very Large-Scale Integration (VLSI) provides the opportunity to design fault tolerant, self-checking circuits with on-chip, concurrent error correction. This study determines the applicability of a variety of error-detecting, error-correcting codes (EDAC) in high speed digital data processors and buses. In considering both microcircuit faults and bus faults, some of the codes examined are: Berger, repetition, parity, residue, and Modified Reflected Binary codes. The report describes the improvement in fault tolerance obtained as a result of implementing these EDAC schemes and the associated penalties in circuit area. GRA

N89-28022# University of Southern California, Los Angeles. Dept. of Electrical Engineering.
BASIC RESEARCH IN RELIABILITY FOR REAL SYSTEMS
Final Technical Report, 15 Jul. 1986 - 14 Jul. 1988
VICTOR O. LI 5 Aug. 1988 6 p
(Contract AF-AFOSR-0269-84; AF PROJ. 2304)
(AD-A209649; AFOSR-89-0783TR) Avail: NTIS HC A02/MF A01
CSCL 12/7

The goal of this research is to develop practical models and efficient algorithms to analyze the reliability, availability and maintainability of complex systems in which component failures are statistically dependent and each component is subject to degradations before complete failure. The Event-Based Reliability Model (EBRM) was developed to model and analyze the reliability of a network in which component failures are statistically dependent. In EBRM, the events that could cause component failures were modeled explicitly. This approach required much fewer parameters than the traditional model employing conditional probabilities. The EBRM was also proved to be a completely general model which could be applied to various types of failure dependencies. For reliability evaluations, many existing algorithms for computing network reliability could be used with minor modifications and no significant increase in computational complexity. An improved algorithm for the approximate evaluation of network performance was also developed. For multi-state systems, ordered enumeration was used to approximate and bound system reliabilities and other performance measures, and an efficient algorithm was developed for this purpose. The author has been studying network management algorithms which are resilient to network failures. GRA

10

LEGALITY, LEGISLATION, AND POLICY

Includes Laws and Legality, Insurance and Liability, Patents and Licensing, Legislation and Government, Regulation, Appropriations and Federal Budgets, Local, National, and International Policy.

A89-12102
COLLOQUIUM ON THE LAW OF OUTER SPACE, 30TH, BRIGHTON, ENGLAND, OCT. 10-17, 1987, PROCEEDINGS
Colloquium sponsored by the International Institute of Space Law of IAF. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, 439 p. For individual items see A89-12103 to A89-12129.
Copyright

National and international legal aspects of space exploration, militarization, and exploitation are examined from a wide range of perspectives. Topics addressed include the maintenance of outer space for peaceful purposes, space environmental problems, space commercialization, and the role of the UN in regulating remote-sensing activities. Consideration is given to mechanisms for improving international cooperation; the history of space law; the space implications of U.S. and Soviet doctrines on ABM, SALT II, SDI, and ASAT; man-made space debris and its control; space pollution; national space legislation in Europe; NASA and commercial ELV services; U.S. DOT regulations; equitable access to orbital and spectral resources; newsgathering from space; conflicts between national and international legislation on remote sensing; EEC regulations on international satellite communication; and COPUOS deliberations on nuclear power in space. T.K.

A89-12103#
UNITED STATES NATIONAL SPACE LEGISLATION ON THE EXPLORATION AND USE OF OUTER SPACE FOR PEACEFUL PURPOSES
JONATHAN F. GALLOWAY (Lake Forest College, IL) and EILENE GALLOWAY IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 32-41. refs
Copyright

The provisions of U.S. law applying to space activities are summarized, and their international implications are analyzed. Topics addressed include the definition of space law, the National Aeronautics and Space Act of 1958 and amendments to it, NASA policy guidelines based on the act, bilateral and international agreements negotiated by NASA and other agencies, the National Science and Technology Policy Organization and Priorities Act of 1976, and the major space-commercialization laws. Also considered are interpretation problems for key terms regarding space militarization (e.g., 'military', 'weapons', 'harmful intervention', peaceful purposes', and 'peaceful uses'). T.K.

A89-12104*# National Aeronautics and Space Administration, Washington, DC.
MAINTAINING OUTER SPACE FOR PEACEFUL PURPOSES THROUGH INTERNATIONAL COOPERATION
GEORGE E. REESE, DAVID J. THACHER (NASA, Washington, DC), and HELEN S. KUPPERMAN IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 52-55. refs
Copyright

NASA activities in support of international cooperation in space exploration and exploitation are briefly reviewed, with a focus on their compatibility with UN treaties. Particular attention is given to the provisions of the National Aeronautics and Space Act of 1958 and other applicable legislation, the over 1000 bilateral and international agreements NASA has entered into since 1958, international participation in currently ongoing NASA projects (Hubble Space Telescope, Galileo, Ulysses, Rosat, the D-2 Spacelab mission), and plans for the International Space Station. T.K.

A89-12105#
SPACE COOPERATION BETWEEN THE U.S. AND THE SOVIET UNION
MARCIA S. SMITH IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 85-92. refs
Copyright

The history of U.S.-Soviet cooperation in space activities is reviewed, and recommendations for its future are outlined. Topics addressed include the U.S. legislation governing international cooperation, international law aimed at maintaining outer space for peaceful purposes, the problem of ASAT testing, the U.S.-Soviet agreements through 1972 (culminating in the Apollo-Soyuz Test Project), political factors affecting space cooperation, and the signing of a new agreement in April 1987. It is concluded that the negotiation of cooperative agreements has depended and will continue to depend more on the status of general U.S.-Soviet relations than on technological factors or the existence of space weapons programs. Further cooperation, for example on international missions to Mars, is found to offer considerable practical advantages; a series of shorter-term projects is suggested to avoid politically determined interruptions. T.K.

A89-12112#
PRIVATE SPACE ACTIVITIES - QUESTIONS OF INTERNATIONAL RESPONSIBILITY
HORST BITTLINGER (Koeln, Universitaet, Cologne, Federal Republic of Germany) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 191-196. refs
Copyright

The impact of increased space commercialization on the orbital environment is considered from an international legal perspective. The provisions of the Outer Space Treaty and the Moon Treaty making the parties responsible for nongovernmental space activities by their nationals are recalled; 'subjective' and 'objective' approaches to the problem of identifying the responsible state for particular kinds of space activities are characterized; and the role of national legislation is explored. A number of discrepancies between the provisions governing private space activities in the Swedish, U.S., and UK national legislation are discussed in detail. T.K.

A89-12115#
COMMERCIAL SPACE TRANSPORTATION - REGULATORY ACTIVITIES OF THE UNITED STATES DEPARTMENT OF TRANSPORTATION
GERALD MUSARRA (DOT, Office of Commercial Space Transportation, Washington, DC) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 224-227.
Copyright

DOT enforcement of the 1984 Commercial Space Launch Act is reviewed. Consideration is given to the initial regulatory documents regarding licensing policy, the emphasis on commercial services in the new national launch strategy issued after the loss of the Space Shuttle Challenger, the established and start-up commercial launch firms and the types of payloads they are contracting for, and the continuing dependence of all launch services on the existing government-operated ground infrastructure. Problem areas identified include redesign of these launch sites for multipurpose use, allocation of risk and liability, assignment of radio frequencies, and environmental protection. T.K.

A89-12116#
INTERNATIONAL COOPERATION IN COMMERCIAL ACTIVITIES IN OUTER SPACE - IS IT NECESSARY, DESIRABLE, OR FEASIBLE?
GRIER C. RACLIN (Heron, Burchette, Ruckert and Rothwell, Washington, DC) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 234-245. refs
Copyright

Multinational commercial space ventures are considered from a legal perspective. The applicable international and national legislation is reviewed, and it is argued that, although international cooperation is not required by any of the treaty provisions, it is desirable for economic and technological reasons and has been shown to be feasible by a number of past and ongoing projects. Examples of such cooperation are listed and briefly characterized, and some modifications of the regulatory structure are suggested on the basis of the 1982 Law of the Sea Convention. T.K.

A89-12118#
INTERNATIONAL LEGAL ASPECTS OF COMMERCIALIZATION OF PRIVATE ENTERPRISE SPACE ACTIVITIES
GABRIELLA CATALANO SGROSSO (Roma, Universita, Rome, Italy) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 251-262. refs
Copyright

The international treaty provisions governing commercial space activities are reviewed, and a number of specific problems involving the utilization of the International Space Station are examined in detail. Consideration is given to pollution control problems; docking and access to Space Station facilities; jurisdiction and control of Space Station activities; national, multinational, and international space station concepts; choice-of-law rules; and bilateral memoranda of understanding governing the Space Station. Particular attention is given to intellectual property rights and patents, ESA-NASA memoranda of understanding, the different types of agreements negotiated between NASA and commercial users (Technical Exchange Agreement, Industrial Guest Investigator, and Joint Endeavor Agreement), the impact of the U.S. Freedom of Information Act and Space Act on international participants, and ESA contract conditions. T.K.

A89-12120#
THE LEGAL AND POLITICAL IMPLICATIONS OF MEDIA NEWSGATHERING FROM SPACE
RICHARD DALBELLO (U.S. Congress, Office of Technology Assessment, Washington, DC) and LARRY MARTINEZ (National Telecommunications and Information Administration, Washington, DC) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 279-288. refs
Copyright

The current status of U.S. and international law governing satellite remote sensing by news organizations is surveyed. The desires of news media for satellite resolution and coverage superior to those currently available from Landsat and SPOT are discussed, and the concept of a mediasat owned and operated by a media consortium is outlined. Consideration is given to U.S. national-security restrictions on mediasat-type activities and questions of First Amendment rights, the 1984 Landsat Act, UN treaties and principles governing communication and remote sensing, the question of prior consent in UN information regulations and space law, and the impact of a future mediasat on these issues. It is concluded that a mediasat will exacerbate problems of international information flow and force national regimes to formulate new policies to account for the technological advances. T.K.

A89-12126#
INTERNATIONAL SPACE LAW NORMS REGULATING REMOTE SENSING OF THE EARTH FROM OUTER SPACE
CHARLES CHUKWUMA OKOLIE (Okolie International Law Chambers, Chicago, IL) IN: Colloquium on the Law of Outer Space, 30th, Brighton, England, Oct. 10-17, 1987, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1988, p. 366-370. refs
Copyright

The applicability of international customary law and treaties to commercial satellite remote sensing of earth resources is examined. The history of space remote sensing is briefly traced, and the applicable UN legislation is characterized in detail. It is argued that currently valid international law, while permitting remote-sensing activities without the consent of the states whose territory is being observed, demands that the states with jurisdiction over the remote-sensing operators encourage them to make the remote-sensing information available to the observed states. T.K.

A89-13446
UNITED STATES SPACE POLICY, LAW, AND REGULATION - THREE KEY ISSUES
JOHN B. GANTT Space Communication and Broadcasting (ISSN 0167-9368), vol. 6, July 1988, p. 189-194.
Copyright

Three issues related to U.S. space policy are reviewed. The shift in liability insurance provision from the government to private enterprise which accompanied the Commercial Space Launch Act of 1984 is examined. It is suggested that NASA's influence has decreased while the role of the DoD in space policy and programs has increased, and that the U.S. lacks a long-range space policy. R.B.

A89-15173
THE LAW AND REGULATION OF INTERNATIONAL SPACE COMMUNICATION
RITA LAURIA WHITE and HAROLD M. WHITE, JR. Research supported by the National Press Foundation. Boston, MA, Artech House, 1988, 337 p. refs
Copyright
Space communication is reviewed from a historical and technical perspective. The impact of space communication on international telecommunication law and policy is discussed. Consideration is also given to the origins and evolution of the international telecommunication union and the regulation of radio. K.K.

A89-16138
SPACE LAW: VIEWS OF THE FUTURE
TANJA L. ZWAAN, ED. (Leiden, Rijksuniversiteit, Netherlands) Deventer, Netherlands, Kluwer Law and Taxation Publishers, 1988, 196 p. For individual items see A89-16139 to A89-16149.
Copyright
Papers concerning space law are presented, focusing on the possibilities for future developments. Topics include a framework for decision making in human activities in outer space, the history of space law, the commercial exploitation of mineral resources in outer space, and competition in space transport. The law-making process concerning outer space, the military in outer space, the contribution of developing countries to space law, the role of municipal law in regulating space-related activities, and environment-related norms in space law are also discussed. The texts from several legal documents pertaining to space law are given. R.B.

A89-16146
THE PROGRESSIVE DEVELOPMENT OF SPACE LAW - NEW OPPORTUNITIES AND RESTRAINTS
GENNADII M. DANILENKO (AN SSSR, Institut Gosudarstva i Prava, Moscow, USSR) IN: Space law: Views of the future. Deventer, Netherlands, Kluwer Law and Taxation Publishers, 1988, p. 99-110. refs
Copyright
General trends which could change the structure of space law are analyzed. The establishment of a more equitable international space order is discussed in detail. The determination of adequate mechanisms for international cooperation and the maintenance of space for peaceful purposes are examined. R.B.

A89-16147
THE CONTRIBUTION OF THE DEVELOPING COUNTRIES TO THE LEGAL FORMULATION OF FUTURE SPACE LAW
IDA BAGUS RAHMADI SUPANCANA (Ministry for Political Affairs and Security, Djakarta, Indonesia) IN: Space law: Views of the future. Deventer, Netherlands, Kluwer Law and Taxation Publishers, 1988, p. 113-124. refs
Copyright
Several areas of space law are analyzed in terms of the needs and interests of developing countries. The way in which legal documents such as the 1967 Outer Space Treaty address the problems of developing countries is discussed. The meaning of 'peaceful uses' of space, the nonappropriation of celestial bodies, international responsibility of states for national activities in space, and liability for damage caused by space objects are examined. R.B.

A89-16148
THE FUTURE ROLE OF MUNICIPAL LAW IN REGULATING SPACE-RELATED ACTIVITIES
PHILLIP DANN (International Maritime Satellite Organization, London, England) IN: Space law: Views of the future. Deventer, Netherlands, Kluwer Law and Taxation Publishers, 1988, p. 125-134. refs
Copyright
The importance of municipal law to space law is discussed. Legal aspects of the commercialization space are outlined, including insurance and liability. Laws in the U.S. and the UK which govern activities in outer space are considered. The future direction of space law is considered, stressing the expected role of municipial law. R.B.

A89-16149
THE SCOPE OF VALIDITY AND EFFECTIVENESS OF ENVIRONMENT-RELATED NORMS IN OUTER SPACE LAW
REINHARD MUELLER (Halle-Wittenberg, Universitaet, Halle, German Democratic Republic) IN: Space law: Views of the future. Deventer, Netherlands, Kluwer Law and Taxation Publishers, 1988, p. 135-141. refs
Copyright
Legal issues related to environmental protection and outer space activities are discussed. The environmental consequences of an arms race in space are considered. International law concerning the protection of the cosmic and terrestrial environment from negative consequences of peaceful outer space activities is examined. R.B.

A89-16538
RECENT DEVELOPMENTS IN AVIATION CASE LAW
JONATHAN M. HOFFMAN and LISA BRETT EGAN (Martin, Bischoff, Templeton, Ericsson and Langslet, Portland, OR) Journal of Air Law and Commerce (ISSN 0021-8642), vol. 54, Fall 1988, p. 1-121. refs
Copyright
Cases in aviation law during the mid-1980s are reviewed. The cases discussed cover various topics, including jurisdiction, products liability, airports, contribution and indemnity, limitation of actions, insurance coverage, and damages. Cases relating to the Federal Tort Claims Act, the Hague Convention, the Warsaw Convention, and air carrier liability are examined. Other aspects of aviation law presented include FAA enforcement and local regulation, administrative law, negligence, antitrust, bankruptcy and FAA recordation, misrepresentation, and choice of law. R.B.

A89-17871#
INTERNATIONAL SPACE PLANS AND POLICIES - FUTURE ROLES OF INTERNATIONAL ORGANIZATIONS
STEPHEN E. DOYLE (Aerojet TechSystems Co., Sacramento, CA) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 14 p. refs
(IAF PAPER 88-622) Copyright
The role of international organizations in international space plans and policy is discussed, including branches of the UN, scientific and technical organizations, and intergovernmental operating global systems. National, regional, and global organizations affecting space activities are outlined. The future needs of space activity are examined, including standardization of astronautic cartography, mission safety practices, health and contamination controls, the definition and policing of criminal activity, and issues of personal status and nationality. The creation of a world space agency within the structure of the UN is proposed to control international space activities. R.B.

A89-17872#
U.S.-SOVIET SPACE RELATIONSHIPS IN THE 1990S - A U.S. PERSPECTIVE ON POLICY ALTERNATIVES
JOHN M. LOGSDON (George Washington University, Washington, DC) IAF, International Astronautical Congress, 39th, Bangalore, India, Oct. 8-15, 1988. 9 p.
(IAF PAPER 88-624) Copyright
Issues which the U.S. must consider in determining policy towards U.S.-Soviet cooperation in space are discussed. The historical background of cooperation between the two countries is reviewed. Reasons for cooperation are examined, including the desire to get into space, accelerating the process of space development, and lessening political tensions. Factors affecting U.S. interests in cooperation include the lack of detailed plans for future Soviet space science activities and the question of the Soviet Union's objectives in space cooperation. It is proposed that U.S. interests would be best served by using space cooperation

with the Soviet Union as an area of building relationships between the two countries. R.B.

A89-19385
UN PRINCIPLES ON REMOTE SENSING - AN AGREEMENT ON ECONOMIC RELATIONS
N. JASENTULIYANA (UN, Outer Space Affairs Div., New York) Space Policy (ISSN 0265-9646), vol. 4, Nov. 1988, p. 281-284.

Consideration is given to the political and economic impact of the principles regarding the remote sensing of earth from space adopted as a resolution by the UN General Assembly in 1986. The fact that these principles were not formalized as a binding international treaty is stressed, and it is suggested that, although commercial relations between the providers of remote-sensing services and developing countries have improved, serious political problems are posed by the commercial availabilty of surveillance-quality remote-sensing images of military installations and other restricted areas. The need for a legal framework to reduce such international tensions is indicated. T.K.

A89-19389
US SPACE TRANSPORTATION POLICY - HISTORY AND ISSUES FOR A NEW ADMINISTRATION
SCOTT PACE Space Policy (ISSN 0265-9646), vol. 4, Nov. 1988, p. 307-318. refs

The space policy decisions facing the incoming U.S. administration are examined on the basis of a historical review of NASA programs and the governmental decision-making processes which defined them. Topics discussed include the Space Shuttle program, the transition from ELVs to the Space Shuttle, the loss of the Challenger and its impact, and current military and NASA programs and funding levels. Particular attention is given to the roles of NASA, Congress, DOD, and administration in the Advanced Launch System program. The major issues identified for 1989 are (1) deployment or nondeployment of SDI, (2) commitment to a civilian manned presence in space, and (3) support for an internationally competitive space industry. T.K.

A89-19390
LAW ABOARD THE SPACE STATION
SCOTT F. MARCH Space Policy (ISSN 0265-9646), vol. 4, Nov. 1988, p. 328-335. refs

Problems of legal jurisdiction over the activities of individual Space Station crew members are discussed. Consideration is given to international treaties and regulations; U.S. federal legislation; the proliferation of U.S. state law into outer space; the Space Station Intergovernmental Agreements signed by the U.S., Canada, ESA, and Japan; and previously proposed alternative solutions to the jurisdiction question. It is concluded that the regulations and agreements currently in force are insufficient and in many cases ambiguous. T.K.

A89-21402
U.S. SPACE POLICY. II [LA POLITIQUE SPATIALE AMERICAINE. II]
LOUIS LAIDET L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 132, 1988, p. 16-22. In French.

Changes in U.S. civil space policy are pointed out, with special attention given to recent improvements in relations between the U.S. and other countries. The 1987 space cooperation agreement between the U.S. and the USSR has resulted in the planning of such joint programs as the Global Change project and manned and unmanned missions to Mars. Other recent indications of the cooperative posture of the U.S. include the Pollack study of potential foreign competition and cooperation and plans for an 'international space year' in 1992. R.R.

A89-22263
AMERICAN SPACE LAW: INTERNATIONAL AND DOMESTIC
NATHAN C. GOLDMAN (Houston, University, TX) Ames, IA, Iowa State University Press, 1988, 385 p. refs

The fundamental principles of U.S. space law are examined in a general introduction intended as a reference for the space industry and a text for law students. The analysis reflects the recent shift from a generalized and international to a domestic and commercial approach to space-law problems. Sections are devoted to the historical evolution of space law, the UN and affiliated organizations, international governmental organizations, international space law before and after 1980, domestic space activities, and the domestic law of outer space. Particular attention is given to the roles of NASA, the FCC, and the DOT, and the texts of major treaties and legislation are included in an appendix. T.K.

A89-23200
ANNALS OF AIR AND SPACE LAW. VOLUME 12
NICOLAS MATEESCO MATTE, ED. (McGill University, Montreal, Canada) Montreal, McGill University, 1987, 516 p. In English and French. No individual items are abstracted in this volume.

Papers are presented on the Canadian Aviation Safety Board, automation and air law, the improvement of civil aircraft safety, and legal aspects of future air navigation systems. Other topics include the Outer Space Treaty, protection of the outer space environment, commercial space activities, and cooperation between Canada and the U.S. in civilian space activities. Also considered are international organizations, relevant judicial cases, and legislative texts. R.R.

A89-23448
IS THE SPACE ENVIRONMENT AT RISK?
G. B. FIELD (Harvard University, Cambridge, MA), M. J. REES (Cambridge University, England), and D. N. SPERGEL (Princeton University, NJ) Nature (ISSN 0028-0836), vol. 336, Dec. 29, 1988, p. 725, 726.

The problems posed by pollution of near-earth space are reviewed, and possible solutions are considered. Measures that need to be taken to monitor the space environment, restrict the growth of space debris and the use of nuclear reactors in space, and emphasize peaceful pursuits in space are discussed. The use of space to verify arms control treaties and the need to ban the development, testing, and deployment of ASAT systems is addressed. C.D.

A89-26667
SPACE LAW OF THE FUTURE
H. PETER VAN FENEMA (Leiden, Rijksuniversiteit, Netherlands) (Latin American Conference on International Air Transport and Outer Space, Mexico City, Mexico, Aug. 14-18, 1988) Air Law (ISSN 0165-2079), vol. 13, Dec. 1988, p. 286-294. refs

The prospects for future space laws are discussed, including laws related to the colonization of outer space, commercial launches, and remote sensing. Examples of developments in each of these fields are presented, showing the trend towards the privatization of commercial space activities. It is suggested that this trend may discourage the governments from helping UN efforts to formulate multilateral space law treaties dealing with commercial space activities. It is concluded that the common interests of countries with similar space industries may lead to the creation of international regulations through separate agreements between those countries concerned. R.B.

A89-28326
VIEWPOINTS OF THE EQUATORIAL COUNTRIES TOWARD GEOSTATIONARY ORBIT - RESULTS OF 12 YEARS OF CONTROVERSY
ALDO ARMANDO COCCA (Council of Advanced International Studies, Buenos Aires, Argentina) (IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987) Acta

Astronautica (ISSN 0094-5765), vol. 17, June 1988, p. 621-630. refs
(IAF PAPER 87-640) Copyright

The historical background of positions taken by nations on issues involved in the equitable use of the GEO is expressed in declarations, UN discussions and resolutions, ITU conferences and regulations. Different viewpoints on legal issues have been clarified by international lawyers in analytical reports. The dispute has had some positive results. It proved that the international community does not accept monopolies, priorities, privileges, or preferential rights for given countries or groups of countries, whether industrialized or developing. It contributed to adjusting the ITU Convention, Article 33, in favor of geographically disadvantaged countries instead of recognizing priorities for equatorial countries; it also established the urgency of delimiting airspace while giving the GSO its own legal regime. Author

A89-30274
THE GREENHOUSE EFFECT - SCIENCE AND POLICY
STEPHEN H. SCHNEIDER (National Center for Atmospheric Research, Boulder, CO) Science (ISSN 0036-8075), vol. 243, Feb. 10, 1989, p. 771-781. refs
Copyright

The scientific questions surrounding the greenhouse effect debate are reviewed, and the issue of plausible responses to the effect is addressed. The projection of future emissions, future greenhouse gas concentrations, and regional climatic response is examined, and the estimation of global climatic response and validation of climatic model forecasts are considered. Scenarios of the environmental impact of CO2, the resulting economic, social, and political impact, and the policy responses are discussed. High leverage actions that may be undertaken to cope with global warming are examined. C.D.

A89-31554
A SUSTAINABLE RATIONALE FOR MANNED SPACE FLIGHT
JOHN M. LOGSDON (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Feb. 1989, p. 3-6.
Copyright

Reasons for maintaining a manned space program are discussed. An historical overview of the basis of the manned space program is presented. It is suggested that political and public support for an unmanned program would be small, leading to a reduction in the space program budget. The development of the Space Station and the possibility of using the Station in the establishment of bases on the moon or Mars are examined. R.B.

A89-31555
CAN INTELSAT AND INTERSPUTNIK COOPERATE?
BURTON I. EDELSON (Johns Hopkins Foreign Policy Institute, Washington, DC) and JOSEPH N. PELTON (INTELSAT, Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Feb. 1989, p. 7-11.
Copyright

The arguments for and against a merger of Intelsat and Intersputnik are reviewed. Reasons against cooperation include the fact that a merger would not provide Intelsat with access to new countries and the risk of losing Intelsat's political cohesion, organizational integrity and technological excellence. It is also suggested that a merger might give Soviet personnel direct access to U.S. technology. Reasons for cooperation include a reduction in cold war tension and consolidated satellite orbital locations which lead to a reduction in orbital requirements. It is also suggested that shared resources could make it possible to meet more service requirements at less cost. R.B.

A89-31557
AUSTRALIAN SPACE POLICY
B. S. MIDDLETON and E. F. CORY (Department of Industry, Technology and Commerce, Australian Space Office, Barton, Australia) Space Policy (ISSN 0265-9646), vol. 5, Feb. 1989, p. 41-46.
Copyright

The Australian space industry and space policy are reviewed. The recommendations for Australian space policy in the Madigan Report (Madigan et al., 1985) and the establishment of the Australian Space Office are examined. Consideration is given to the Australian National Space Program's emphasis on satellite-based communications, remote sensing, spacecraft ground support, a rocket launching site, and scientific research supporting space industry development. In addition, the Australian strategy for space industry development and the establishment of the Cape York Spaceport commercial launching site are discussed. R.B.

A89-31559
SPACE AND THE EUROPEAN COMMUNITY
KARL-HEINZ NARJES (CEC, Brussels, Belgium) Space Policy (ISSN 0265-9646), vol. 5, Feb. 1989, p. 59-64.
Copyright

The development of a comprehensive space policy for the European Community is discussed. The activities of the ESA are reviewed. Specific programs in several fields are proposed as a framework for developing European space policy. In the field of research and technological development, plans include the study of global change and in-orbit microgravity experiments. In addition, suggestions for telecommunications, earth observation, industrial development, legislative, and training programs are presented. R.B.

A89-33029
ENVIRONMENTAL IMPACT OF SPACE ACTIVITIES AND MEASURES FOR INTERNATIONAL PROTECTION
QIZHI HE Journal of Space Law (ISSN 1012-3431), vol. 16, no. 2, 1988, p. 117-127. refs
Copyright

The response of international space law to the impact of space activities on the environment is discussed. Chemical, biological, and radiological pollution arising from space activities is described. Provisions of existing treaties to protect the space environment are examined, including the 1963 Partial Test Ban Treaty, the 1967 Outer Space Treaty, the 1979 Moon Agreement, and the 1976 Convention on the Prohibition of Military and Other Hostile Use of Environmental Modification Techniques. Recommendations to strengthen international protection measures are given, including the definition of terminology, a ban on intentional destruction and fragmentation on space objects, measures to minimize the production of debris, the establishment of an international expert group and a mandatory consultation regime, furthering the norms of liability, and increasing international cooperation. R.B.

A89-33030
LEGAL PROBLEMS POSED BY THE COMMERCIALIZATION OF DATA COLLECTED BY THE EUROPEAN REMOTE SENSING SATELLITE ERS-1
MICHEL BOURELY Journal of Space Law (ISSN 1012-3431), vol. 16, no. 2, 1988, p. 129-146. refs
Copyright

Legal issues related to the commercialization of remote sensing data from ERS-1 are examined. The general principles of remote sensing activities and the commercialization of Eosat, Landsat, SPOT, and Soviet satellite data are reviewed. The legal bases and technical aspects of the ERS-1 program are discussed. The specific rules in the framework of the ERS-1 program concerning the role of the ESA and the participating states in the operational phase are outlined. In addition, consideration is given to international laws which are applicable to the intellectual property regime and the dissemination of ERS-1 data. R.B.

A89-33031
LEGAL AND POLICY ISSUES OF THE AEROSPACE PLANE
STEPHEN GOROVE (Mississippi, University, University; International Institute of Space Law, Dallas, TX) Journal of Space Law (ISSN 1012-3431), vol. 16, no. 2, 1988, p. 147-156. refs
Copyright

An overview of legal and policy issues related to the development of the aerospace plane is presented. The problem of whether or not the aerospace plane would be subject to air and/or space law and the delimitation of airspace and outer space are discussed. The legal status of astronauts, liability and registration issues, and the question of whether or not the aerospace plane would be a space object are addressed. The importance of studying relevant international agreements to determine the circumstances in which they would apply to the aerospace plane is emphasized. R.B.

A89-38378
THE SEARCH FOR AUTONOMY
LAWRENCE ARONOVITCH (MIT, Cambridge, MA) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2541-2545. refs
Copyright
The history of space science and technology is briefly recalled, with an emphasis on the roles of competition and cooperation, and the meaning of space autonomy for nations of different sizes and stages of economic development is discussed. The European effort, through ESA, to gain a degree of autonomy on a regional level while continuing to cooperate with NASA is described, and the feasibility of a similar program for the Pacific Basin countries is considered. Of special value for the Pacific would be a comprehensive remote-sensing project such as the Mission to Planet Earth proposed for 1992 (Ride, 1987). T.K.

A89-38379
THE ADOPTION OF LEGAL PRINCIPLES ON REMOTE SENSING
MEGUMU NAKAMURA (Otaru University of Commerce, Japan) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2547-2551. refs
Copyright
UN treaties and agreements aimed at regulation of terrestrial remote sensing from space are surveyed. The three major draft proposals considered by the UN committees during 1975-1985 (one French-Soviet, one Latin American, and one U.S.) are characterized; the history of discussions is reviewed; the principles adopted by the General Assembly in 1986 are summarized; and the further legal implications are explored. It is suggested that, since neither a right of prior consent for states whose territory is being observed nor a complete freedom of action for the state operating the space sensor was included in the 1986 principles, their ultimate effect is to encourage international consultation and cooperation, including the sharing of remote-sensing data with the state observed. T.K.

A89-38380
STATE RESPONSIBILITY FOR ENVIRONMENTAL DEGRADATION ARISING FROM SPACE ACTIVITIES - OBLIGATIONS OF RESULT AND GENERAL PRINCIPLES OF LAW
LIANE I. DEGVILLE (Keio University, Tokyo, Japan) IN: International Symposium on Space Technology and Science, 16th, Sapporo, Japan, May 22-27, 1988, Proceedings. Volume 2. Tokyo, AGNE Publishing, Inc., 1988, p. 2553-2558.
Copyright

A89-38975
SPACE POLICY - DECIDING WHERE TO GO
DAVID L. BODDE (National Research Council, Washington, DC) and H. GUYFORD STEVER Issues in Science and Technology (ISSN 0748-5492), vol. 5, Spring 1989, p. 66-71. refs
Copyright
The fundamental goals of the U.S. space program are discussed in light of the various alternative priorities that Federal budgetary constraints impose, and with a view to the consequences for overall program pace, direction, and cost, of the various major options. These options are characterized as: (1) preeminence in space science, with extensive use of robotic planetary exploration; (2) a 'mission to planet earth', involving concentration on remote sensing of the terrestrial environment; and (3) human exploration, leading to the establishment of habitable outposts on the moon or Mars. The roles of Presidential leadership and international cooperation are discussed. O.C.

A89-39225
LEGAL ASPECTS OF THE INTERNATIONAL SPACE STATION AGREEMENT [RECHTLICHE ASPEKTE DES UEBEREINKOMMENS UEBER DIE INTERNATIONALE RAUMSTATION]
JUERGEN REIFARTH Zeitschrift fuer Luft- und Weltraumrecht (ISSN 0340-8329), vol. 38, March 1989, p. 35-52. In German.
Copyright
The performance of the International Space Station agreement is discussed. The division of rights and duties among the partners to the agreement is addressed, and cooperative efforts envisioned in the agreement are taken into consideration. The impact of outer space law on the agreement is examined. C.D.

A89-39741
ACHIEVING WORLDWIDE COOPERATION IN SPACE
K. B. SERAFIMOV (Bulgarian Astronautical Society, Sofia, Bulgaria) Space Policy (ISSN 0265-9646), vol. 5, May 1989, p. 111-116. refs
Copyright
The political, technological, financial, and educational issues related to the international integration of space activities are discussed. International organizations which address aerospace issues are reviewed. The political problems which are obstacles to cooperation between developed and developing nations are examined. The creation of a World Space Organization is recommended and various proposals for the establishment of an international space organization are outlined. The international subsidization of an equatorial satellite station in India is presented as an example of worldwide cooperation. Also, the problem of sharing scientific data and technology is considered. R.B.

A89-39742
SPACE DEBRIS
ELMAR VITT (Cologne Court of Appeals, Federal Republic of Germany) Space Policy (ISSN 0265-9646), vol. 5, May 1989, p. 129-137. refs
Copyright
The basic facts about debris in outer space are reviewed and legal questions concerning the hazards of space debris are examined. The findings of the Cologne Colloquium on the protection of the space environment (Vitt, 1988) are discussed. A survey of proposals for protective measures is presented, including disposal orbits, the prevention of new debris production, and design changes to minimize debris. The application of the Outer Space Treaty of 1967, the Liability Convention of 1972, and other international laws to the problem of space debris is investigated. R.B.

A89-40815
REGULATION/DEREGULATION OF SATELLITE COMMUNICATIONS IN FRANCE [REGULATION/DEREGULATION DES COMMUNICATIONS PAR SATELLITES EN FRANCE]
P. CONRUYT (France Telecom, France) L'Aeronautique et l'Astronautique (ISSN 0001-9275), no. 135, 1989, p. 15-20. In French.
Copyright
Governmental regulation and legal aspects of satellite communications in France are reviewed. France has pursued a liberal policy with respect to fixed satellite services and small antennas for TV reception. A similar policy has been adopted with respect to the control of various satellite data-transmission services. The French participation in such international organizations as Eutelsat, Inmarsat, Eumetsat, and ESA is also addressed. R.R.

A89-41057
SOVIET AEROSPACE INDUSTRY - PERESTROIKA'S CHANGES GRIP SOVIET AEROSPACE INDUSTRY
DONALD E. FINK Aviation Week and Space Technology (ISSN 0005-2175), vol. 130, June 5, 1989, p. 34, 35, 37.
Copyright
A political background evaluation is made of the recent opening of Soviet aerospace facilities, including the design bureaus of Antonov, Ilyushin, Mikoyan, Mil, and Sukhoi, to Western journalists. Visits to these design and research institutes, as well as to various manufacturing plants, indicate that the Soviets are producing state-of-the-art aerospace equipment whose sophistication is comparable to that of its Western counterparts. Industrial managers are uniformly found to be preoccupied with the implementation of 'perestroika' political-economic reforms, turning their enterprises into profit-making centers. O.C.

A89-41654
U.S. GOVERNMENT POLICIES AND HYPERSONIC FLIGHT IN THE 21ST CENTURY
THOMAS R. GOLDBERG (Radian Corp., Herndon, VA) IEEE Aerospace and Electronic Systems Magazine (ISSN 0885-8985), vol. 4, May 1989, p. 26-31. refs
Copyright
The author examines the potentially negative impact of the U.S. regulations on the development of advanced materials, components, and systems. High priority is given to modification of US antitrust laws if the U.S. is to have the best possible opportunity to compete with more aggressive economies abroad. Export controls are identified as limiting the availability of data to U.S. firms engaged in developing commercial applications. It is asserted that policies must also be enacted to better protect intellectual property rights. I.E.

A89-41655
HYPERSONIC FLIGHT - THE NEED FOR A NEW LEGAL REGIME
F. KENNETH SCHWETJE and DONALD E. WALSH (USAF, International Law Div., Washington, DC) IEEE Aerospace and Electronic Systems Magazine (ISSN 0885-8985), vol. 4, May 1989, p. 32-36. refs
Copyright
The author briefly examines the question, 'where does space begin?' He discusses how certain priciples, such as overflight, meet the respective needs of the air law and space law regimes. He then focuses on the existing laws that might regulate the proposed Transatmospheric Vehicle (TAV). I.E.

A89-43818
LAND MOBILE SATELLITE COMMUNICATIONS - A FURTHER DEVELOPMENT IN INTERNATIONAL SPACE LAW. I
WOLF D. VON NOORDEN and PHILLIP DANN (International Maritime Satellite Organization, London, England) Journal of Space Law, vol. 17, no. 1, 1989, p. 1-11. refs
Copyright
The applications of land mobile satellite communications and the types of services which have been provided through the Inmarsat space segment are described. The history and origins of the recent amendments to the Inmarsat practices, in particular changes to the radio regulations, are discussed. The effects of these amendments on land mobile-satellite services are examined. The basic components of the framework for international land mobile-satellite services are considered. I.F.

A89-43820
THE INTERGOVERNMENTAL SPACE STATION AGREEMENT AND INTELLECTUAL PROPERTY RIGHTS
R. OOSTERLINCK (ESA, Directorate of Administration, Paris, France) Journal of Space Law, vol. 17, no. 1, 1989, p. 23-36. refs
Copyright
The legal framework governing the cooperative design, development, operation, and utilization of the permanently manned civil Space Station by the USA, ESA members, Japan, and Canada is examined. The legal framework is composed of three agreements: (1) the Intergovernmental Agreement, (2) the Memoranda of Understanding, and (3) the Implementing Arrangements. The objectives and signatories of these agreements are described. The establishment of a multiterritorial definition for intellectual property rights is discussed. Particular attention is given to patent laws and acts of infringement. I.F.

A89-43821
THREAT OR USE OF FORCE - OBSERVATIONS TO ARTICLE 2 OF THE U.N. CHARTER AND ARTICLE III OF THE OUTER SPACE TREATY
GYULA GAL (Budapesti Muszaki Egyetem, Budapest, Hungary) Journal of Space Law, vol. 17, no. 1, 1989, p. 54-61. refs
Copyright
Prohibiting the use of space-based weapons for the purpose of destruction of objects on earth, in the atmosphere, or in outer space is discussed. Current space laws and international laws are analyzed in terms of their effectiveness in preventing the militarization of outer space. The requirements for a treaty which would limit the use of space for military objectives are proposed. I.F.

A89-45175
ANNALS OF AIR AND SPACE LAW. VOLUME 13
NICOLAS MATEESCO MATTE, ED. (McGill University, Montreal, Canada) Montreal, McGill University, 1988, 429 p. In English and French. No individual items are abstracted in this volume.
Papers are presented on the obsolescence of bilateral air transport agreements, air transport deregulation in jurisdictions other than the U.S., the role of the ICAO in the suppression of drug trafficking, and aircraft accidents in Japan. Also considered are legal aspects of space conquest, liability for damage caused in outer space by space refuse, international organizations for space regulation, and key judical decisions related to space law. Other topics include space surveillance for arms control and verification, the extraterritorial application of U.S. antitrust laws, ESA resolutions on participation in the Space Station program, and an international agreement on the establishment of tariffs for intra-European scheduled air services. R.R.

A89-45827
COMMERCIAL EXPLOITATION OF SPACE RESOURCES UNDER THE 'MOON TREATY'
DETLEF G. LEHNARDT (Lehnardt and Bauman, P.C., New York) IN: Engineering, construction, and operations in space; Proceedings of the Space '88 Conference, Albuquerque, NM, Aug. 29-31, 1988. New York, American Society of Civil Engineers, 1988, p. 1220-1231. refs
Copyright
The advancement of space technology over the last few decades has aroused in private enterprise an interest in exploiting space resources. The necessary legal structure regulating space activity is still being developed by international organizations, primarily the United Nations, with the help of its member States. The negotiations that led to the Moon Treaty, as yet unratified by any space power, suggest that nations are willing to make some concessions to the realization that the moon and space will remain primarily objects for dreaming unless accommodations are made to various interests. Private enterprise has the opportunity to take advantage of this environment to help break the current log-jam in development and help influence policy makers to allow for further exploitation by, and profit for, private enterprise. Author

A89-48730
LEGAL FRAMEWORK OF THE INTERNATIONAL SPACE STATION COOPERATION
J. REIFARTH (BMFT, Bonn, Federal Republic of Germany) (ESA, Ministry for Science and Technology of Italy, and BMFT, Columbus Symposium, 4th, Friedrichshafen, Federal Republic of Germany, Sept. 12-15, 1988) Space Technology - Industrial and Commercial

Applications (ISSN 0892-9270), vol. 9, no. 1-2, 1989, p. 185-188.
Copyright

The legal agreement among the governments cooperating in the Space Station is discussed. The history of the negotiations, the hierarchy of the legal instruments, and the negotating principles are reviewed. The issues of space treaties, jurisdiction, control, criminal jurisdiction, and intellectual property are addressed. Liability provisions, consultations, and arbitration, and entry into force are considered. C.D.

A89-48731
HANDLING AND CONTROL OF TRANSATLANTIC DATA TRANSFER DURING PHASE CD
H. ERSFELD (MBB-ERNO, Bremen, Federal Republic of Germany) (ESA, Ministry for Science and Technology of Italy, and BMFT, Columbus Symposium, 4th, Friedrichshafen, Federal Republic of Germany, Sept. 12-15, 1988) Space Technology - Industrial and Commercial Applications (ISSN 0892-9270), vol. 9, no. 1-2, 1989, p. 189-193.
Copyright

The rules on data and technology transfer during the development and construction phase (C/D) of the Columbus program as outlined in the Intergovernmental Agreement (IGA) and the Memorandum of Understanding (MOU) between NASA and ESA are analyzed from an industry point of view. It is concluded that a complementary agreement between these agencies should be established to facilitate the necessary data transfer in a time- and cost-efficient manner. The reasons for such an additional legal instrument include the complex industrial program structures involved, the time- and cost-saving short links permitted by transatlantic contractor-to-contractor exchanges of data, and the facilitation of expeditious U.S. export control licensing. C.D.

A89-48851
COLLOQUIUM ON THE LAW OF OUTER SPACE, 31ST, BANGALORE, INDIA, OCT. 13, 14, 1988, PROCEEDINGS
Colloquium sponsored by IAF. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, 384 p. For individual items see A89-48852 to A89-48880.
Copyright

Papers in space law are presented, covering topics such as the legal aspects of maintaining space for peaceful purposes, keep-out zones and the nonappropriation principle, verification of outer space treaties, environmental space law, averting space militarization, the arms race in space, and the question of using space stations for military purposes. Other topics include the impact of remote sensing on developing countries, space law problems for developing countries, prospects for a Latin American space agency, UN resolution 41/65, accidents and breaches of contract in outer space, nuclear energy in space, regulating space refuse, aerospace transportation, legal issues of international cooperative Mars missions, the legal implications of space stations, and the protection of the ozone layer. In addition, papers are given on the aerospace plane, international direct television broadcasting, the Antarctic treaty systems as a model for space law, space business contracts, and the regulation of commercial space activities. R.B.

A89-48863#
WHAT SPACE LAW WILL GOVERN ACCIDENTS AND BREACHES OF CONTRACT IN OUTER SPACE?
LELAND G. DRIBIN IN: Colloquium on the Law of Outer Space, 31st, Bangalore, India, Oct. 13, 14, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 165-171. refs
Copyright

Consideration is given to the question of what body of law will be applied to resolve disputes between contracting parties arising out of launch mishaps or involving innocent third parties in the U.S. The applicable treaties, statutes, regulations, legal precedents, and court decisions are examined. Tort liability to third parties, product liability, and possible cases involving the government are discussed. R.B.

A89-48876#
SOME ISSUES OF THE NEXT PROGRESSIVE DEVELOPMENT OF INTERNATIONAL SPACE LAW
VLADIMIR KOPAL (UN, Outer Space Affairs Div., New York) IN: Colloquium on the Law of Outer Space, 31st, Bangalore, India, Oct. 13, 14, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 297-303. refs
Copyright

The historical development of international space law and the prospects for future developments are discussed. The treaties between states and UN treaties concerning space law are reviewed. The role of the UN Committee on the Peaceful Uses of Outer Space is considered. The possibility of expanding the juridical content of the fundamental principle of the 1967 Outer Space Treaty is examined. R.B.

A89-48880#
THE REGULATION OF COMMERCIAL SPACE ACTIVITIES BY THE NON-GOVERNMENTAL ENTITIES IN SPACE LAW
KUNIHIKO TATSUZAWA (Chuo Gakuin University, Tokyo, Japan) IN: Colloquium on the Law of Outer Space, 31st, Bangalore, India, Oct. 13, 14, 1988, Proceedings. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 341-348. refs
Copyright

The regulation of commercial space activities on the international level is discussed, focusing on the problems of legality and jurisdiction. The applicability of the principle of freedom of outer space and the common interest principle in commercial space activities is examined. Consideration is given to the problems of intellectual property and inventions in space, product liability in space, and governmental aid in space industrialization. R.B.

A89-48993
PROJECT CONDOR, THE ANDEAN REGIONAL SATELLITE SYSTEM - KEY LEGAL CONSIDERATIONS
SYLVIA OSPINA (COMSAT, Washington, DC) Space Communication and Broadcasting (ISSN 0167-9368), vol. 6, June 1989, p. 367-377. refs
Copyright

Project CONDOR is a regional satellite system proposed for the Andean Pact countries. Several key legal questions which should be resolved prior to its becoming operational are addressed herein. These issues primarily relate to Colombia and Ec uador, the equatorial countries of the region, and their claims of sovereignty over parts of the geostational orbit. In the ensuing analysis, the Bogota Declaration is related to space law, international telecommunications, and even its impact on regional cooperation and integration. Author

A89-49427#
FAA CONCEPTUAL CHANGES IN MINIMUM EQUIPMENT LIST POLICIES
D. BRIDGENS (American Airlines, Inc., Flight Academy, Fort Worth, TX) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Seattle, WA, July 31-Aug. 2, 1989. 8 p. (AIAA PAPER 89-2055) Copyright

A minimum equipment list concept (MEL) within the FAA, requires that all equipment installed on an aircraft in compliance with either airworthiness standards or the operating rules must be operative all the time. The primary driving force for timely restoration of MEL items was the risk of subsequent failures that could render an aircraft unserviceable. FAA policymakers recognized that it would not always be possible to restore inoperative items within the established time limits and provide an extended restoration plan to certain individual operators. Certain features incorporated into aircraft design are considered as not essential for airplane operation, but become required unless the FAA can be convinced of an acceptable level of safety. Aircraft manufacturers should develop certification programs that include only the equipment essential to the design type. The FAA would then find it necessary to take a more objective position, considering the alternative to be aircraft with only minimal airworthiness standards. C.E.

A89-51858
CONSIDERATIONS ON SATELLITE LIABILITY INSURANCE
MOHAMMED B. DAHBI (Faugere et Jutheau, S.A., Paris, France) IN: Space commerce; Proceedings of the Second International Conference and Exhibition on the Commercial and Industrial Uses of Outer Space, Montreux, Switzerland, Feb. 21-25, 1988. New York, Gordon and Breach Science Publishers, 1988, p. 421-431.
Copyright
Issues related to public liability and the commercial satellite industry are examined. The types of public liability that may be incurred during the launching and operation of commercial satellites are given. The legal principles and procedures governing claims which arise from these liabilities are discussed. Also, consideration is given to the amount of coverage provided by spacecraft liability insurance. R.B.

A89-51891
JAPAN'S SPACE POLICY - BACKGROUND AND OUTLOOK
SHIGEBUMI SAITO (Science and Technology Agency, Tokyo, Japan) Space Policy (ISSN 0265-9646), vol. 5, Aug. 1989, p. 193-200.
Copyright
This article describes the formation of the Space Activities Commission as the country's primary policy-making body, and of the National Space Development Agency, which oversees the development of space technology. The fundamental guidelines governing space activities are explained, and a detailed breakdown is given of projects agreed to for the coming years. Author

A89-51895
TOWARDS A NEW ERA IN SPACE - REALIGNING US POLICIES TO NEW REALITIES
H. GUYFORD STEVER (National Academy of Engineering, Washington, DC), WILLIAM A. ANDERS (Textron, Inc., Providence, RI), ARDEN L. BEMENT (TRW, Inc., Cleveland, OH), JOSEPH V. CHARYK (Charles Stark Draper Laboratory, Inc., Cambridge, MA), LAURENCE J. ADAMS et al. Space Policy (ISSN 0265-9646), vol. 5, Aug. 1989, p. 237-255. refs
Copyright
Recommendations by the US National Academies of Science and Engineering regarding the US space program are presented. The role of the President and the need for a stable budgetary policy are discussed. Particular attention is given to budgetary distinctions between base programs and special projects. Consideration is given to the committee's suggestions on how to revitalize NASA and creating a good relationship between civil and defense programs. I.F.

A89-54356
TRANSNATIONAL LEGAL PROBLEMS FOR COMMERCIAL HYPERSONIC FLIGHT
NATHAN C. GOLDMAN IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 316-318. refs
Copyright
The National Aerospace Plane's (NASP) hypersonic flight will break more than the sound barrier when it flies in the 1990s: it will break the technological and legal barriers between air and space. This paper narrowly focusses on the legal issues. Indeed, narrowing the subject further, the paper will deal specifically with the problems and possible solutions raised by flight and landing rights for a U.S. Aerospace plane in foreign territories. Author

A89-54358
HYPERSONIC FLIGHT AND THE WARSAW CONVENTION
WILLIAM E. THOMS (North Dakota, University, Grand Forks) IN: International Conference on Hypersonic Flight in the 21st Century, 1st, Grand Forks, ND, Sept. 20-23, 1988, Proceedings. Grand Forks, ND, University of North Dakota, 1988, p. 333, 334. refs
Copyright
The relationship between the 1929 Warsaw Convention laws on tort liability and the development of hypersonic commercial aircraft is considered. Problems associated with the the Warsaw agreement limitations on liability are discussed. The applicability of the Warsaw Convention to hypersonic flight is examined, including the question of whether or not hypersonic flight is 'carriage by air' or 'carriage by space'. R.B.

N89-12494# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1989
Washington GPO 1988 127 p A report on S. 2209 presented by the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 26 Jul. 1988
(S-REPT-100-429; GPO-19-010) Avail: US Capitol, Senate Document Room
Appropriations to NASA for research and development, space flight, control and data management, construction of facilities, and research and program management were examined and discussed. B.G.

N89-12498# Committee on Science, Space and Technology (U.S. House).
MULTIYEAR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT
ROBERT A. ROE Washington GPO 1988 343 p Report together with supplemental views to accompany H.R. 4561 presented by the Committee on Science, Space and Technology, 100th Congr., 2nd Sess., 24 May 1988
(H-REPT-100-650; GPO-83-986) Avail: Document Room, House of Representatives, Washington, D.C. 20515 HC free
This congressional report is from the Committee on Science, Space, and Technology on Multiyear NASA Authorization Act. The Committee has taken a significant departure from its previous practice of authorizing appropriations for the Nation's space and aeronautics programs on an annual basis by setting three year funding levels. The authorization bill also establishes an aggressive set of goals and objectives for the next decade. These goals and objectives are detailed. E.R.

N89-12501# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) AUTHORIZATION FOR FISCAL YEAR 1989
Washington GPO 1988 148 p Hearing before the Subcommittee on Science, Technology and Space of the Committee on Commerce, Science and Transportation, 100th Congress, 2d Session, 22 Mar. 1988, part 3
(S-HRG-100-579-PT-3; GPO-87-269) Avail: Subcommittee on Science, Technology and Space
The hearing of the subcommittee on Science, Technology and Space of the Committee on Commerce, Science, and Transportation of the U.S. Senate of the 100th Congress is presented. The second session on NASA authorization for fiscal year 1989 is presented with the prepared statement of James C. Fletcher, administrator of NASA. Also presented is the statement of the American Institute of Aeronautics and Astronautics, and the statement of Dr. Norris J. Krone, of the Advisory Committee on National Aeronautics, American Institute of Aeronautics and Astronautics. E.R.

N89-12502# Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.).
AGREEMENT ON THE INTERNATIONAL SPACE STATION AND THE COLUMBUS PROGRAM. DOCUMENTATION [UEBEREINKOMMEN UEBER DIE INTERNATIONALE RAUMSTATION UND DAS PROGRAMM COLUMBUS. DOKUMENTATION]
22 Jul. 1988 95 p In GERMAN
(REPT-27/88; ETN-88-93226) Avail: NTIS HC A05/MF A01
Agreements between NASA, ESA, Japan, and Canada on the collaboration for the detailed design, development, operation, and use of the manned orbital space station of Columbus program

are presented. Main points are listed and the texts of resolutions are given. ESA

N89-13306# Los Alamos National Lab., NM.
UNITED STATES SPACE POLICY: REVIEW AND ASSESSMENT
PATRICK J. GARRITY Jun. 1988 40 p
(Contract W-7405-ENG-36)
(DE88-015538; LA-11181; CNSS-3) Avail: NTIS HC A03/MF A01

This report summarizes two key documents that reflect official U.S. space policy: (1) the January 1988 Presidential directive on overall U.S. national space policy; and (2) the February 1987 Department of Defense space policy. The report examines various U.S. military, civilian, commercial, and arms control activities as they relate to space. DOE

N89-21711# Air War Coll., Maxwell AFB, AL.
NATIONAL SPACE POLICY
ERNEST B. SUTTON May 1988 93 p
(AD-A202644; AD-E900870) Avail: NTIS HC A05/MF A01
CSCL 22/1

National space policy forms the foundation for decisions and direction of the United States national space program. This review begins with the Eisenhower era and the launching of Sputnik 1, considered by most as the start of the space race with the Soviet Union for national space preeminence. Succeeding administrations are discussed to provide the historical setting affecting the actions of presidents, leaders within NASA, the DOD, and Congress as well as other players in the national space arena. This review analyzes the latest national space policy, established by President Reagan in February, 1988. Finally, specific space development programs are offered as topics which will demand the attention of future administrations. GRA

N89-28451# Committee on Science and Technology (U.S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MULTIYEAR AUTHORIZATION ACT OF 1989
Washington GPO 1989 51 p A bill, H.R. 1759, referred to the Committee on Science, Space and Technology, 101st Congress, 1st Session, 10 Apr. 1989
(H-REPT-101-226) Avail: Document Room, House of Representatives, Washington, D.C. 20515 HC free

Hearings before a subcommittee of U.S. House of Representatives are presented to authorize appropriations for the National Aeronautics and Space Administration for the fiscal year 1990. All written testimony and submittals for the record are also included. The budget estimates provide a detailed outline of the budgetary information and justifications for research and development, space flight, control and data communications, construction of facilities, and research and program management. B.G.

N89-28452# Army War Coll., Carlisle Barracks, PA.
INTERNATIONAL TECHNOLOGY TRANSFER: THE ROPE TO HANG THE WEST
NEIL W. GROTEGUT 28 Mar. 1989 39 p
(AD-A207347) Avail: NTIS HC A03/MF A01 CSCL 05/1

The United States relies on the superior technology of its defense systems as a competitive edge against overwhelming Soviet numerical advantages. There is strong evidence to suggest that the U.S.S.R. is rapidly reducing the U.S. technology lead through the transfer and assimilation of technology gained from the West. The relevant issues of West to East technology transfer is examined in order to provide awareness and appreciation of its importance to the security of the U.S. GRA

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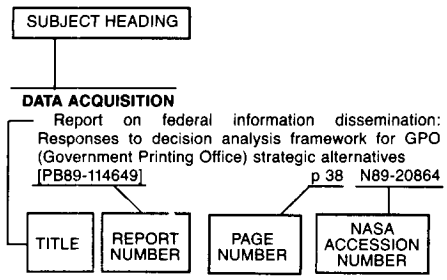

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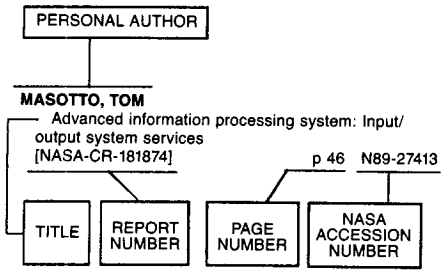

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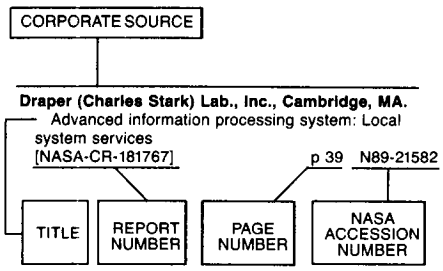

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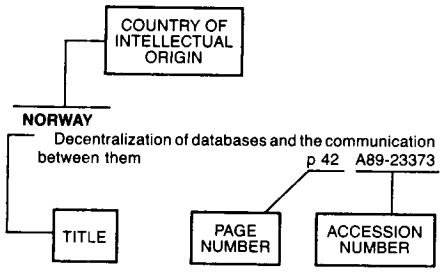

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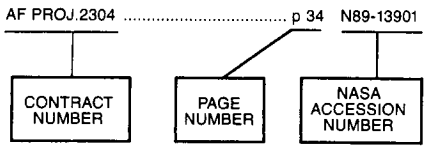

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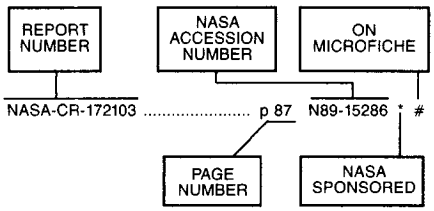

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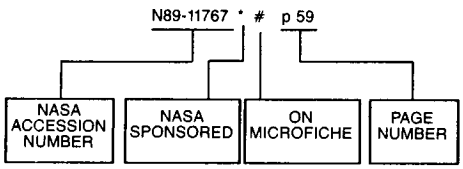

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