NASA

Management
A Bibliography
for NASA
Managers

NASA SP-7500(21)
April 1987

National Aeronautics and
Space Administration

(NASA-SP-7500(21)) MANAGEMENT: A BIBLIOGRAPHY FOR NASA MANAGERS (National Aeronautics and Space Administration) 70 p N87-20833
CSCL 05A Unclas
00/81 45217

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

NASA SP-7500(21)

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 1986.

NASA Scientific and Technical Information Branch 1987
National Aeronautics and Space Administration
Washington, DC

This document is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, price code A08

FOREWARD

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.

TABLE OF CONTENTS

TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED

ON MICROFICHE

ACCESSION NUMBER → **N86-11540*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. ← CORPORATE SOURCE

TITLE → **COMPUTATIONAL STRUCTURAL MECHANICS: A NEW ACTIVITY AT THE NASA LANGLEY RESEARCH CENTER**

AUTHORS → N. F. KNIGHT, JR. and W. J. STROUD Sep. 1985 39 p refs

Presented at 22nd Ann. Tech. Meeting of the Soc. of Eng. Sci., University Park, Pa., 7-9 Oct. 1985

REPORT NUMBERS → (NASA-TM-87612; NAS 1.15:87612) Avail: NTIS HC A03/MF A01 CSCL 20K

Complex structures considered for the late 1980's and early 1990's include composite primary aircraft structures and the space station. These structures are much more difficult to analyze than today's structures and necessitate a major upgrade in computerized structural analysis technology. A major research activity in computational structural mechanics (CSM) was initiated. The objective of the CSM activity is develop advanced structural analysis technology that will exploit modern and emerging computers such as computers with vector and/or parallel processing capabilities. The three main research activities underway in CSM include: (1) structural analysis methods development; (2) a software testbed for evaluating the methods; and (3) numerical techniques for parallel processing computers. The motivation and objectives of the CSM activity are presented and CSM activity is described. The current CSM research thrusts, and near and long term CSM research thrusts are outlined. E.A.K.

PUBLICATION DATE

AVAILABILITY SOURCE

COSATI CODE

ABSTRACT

TYPICAL JOURNAL ARTICLE AND ABSTRACT

ON MICROFICHE

ACCESSION NUMBER → **A86-39567#**

TITLE → **NEXT GENERATION AIRCRAFT STRUCTURES - THE NEED FOR CO-ORDINATED CANADIAN R & D PROGRAMS**

AUTHOR → J. THOMPSON (CASI, Structures and Materials Section, Ottawa, Canada) ← AUTHOR'S AFFILIATION

JOURNAL TITLE → Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 32, March 1986, p. 50-53. ← PUBLICATION DATE

The directions which Canadian R & D in aircraft structures are expected to take over the next 25 yr are discussed. Current programs are targeted at developing composite secondary structures which can be certified for regular use, particularly in the DHC-7 and DHC-8 aircraft. Near- and mid-term research will examine carbon-fiber, aramid, aramid/aluminum hybrids, aluminum lithium alloys, and powder metallurgy ingot aluminum alloys, mainly for commuter aircraft. The parts which will receive the most attention are wings and flaps, empennages, fuselages and flight control surfaces. The efforts will require the development of standardized analytical and numerical tools, NDE testing methods and test procedures, extensive material characterization studies, and funding and performance of components testing programs. It is notable that commuter aircraft primary structures will be required to be as resistant to impact damage from, e.g., birds, as typical modern larger passenger aircraft. M.S.K.

ABSTRACT

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.

A86-17320
HUMAN ROLES IN FUTURE SPACE SYSTEMS
H. L. WOLBERS (McDonnell Douglas Astronautics Co., Huntington Beach, CA) IN: Permanent presence - Making it work; Proceedings of the Twenty-second Goddard Memorial Symposium, Greenbelt, MD, March 15, 16, 1984 . San Diego, CA, Univelt, Inc., 1985, p. 57-69. refs
(AAS PAPER 84-117)

U.S. and Soviet space programs to date have graphically demonstrated the value of humans working in space. The point at issue is to determine where, along the continuum from direct manual intervention to completely automated operations, the mission requirements of future space programs can best be met. The criteria of performance, cost, and risk (mission success probability) are suggested as the principal factors by which program or project managers and systems engineers should select the most effective approach to meeting specific mission objectives. Examples of the application of these criteria are presented. Author

A86-17771* Search Technology, Inc., Norcross, Ga.
THE EFFECTS OF TYPE OF KNOWLEDGE UPON HUMAN PROBLEM SOLVING IN A PROCESS CONTROL TASK
N. M. MORRIS (Search Technology, Inc., Norcross, GA) and W. B. ROUSE (Georgia Institute of Technology, Atlanta) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-15, Nov.-Dec. 1985, p. 698-707. refs
(Contract NAG2-123)

The question of what the operator of a dynamic system needs to know was investigated in an experiment using PLANT, a simulation of a generic dynamic production process. Knowledge of PLANT was manipulated via different types of instruction, so that four different groups were created: (1) minimal instructions only; (2) minimal instructions and guidelines for operation (procedures); (3) minimal instructions and dynamic relationships (principles); and (4) minimal instructions, and procedures, and principles. Subjects controlled PLANT in a variety of situations which required maintaining production while also diagnosing familiar and unfamiliar failures. Despite the fact that these manipulations resulted in differences in subjects' Knowledge, as assessed via a written test at the end of the experiment, instructions had no effect upon achievement of the primary goal of production, or upon subjects' ability to diagnose unfamiliar failures. However, those groups receiving procedures controlled the system in a more stable manner. Possible reasons for the failure to find an effect of principles are presented, and the implications of these results for operator training and aiding are discussed. Author

A86-18541* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PILOTS OF THE FUTURE - HUMAN OR COMPUTER?
A. B. CHAMBERS and D. C. NAGEL (NASA, Ames Research Center, Moffett Field, CA) Computer (ISSN 0018-9162), vol. 18, Nov. 1985, p. 74-87. refs

In connection with the occurrence of aircraft accidents and the evolution of the air-travel system, questions arise regarding the computer's potential for making fundamental contributions to improving the safety and reliability of air travel. An important result of an analysis of the causes of aircraft accidents is the conclusion that humans - 'pilots and other personnel' - are implicated in well over half of the accidents which occur. Over 70 percent of the incident reports contain evidence of human error. In addition, almost 75 percent show evidence of an 'information-transfer' problem. Thus, the question arises whether improvements in air safety could be achieved by removing humans from control situations. In an attempt to answer this question, it is important to take into account also certain advantages which humans have in comparison to computers. Attention is given to human error and the effects of technology, the motivation to automate, aircraft automation at the crossroads, the evolution of cockpit automation, and pilot factors. G.R.

A86-23521
THE ROLES OF ASTRONAUTS AND MACHINES FOR FUTURE SPACE OPERATIONS
R. H. SCHAEFER, R. E. OLSEN, and F. J. ABELES (Grumman Aerospace Corp., Bethpage, NY) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 15th, San Francisco, CA, July 15-17, 1985. 13 p.
(SAE PAPER 851332)

A comparative assessment is made of remote operation space environment systems and human EVAs, with a view to future space missions, both individually and in combination. The tasks in question encompass servicing and construction operations on manned space station and unmanned platforms. Laboratory tests and simulations of representative remote system and EVA task performance are discussed and recommendations for additional development activities are presented. O.C.

A86-25036
APPLICATION OF A MATHEMATICAL MODEL OF HUMAN DECISIONMAKING FOR HUMAN-COMPUTER COMMUNICATION
M. E. REVESMAN (BDM Corp., Albuquerque, NM) and J. S. GREENSTEIN (Clemson University, SC) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-16, Jan.-Feb. 1986, p. 142-147. refs
(Contract N00014-81-K-0143)

When a human and computer perform similar tasks in parallel, it is important that there be effective communication between the two entities. Because explicit communication may add to the human's workload, an implicit method of communication is suggested in which the computer references a model of human performance to predict the human's actions. The computer then determines its own actions so as to complement rather then conflict with the predicted human actions. A two-stage mathematical model of human performance is employed in an experimental situation in which both a human and computer act as decisionmakers.

Implementation of the model significantly improves the human's performance, without degrading the computer's performance. Research into additional experimental and real-world situations is suggested. Author

A86-25037
DEVELOPMENT AND VALIDATION OF A MATHEMATICAL MODEL OF HUMAN DECISIONMAKING FOR HUMAN-COMPUTER COMMUNICATION
J. S. GREENSTEIN (Clemson University, SC) and M. E. REVESMAN (BDM Corp., Albuquerque, NM) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-16, Jan.-Feb. 1986, p. 148-154. refs
(Contract N00014-81-K-0143)

Since effective communication between computers and their human operators is essential to preventing redundant or interfering actions, attention is presently given to a method for accurately predicting human actions so that the computer may be able to complement an operator's activities rather than interfere with them. The two-stage mathematical model developed and empirically validated treats human performance in a real time situation with multiple tasks and process control. The model is able to consistently and accurately predict over 80 percent of the subject's actions over a range of situations. O.C.

A86-25038* Georgia Inst. of Tech., Atlanta.
SIGNIFICANCE TESTING OF RULES IN RULE-BASED MODELS OF HUMAN PROBLEM SOLVING
C. M. LEWIS and J. M. HAMMER (Georgia Institute of Technology, Atlanta) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-16, Jan.-Feb. 1986, p. 154-158. refs
(Contract NAG2-123)

Rule-based models of human problem solving have typically not been tested for statistical significance. Three methods of testing rules - analysis of variance, randomization, and contingency tables - are presented. Advantages and disadvantages of the methods are also described. Author

A86-26011* Arizona State Univ., Tempe.
SUBJECTIVE WORKLOAD AND INDIVIDUAL DIFFERENCES IN INFORMATION PROCESSING ABILITIES
D. L. DAMOS (Arizona State University, Tempe) IN: Aerospace Behavioral Engineering Technology Conference, 3rd, Long Beach, CA, October 15-18, 1984, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1984, p. 71-74. refs
(Contract NCC2-202)
(SAE PAPER 841491)

This paper describes several experiments examining the source of individual differences in the experience of mental workload. Three sources of such differences were examined: information processing abilities, timesharing abilities, and personality traits/behavior patterns. On the whole, there was little evidence that individual differences in information processing abilities or timesharing abilities are related to perceived differences in mental workload. However, individuals with strong Type A coronary prone behavior patterns differed in both single- and multiple-task performance from individuals who showed little evidence of such a pattern. Additionally, individuals with a strong Type A pattern showed some dissociation between objective performance and the experience of mental workload. Author

A86-29090
A REVIEW OF THE PSYCHOLOGICAL ASPECTS OF SPACE FLIGHT
J. M. CHRISTENSEN (Federation of American Societies for Experimental Biology, Bethesda, MD; Universal Energy Systems, Inc., Dayton, OH) and J. M. TALBOT (Federation of American Societies for Experimental Biology, Bethesda, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, March 1986, p. 203-212. refs

The major observations and conclusions of the FASEB's ad hoc Working Group's report to NASA on the aspects of human behavior and performance related to the Shuttle Program and to the planned U.S. Space Station are presented. The report focuses on the performance requirements for the long-term manned missions; human perceptual, cognitive, and motor capabilities and limitations in space; crew composition, individual competences, selection criteria, and special training; and environmental factors influencing behavior. Consideration is also given to the psychosocial aspects of multi-person spacecrews on long-term missions; career determinants in NASA; investigational methodology and equipment; and psychological support. Suggestions for near-term planning cover uses of the Shuttle onboard video and audio resources for the behavioral observations, and include the perceptual, cognitive, and psychomotor parameters and group dynamics into space station mock-up studies. For the long-term research, the need of methodology and instrumentation for objective measurements of psychophysiological processes, status, and performance is emphasized. I.S.

A86-29851
SYMPOSIUM ON AVIATION PSYCHOLOGY, 3RD, COLUMBUS, OH, APRIL 22-25, 1985, PROCEEDINGS
R. S. JENSEN, ED. and J. ADRION, ED. (Ohio State University, Columbus) Symposium sponsored by the Ohio State University and Association of Aviation Psychologists. Columbus, OH, Ohio State University, 1985, 777 p. For individual items see A86-29852 to A86-29861, A86-29863 to A86-29936.

The present conference on the complex interactions between pilots and their cockpit environments discusses topics in such fields as cockpit design, voice data entry for avionics, cockpit displays, air traffic control automation, pilot workload monitoring and management, pilot judgment and reliability, cockpit communications and resource management, pilot selection and training, pilot visual perception, pilot physiology, and accident investigation. Specific attention is given to cockpit design and evaluation data bases, ergonomic principles for auditory signals in military aircraft, subjective assessments of workloads in an advanced fighter cockpit, time-sharing ability in zero-input tracking analyzer scores, cockpit speech interference considerations, psychosocial aspects of male and female pilot errors, test anxiety in cockpit simulators, fatigue, stress and preoccupation effects, and aircraft accident investigation psychological methods. C.D.

A86-29879*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PREDICTED VERSUS EXPERIENCED WORKLOAD AND PERFORMANCE ON A SUPERVISORY CONTROL TASK
V. BATTISTE and S. G. HART (NASA, Ames Research Center, Moffett Field, CA) IN: Symposium on Aviation Psychology, 3rd, Columbus, OH, April 22-25, 1985, Proceedings . Columbus, OH, Ohio State University, 1985, p. 255-262.

The multitask simulation of a supervisory control system was examined in order to evaluate the ability of operators to predict the workload and performance impact of unfamiliar task features, using their basic knowledge and specific information provided before each scenario. Task difficulty and experienced workload were varied by manipulating the number of elements per task, the number of tasks, task schedule, and availability of task elements for performance. The results have indicated that an operator might correctly predict the workload of a realistically complex task if (1) he is familiar with the basic system, and (2) the design, functional requirements, and operational procedures of the proposed modifications are described clearly. He is less able to predict unfamiliar rate or schedule complexity manipulations for which timing is an important element. I.S.

A86-31823
THE FUNCTIONAL AGE PROFILE - AN OBJECTIVE DECISION CRITERION FOR THE ASSESSMENT OF PILOT PERFORMANCE CAPACITIES AND CAPABILITIES
R. BRAUNE and C. D. WICKENS (Illinois, University, Urbana) Human Factors (ISSN 0018-7208), vol. 27, Dec. 1985, p. 681-693. refs
(Contract N00204-82-C-0113)
The initial development of a computer-based information-processing performance battery with aviation-relevant task structures is reported. It is shown that the currently existing prototype is sensitive to individual differences within chronological age groups as well as to age-related changes across different age groups. The utilization of such a test battery for the longitudinal assessment of aviator performance capabilities is discussed. Author

A86-33787
WORKLOAD MEASUREMENT IN SYSTEM DESIGN AND EVALUATION
F. T. EGGEMEIER (Wright State University, Dayton, OH), C. A. SHINGLEDECKER, and M. S. CRABTREE (Ergometrics Technology, Inc., Dayton, OH) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 1 . Santa Monica, CA, Human Factors Society, 1985, p. 215-219. refs
(Contract F33615-82-K-0522)
Because of its central role in system development, workload measurement has been extensively researched. These efforts have produced a variety of workload assessment techniques, many of which can be classified as either subjective, physiological, or behavioral measures. These categories of measures can vary along several dimensions that can be used as criteria in selection of a technique for a particular application. The proposed selection criteria include the sensitivity, diagnosticity, and intrusiveness associated with a technique. Different stages of system design can require techniques that differ on the noted dimensions. Since no technique is capable of meeting all of the applicable criteria, a comprehensive approach to workload assessment will require a battery of subjective, physiological, and behavioral measures. Further research dealing with comparative evaluation of the various assessment techniques along the noted dimensions will be required in order to refine workload metric selection criteria. Author

A86-33804* Technion - Israel Inst. of Tech., Haifa.
THE PSYCHOPHYSICS OF WORKLOAD - A SECOND LOOK AT THE RELATIONSHIP BETWEEN SUBJECTIVE MEASURES AND PERFORMANCE
D. GOPHER, N. CHILLAG, and N. ARZI (Technion - Israel Institute of Technology, Haifa) IN: Human Factors Society, Annual Meeting, 29th, Baltimore, MD, September 29-October 3, 1985, Proceedings. Volume 2 . Santa Monica, CA, Human Factors Society, 1985, p. 640-644.
(Contract NAGW-494)
Load estimates based upon subjective and performance indices were compared for subjects performing size matching and letter typing tasks under 6 levels of priorities, in single and dual task conditions. Each half of the group used a different task as reference in their subjective judgement. The results are interpreted to indicate that subjective measures are especially sensitive to voluntary allocation of attention and to the load on working memory. Association with performance is expected whenever these two factors are main determinants of performance efficiency, otherwise the two are likely to dissociate. Author

A86-34983
THE ROLE OF THE TECHNOLOGIST IN SPACE PRODUCTIVITY
K. E. MCKEE (IIT Research Institute, Chicago, IL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 9-26 to 9-36.
In this paper the role of technologists throughout the space program is reviewed, i.e., from R&D through system maintenance. The interactions of the technologists with management, labor, capital, technology, and government are considered. Recommendataions to enhance the contribution of the technical staff are made. Author

A86-35440
WORKLOAD ASSESSMENT - PROGRESS DURING THE LAST DECADE
T. M. MCCLOY and W. L. DERRICK (U.S. Air Force Academy, Colorado Springs, CO) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 125-130. USAF-supported research. refs
(SAE PAPER 851877)
Over the last decade, considerable research has been conducted on the construct of operator workload and its measurement. From this research, both theory and methods have evolved to provide valid assessment of this construct. Two classes of assessment methods, secondary tasks and subjective scales, dominate the literature at this time. This paper traces the development of both methods, ties their use to current theories of human processing resources, and evaluates both with respect to five criteria. Author

A86-37037* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE HUMAN ROLE IN SPACE: TECHNOLOGY, ECONOMICS AND OPTIMIZATION
S. B. HALL, ED. (NASA, Marshall Space Flight Center, Huntsville, AL) Park Ridge, NJ, Noyes Publications, 1985, 398 p. No individual items are abstracted in this volume.
Man-machine interactions in space are explored in detail. The role and the degree of direct involvement of humans that will be required in future space missions are investigated. An attempt is made to establish valid criteria for allocating functional activities between humans and machines and to provide insight into the technological requirements, economics, and benefits of the human presence in space. Six basic categories of man-machine interactions are considered: manual, supported, augmented, teleoperated, supervised, and independent. Appendices are included which provide human capability data, project analyses, activity timeline profiles and data sheets for 37 generic activities, support equipment and human capabilities required in these activities, and cumulative costs as a function of activity for seven man-machine modes. C.D.

N86-11073# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering.
ON THE STRUCTURE OF MANPOWER PLANNING, A CONTRIBUTION OF SIMULATION EXPERIMENTS WITH DECOMPOSITION METHODS
J. D. VANDERBIJ, J. WESSELS, and J. WIJNGAARD Aug. 1983 19 p refs
(MANPOWER-PLANNING-28) Avail: NTIS HC A02/MF A01
Manpower planning in a personnel system consisting of one personnel group, located in different organizational units is considered. The ease with which personnel availability can be matched to personnel requirement, when the flexibility within the personnel group is used is analyzed. This is done by comparing the performance of integrated planning, coordinated planning, and decomposed planning. Results are derived by simulation experiments. Author (ESA)

N86-11075# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering.
ON THE STRUCTURE OF MANPOWER PLANNING, A CONTRIBUTION OF SIMULATION EXPERIMENTS WITH AGGREGATION METHODS
J. D. VANDERBIJ, J. WESSELS, and J. WIJNGAARD Aug. 1983 24 p refs
(MANPOWER-PLANNING-30) Avail: NTIS HC A02/MF A01
Two ways to estimate the possibilities of matching manpower availability to manpower requirement in the organization activity plan of a task oriented unit of an organization are considered. One estimation procedure is based on detailed information about the personnel groups which are located in the task oriented unit. The other procedure is based on aggregate information about total availability and total personnel requirement in the whole unit. A situation for the case that steps are taken on the basis of detailed information and for the case that steps are taken on the basis of aggregate information was analyzed. Results show that use of aggregate information in drawing up personnel plans causes no extra problems if the maximum potential mobility is high or if future manpower requirements in personnel groups is highly correlated. Author (ESA)

N86-12212*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
AN ANALYSIS OF THE APPLICATION OF AI TO THE DEVELOPMENT OF INTELLIGENT AIDS FOR FLIGHT CREW TASKS
S. BARON and C. FEEHRER Washington NASA Oct. 1985 114 p refs
(Contract NAS1-17335)
(NASA-CR-3944; NAS 1.26:3944) Avail: NTIS HC A06/MF A01 CSCL 05H
This report presents the results of a study aimed at developing a basis for applying artificial intelligence to the flight deck environment of commercial transport aircraft. In particular, the study was comprised of four tasks: (1) analysis of flight crew tasks, (2) survey of the state-of-the-art of relevant artificial intelligence areas, (3) identification of human factors issues relevant to intelligent cockpit aids, and (4) identification of artificial intelligence areas requiring further research. Author

N86-13906# Purdue Univ., West Lafayette, Ind.
ALERTED MONITORS: HUMAN OPERATORS AIDED BY AUTOMATED DETECTORS Final Report
R. D. SORKIN and D. E. ROBINSON Dec. 1984 55 p
(Contract DTRS56-83-C-00047)
(PB85-222750; DOT/OST/P34-85/021) Avail: NTIS HC A04/MF A01 CSCL 05H
In an alerted monitor system, an automated detector assists a human operator in the detection and diagnosis of problems occurring in some monitored process. Air traffic control centers and the flight decks of commercial aircraft include many examples of such systems. This project developed a general model of the altered-monitor system and evaluated the effects on system performance of interactions between the human operator and automated detector. One of the types of interaction evaluated (contingent criterion strategy) yields optimal performance from the combined person-machine system. Two laboratory experiments were performed to evaluate the assumptions of the model and the interactions between the operator and automated components. GRA

N86-15163*# Columbia Univ., New York. Teachers Coll.
MANAGEMENT BEHAVIOR, GROUP CLIMATE AND PERFORMANCE APPRAISAL AT NASA
G. MANDERLINK, L. P. CLARK, W. M. BERNSTEIN, and W. W. BURKE *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 51-62 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
The relationships among manager behavior, group climate and managerial effectiveness are examined. Survey data were collected from 435 GM14-15 managers and their subordinates at NASA concerning management practices and perceptions of the group environment. Performance ratings of managers were obtained from their superiors. The results strongly supported a causal model in which subordinates' climate perceptions mediate the effects of manager behavior on performance. That is, the development of group climate provides the process through which the effects of manager practices may be understood. Analyses also revealed that the function performed by a manager and his group (e.g., research) influenced the specific nature of the causal dynamics. Some implications of the results for management training and development are discussed. Author

N86-15164*# Federal Express Corp., Memphis, Tenn.
MENTORING AS A COMMUNICATION CHANNEL: IMPLICATIONS FOR INNOVATION AND PRODUCTIVITY
L. AVANT and R. W. BOOZER (Memphis State Univ.) *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 63-72 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
The impact of a formalized mentoring program as a communication channel for enhancing information distribution, innovation, and productivity is investigated. Formal and informal approaches to mentoring are discussed. Interviews with 11 members of formal mentor-protege teams indicate communications in the mentoring relationship can affect individual and organizational innovation and productivity. Author

N86-15167*# Universities Space Research Association, Huntsville, Ala.
PRODUCTIVITY ISSUES AT ORGANIZATIONAL INTERFACES
A. W. HOLLAND *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 109-119 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
The need for close interdependence between large numbers of diverse and specialized work groups makes the Space Program extremely vulnerable to loss of productivity at organizational interfaces. Trends within the program also suggest that the number and diversity of interfaces will grow in the near term. Continued maintenance of R&D excellence will require that interface performance issues be included in any future productivity improvement effort. The types and characteristics of organizational interfaces are briefly presented, followed by a review of factors which impact their productivity. Approaches to assessing and improving interface effectiveness are also discussed. Author

N86-15170*# Texas Univ., Arlington.
A CASE STUDY IN R AND D PRODUCTIVITY: HELPING THE PROGRAM MANAGER COPE WITH JOB STRESS AND IMPROVE COMMUNICATION EFFECTIVENESS
W. D. BODENSTEINER and E. A. GERLOFF *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 142-148 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
Certain structural changes in the Naval Material Command which resulted from a comparison of its operations to those of selected large-scale private sector companies are described. Central to the change was a reduction in the number of formal reports from systems commands to headquarters, and the provision of Program Management Assistance Teams (at the request of the program manager) to help resolve project problems. It is believed that these changes improved communication and information-processing, reduced program manager stress, and resulted in improved productivity. Author

N86-15178*# Rockwell International Corp., Canoga Park, Calif.
PRODUCTIVITY IMPROVEMENT IN ENGINEERING AT ROCKETDYNE
R. M. NORDLUND, S. T. VOGT, and A. K. WOO *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 231-238 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

The Rocketdyne Division of Rockwell International has embarked on a productivity improvement program in engineering. This effort included participation in the White Collar Productivity Improvement (WCPI) project sponsored by the American Productivity Center. A number of things have been learned through this project. It seems that any productivity improvement project should be employee driven. The Rocketdyne project was essentially started as a result of a grassroots effort to remove some particular hindrances, and employee enthusiasm was a prime factor in the continuing progress of the effort. A significant result was that awareness of problems at all levels increased. Many issues surfaced in the diagnostic phase, and were then noted and discussed. This process added legitimacy to issues that had previously been merely unspoken concerns. The initial feelings of many members of the pilot group was that significant changes would occur relatively quickly. It is now recognized that this will have to be an ongoing, long-term effort. Author

N86-15182*# Westinghouse Mfg. Systems and Technology Center, Columbia, Md. Socio-Technical Engineering.
SOCIO-TECHNICAL INTEGRATION OF THE WORKPLACE
G. L. CARTER *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 275-288 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05K

The objective of socio-technical theory and design is to provide the best match between the social system and the technical system. The achievement of a best match makes optimal use of the resources of both systems. Implementation of this theory is best served when there is involvement by the user organization. The involvement relative to the introduction of new technology in the organization is extremely significant. Employee involvement is critical to effective participative management. The trends toward participative management and employee involvement have taken various forms. These have included quality circles, semi-autonomous teams and adhoc action teams. It is noteworthy to point out, as these processes have evolved, the role of a facilitator has become more prevalent. The facilitation of the socio-technical design system in industrial engineering is described. B.W.

N86-15184*# Hughes Aircraft Co., Los Angeles, Calif.
TRAINING MANAGERS FOR HIGH PRODUCTIVITY: GUIDELINES AND A CASE HISTORY
R. M. RANFTL *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 310-323 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

Hughes Aircrafts 13-year productivity study clearly identifies management as the key link in the entire productivity chain. This fact led to the establishment of a long-term series of seminars on personal, managerial, organizational, and operational productivity for all levels and sectors of line and staff management. To inspire the work force to higher levels of productivity and creativity management, itself, must first be inspired. In turn they have to clearly understand the productive and creative processes, fashion an effective productivity improvement plan with sound strategy and implementation, create an optimal environmental chemistry, and provide the outstanding leadership necessary to propel their organizations to achieve full potential. The primary goals of the seminars are to (1) ignite that spark of inspiration, enabling productive action to follow, (2) provide participants a credible roadmap and effective tools for implementation, and (3) develop a dedicated commitment to leadership and productivity throughout the management team. Author

N86-15186*# Loyola Univ., Chicago, Ill.
GROUP STRUCTURE AND GROUP PROCESS FOR EFFECTIVE SPACE STATION ASTRONAUT TEAMS
J. M. NICHOLAS and R. S. KAGAN *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 330-339 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A

Space Station crews will encounter new problems, many derived from the social interaction of groups working in space for extended durations. Solutions to these problems must focus on the structure of groups and the interaction of individuals. A model of intervention is proposed to address problems of interpersonal relationships and emotional stress, and improve the morale, cohesiveness, and productivity of astronaut teams. Author

N86-15187*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Man-Machine Systems.
SPACE CREW PRODUCTIVITY: A DRIVING FACTOR IN SPACE STATION DESIGN
H. L. WOLBERS *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 340-350 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A

The criteria of performance, cost, and mission success probability (program confidence) are the principal factors that program or project managers and system engineers use in selecting the optimum design approach for meeting mission objectives. A frame of reference is discussed in which the interrelationships of these pertinent parameters can be made visible, and from which rational or informed decisions can be derived regarding the potential impact of adjustments in crew productivity on total Space Station System effectiveness. Author

N86-15194*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
STREAMLINING: REDUCING COSTS AND INCREASING STS OPERATIONS EFFECTIVENESS
R. K. PETERSBURG *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 415-424 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

The development of streamlining as a concept, its inclusion in the space transportation system engineering and operations support (STSEOS) contract, and how it serves as an incentive to management and technical support personnel is discussed. The mechanics of encouraging and processing streamlining suggestions, reviews, feedback to submitters, recognition, and how individual employee performance evaluations are used to motivation are discussed. Several items that were implemented are mentioned. Information reported and the methodology of determining estimated dollar savings are outlined. The overall effect of this activity on the ability of the McDonnell Douglas flight preparation and mission operations team to support a rapidly increasing flight rate without a proportional increase in cost is illustrated. E.A.K.

N86-15201*# Martin Marietta Aerospace, New Orleans, La.
QUALITY CIRCLES: ORGANIZATIONAL ADAPTATIONS, IMPROVEMENTS AND RESULTS
R. TORTORICH *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 490-494 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 14D

The effective application in industry and government of quality circles work was demonstrated. The results achieved in quality and productivity improvements and cost savings are impressive. The circle process should be institutionalized within industry and government. The stages of circle program growth, innovations that help achieve circle process institutionalization, and the result achieved at Martin Marietta's Michoud Division and within the National Aeronautics and Space Administration (NASA) are addressed. E.A.K.

N86-15202*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PRODUCTIVITY ENHANCEMENT PLANNING USING PARTICIPATIVE MANAGEMENT CONCEPTS
M. E. WHITE and J. C. KUKLA *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 495-505 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

A productivity enhancement project which used participative management for both planning and implementation is described. The process and results associated with using participative management to plan and implement a computer terminal upgrade project where the computer terminals are used by research and development (R&D) personnel are reported. The upgrade improved the productivity of R&D personnel substantially, and their commitment of the implementation is high. Successful utilization of participative management for this project has laid a foundation for continued style shift toward participation within the organization. E.A.K.

N86-15203*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
RESULTS OF INNOVATIVE COMMUNICATION PROCESSES ON PRODUCTIVITY GAINS IN A HIGH TECHNOLOGY ENVIRONMENT
B. J. KELLY *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 506-515 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

The technology which resulted in performance breakthroughs at engineering and management services is discussed. As a result of the innovative approaches of communicating productivity concepts to the employees, specific outcomes can now be pinpointed at all levels of the organization such as: (1) employee-headed program; (2) performance feedback processes; and (3) an investigative approach to creating leadership. The Lockheed Corporation began the innovative trend in 1974 when they became the first company to introduce quality circles in America. Although some of Lockheed-EMSCO's processes may sound different from traditional improvement processes, the context out of which those to be presented evolved has sustained more than 10 years of positive results through employee involvement activities. E.A.K.

N86-15957# Washington Univ., Seattle. Dept. of Psychology.
PROBLEM SOLVING UNDER TIME-CONSTRAINTS
M. RICHARDSON and E. HUNT 15 Aug. 1985 29 p
(Contract N00014-84-K-5553)
(AD-A158921; TR-10) Avail: NTIS HC A03/MF A01 CSCL 05J

The computer science concept of production execution has been the basis of a large number of simulations of human problem solving. Typically these simulations have operated in a timeless environment, in the sense that they did not consider any constraints to solve problems quickly. In a previous technical report in this series Hunt and Lansman proposed an architecture for production-executing machines that could be applied to real-time problem solving. Hunt and Lansman supported their ideas by simulating data from laboratory studies drawn from the attention and performance field. In this paper Hunt and Lansman's approach is extended to the simulation of people doing a simple arithmetic task under considerable time pressure and when subject to interruptions. Data from the simulation is compared to data from college students doing the same task. GRA

N86-20013# MacAulay-Brown, Inc., Fairborn, Ohio.
AUTOMATION AND THE ALLOCATION OF FUNCTIONS BETWEEN HUMAN AND AUTOMATIC CONTROL: GENERAL METHOD
R. PULLIAM and H. E. PRICE Jan. 1985 106 p Prepared in cooperation with Essex Corp., Alexandria, Va.
(Contract F33615-82-C-0513)
(AD-A161072; AFAMRL-TR-85-017) Avail: NTIS HC A06/MF A01 CSCL 05H

This report was prepared as a Human Engineering Data Base Supplement to the Integrated Perceptual Information for Designers (IPID) Engineering Data Compendium. It describes a general method for allocation of functions during systems development, with particular focus on what functions should be automatic. The method was originally developed for use in the nuclear power industry, and has here been redeveloped for use in aerospace systems. The report is intended for use of project managers, systems engineers and system designers, as an applied guide during the development of aerospace systems. It provides a detailed procedure for allocation of functions (AOF), a procedure to be applied during the research, development, test and evaluation (RDT&E) process. The report uses a hierarchical structure in which each of five sections treats the AOF process at an increasing level of detail, as follows: section 1 concerns how to use the report; section 2 describes the RDT&E process in terms of the cyclic decision and test steps by which design proceeds, and identifies those steps which are critical to a successful AOF; section 3 focuses on one critical step in RDT&E, the formation of design hypotheses, and describes that step in greater detail; section 4 focuses even more narrowly on a step within design hypothesis, and identifies four sets of criteria which should be applied in sequence to assist AOF decisions; finally, section 5 identifies human-machine models by which aerospace systems can be analyzed during systems design. GRA

N86-21419*# American Productivity Center, Houston, Tex.
WHITE COLLAR PRODUCTIVITY IMPROVEMENT: SPONSORED ACTION RESEARCH 1983 - 1985
1985 41 p Presented at the National Conference on White Collar Productivity Improvement, Dallas, 30-31 Oct. 1985; sponsored by Dun and Bradstreet Corp., General Dynamics Corp., McDonnell Douglas Corp., Northern Telecom Ltd., Westinghouse Furniture Systems, and the US Dept. of Labor Sponsored in part by Armco., Inc., Atlantic Richfield Co., Johnson and JohnsonMotorola, Inc., Ortho Pharmaceutical Corp., Rockwell International Corp., TRW, Inc., and Warner-Lambert Co.
(Contract NASW-3834)
(NASA-CR-176366; NAS 1.26:176366) Avail: NTIS HC A03/MF A01 CSCL 05A

A program developed by the American Productivity Center to boost white collar worker effectiveness is described. This program is the culmination of a two-year sponsored action research project, White Collar Productivity Improvement. Traditional attempts aimed at cutting costs or staffing levels, often alienating workers at the outset. They typically focused on increased efficiencies in individual activities or specific procedures, such as paperwork processing. In contrast, the Center's approach to white collar productivity focuses on the effectiveness of actual outputs, typically professional services. These typically consist of both tangible products, such as a financial report or research study, and intangibles, such as the expertise, advice or guidance that accompanies the product. Eight general observations about white collar productivity improvement are summarized. B.W.

N86-21499# Committee on Science and Technology (U. S. House).
ASTRONAUTS AND COSMONAUTS BIOGRAPHICAL AND STATISTICAL DATA, REVISED JUNE 28, 1985
Washington GPO Dec. 1985 407 p Presented to the Subcommittee on Space Science and Applications of the Committee on Science and Technology, 99th Congress, 1st Session, 26 Aug. 1985 Prepared by the Library of Congress, Congressional Research Service
(GPO-52-498) Avail: Subcommittee on Space Science and Applications

Astronauts' and cosmonauts' biographical and statistical data are reported. The following issues are described. Astronaut selection criteria, education and experience, medical and psychological condition; US payload specialists and passengers; the X-15, X-20 Dynasolar, and manned orbiting laboratory program, Soviet cosmonauts; non-US, non-Soviet spacenauts, and comparative data on American and Soviet spaceflights. E.A.K.

N86-23260# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF COMPLEXITY OF CONTROL TASK ON LEVEL OF ACTIVATION OF OPERATORS PHYSIOLOGICAL FUNCTIONS WHEN WORKING WITH WAITING Abstract Only
M. A. GRITSEVSKIY and Z. I. ZAYTSEVA *In its* USSR Report: Life Sciences. Biomedical and Behavioral Sciences (JPRS-UBB-86-004) p 102 12 Mar. 1986 Transl. into ENGLISH from Fiziologiya Cheloveka (Moscow, USSR), v. 11, no. 3, May - Jun. 1985 p 504-510
Avail: NTIS HC A07/MF A01

Experiments were conducted to answer two questions: (1) do model experiments reveal differences in the functional status in comparing operator's work with various degrees of complexity; and (2) are these changes similar in nature to those manifestations of differing intensity discovered under production conditions. Programs with various specific shares of single and multiple movement control tasks were used to model operators work of varying degrees of complexity. During the experiments, reaction time, EEG, skin-galanic reaction and pulse rate were continually recorded. Differences in bioenergetic activity of the cerebral cortex and differences in autonomic activity and regulations were observed. It is indicated that waiting for signals requiring complex processing is accompanied by higher mobilization of preparedness of the operator. Decreased attention level was observed at the beginning of the day and toward the end of long days. E.A.K.

N86-24257# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
COMMUNICATION AND MISCOMMUNICATION
B. A. GOODMAN Oct. 1985 234 p
(Contract N00014-77-C-0378; N00014-85-C-0079)
(AD-A162843; BBN-5681) Avail: NTIS HC A11/MF A01 CSCL 09B

This report discusses one aspect of enabling people to communicate in natural language with computers. The central focus of this work is a study on how one could build robust natural language processing systems that can detect and recover from miscommunication. The study of miscommunication is a necessary task within such a context since any computer capable of communicating with humans in natural language must be tolerant of the complex, imprecise, or ill-devised utterances that people often use. This goal first required an inquiry into how people communicate and how they recover from problems in communication. This led to the development of techniques for avoiding failures of reference that were employed in the reference identification component of a natural language understanding program. The traditional approaches to reference identification in previous natural language systems were found to be less elaborate than people's real behavior. To model a listener's behavior, a new component was added to the traditional reference identification mechanism to resolve difficulties in a speaker's description. GRA

N86-24554# Horizon Inst. for Advanced Design, Inc., Rockville, Md.
COMPARISON OF SCIENTIFIC AND TECHNICAL PERSONNEL TRENDS IN THE UNITED STATES, FRANCE, WEST GERMANY AND THE UNITED KINGDOM SINCE 1970
J. MINTZES and W. TASH Mar. 1985 253 p
(Contract NSF SRS-82-15756)
(PB86-133030; NSF-84-335) Avail: NTIS HC A12/MF A01 CSCL 05A

Comparative data on the number of natural scientists and engineers showed that in the early 1980's, the United States had 2.6 million natural scientists and engineers in the labor force compared with 621 thousand for West Germany, 633 thousand for fFrance, and 592 thousand for the United Kingdom. Although the United States has more natural scientists and engineers in the labor force than these three countries combined, the U.S. proportion of natural scientists and engineers in the labor force in the early 1980's was about the same as that of other countries. It is agreed that scientists and engineers in the United States demonstrate a higher degree of mobility (geographic and occupational) than do their counterparts in the European countries. Engineers in France and West Germany more frequently move into top management positions than do those in the United States and the United Kingdom. Less attention is given in the United States to the systematic training of technicians and establishment of standards than in the European countries. Updating of skills of scientists and engineers is also more systematic in the European countries than in the United States with special tax-supported programs, notably in France. In the United States, larger firms often carry out such training for their staff and, more often than in Europe, it is up to the individuals. GRA

N86-25123# Naval Postgraduate School, Monterey, Calif.
MAN-MACHINE SYSTEMS OF THE 1990 DECADE: COGNITIVE FACTORS AND HUMAN INTERFACE ISSUES
P. J. HOFFMAN Aug. 1985 53 p refs
(AD-A163865; NPS74-85-002) Avail: NTIS HC A04/MF A01 CSCL 05H

This paper presents the primary psychological concepts which are fundamental to the design of man-machine interfaces for intelligent systems of the 1990's. These concepts embrace perception, learning motivation, and cognitive capacities of human operators, in systems which require a high degree of operator-machine interaction. The central role of feedback is emphasized through simple schematic examples, designed to provide an understanding of the reciprocity requirements in man-machine communication. Cognitive theory and recent experimental data form the basis for discussion of visual image storage, short-term memory, long-term memory, transfer rates and buffering of information being processed by the human operator, under control of a central processor with a cycle time of roughly 70 milliseconds. Systems of the 1990 era will provide increased capability for high-speed processing of data and will utilize increasing numbers of decision-aides, spreadsheets and AI tools. Users of these systems will be components of networks, linked via efficient communication systems to other users and other subsystems. These developments will lead to fundamental changes in the work place. GRA

N86-26078# California Univ., Berkeley. Operations Research Center.
THE GROUP CONSENSUS PROBLEM
K. CHANG Dec. 1985 49 p refs
(Contract N00014-85-K-0384; AF-AFOSR-0122-81)
(AD-A164064; ORC-85-13) Avail: NTIS HC A03/MF A01 CSCL 12A

In a group consensus problem, there is a group with K greater than or equal to 2 members who are jointly responsible for the aggregation of their opinions. The group may not have a predefined real decision problem. French called the group consensus problem with a predefined real decision problem a group decision problem and the group consensus problem without a real decision problem a text-book problem. Suppose a group with K members are interested in forecasting demands for a commodity for a given time period. Production planning for this commodity depends on demands. Each group member may have his own opinion for demands in the form of probability distribution. In this case the group has a real decision problem in which they should determine the amount of the commodity to be produced. Here the group consensus opinion is a probability distribution for demands obtained from the group members' prior opinions for demands. For example a group of meteorologists are required to give a single forecast for weather without having any real decision problem. This is an example of the text-book problem. Savage suggested that the whole of statistical theory is directly or indirectly aimed at the solution of a version of the text-book problem. The objective of this paper is to give a unified approach for these two problems. In this paper all the group members are assumed to be Bayesians. GRA

N86-26840# Pattern Analysis and Recognition Corp., McLean, Va.
HUMAN FACTORS IN RULE-BASED SYSTEMS Final Report
P. E. LEHNER, D. ZIRK, R. B. HALL, and L. ADELMAN 14 Oct. 1985 30 p refs
(Contract N00014-83-C-0537)
(AD-A165309; AD-E301922; PAR-85-109) Avail: NTIS HC A03/MF A01 CSCL 05H

This report summarizes several experiments investigating the impact of mental models and cognitive consistency on user/expert system interaction. Results indicate that user/expert system combined problem solving performance significantly improves if the user has a good mental model of expert system processes. Furthermore, cognitive consistency between the user and system problem solving procedures only degrades performance in situations where users do not have a good mental model. Some practical implications of this research is discussed. Author (GRA)

N86-26843# Pattern Analysis and Recognition Corp., McLean, Va.
MENTAL MODELS AND PROBLEM SOLVING WITH A KNOWLEDGE-BASED EXPERT SYSTEM
R. B. HALL Oct. 1985 28 p
(Contract N00014-83-C-0537)
(AD-A165398; PAR-85-108) Avail: NTIS HC A03/MF A01 CSCL 09B

Previous research in the area of user/expert system interaction has shown that the quality of problem solving with a general expert system (ES) is associated with mental model, a user's conceptual understanding of the basic principle of an ES's problem solving process. The current paper describes an experiment with MYCIN, a medical knowledge-based expert system, that lends additional support to the link between problem solving quality and mental model. GRA

N86-27941# Softech, Inc., Waltham, Mass.
ADA (TRADEMARK) TRAINING CURRICULUM: SOFTWARE ENGINEERING FOR MANAGERS M101 TEACHER'S GUIDE
1986 359 p
(Contract DAAB07-83-C-K506)
(AD-A165123) Avail: NTIS HC A16/MF A01 CSCL 05I

The Ada training curriculum: Software engineering for managers M101 teacher's guide contains the following: (1) Background and Motivation - Definition of Software Engineering, and Motivation for Software Engineering (Software Crisis); (2) Software Engineering and its Goals - Software Engineering Goals, and Software Engineering Principles; (3) Achieving Software Engineering Goals - Software Life-Cycle, Methods and Tools for each phase of Life-Cycle, Testing, and Software Management: (4) Software Engineering and Ada - Relationship of Software Engineering to Ada. GRA

N86-29805# Air Command and Staff Coll., Maxwell AFB, Ala.
WILL THE USAF NEED GROUND-BASED AIR TRAFFIC CONTROL RADAR IN THE YEAR 2000?
G. L. VARN Apr. 1986 49 p
(AD-A166504; AD-E750871; ACSC-86-2585) Avail: NTIS HC A03/MF A01 CSCL 17G

Advanced technology in military aviation is developing rapidly. The Global Positioning System (GPS) and Microwave Landing System (MLS) will give the pilot precision navigation capability when fully deployed in the 1990s. The Joint Tactical Information Distribution System (JTIDS) will give the pilot the capability to display enemy and friendly aircraft in his area in his cockpit. At the same time, our mobile air traffic control (ATC) radars are aging and need to be replaced. But, with the new technology in the cockpit, it may be more feasible to eliminate ground-based ATC radar and let the pilot do his own ATC from the cockpit. This study examines the feasibility of a cockpit-based ATC system by looking at the requirement for military ATC, specific capabilities that new technologies give the pilot, and human considerations in a cockpit-based ATC system. The study concludes that a cockpit-based ATC system is not feasible and that there will be a need for ground-based ATC radar, at least through the year 2000. Author (GRA)

N86-31223# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. System Safety Development Center.
BASIC HUMAN FACTORS CONSIDERATIONS
R. J. NERTNEY and D. L. FILLMORE Dec. 1985 37 p
(Contract DE-AC07-76ID-01570)
(DE86-008181; SSDC-34) Avail: NTIS HC A03/MF A01

Models and concepts for analyzing the human element in working programs and systems are introduced. The method of attack is a functional one based on analysis of the work to be done (job-task analysis). Based on the results of the job-task analysis, psychological and physiological requirements and criteria can be defined for the system. DOE

N86-31226# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. System Safety Development Center.
HUMAN FACTORS MANAGEMENT
R. J. NERTNEY and D. L. FILLMORE Jul. 1985 44 p
(Contract DE-AC07-76ID-01570)
(DE86-008184; SSDC-30) Avail: NTIS HC A03/MF A01

Evaluating a system to determine if it has the right people working using the right procedures and management controls with the right hardware at all times is the facet of human factors discussed in this manual. The following areas of concern are specifically addressed: (1) the selection process must be proper to select qualified workers who are given proper training for the work and whose skills are maintained; (2) a proper behavioral climate must be established at the work station; (3) all task assignments must contain elements of instruction and training; and (4) all supporting systems must interact with the human to ensure that the work can be completed. All of these areas of concern can be successfully completed using the existing company organization by following the considerations presented in this document and maintaining proper interfaces between the different branches of the company. DOE

N86-31251# Oak Ridge Gaseous Diffusion Plant, Tenn. Computer-Aided Engineering.
IN-HOUSE CAD TRAINING: A REALISTIC APPROACH
T. WHITUS 10 Apr. 1986 11 p Presented at the American Institute for Design and Drafting Convention, Hollywood, Fla., 7 Apr. 1986
(Contract DE-AC05-84OT-21400)
(DE86-008926; K/D-5697; CONF-8604150-1) Avail: NTIS HC A02/MF A01

The need for industry to retrain its engineering personnel to use a CAD system can be demanding, as well as frustrating. In fact, the larger and more diverse the organization, the more demanding these requirements may be. It should be noted that in preparing for CAD implementation, the training needs and requirements are often underestimated. Additionally, most engineering organizations implementing CAD do not have personnel experienced in developing training programs or in teaching manipulative skills. This text describes the evolution of the in-house CADAM basic training program at Martin Marietta Energy Systems, Inc. Rather than emphasize the theoretical aspects of designing such a program, the paper will concentrate on the practical, more realistic aspects of program development. The paper should serve as a guide to others desiring to develop a similar program. This paper first presents a brief look at factors concerning retraining the experienced engineering employee. Then, the actual planning, organization, structuring, implementation, and evaluation of the training program, as well as possible future directions are presented. Finally, the paper offers advice to those planning similar in-house CAD training programs. DOE

N86-32102*# National Aeronautics and Space Administration, Washington, D.C.
NASA FACTS: SPACE SHUTTLE FOOD SYSTEMS
1986 15 p
(NF-150/1-86) Avail: Issuing Activity CSCL 06H

On the Space Shuttle, the food is prepared at a galley installed on the Orbiter's mid-deck. The galley is a modular unit that can be removed for special weight-critical missions or missions that require extra interior space. It contains a personal hygiene station, a water dispenser, an oven, condiment and meal tray stowage, and a food preparation area. Foods are individually packaged and stowed for easy handling in the zero gravity of space. All food is precooked or processed so it requires no refrigeration and is either ready to eat or can be prepared simply by adding water or heating. The only exception is the fresh fruit and vegetables stowed in the fresh food locker. The supplies consist of rehydratable food and beverages, thermostabilized food, intermediate moisture foods, natural form foods, irradiated meats, and condiments. A sample menu is also included. B.G.

N86-32969# Hershey (Milton S.) Medical Center, Hershey, Pa.
DATA COLLECTION VIA A QUASI-EXPERIMENTAL SIMULATION TECHNOLOGY. PART 1: MULTIPLE MEASUREMENT OF PERFORMANCE EXCELLENCE IN COMPLEX AND UNCERTAIN MANAGERIAL TASKS Interim Report
S. STREUFERT, R. M. POGASH, and M. T. PIASECKI Apr. 1986 74 p
(Contract MDA903-83-C-0106; DA PROJ. 2Q1-61102-B-74-F)
(AD-A167949; ARI-RN-86-41) Avail: NTIS HC A04/MF A01 CSCL 05A

A simulation technique is used to determine whether complexity (multidimensionality) of task performance in complex managerial tasks is trainable. The present report is specifically concerned with measurement. Previous simulation based measurement, which had included sixteen measures was extended to thirty-seven primary measures and twelve derived measures. Information is provided on the characteristics and purpose of each of those measures. In addition formulas or related statements that allow calculation of performance scores by other researchers and/or in other settings is provided. Further, this report considers the Time-Event Matrix on which measurement is based. GRA

N86-32985*# California Univ., Los Angeles. Dept. of Safety Science and Human Factors.
KNOWLEDGE-BASED LOAD LEVELING AND TASK ALLOCATION IN HUMAN-MACHINE SYSTEMS
M. H. CHIGNELL and P. A. HANCOCK *In* NASA. Ames Research Center, 21st Annual Conference on Manual Control 11 p May 1986
Avail: NTIS HC A22/MF A01 CSCL 05H

Conventional human-machine systems use task allocation policies which are based on the premise of a flexible human operator. This individual is most often required to compensate for and augment the capabilities of the machine. The development of artificial intelligence and improved technologies have allowed for a wider range of task allocation strategies. In response to these issues a Knowledge Based Adaptive Mechanism (KBAM) is proposed for assigning tasks to human and machine in real time, using a load leveling policy. This mechanism employs an online workload assessment and compensation system which is responsive to variations in load through an intelligent interface. This interface consists of a loading strategy reasoner which has access to information about the current status of the human-machine system as well as a database of admissible human/machine loading strategies. Difficulties standing in the way of successful implementation of the load leveling strategy are examined. Author

N86-33023# Lawrence Livermore National Lab., Calif.
HUMAN FACTORS REVIEW PLAN
B. PARAMORE, ed. and L. R. PETERSON, ed. Dec. 1985 261 p Prepared in cooperation with Essex Corp., Alexandria, Va.
(Contract W-7405-ENG-48)
(DE86-010561; UCRL-15688) Avail: NTIS HC A12/MF A01

Human Factors is concerned with the incorporation of human user considerations into a system in order to maximize human reliability and reduce errors. This review plan is intended to assist in the assessment of human factors conditions in existing DOE facilities. In addition to specifying assessment methodologies, the plan describes techniques for improving conditions which are found to not adequately support reliable human performance. The following topics are addressed: (1) selection of areas for review describes techniques for needs assessment to assist in selecting and prioritizing areas for review; (2) human factors engineering review is concerned with optimizing the interfaces between people and equipment and people and their work environment; (3) procedures review evaluates completeness and accuracy of procedures, as well as their usability and management; (4) organizational interface review is concerned with communication and coordination between all levels of an organization; and (5) training review evaluates training program criteria such as those involving: trainee selection, qualification of training staff, content and conduct of training, requalification training, and program management. DOE

N86-33210*# Washington Univ., Seattle. Coll. of Architecture and Urban Planning.
THE QUANTITATIVE MODELLING OF HUMAN SPATIAL HABITABILITY Final Report, Feb. - Dec. 1985
J. A. WISE 1985 154 p
(Contract NAG2-346)
(NASA-CR-179716; NAS 1.26:179716) Avail: NTIS HC A08/MF A01 CSCL 05K

A model for the quantitative assessment of human spatial habitability is presented in the space station context. The visual aspect assesses how interior spaces appear to the inhabitants. This aspect concerns criteria such as sensed spaciousness and the affective (emotional) connotations of settings' appearances. The kinesthetic aspect evaluates the available space in terms of its suitability to accommodate human movement patterns, as well as the postural and anthrometric changes due to microgravity. Finally, social logic concerns how the volume and geometry of available space either affirms or contravenes established social and organizational expectations for spatial arrangements. Here, the criteria include privacy, status, social power, and proxemics (the uses of space as a medium of social communication). B.G.

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.

A86-15619*# National Aeronautics and Space Administration, Washington, D.C.

AN OVERVIEW OF THE SPACE STATION TECHNOLOGY/ADVANCED DEVELOPMENT PROGRAM

R. F. CARLISLE, J. H. AMBRUS, and D. L. HALL (NASA, Office of Space Station, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 12 p.
(IAF PAPER 85-28)

The Advanced Technology Plan of the Fiscal Year (FY) 1986 is designed to focus on the most promising technology options applicable to the Space Station (SS), selected from the list of tasks identified by the FY 1984 Technology Program as the most critical technologies to be developed for the initial SS Initial Operating Capability. Most of the current activities are in the stages of manufacture and life tests of specific SS subsystems. Special attention is given to major technologies, which include power systems (PSs) (with emphasis on a Solar Dynamic PS concept); the thermal control system (with the focus on the 'thermal bus' concept); the environmental control and life support system; and the data management system; all are illustrated schematically. Other tasks, including dynamics, communications, extravehicular activities, mechanics, propulsion, and fluid, as well as the tasks of cost, maintainability, automation and robotics, and productivity are discussed. I.S.

A86-15635*# National Aeronautics and Space Administration, Washington, D.C.

PLANNING FOR SPACE STATION UTILIZATION

W. RANEY (NASA, Office of Space Station, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 5 p.
(IAF PAPER 85-48)

User requirements for the planned Space Station, and utilization planning to meet those needs, are discussed. The continual involvement of the customer in all aspects of the Space Station Program is to be achieved by identifying customers and by defining, refining, and integrating their requirements so as to stimulate the best possible design, development, and operations. Planning guidelines to be used in the Space Station definition process are shown and discussed, as is the Space Station Planning Schedule. C.D.

A86-15849#

PLANNING FOR TELESAT CANADA'S NEXT GENERATION SATELLITES

E. BERTENYI and R. TINLEY (Telesat Canada, Ottawa) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 11 p.
(IAF PAPER 85-354)

Telesat Canada's present satellites and the current planning of Telesat's next generation satellites are examined. In particular, single versus dual band payload space segment replenishment scenarios are reviewed, as are various spacecraft communication system related features which are expected to improve system performance. As a result of the planning process, it has been determined that the optimum configuration in terms of total system cost, performance, and risk is the large dual band satellite with C-band and Ku-band capacity similar to ANIK C and ANIK D designs. V.L.

A86-19487

REMOTE SENSING RESEARCH - THE PAST AS PROLOG

D. A. LANDGREBE (Purdue University, West Lafayette, IN) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 130-135.

It is pointed out that the remote sensing community has a major opportunity at the present time which it must seize and use effectively. This opportunity is related to the undeveloped potential of the technology, the base of new fundamental knowledge now available, and the recognition that some good planning must now be done. The basic elements of a remote sensing research program are introduced, and the assembly of these elements into a unified program is considered. The elements of the development dimension include basic research, technology research, earth surface research, application research, projects, and operations. Elements of the system dimension include sensor, preprocessing, data analysis, and user application. G.R.

A86-23561* Honeywell, Inc., Minneapolis, Minn.

AUTOMATED SUBSYSTEMS CONTROL DEVELOPMENT

R. F. BLOCK (Honeywell, Inc., Space and Strategic Systems Div., Minneapolis, MN), D. B. HEPPNER (Life Systems Inc., Cleveland, OH), F. H. SAMONSKI, JR., and N. LANCE, JR. (NASA, Johnson Space Center, Houston, TX) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 15th, San Francisco, CA, July 15-17, 1985. 14 p. NASA-sponsored research.
(SAE PAPER 851379)

NASA has the objective to launch a Space Station in the 1990s. It has been found that the success of the Space Station engineering development, the achievement of initial operational capability (IOC), and the operation of a productive Space Station will depend heavily on the implementation of an effective automation and control approach. For the development of technology needed to implement the required automation and control function, a contract entitled 'Automated Subsystems Control for Life Support Systems' (ASCLSS) was awarded to two American companies. The present paper provides a description of the ASCLSS program. Attention is given to an automation and control architecture study, a generic automation and control approach for hardware demonstration, a standard software approach, application of Air Revitalization Group (ARG) process simulators, and a generic man-machine interface. G.R.

A86-24116

ENTREPRENEURIAL SPIRIT COMBINES WITH HARD-HEADED BUSINESS SENSE

R. G. OLONE Commercial Space (ISSN 8756-4831), vol. 1, Fall 1985, p. 37-39.

The difficulties encountered by small companies in their development and completion of space projects are examined. The lack of adequate capital to complete the intended projects is analyzed. The inexperience of the personnel, the selection of improper projects, and improper calculation of the time required to complete the projects are all factors which contributed to the failure of many companies. The assembly of experienced and competent management teams is discussed. The possible need for private entrepreneurs to join with large aerospace firms in order to complete space projects is investigated. Examples of companies which have tried and failed to complete space projects are presented. I.F.

A86-27887#

LEARNING FROM THE PAST - BRINGING ADAM SMITH INTO ORBIT

F. L. SMITH, JR. (Competitive Enterprise Institute, Washington, DC) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 246-254.

An historical evaluation of the development of U.S. transportation is used as the basis for projections of useful governmental activities in the case of future space commercialization policy. Restrictive regulation, predatory pricing, a possibility of the socialization of space insurance, a lack of enforceable property rights in space, and export/import imbalances, are among the problems anticipated. The inherent difficulties that will be encountered by attempts to improve the productivity of government agencies, and the political obstacles that will arise to attempts at privatization, are noted to be among the more difficult aspects of this issue. O.C.

A86-29652#
SATELLITE SYSTEM OPERATIONS - A VIEW FROM THE TRENCHES
J. W. MCBEATH (AT&T Communications, Hawley, PA) IN: Communication Satellite Systems Conference, 11th, San Diego, CA, March 17-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 614-620. refs
(AIAA PAPER 86-0705)

AT&T's approach to managing the operation of its satellite system is discussed. A brief overview of AT&T's satellite history and services is given, followed by a discussion of TT&C, orbital dynamics, earth station operation and maintenance, customer service, and computer software. Organization, staffing, and training are reviewed, and the major operational issues are discussed. Particular emphasis is placed on the role of human beings in the successful operation of the satellite system. C.D.

A86-40526
AUTOMATION REQUIREMENTS DERIVED FROM SPACE MANUFACTURING
H. R. HALLETT and D. A. KUGATH (General Electric Co., Philadelphia, PA) IN: Space tech; Proceedings of the Conference and Exposition, Anaheim, CA, September 23-25, 1985 . Dearborn, MI, Society of Manufacturing Engineers, 1985, p. 9-1 to 9-18.

Automation, robotics, and expert systems are necessary to support two conceptual space manufacturing facilities envisioned for the year 2010. The two concepts were chosen because they require a high degree of automation, and therefore involve extensive use of teleoperators, robotics, process mechanization, and artificial intelligence. The major challenges of space manufacturing are maintenance, repairs, and waste management. Without the automation capabilities to accomplish these functions, manufacturing in space of items in large production lots will be unattainable. Author

A86-40602*# Air Force Space Div., Los Angeles, Calif.
NATIONAL SPACE TRANSPORTATION AND SUPPORT STUDY/MISSION REQUIREMENTS AND ARCHITECTURE STUDIES
C. L. DUROCHER (USAF, Space Div., Los Angeles, CA) and C. R. DARWIN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Space Systems Technology Conference, San Diego, CA, June 9-12, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 201-203.
(AIAA PAPER 86-1211)

The government approach to fulfilling the requirements of the National Space Transportation and Support Study is described. DOD and NASA were required to determine the architecture and technology that would be needed for civil and defense space transportation during the 1995-2010 time range. NASA collected data from the National Commission on Space and the DOD research focused on SDI requirements. The objectives and recommendations of the space transportation architecture, transportation and support systems, and technology assessment and planning tasks are discussed. I.F.

A86-41385
GENERALIZATION IN DECISION RESEARCH - THE ROLE OF FORMAL MODELS
R. M. HOGARTH (Chicago, University, IL) IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-16, May-June 1986, p. 439-449. Navy-supported research. refs

A given generalization, which is a working hypothesis typically expressed in terms of cause-effect relations, 'decays' due to the difficulty of identifying appropriate cause-effect relations and the sensitivity of such relations to the influence of environmental conditions. Attention is given to two basic types of model for generalizable knowledge: the replica model and the symbolic model. In addition to suggesting what experimental evidence should be collected, symbolic models can help determine when data collection may be of little value. The nature of the evidence generated by replica models (experiments) is considered from three viewpoints: (1) asymmetries in the way data and theory interact in affecting conclusions; (2) apparent but illusory conflicts between the goals of internal and external validity; and (3) the importance of conducting experiments despite poor prospects for the creation of generalizable knowledge. O.C.

A86-46425* National Aeronautics and Space Administration, Washington, D.C.
SPACE SHUTTLE DEVELOPMENT
J. C. FLETCHER (NASA, Washington, DC) and J. LOGSDON (George Washington University, Washington, DC) Science (ISSN 0036-8075), vol. 233, July 18, 1986, p. 263.

The technical-planning and decision-making processes involved in the initiation of the NASA Space Shuttle program in 1970-1972 are briefly discussed, responding to the critical evaluation of Logsdon (1986). The complex nature of the interactions among White House, OMB, DOD, and NASA; the difficulty of making long-term commitments under the U.S. system; the positive technological achievements of the program; and the need for unemotional evaluation of the policy options available after the loss of the Challenger are stressed. In a reply by Logsdon, it is argued that the structuring of the policy process itself and the presentation of the Shuttle to Congress as a relatively inexpensive routine launch system for virtually all government needs were directly related to its failure to gain continuing full funding from Administrations and Congress. It is suggested that a strong proposal of bold scientific and exploratory objectives for the space program could be more successful in gaining such long-term support. T.K.

A86-49558*# National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION OVERALL MANAGEMENT APPROACH FOR OPERATIONS
G. PAULES (NASA, Office of Space Station, Washington, DC) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 6 p.
(AIAA PAPER 86-2322)

An Operations Management Concept developed by NASA for its Space Station Program is discussed. The operational goals, themes, and design principles established during program development are summarized. The major operations functions are described, including: space systems operations, user support operations, prelaunch/postlanding operations, logistics support operations, market research, and cost/financial management. Strategic, tactical, and execution levels of operational decision-making are defined. C.D.

A86-50265*# National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION IN THE 21ST CENTURY - A SOCIAL PERSPECTIVE
B. J. BLUTH (NASA, Space Station Program Office, Washington, DC) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 9 p. refs
(AIAA PAPER 86-2349)

A human factors and sociological consideration of Space Station crew facilities and interactions is presented which attempts to place the experiences of astronaut communities in the larger context of late 20th century industrial, economic, and cultural trends. Attention is given to the relationship of Space Station communities to 'Information Society' - related historical developments. O.C.

N86-10899# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
DERIVATIONAL ANALOGY: A THEORY OF RECONSTRUCTIVE PROBLEM SOLVING AND EXPERTISE ACQUISITION
J. G. CARBONELL 5 Mar. 1985 26 p
(Contract N00014-79-C-0661; N00014-82-C-5076)
(AD-A156817; CMU-CS-85-115) Avail: NTIS HC A03/MF A01 CSCL 05J

Derivational analogy, a method of solving problems based on the transfer of past experience to new problem situations, is discussed in the context of other general approaches to problem solving. The experience transfer process consists of recreating lines of reasoning, including decision sequences and accompanying justifications, that proved effective in solving particular problems requiring similar initial analysis. The role of derivational analogy in case-based reasoning and in automated expertise acquisition is discussed. Author (GRA)

N86-11072# Research Inst. of National Defence, Stockholm (Sweden).
MANAGEMENT OF ORGANIZATIONAL OPERATIONS IN DYNAMIC ENVIRONMENTS. TOWARDS A FRAME OF REFERENCE.
R. HAGAFORS and R. ALLARD Feb. 1985 25 p refs
(FOA-C5-85-0003-H2; ISSN-0347-7665) Avail: NTIS HC A02/MF A01

The premises, the structure and the process of managing organizations are discussed. The organization is regarded as an open system and a dynamic environment model is assumed. The implications of the assumptions are described, and a frame of reference for analyzing the management situation is put forward. The hierarchical structure of organizations, the dimension of time in the management process, and the role of the management task, are discussed. Author (ESA)

N86-11076# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering.
FAILURES AND SUCCESSES OF QUANTITATIVE METHODS IN MANAGEMENT
C. B. TILANUS May 1984 18 p refs Presented at ORSA/TIMS Joint Natl. Meeting, San Diego, CA., 25-27 Oct. 1982, 15th Operational Res. Soc. of India Ann. Conv., Kharagpur, India, 9-11 Dec. 1982, and Netherlands Soc. of Statistics and Operations Res. Ann. Conf., Eindhoven, Netherlands, 31 Mar. 1983 Revised
(ARW-03-THE-BDK/ORS/83-06) Avail: NTIS HC A02/MF A01

About 60 cases of failures and successes of quantitative methods in management, collected in industry, business and government are analyzed for features determining failure or success. Author (ESA)

N86-11077# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Experimental Psychology Group.
RISK PROPENSITY, ACTION READINESS AND THE ROLES OF SOCIETAL AND INDIVIDUAL DECISION MAKERS
S. LICHTENSTEIN, W. A. WAGENFAR, G. B. KEREN, and T. W. VANDERSCHAAF Aug. 1984 21 p refs Sponsored by Central Organization TNO
(IZF-1984-27; TDCK-79524) Avail: NTIS HC A02/MF A01

Decision making by public officials and citizens was compared by eliminating different socio-economic backgrounds and different available information; to investigate the effects of adopting one role or the other (societal vs individual). Dependent measures were the willingness to choose a risky option vs a sure outcome, and the readiness to take explicit action or not. A total of 478 student subjects read the same cover story which deals with the decision problem of how to limit the number of victims of an epidemic. The results (choices and reasons) show that societal decision makers are less likely than individuals to take explicit action. Taking action is more often preferred when associated with the risky option than with the sure outcome. The large majority of subjects justify their choice on the basis of the number of victims. Results are discussed in terms of framing. Author (ESA)

N86-15161*# Rockwell International Corp., Pittsburgh, Pa.
THE KEY TO SUCCESSFUL MANAGEMENT OF STS OPERATIONS: AN INTEGRATED PRODUCTION PLANNING SYSTEM
W. A. JOHNSON and C. T. THOMASEN *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 33-40 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

Space Transportation System operations managers are being confronted with a unique set of challenges as a result of increasing flight rates, the demand for flight manifest/production schedule flexibility and an emphasis on continued cost reduction. These challenges have created the need for an integrated production planning system that provides managers with the capability to plan, schedule, status and account for an orderly flow of products and services across a large, multi-discipline organization. With increased visibility into the end-to-end production flow for individual and parallel missions in process, managers can assess the integrated impact of changes, identify and measure the interrelationships of resource, schedule, and technical performance requirements and prioritize productivity enhancements. Author

N86-15181*# Bendix Corp., Southfield, Mich.
IMPROVED PRODUCTIVITY THROUGH INTERACTIVE COMMUNICATION
P. P. MARINO *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 265-274 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

New methods and approaches are being tried and evaluated with the goal of increasing productivity and quality. The underlying concept in all of these approaches, methods or processes is that people require interactive communication to maximize the organization's strengths and minimize impediments to productivity improvement. This paper examines Bendix Field Engineering Corporation's organizational structure and experiences with employee involvement programs. The paper focuses on methods Bendix developed and implemented to open lines of communication throughout the organization. The Bendix approach to productivity and quality enhancement shows that interactive communication is critical to the successful implementation of any productivity improvement program. The paper concludes with an examination of the Bendix methodologies which can be adopted by any corporation in any industry. Author

N86-19249# Science Applications International Corp., McLean, Va. Behavioral Sciences Research Center.
AN ANNOTATED BIBLIOGRAPHY OF LITERATURE INTEGRATING ORGANIZATIONAL AND SYSTEMS THEORY
E. G. DAVIS, G. D. FOSTER, E. KIRCHNER-DEAN, and R. W. SWEZEY Sep. 1985 341 p
(Contract MDA903-79-C-0699; DA PROJ. 2Q1-62722-A-791)
(AD-A160912; SAI-82-03-178; ARI-RN-85-95) Avail: NTIS HC A15/MF A01 CSCL 05A

This annotated bibliography presents a summary of articles on organizational and systems theory up to and including 1980. The articles are divided into three categories: (1) systems theory, (2) organizational behavior, effectiveness and development and (3) simulation and training. The primary purpose of this report is to examine the literature in this area to identify the dimensions of organizational structure and processes that are related to various organizational outcomes. It is suggested that the identification of these dimensions can lead to increased effectiveness of simulation and training programs. Author (GRA)

N86-22437# Science Applications International Corp., McLean, Va. Behavioral Sciences Research Center.
ASPECTS OF COGNITIVE COMPLEXITY THEORY AND RESEARCH AS APPLIED TO A MANAGERIAL DECISION MAKING SIMULATION
S. STREUFERT and R. W. SWEZEY Sep. 1985 133 p
(Contract MDA903-79-C-0699; DA PROJ. 2Q1-62722-A-791)
(AD-A161376; SAI-82-03-178; ARI-RN-85-96) Avail: NTIS HC A07/MF A01 CSCL 05A

This research note is a post-1977 review of the literature in the areas of theory, research, and measurement of cognitive complexity. It updates the previous major review effort of Streufert and Streufert (1978). Additional discussion is devoted to the approaches selected for measuring cognitive complexity with a mini-computer based Management Assessment and Training Simulation System. Author (GRA)

N86-25289# Coopers and Lybrand, Washington, D.C.
EVALUATING R AND D AND NEW PRODUCT DEVELOPMENT VENTURES: AN OVERVIEW OF ASSESSMENT METHODS
Jan. 1986 56 p Prepared in cooperation with Commerce Dept., Washington, D.C.
(PB86-110806) Avail: NTIS HC $12.00/MF A01 CSCL 05A

Techniques to assess the business potential of technology projects are introduced. The intent is to familiarize decisionmakers with the range of available techniques. The principles involved are applicable to all those involved in the process of technological innovation: investors, financial intermediaries, individual entrepreneurs and other personnel who screen projects for possible commercial application. The assessment techniques include: checklist analyses, constraint analysis, environmental scoring model, profitability measures, sensitivity analysis, risk analysis, decision analysis and decision trees, and assessment of probabilities. GRA

N86-25299# Office of Management and Budget, Washington, D.C.
MANAGING FEDERAL INFORMATION RESOURCES: REPORT UNDER THE PAPERWORK REDUCTION ACT OF 1980
Sep. 1985 54 p refs
(PB86-247682; AR-4) Avail: NTIS HC A04/MF A01 CSCL 05B

Topics covered include: controlling paperwork (information collection reviews, the information collection budget, other paperwork reduction act activities, legislative activites and issues, delegation of clearance authority); information policy (information technology planning process, federal information policy circular, federal telecommunications systems, security of information technology systems, protecting personal privacy, coordination of U.S. Government information flows in support of international affairs, Office of Management and Budget's leadership role); and statistical policy (long range planning, evaluation, coordination standards, major statistical policy issues addressed in 1984 to 1985). GRA

N86-25687# RAND Corp., Santa Monica, Calif.
TELECOMMUNICATIONS ALTERNATIVES FOR FEDERAL USERS: MARKET TRENDS AND DECISIONMAKING CRITERIA
L. L. JOHNSON, M. A. SIRBU, and B. M. MITCHELL Dec. 1985 237 p refs Sponsored by NSF
(Contract NSF PRA-84-00689)
(PB86-153764; R-3355-NSF; ISBN-0-8330-0692-4; NSF/PRA-85023) Avail: NTIS HC A11/MF A01 CSCL 17B

The telecommunications market has been marked by growing competition in local and long-distance transmission and in terminal equipment. In response to this, the goal of the study is to show what kinds of information government agencies should collect, and how they should use it, to improve decision making. The study considers four objectives: (1) to identify and assess options for meeting voice and data needs, taking into account technical, economic, and regulatory constraints; (2) to show how Federal agencies can evaluate their needs in light of the options for supplying them; (3) to establish criteria for evaluating the relative merits of options in light of these needs; and (4) to construct a decision making framework for choosing among options, taking into account uncertainties about costs, performance, and benefits. Author (GRA)

N86-25992# Engineering Research Associates, Inc., Vienna, Va.
SCHEMA-BASED THEORY OF INFORMATION PRESENTATION FOR DISTRIBUTED DECISION MAKING Interim Report
D. F. NOBLE and J. A. TRUELOVE Aug. 1985 120 p refs
(Contract N00014-84-C-0484)
(AD-A163150; R-028-85) Avail: NTIS HC A06/MF A01 CSCL 05J

The Schema-Based Theory of Information Presentation for Distributed Decision Making describes a schema structure appropriate for understanding connections between the way that information is presented and its impact on distributed decision making. The theory suggests a process for determining how information should be presented so that consensus and coordination will be improved and decision conflicts will be reduced. The theory proposes that experienced decision makers select alternatives by mental processes that match the features of the current situation to features of reference situations for which possible alternatives are known to be appropriate. These reference situations may specify particular threat activities and dispositions, own Battle Group objectives, prescribed contingency plan action, and decision behavior of other decision makers to the group. Information presented according to the principles derived from the theory will encourage each decision maker to more fully consider the impact of each action on the objectives of other decision makers. Applying the principles requires that the general schema used by decision makers be determined prior to the time when particular situation-specific information is presented. Given this prior determination, the principles sugg est what emphasis needs to be given to specific features and feature relationships in the presentation of the current situation. GRA

N86-27113# Colorado Univ., Boulder. Center for Research on Judgement and Policy.
A THEORETICALLY BASED REVIEW OF THEORY AND RESEARCH IN JUDGMENT AND DECISION MAKING
K. R. HAMMOND Feb. 1986 96 p refs
(Contract N00014-81-C-0591)
(AD-A164914; CRJP-260) Avail: NTIS HC A05/MF A01 CSCL 05J

Barriers to unification lie in the false dichotomy and rivalry between intuition and analysis, the arbitrary choice of task conditions, and the absence of a theory of successful intuition, as well as in current research practices. A theoretical framework is presented that is intended to overcome these barriers. The theory is anchored in task conditions, specifies the variety of cognitive properties they induce, and indicates subsequent behavior. GRA

N86-27950# Dynamic Systems, Inc., Urbana, Ill.
LEADER-FOLLOWER STRATEGIES UNDER MODELING AND INFORMATION UNCERTAINTIES Final Technical Report
26 Apr. 1986 260 p
(Contract DE-AC01-81RA-50658)
(DE86-000203; DOE/RA-50658/T1) Avail: NTIS HC A12/MF A01

Focus of the research is the characterization and formulation of control strategies for large-scale systems which have two or more decision making authorities. The actions of each decision maker contribute to the total behavior of the system. Furthermore, the information on which each decision maker is based is affected by the action of the other decision makers. Thus the role of multiple decision making in the theory and methodology pertaining to the analysis, planning, and control of large-scale systems is very significant. This research addressed the central influence of hierarchical organizational forms in developing control strategies in large-scale systems when the decision makers do not have identical capabilities, priorities, and information structures. This *report is divided into five parts corresponding to the five tasks for* the project: global feedback, adaptive control concepts, multiparameter singularly perturbed systems with multiple decision makers, multitime scales induced by the information pattern, and problems of control organizations where the organizational center is the leader and the agents are followers. DOE

N86-28007# National Oceanic and Atmospheric Administration, Washington, D. C.
OPTIMUM MANAGEMENT STRATEGIES FOR THE NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) POLAR-ORBITING OPERATIONAL ENVIRONMENTAL SATELLITES, 1985-2000. VOLUME 1 Final Report
W. H. ESKITE and W. P. BISHOP Apr. 1985 70 p
(AD-A165143) Avail: NTIS HC A04/MF A01 CSCL 05A

The experience of the past 15 years was used as a basis to establish the best management principles to apply to the POES for the next 15 years. This was done for both a two-satellite configuration and a one-satellite configuration. The principles include always having a spare available, a 4-month call-up capability, taking advantage of satellites that live longer than their design life, and taking advantage of early indications of imminent failure. These principles must be applied in different ways to the two configurations. Applying these principles to several scenarios for the future leads to the conclusion that we should plan for 12 *satellites for the next 15 years for either the one-satellite or the* two-satellite system. Author (GRA)

N86-29874# Lawrence Livermore National Lab., Calif.
TOWARD A PERMANENT LUNAR SETTLEMENT IN THE COMING DECADE: THE COLUMBUS PROJECT
R. A. HYDE, M. Y. ISHIKAWA, and L. L. WOOD 19 Nov. 1985 28 p Presented at the US Space Foundation Symposium, Colorado Springs, Colo., 20 Nov.1985
(Contract W-7405-ENG-48)
(DE86-006709; UCRL-93621; CONF-8511155-1) Avail: NTIS HC A03/MF A01

The motivation for creating a permanent lunar settlement is sketched, and reasons for doing so in the coming decade are put forward. A basic plan to accomplish this is outlined, along technical and programmatic axes. It is concluded that founding a lunar settlement on the five hundredth anniversary of the Columbus landing - a Columbus Project - could be executed as a volunteer-intensive American enterprise requiring roughly six thousand man-years of skilled endeavor and a total Governmental contribution of the order of a half-billion dollars. DOE

N86-31412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
EVALUATING SPACE STATION APPLICATIONS OF AUTOMATION AND ROBOTICS TECHNOLOGIES FROM A HUMAN PRODUCTIVITY POINT OF VIEW
J. F. BARD *In its* NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 46 p Jul. 1986
Avail: NTIS HC A99/MF E03 CSCL 05H

The role that automation, robotics, and artificial intelligence will play in Space Station operations is now beginning to take shape. Although there is only limited data on the precise nature of the payoffs that these technologies are likely to afford there is a general consensus that, at a minimum, the following benefits will be realized: increased responsiveness to innovation, lower operating costs, and reduction of exposure to hazards. Nevertheless, the question arises as to how much automation can be justified with the technical and economic constraints of the program? The purpose of this paper is to present a methodology which can be used to evaluate and rank different approaches to automating the functions and tasks planned for the Space Station. Special attention is given to the impact of advanced automation on human productivity. The methodology employed is based on the Analytic Hierarchy Process. This permits the introduction of individual judgements to resolve the confict that normally arises when incomparable criteria underly the selection process. Because of the large number of factors involved in the model, the overall problem is decomposed into four subproblems individually focusing on human productivity, economics, design, and operations, respectively. The results from each are then combined to yield the final rankings. To demonstrate the methodology, an example is developed based on the selection of an on-orbit assembly system. Five alternatives for performing this task are identified, ranging from an astronaut working in space, to a dexterous manipulator with sensory feedback. Computational results are presented along with their implications. A final parametric analysis shows that the outcome is locally insensitive to all but complete reversals in preference. Author

N86-32111*# State Univ. of New York, Binghamton. Dept. of Biological Sciences.
EVALUATION OF THE NEED FOR A LARGE PRIMATE RESEARCH FACILITY IN SPACE
F. M. SULZMAN 1986 50 p
(Contract NAG2-232)
(NASA-CR-179661; NAS 1.26:179661) Avail: NTIS HC A03/MF A01 CSCL 06B

In the summer of 1983, an advisory committe was organized that would be able to evaluate NASA's current and future capabilities for nonhuman primate research in space. Individuals were chosen who had experience in four key research areas: cardiovascular physiology, vestibular neurophysiology, musculo-skeletal physiology, and fluid and electrolyte balance. Recommendations of the committee to NASA are discussed. B.G.

N86-32750# Carnegie-Mellon Univ., Pittsburgh, Pa. Robotics Inst.
A COMPARISON OF A MANUAL AND COMPUTER-INTEGRATED PRODUCTION PROCESS IN TERMS OF PROCESS CONTROL DECISION-MAKING Interim Report
S. M. MILLER and S. R. BEREITER Mar. 1986 50 p
(AD-A168037; CMU-RI-TR-86-6) Avail: NTIS HC A03/MF A01 CSCL 13H

This report is an investigation into the changes in process control that took place in the body shop of a vehicle assembly plant that was modernized from a principally manual process to one that extensively uses programmable automation. In this study, process control is defined as the information flow and decision-making required to perform basic process operations. We investigate affects of the *implementation of a computer-integrated* production system on the amount of process control decision-making, the types of process control decisions being made, and the distribution process control decision-making between humans and machines. We found that as a result of the modernization, the amount of process control decision-making *nearly tripled, the emphasis on decisions to meet product quality* specifications increased, and the emphasis on decisions related to flexibility in handling a variety of product options decreased. Decisions relating to meeting product quality specifications and to timing and synchronization of tasks were mostly taken on by the automated equipment, while decisions relating to the flexibility of the process remained to a large extent under manual control. Whereas humans made nearly 75 percent of the decisions required to assemble and weld a vehicle body in the principally manual system, humans made fewer than ten percent of the comparable decisions in the automated system. GRA

N86-32864*# California Univ., Santa Barbara.
SUPPORT FOR GLOBAL SCIENCE: REMOTE SENSING'S CHALLENGE
J. E. ESTES and J. L. STAR *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 13 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

Remote sensing uses *a wide variety of techniques and methods.* Resulting data are analyzed by man and machine, using both analog and digital technology. The newest and most important initiatives in the U. S. civilian space program currently revolve around the space station complex, which includes the core station as well as co-orbiting and polar satellite platforms. This proposed suite of platforms and support systems offers a unique potential for facilitating long term, multidisciplinary scientific investigations on a truly global scale. Unlike previous generations of satellites, designed for relatively limited constituencies, the space station offers the potential to provide an integrated source of information which recognizes the scientific interest in investigating the dynamic coupling between the oceans, land surface, and atmosphere. Earth scientist already face problems that are truly global in extent. Problems such as the global carbon balance, regional deforestation, and desertification require new approaches, which combine multidisciplinary, multinational research teams, employing advanced technologies to produce a type, quantity, and quality of data not previously available. The challenge before the international scientific community is to continue to develop both the infrastructure and expertise to, on the one hand, develop the science and technology of remote sensing, while on the other hand, develop an integrated understanding of global life support systems, and work toward a quantiative science of the biosphere. Author

N86-33198# Department of Energy, Washington, D. C. Office of Project and Facilities Management.
COST AND SCHEDULE CONTROL SYSTEMS CRITERIA FOR CONTRACT PERFORMANCE MEASUREMENT. DATA ANALYSIS GUIDE
Mar. 1986 128 p
(DE86-010796; DOE/MA-0221) Avail: NTIS HC A07/MF A01

The Data Analysis Guide has been prepared to aid both DOE and industry personnel in the effective use of contract performance measurement data. It suggests techniques for analyzing contractor cost and schedule data to give insight into current contract performance status and help validate contractor estimates of future contract performance. The techniques contained herein should be modified and tailored to fit particular project and special needs. DOE

N86-33201# Texas A&M Univ., College Station. Dept. of Management.
ORGANIZATIONS AS INFORMATION PROCESSING SYSTEMS: ENVIRONMENTAL CHARACTERISTICS, COMPANY PERFORMANCE AND CHIEF EXECUTIVE SCANNING, AN EMPIRICAL STUDY
R. DAFT, J. SORMUNEN, and D. PARKS Apr. 1986 59 p
(Contract N00014-83-C-0025)
(AD-A168035; TR-DG-20-ONR) Avail: NTIS HC A04/MF A01 CSCL 05B

Chief executives in fifty manufacturing companies were interviewed about the perceived strategic uncertainty in six environmental sectors, and the frequency and mode of scanning used for each sector. The findings suggest customer, economic, and competitor sectors generated greater strategic uncertainty than technological, regulatory, and socio-cultural sectors. When sector uncertainty was high, executives reported greater frequency of scanning and greater use of personnal information sources. Chief executives in high performing companies scanned more frequently and more broadly in response to strategic uncertainty than their counterparts in low performing companies. GRA

03

INDUSTRIAL MANAGEMENT AND MANUFACTURING

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

A86-10926#
LARGE AIRPLANE DERIVATIVE DEVELOPMENT METHODOLOGY
D. L. ROBINSON and M. F. MELARY (Boeing Co., Seattle, WA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 14 p.
(AIAA PAPER 85-3043)

The methodology and technologies applied to design derivatives of large commercial aircraft are described. Redesigns are achieved after a five-stage process consisting of requirements definition, preliminary design, detail design and analysis, testing and qualification and product development/design refinement. All factors involved in initiating and accomplishing a new design are performed with an eye to safety as a fundamental design criteria. Decisions can then proceed on the basis of the needs of the market up to 4 yr in advance. The designs must also minimize the airlines' acquisition and operating costs while incorporating state of the art technologies and configuration flexibility. CAD has emerged as a central tool to the development and assessment process. The 747-300 design process is outlined as a case study to illustrate the procedures described. M.S.K.

A86-10930*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SOME COMPARISONS OF US AND USSR AIRCRAFT DESIGN DEVELOPMENTS
M. L. SPEARMAN (NASA, Langley Research Center, Hampton, VA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 15 p. refs
(AIAA PAPER 85-3060)

A review is given of the design and development of some U.S. and U.S.S.R. aircraft. The emphasis is on the historical development of large aircraft - civil and military transports and bombers. Design trends are somewhat similar for the two countries and indications are that some fundamental characteristics are dictated more by ideological differences rather than technological differences. A brief description is given in a more or less chronological order of the major bomber aircraft, major civil and military transport aircraft, and the development of the air transport systems. Author

A86-10932#
A RAPID EVALUATION APPROACH FOR CONFIGURATION DEVELOPMENT OF NEW AIRCRAFT
Y. T. PHOA, F. CAMPISANO, P.-C. CHEN, and G. WAKAYAMA (Northrop Corp., Aircraft Div., Hawthorne, CA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 9 p. refs
(AIAA PAPER 85-3068)

Procedures followed in a computerized rapid evaluation (REV) approach to in-depth evaluations of new aircraft configurations at the early conceptual design stage are outlined. REV permits the incorporation of state of the art technology, design trade-off studies and structural design practices which lead to an optimal planform before metal cutting begins. Details of aerodynamic and structural optimization of a wing are reviewed, including the optimization codes employed in the REV CAD studies. Future extensions of the REV process to aeroelastic tailoring of entire aircraft are discussed from the point of view of the required algorithms, particularly in applications with forward swept wing aircraft. M.S.K.

A86-10936#
REQUIREMENTS, DEVELOPMENT AND PARAMETRIC ANALYSIS FOR SPACE SYSTEMS DIVISION
B. G. MORAIS (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 7 p. (AIAA PAPER 85-3078)

This paper presents a tutorial on requirements development and parametric analysis. It provides an overview of the System Engineering process and presents the approach and an example of parametric analysis as it relates to deriving requirements for large space systems. Author

A86-10960#
RAPID SIZING METHODS FOR AIRPLANES
J. ROSKAM (Kansas, University, Lawrence) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 8 p.
(AIAA PAPER 85-4031)

A rapid method for preliminary weight sizing of aircraft which uses a series of logarithmic correlations between takeoff weight and empty weight is presented. The method allows rapid calculation of aircraft growth factors due to changes in mission specifications or changes in drag polar, engine specifics, payload, and empty weight. For a given mission specification, a rapid method for estimating takeoff gross weight, empty weight, and mission fuel weight is presented. The method applies to the following 12 types of aircraft: (1) homebuilts; (2) single engine props; (3) twin engine props; (4) agriculturals; (5) business jets; (6) regional turboprops; (7) transport jets; (8) military trainers; (9) fighters; (10) military patrol, bomb, and transport aircraft; (11) flying boats, amphibious, and float aircraft; (12) supersonic cruise aircraft. C.D.

A86-11961
OPTIMUM WING - FOR ALL FLIGHT CONDITIONS?
J. H. BRAHNEY Aerospace Engineering (ISSN 0736-2536), vol. 5, Oct. 1985, p. 36-40.

The present paper is concerned with a mission adaptive wing which will automatically adjust its camber to achieve optimum performance throughout the flight envelope. It is pointed out that such a wing is nearing reality. The mission adaptive wing (MAW) installed on the AFTI/F-111 (Advanced Fighter Technology Integration) test bed will soon be proving the concept. Eventually, the mission adaptive wing will operate in four automatic modes, each of which can be selected individually or combined. These modes include the 'cruise camber control', the 'maneuver camber control', the 'maneuver load control', and the 'maneuver enhancement and gust control mode'. G.R.

A86-14243#
A SELF-REPAIRING AIRCRAFT?
E. J. LERNER Aerospace America (ISSN 0740-722X), vol. 23, Nov. 1985, p. 22, 24.

Attention is given to a computer program which will allow future control-configured fighter aircraft to automatically compensate for the loss of a control surface due to combat damage, in order to maintain stability. Such a system, if successfully implemented, would also be able to compensate for electronic and hydraulic system failures, effectively obviating the presently critical requirement for four-fold redundancy in such systems. This would reduce cost and complexity, while increasing MTBF. The reliable detection of system failures is identified as a major problem in implementation. O.C.

A86-19489
FUTURE OF REMOTE SENSING - A VIEWPOINT FROM INDUSTRY
A. B. PARK (Natural Resources Consulting Services, Arnold, MD) IN: Remote sensing; Proceedings of the Meeting, Arlington, VA, May 1, 2, 1984 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 148-151.

It appears that the present paper is presented at a critical time in the life of land remote sensing. The technology involved is just over 20 years old, and remote sensing has undergone a remarkable growth during this time. An intensive effort is currently being made to create a Commercial Land Remote Sensing (CRLS) system including both space and ground segments. The present time represents a major milestone in remote sensing. This milestone serves to divide the program into two segments, including a research program largely but not completely sponsored by the Federal Government, and commercial program driven almost entirely by the profit motive. Over the past five years, industry has intensely studied the viability of a commercial program. It was concluded that money could be made by industry in operating the ground segment. Such a result leaves in the hands of the government the space segment and the space/ground communications responsibility. G.R.

A86-19525* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEMS ENGINEERING - SPACE TELESCOPE PROJECT
F. S. WOJTALIK (NASA, Marshall Space Flight Center, Huntsville, AL) IN: The National Symposium and Workshop on Optical Platforms, Huntsville, AL, June 12-14, 1984, Proceedings . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 10-18.

At midpoint in the development of the Space Telescope (ST), a review process was conducted which determined that much benefit could be derived from an expanded systems engineering effort. The Systems Engineering Office thus established is responsible for the running of a management information system whose functions encompass design change control and the implementation of a maintenance and refurbishment program. By these means, interface hardware/software incompatibilities between critical ST modules and subsystems have been revealed and corrected. O.C.

A86-20039#
ASSESSING COST-EFFECTIVE WEIGHT SAVING IN AIRCRAFT OPERATIONS
D. G. PECK (Transport Canada, Ottawa) (CASI, Annual General Meeting, 31st, Ottawa, Canada, May 28, 1984) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 31, March 1985, p. 45-51.

Three methods of establishing cost/weight savings for aircraft are analyzed. The first method described involves measuring the value of the weight by useful load; dividing the points of useful load into the aircraft cost will establish the cost/pound value of the aircraft. A table of values of useful load for various aircraft types is provided. The second technique which calculates the value of weight by the amount of fuel saved is examined; it is observed that jets provide more savings than propeller aircraft and more flight time increases savings. The usefulness of the third method where a value is assigned to weight saving revenue purposes is revealed through an example. I.F.

A86-20591
HAVE FACTORY, WILL LAUNCH
M. REGISTER Space World (ISSN 0038-6332), vol. W-1, Jan. 1986, p. 11-13.

The design of the Industrial Space Facility (ISF) is described. The ISF, which will be powered by solar arrays, consists of a 35 ft long facility module for manufacturing and a 6 or 12 ft supply module. The ISF is to be fully operational when it is deployed in a 230-nautical-mile orbit inclined to 28.5 degrees. The equipping of the factory to meet the requirements of its users is discussed. The stabilization and stationkeeping systems for the ISF are analyzed. The agreement with NASA that does not require any payments prior to launching of the factory is examined. I.F.

A86-21896#
'SMART' ENGINE COMPONENTS - A MICRO IN EVERY BLADE?
A. H. EPSTEIN (MIT, Cambridge, MA) Aerospace America (ISSN 0740-722X), vol. 24, Jan. 1986, p. 60-62, 64.
'Smart' gas turbine engine technology applies feedback control to the adaptive variation of component settings in changing local conditions; as in any closed loop control system, the smart engine employs sensors, processors, and actuators. Near-term applications of these principles encompass active control of blade tip clearances and active exhaust nozzle position improvement. Longer-term applications extend to active compressor inlet distortion control, active stall alleviation of compressor flow, and active noise control. Hot section smart features may be very long term design concerns, focusing on turbine blade stress or temperature distribution. O.C.

A86-22141#
AIRFRAME DESIGN TO ACHIEVE MINIMUM COST
B.R. NOTON (Battelle Memorial Institute, Columbus, OH) IN: Evolution of Aircraft/Aerospace Structures and Materials Symposium, Dayton, OH, April 24, 25, 1985, Proceedings . Dayton, OH, American Institute of Aeronautics and Astronautics, 1985, p. 18-1 to 18-11. refs
Cost drivers related to aircraft performance, design, material selection and manufacturing are discussed, and also those related to industry in general. The design objectives and manufacturing technology requirements for low-speed and high-speed aircraft are illustrated to indicate possible cost drivers. The importance of the early developmental phases to reduce cost of engineering systems, is emphasized. To minimize cost drivers, the Air Force has developed a 'Manufacturing Cost/Design Guide' which puts designers on the lowest cost track early in the design phase and also enables trade-off studies to be conducted while developing alternative structural configurations. The methodology used to address cost drivers and to quantify these ae reviewed. Due to problems of cyclic production and stretched-out delivery schedules, some guidance is provided to designers with respect to the importance of learning curves. A worksheet is provided for designers to summarize the cost of parts, subassemblies and the program aircraft. Author

A86-24106
STRUCTURES IN SPACE - CONTRACTORS ADAPT EARTH-BASED CONSTRUCTION METHODS TO MICROGRAVITY
S. W. KANDEBO Commercial Space (ISSN 8756-4831), vol. 1, Summer 1985, p. 52, 53.
The development of construction techniques for the Space Station is briefly considered. Emphasis is given to the application of earth-based construction techniques and structural frameworks to the microgravity environment. A design concept for the modular Power Tower of the Space Station, which uses a repeating geometry network of interlocking struts and hubs, is described in detail. Color photographs of a typical hub-strut construction system are provided. I.H.

A86-24667
ROBOTIC APPLICATIONS TO AUTOMATED COMPOSITE AIRCRAFT COMPONENT MANUFACTURING
B. SARH (Rohr Industries, Inc., Riverside, CA) Society of Manufacturing Engineers, Conference on Fabricating Composites, Hartford, CT, June 11-13, 1985. 18 p.
(SME PAPER MF85-506)
This paper considers robotic applications in aircraft prepreg composite structure fabrication. The process steps involved in automated prepreg production are described with a focus on process efficiency. For a typical composite structural shell, the number of different preprep pieces used is compared to the number of parts involved in a conventional metal structure, and the potential for automated production is shown. Specific process times and efficiencies for the process steps in fabricating a composite aircraft shell are calculated. Author

A86-24828
ELECTRIC POWER MANAGEMENT AND DISTRIBUTION FOR AIR AND SPACE APPLICATIONS
B. MEHL and E. HENDERSON (Sundstrand Corp., Rockford, IL) IN: Intersociety Energy Conversion Engineering Conference, 20th, Miami Beach, FL, August 18-23, 1985, Proceedings. Volume 1 . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 1.374-1.381. refs
The historical growth of electric power systems for aircraft and space applications is briefly reviewed, and the technical issues involved in electric power management and distribution are discussed. The discussion covers bus architectures, power management components, power system controls, autonomous power management, transient reduction, and autonomous system reconfiguration. Particular attention is given to advanced electric power systems concepts and alternative implementations. V.L.

A86-24988
ONE MAN AND 3,000 MILLION OPERATIONS A SECOND - PREPARING FOR THE LHX COCKPIT
M. LAMBERT Interavia (ISSN 0020-5168), vol. 41, Jan. 1986, p. 27-30.
With the use of the Advanced Rotorcraft Technology Integrator (ARTI), an equipment system is being developed for the mid-1990's for the LHX helicopter to enable single pilot operation of all eight of its scout and attack missions. The system must be capable of executing 3,231 million operations/sec covering navigation, communication, electronic defensive measures, displays, interfaces, target recognition and weapon delivery. If it becomes available, Very High-Speed Integrated Circuitry will make possible a system design of relatively low weight (54 kg), volume, and cost. The system necessitates helicopter design changes to simplify handling, such removal of cross coupling between the axes of control, and creating an optimum combination of side-stick and rudder pedal control. A computer-based Cockpit Emergency Directed Action Program could be used to detect and take action on system faults. Information will have to be circulated over multiple electronic and optical data buses. R.R.

A86-26114
THE WORLD AIRCRAFT INDUSTRY
D. TODD (Manitoba, University, Winnipeg, Canada) and J. SIMPSON London/Dover, MA, Croom Helm/Auburn House Publishing Co., 1986, 282 p. refs
A comprehensive survey of the current state of the world aircraft industry is presented. The development of the industry and its current problems are considered. The role of governments is examined, showing how this differs from country to country. The prospects for the future shape of the industry, as newly industrialized countries become involved, are assessed. C.D.

A86-26299
TOMORROW . . . CONCORDE'S SUCCESSOR?
G. CORMERY (Aerospatiale, Division Avions, Paris, France) and G. PATRI Revue Aerospatiale (ISSN 0065-3780), Feb. 1986, p. 10-15. In English and French.
The current state-of-the-art in supersonic transport is discussed along with studies for the development of the Future (second-generation) Supersonic Transport (FSST). Technological advances flight-proven in Concorde's 10 years of commercial experience include full-authority fly-by-wire controls on all three axes and on the engine, digital computers, and an automatic flight management system. Studies for the development of an FSST center on wind-tunnel model testing using the following parameters: Mach 2-2.2, 50 percent aerodynamic, propulsion and weight improvement over the Concorde, an 8000 km/200 passenger profile with 1000 km subsonic flight, the use of existing airport installations, and ICAO A.16.1971 subsonic aircraft noise limitations. The adoption of a variable-cycle engine providing a bypass flow at subsonic regimes and a single flow for supersonic flight will provide the best compromise between general performance and noise limitations. Other projected technologies include the extensive use

of the control-configured vehicle concept, permitting flight with zero static margins. R.R.

A86-28346

DIGITAL AVIONICS FOR MODERN AIRCRAFT - A CASE STUDY INTO THE PROBLEMS AND PROMISE OF AIRCRAFT ELECTRONICS

H. S. ARCHER, III (Lockheed-Georgia Co., Marietta) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 144-151.

With decreasing static stability margins and increasingly rigorous mission requirements, the role of aircraft electronics has become vital. A brief historical perspective of the evolution of avionics is given, and the harsh environmental constraints under which current avionics must operate are noted. The case for spatially redundant integrated racks composed of standardized modules is made. A state-of-the-art design approach is then presented, followed by a discussion of an advanced system that will be typical of aircraft in the 1990's. The topics discussed include: designing for thermal management, distributed processing, built-in-test requirements, and redundant systems for flight-critical applications. Author

A86-28455#

2010 - THE SYMBIONIC COCKPIT

J. M. REISING and R. W. MOSS (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1050-1054. refs

The cockpit of the year 2010 is described in terms of both the capabilities and systems it contains and how the pilot interacts with it. A brief mission narrative is provided describing several hours in the life of the Manta air superiority fighter. This is followed by a discussion of the pilot interface components employed in the cockpit including hueristic voice, instrument panel display, canopy display, and holographic display systems. The concept of a 'symbionic' system is then introduced, describing in some detail the capabilities and features of a cockpit system that senses the physiological and mental state of the pilot and responds accordingly. Finally, conclusions and predictions are made that summarize and emphasize the points made in the paper. Author

A86-28596

ARIANE 5 - A NEW LAUNCHER FOR EUROPE

H. LAPORTE-WEYWADA and E. RAILLON (CNES, Etablissement d'Evry, France) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 389-404.
(AAS 84-226)

The design characteristics of the Ariane 5 launcher system are described. The launcher consists of three separate stages, with the two stages of the lower section operating in parallel, and an upper section comprising the third stage, Vehicle Equipment Bay (VEB) payload, and nose fairing. The lower section is driven by an HM60 motor and two solid propellant boosters similar to those of the Shuttle. The two boosters are arranged on either side of the second stage and provide a thrust of 900 tons on liftoff. The upper stage incorporates a spherical tank design containing the same LOX fuel used in the lower section. The storable propellant third stage of the Ariane 5 is driven by an MMH/N2O4 motor delivering between 10 and 15 kN thrust. The MMH/N2O4 propellant is contained in two small spherical tanks. Commencement of actual production of the Ariane 5 launcher and the MH60 motor is scheduled for mid-1986 in order to achieve ground qualifications by the middle of 1993 with test flights starting in 1994. Detailed line drawings of the fuel tanks, motors, and fairings of the separate launcher stages are provided. I.H.

A86-29586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SPACECRAFT 2000

K. A. FAYMON (NASA, Lewis Research Center, Cleveland, OH) IN: Communication Satellite Systems Conference, 11th, San Diego, CA, March 17-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 88-91. refs
(AIAA PAPER 86-0616)

The Spacecraft 2000 program has been conceived by NASA with the objective to maintain the U.S. in a strong technical position in the space arena. The program is to involve a cooperative NASA/industry effort with long-range technology development aims. The technology areas addressed are related to spacecraft power, spacecraft energy storage, power management and distribution, autonomous operation-control, onboard systems integration, secondary propulsion, communications technologies, and systems/subsystems technology verification. Aspects of Spacecraft 2000 interactions with industry are discussed, taking into account visitations of NASA personnel to selected industrial concerns, most critical concerns (general), major technical concern, technology drivers for future spacecraft power systems, technology considerations for secondary propulsion, and questions of commercialization. Plans related to a Spacecraft 2000 program formulation are also considered. G.R.

A86-29668#

ARIANE AND ARIANESPACE STATUS AND CAPABILITY

D. A. HEYDON (Arianespace, Inc., Washington, DC) AIAA, Communication Satellite Systems Conference and Exhibits, 11th, San Diego, CA, Mar. 16-20, 1986. 24 p.
(AIAA PAPER 86-0671)

A European company has provided launch vehicles for over six years, taking into account the launching of satellites for communications and other applications. This paper presents a review of the status of the Ariane program, giving attention to its ability to respond to the increasing demands of today's dynamic conditions. In response to a third stage ignition problem, liquid hydrogen and liquid oxygen inlet valves were modified to improve seal performance. An increase in the launch rate is expected from six launches in 1986 to eight in 1987 and 1988. Payload mass/weight performance is discussed along with payload volume, injection accuracy, and the operating environment. G.R.

A86-29674#

A COMMERCIAL COMMUNICATIONS SATELLITE SYSTEM FOR JAPAN

M. A. BERTA (Hughes Communications, Inc., El Segundo, CA) and M. MARUMO (Japan Communications Satellite Co., Inc., Tokyo) AIAA, Communication Satellite Systems Conference and Exhibits, 11th, San Diego, CA, Mar. 16-20, 1986. 8 p.
(AIAA PAPER 86-0680)

JC SAT will provide commercial Ku-band communications service to the Japanese islands commencing in early 1988. The satellite is a Hughes HS-393 with 32 transponders and a 27 MHz bandwidth. The communications payload has 40 for 32 redundancy with nominal 20 watt traveling wave tubes. Eighteen of the transponders contain linearizer-TWT combinations. This system will provide highly reliable service for the complete range of applications from TV broadcast to digital data dissemination using relatively small receiving antennas. Author

A86-29680#

SATELLITE COMMUNICATIONS BASICS - A COLLOQUIUM LECTURE

J. KAISER (Kaiser, Inc., Bethesda, MD) AIAA, Communication Satellite Systems Conference and Exhibits, 11th, San Diego, CA, Mar. 16-20, 1986, Paper. 24 p.

The basic concepts of satellite communications are reviewed. Digital and satellite methods of communications are examined; a schematic of a satellite communication link is provided. The calculations of uplink and downlink budgets which estimate the power necessary to transmit digital signals are discussed; the required formulas and parameters are listed. The components of earth stations including antennas, transmitters, receivers, and converters are described. Consideration is given to wideband receivers, switching, amplifiers, antenna systems, spacecraft bus subsystems, launch vehicle interface, and satellite orbits. Diagrams of various communication satellites and system components are presented. I.F.

A86-30187
SATELLITE COMMUNICATIONS PLANNING AND EQUIPMENT MANUFACTURING IN LATIN AMERICA
A. SERRANO and J. C. POMALAZA (CICESE, Ensenada, Mexico) International Journal of Satellite Communications (ISSN 0737-2884), vol. 3, Oct.-Dec. 1985, p. 295-299. refs

This paper emphasizes the importance of and presents ideas for the participation of Latin American countries in the planning and manufacturing of their satellite communication systems. A strategy to stimulate manufacturing of local satellite communications equipment is presented considering the planning and manufacturing experience obtained in Mexico. Author

A86-31038
WHAT TECHNOLOGIES AWAIT THE FUTURE AIRLINER?
P. CONDOM and M. LAMBERT Interavia (ISSN 0020-5168), vol. 41, Feb. 1986, p. 145-149.

The present assessment of technology readiness in the fields of airliner aerodynamics, structures, avionics, control systems, and propulsion, attempts to forecast the likely character of the next generation in commercial aircraft design. Although both political and commercial pressures exist for renewed efforts toward a second-generation SST, current technology development efforts are centered on continued refinement of laminar aerodynamics, propfan and unducted fan propulsion, thermoplastic matrix composites and aluminum-lithium alloys for structures and digital avionics and control. Attention is given to the boundary layer wing-skin suction flow laminarization technique and the competition between engine manufacturer's innovative propfan technologies. O.C.

A86-31253
AEROSPACE AND ELECTRONIC SYSTEMS - ADVANCED CONCEPTS AND PIONEERING PERSPECTIVES; PROCEEDINGS OF THE SIXTH SYMPOSIUM, DAYTON, OH, NOVEMBER 14, 15, 1984
Symposium sponsored by IEEE. New York, Institute of Electrical and Electronics Engineers, 1984, 116 p. No individual items are abstracted in this volume.

Among the topics discussed are: the PRAM approach to technology transfer; all-electric aircraft development; and electronic enhancements for the combat aircraft cockpit. Consideration is also given to application of AI systems to military aircraft; ECM and ECCM technology; and the history of monolithic ICs. Developments in the USAF Avionics Integrity Program (AVIP) are reviewed, with emphasis given to: preventive measures for electrostatic discharges; corrosion prevention to increase avionics integrity; and criteria for stress screening temperature levels. I.H.

A86-31330#
X-AIRCRAFT FOR WORLD LEADERSHIP IN AERONAUTICS
R. S. COOPER Aerospace America (ISSN 0740-722X), vol. 24, Feb. 1986, p. 26-28.

Continuing vigorous and sufficiently funded aeronautical research involving experimental aircraft is a necessity if the U.S. is to retain world leadership in aerospace defense and industrial technologies. The most recent program, the X-29, illustrates the process of demonstrating a proof of concept as a key effort in introducing new ideas into operational aircraft. The alternative to flight testing experimental demonstrator aircraft can be several years of studies in wind tunnels and in computer time, substantially increasing program costs and usually producing only an incremental increase in performance instead of an integer multiplicative advance. The next likely demonstrator program will be the DARPA-NASA X-wing circulation control (CC) rotor aircraft. CC experiments will examine techniques for generating lift, providing distributed propulsion and controlling drag, concepts which may eventually be applied in long-endurance high altitude atmospheric aircraft that may replace geosynchronous satellites. A subsequent program to develop a hydrogen-fueled aerospaceplane powered by a supersonic-combustion ramjet propulsion system may encounter funding obstacles when the time comes to construct a demonstrator experimental aircraft near the end of the 1980s. M.S.K.

A86-31777
AEROSPACE GUIDANCE AND CONTROL IN THE UNIVERSITY - ANTICIPATED TRENDS
R. D. CULP (Colorado, University, Boulder) IN: Guidance and control 1985; Proceedings of the Eighth Annual Rocky Mountain Conference, Keystone, CO, February 2-6, 1985 . San Diego, CA, Univelt, Inc., 1985, p. 3-7.
(AAS PAPER 85-001A)

Advances in microelectronics and computational capabilities that have changed guidance, navigation, and control are examined. These hardware improvements have occurred primarily in industry; therefore, the universities are not able to produce the type or quantity of aerospace control engineers required by industry. The development of programs which will foster industry/university interaction is proposed. I.F.

A86-34124
IN-PROCESS INSPECTION OF THE PARAMETERS OF THE ELECTRON BEAM IN ELECTRON BEAM WELDING
V. V. BASHENKO, E. A. MITKEVICH, and N. N. DETSIK (Leningradskii Politekhnicheskii Institut, Leningrad, USSR) (Svarochnoe Proizvodstvo, no. 5, 1985, p. 18, 19) Welding Production (ISSN 0043-230X), vol. 32, May 1985, p. 13, 14. Translation. refs

A simple and reliable in-process method for the electron beam welding process is described, which makes it possible to control the beam current and specific power in the heating spot. The method is based on the use of a signal, formed at the instant of plasma formation above the surface heated by the beam. The applicability of the method is limited by the possibilities of measuring the duration of the short pulses and the curvature of the front of the leading edge of the welding current. A diagram of the controlling device is included. I.S.

A86-34989* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
COST CONTAINMENT AND KSC SHUTTLE FACILITIES OR COST CONTAINMENT AND AEROSPACE CONSTRUCTION
J. A. BROWN (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 12-15 to 12-25. refs

This presentation has the objective to show examples of Cost Containment of Aerospace Construction at Kennedy Space Center (KSC), taking into account four major levels of Project Development of the Space Shuttle Facilities. The levels are related to conceptual criteria and site selection, the design of construction and ground support equipment, the construction of facilities and ground support equipment (GSE), and operation and maintenance. Examples of cost containment are discussed. The continued reduction of processing time from landing to launching represents a demonstration of the success of the cost containment methods. Attention is given to the factors which led to the selection of KSC, the use of Cost Engineering, the employment of the Construction Management Concept, and the use of Computer Aided Design/Drafting. G.R.

A86-35216
SPACE STATION DESIGN-TO-COST - A MASSIVE ENGINEERING CHALLENGE
M. C. SIMON (General Dynamics Corp., Space Systems Div., San Diego, CA) Society of Allied Weight Engineers, Annual Conference, 44th, Arlington, TX, May 20-22, 1985. 11 p. refs
(SAWE PAPER 1673)

The Space Station, NASA's first major test of design-to-cost concepts, must include: (1) pressurized modules with habitat provisions for six crewpersons as well as space for laboratory and logistics functions; (2) a power system capable of generating 75 kilowatts of continuous power; and (3) unmanned platforms for conducting experiments that cannot be accommodated on the core facility. Beyond the implementation of these basic necessities, NASA and its contractors must adhere to a rigorous design-to-cost approach to SS design, development and production. Ultimately, size, shape and function of the SS will be determined by cost more than any single evaluation criterion. K.K.

A86-35223
STARSHIP I - A WEIGHT CONTROL CHALLENGE
H. L. FRISCH (Beech Aircraft Corp., Wichita, KS) Society of Allied Weight Engineers, Annual Conference, 44th, Arlington, TX, May 20-22, 1985. 17 p.
(SAWE PAPER 1682)

The Starship I utilizes many new state-of-the-art concepts in design, materials selection, and fabrication techniques for development of a next generation business aircraft. Composite materials comprise approximately 72 percent of the aircraft structural weight and are a major contribution to the success of the program. This presentation includes a description of the aircraft configuration, weight control philosophy, and computerized mass properties accounting system. Author

A86-35438* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADVANCED CONCEPTS TRANSPORT AIRCRAFT OF 1995
S. L. CHAPPELL (NASA, Ames Research Center; Informatics General Corp., Moffett Field, CA) and G. A. SEXTON (Lockheed-Georgia Co., Marietta) IN: Aerospace Behavioral Engineering Technology Conference, 4th, Long Beach, CA, October 14-17, 1985, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 103-108.
(SAE PAPER 851808)

The components of the Advanced Concepts Flight Simulation Facilities used to evaluate proposed human-machine interfaces are described. The facilities consist of: (1) an advanced concept flight station, which is a wide-body, composite airframe propelled by two turbo-fan engines; (2) an integrated air traffic control simulation; and (3) experimenter/observer stations. The flight controls and displays, and their operation are studied. The air traffic control provided in the simulation is examined. The control of the flight conditions and data collection by the experimenter are discussed. I.F.

A86-35644
HELICOPTER CUSTOMER SUPPORT - ARE WE AWARE OF HOW GREAT IT CAN BE
J. J. ALEXANDER (Aerospatiale Helicopter Corp., Grand Prairie, TX) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 617-622. refs

Helicopter manufacturers' customer support services encompass the provision of spare parts, maintenance and repair equipment, and technical expertise, to customers on the basis of analyses of product histories. The manufacturer must address the service requirements of pilots, maintenance personnel, and spare parts inventory managers, in addition to members of administrative and financial departments. Attention is presently given to support service requirement information flowing from customers to manufacturers, typical product accident/incident cause analysis, and both obvious and hidden expenditures by customers that must be anticipated by support services. O.C.

A86-35645
THE FIELD REPRESENTATIVE 'FRONT LINE ACTIONEER'
W. G. TRIPP (United Technologies Corp., Sikorsky Aircraft Div., Stratford,, CT) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 623-627.

A helicopter manufacturer's field service representative must address the maintenance, operation and support requirements of customers operating one or several of the manufacturer's products. In addition to the technical expertise required to soundly advise operators on cost-minimizing procedures in operations, maintenance and repair, the representative must also possess and exercise evaluative judgment through which the manufacturer's staff can act on customers feedback. The degree to which a field service representative's work will enhance customer performance and satisfaction is presently assessed. O.C.

A86-35660
ROBOTICS IN AIRCRAFT MANUFACTURING
J. J. BARTO, JR. (United Technologies Corp., Sikorsky Aircraft Div., Stratford, CT) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 793-800.

Attention is given to two robotic installations for the manufacture of helicopter airframe components: a small hole-drilling and deburring system, an assembly system for drill/wet-seal/rivet operations. The multistation drilling system employs a robot to drill pilot holes in a family of machined aluminum cabin frame structures, and also brush-deburrs the machined surfaces. The assembly system involves a track-mounted robot designed to drill, wet-seal, and rivet Kevlar and aluminum panels onto preassembled frames that are positioned in a work cell arrangement. O.C.

A86-36853#
DEVELOPMENT OF A KNOWLEDGE BASE FOR AN EXPERT SYSTEM FOR DESIGN OF STRUCTURAL PARTS
J. J. SHAH (Arizona State University, Tempe) IN: Computers in engineering 1985; Proceedings of the International Computers in Engineering Conference and Exhibition, Boston, MA, August 4-8, 1985. Volume 2 . New York, American Society of Mechanical Engineers, 1985, p. 131-136. refs

The paper describes some preliminary work done in developing an expert system for conceptual form design of load-bearing machine parts. Design of this nature can be done without calculating stress magnitude. The knowledge base is built from case studies of form design, starting with simple structures and gradually increasing the complexity. It was found that this method of case studies was a convenient way of gradually building universal rules for designing. Several types of constraints were also considered. It has been demonstrated that knowledge bases for such design problems are not just knowledge intensive but procedure and analysis dependent. Author

A86-36941
ENGINEERING FLIGHT SIMULATION - A REVOLUTION OF CHANGE
T. L. FRASER and C. E. PHILLIPS (Boeing Computer Services Flight Systems Laboratory, Seattle, WA) IN: Flight simulation/simulators; Proceedings of the Aerospace Technology Conference and Exposition, Long Beach, CA, October 14-17, 1985 . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 11-17.
(SAE PAPER 851901)

Issues which require consideration when developing an engineering simulation facility are presented, with emphasis placed on the incorporation of a dynamic computing technology into short and long-term planning. The effects of the operation environment, simulation growth, and simulation payoff are discussed in relation to external influences of computer architecture, re-education of the programmer, and simulation user help. It is concluded that new simulation technology may include the application of a modular computing architecture in the form of multi-processors and engineering workstations, as well as extensive input/output and file networking systems. Moreover, it would include the selection and education of new programming languages and the development of adequate help systems. K.K.

A86-37060*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

CONSTRUCTION AND CONTROL OF LARGE SPACE STRUCTURES

M. F. CARD, W. L. HEARD, JR. (NASA, Langley Research Center, Hampton, VA), and D. L. AKIN (MIT, Cambridge, MA) Israel Annual Conference on Aviation and Astronautics, 28th, Tel Aviv and Haifa, Israel, Feb. 19, 20, 1986, Paper. 21 p. refs

Recent NASA research efforts on space construction are reviewed. Preliminary results of the EASE/ACCESS Shuttle experiments are discussed. A 45-foot beam was constructed on orbit in 30 minutes using a manual assembly technique at a work station. A large tetrahedron was constructed several times using a free floating technique. The capability of repair, utilities installation, and handling the structures using a mobile foot restraint on the RMS was also demonstrated. Implications of the experiments for Space Station are presented. Models of 5-meter Space Station structure together with neutral buoyancy simulations suggest manual assembly techniques are feasible. Selected research on control of flexible structures is discussed. To support planned flight experiments, studies of the design and optimal placement of distributed active dampers are underway. Author

A86-39567#

NEXT GENERATION AIRCRAFT STRUCTURES - THE NEED FOR CO-ORDINATED CANADIAN R & D PROGRAMS

J. THOMPSON (CASI, Structures and Materials Section, Ottawa, Canada) Canadian Aeronautics and Space Journal (ISSN 0008-2821), vol. 32, March 1986, p. 50-53.

The directions which Canadian R & D in aircraft structures are expected to take over the next 25 yr are discussed. Current programs are targeted at developing composite secondary structures which can be certified for regular use, particularly in the DHC-7 and DHC-8 aircraft. Near- and mid-term research will examine carbon-fiber, aramid, aramid/aluminum hybrids, aluminum lithium alloys, and powder metallurgy ingot aluminum alloys, mainly for commuter aircraft. The parts which will receive the most attention are wings and flaps, empennages, fuselages and flight control surfaces. The efforts will require the development of standardized analytical and numerical tools, NDE testing methods and test procedures, extensive material characterization studies, and funding and performance of components testing programs. It is notable that commuter aircraft primary structures will be required to be as resistant to impact damage from, e.g., birds, as typical modern larger passenger aircraft. M.S.K.

A86-39794

ON A MICROCOMPUTER INTEGRATED SYSTEM FOR STRUCTURAL ENGINEERING PRACTICES

W. KANOK-NUKULCHAI (Tokyo, University, Japan) Computers and Structures (ISSN 0045-7949), vol. 23, no. 1, 1986, p. 33-37. refs

This paper describes a comprehensive use of microcomputer for professional practices of structural engineers. Transition from the conventional method to a computer-based procedure calls for a complete rethinking of an accurate, unambiguous definition of all the elementary activities, their logical orders as well as inter-relationships. An integrated database software system is then proposed for analysis and design of structures, on microcomputer. With a common data bank, all previously processed data can serve directly as a basis for subsequent activities, such as computer-aided drafting, computer-aided construction planning, etc. Several program strategies to attain a maximum efficiency within existing microcomputer constraints are discussed. Author

A86-40514

TRADES AND ANALYSES MANAGEMENT SYSTEM (TRAMS)

H. WYLE (Abacus Programming Corp., Van Nuys, CA) and L. M. SUAREZ (Rockwell International Corp., Downey, CA) IN: Space tech; Proceedings of the Conference and Exposition, Anaheim, CA, September 23-25, 1985 . Dearborn, MI, Society of Manufacturing Engineers, 1985, p. 6-1 to 6-13. Research supported by the Rockwell International Corp.

TRAMS is a database system for managing and providing user visibility into a large group of inter-related engineering studies. It permits on-line scanning of study definitions, schedules and results, detects study-to-study incompatibilities, and provides a simulation capability allowing users to determine potential impacts of proposed changes in a given study on other studies. TRAMS should be seen as a part of the movement towards greater use of automated tools in reducing the life-cycle costs of large aerospace systems. Author

A86-41155

KEYS TO ENGINEERING MANAGEMENT REDUCING THE RISKS OF R&D START-UPS PLANNING

R. N. WOLL (N. Woll and Co., Inc., San Jose, IL) IN: Winter National Design Engineering Show and Conference, Anaheim, CA, December 11-13, 1985, Conference Talks . Stamford, CT, Cahners Exposition Group, 1985, p. 241-252.

Planning is crucial to success in every venture and can minimize exposure to risk. The risks of research and development ventures are of special concern because of the nature of the work. All organizations involved in research and development share this concern. This paper discusses potential areas of risk and provides suggestions for dealing with risk as it pertains to both large and small organizations. Author

A86-42764*# Rockwell International Corp., Canoga Park, Calif.

DEVELOPMENT HISTORY OF THE SPACE SHUTTLE MAIN ENGINE

T. J. PETERSON (Rockwell International Corp., Rocketdyne Div., Canoga Park, CA) AIAA, ASME, SAE, and ASEE, Joint Propulsion Conference, 22nd, Huntsville, AL, June 16-18, 1986. 8 p.
(Contract NAS8-27980)
(AIAA PAPER 86-1635)

The development of the Space Shuttle Main Engine has provided a high performance, reusable component for the Space Transportation System. A discussion of how ground testing identified problems and their resolution paved the way for certification of the engine for flight. A launch summary and a discussion of launch anomalies are included. Continuing improvements and established overhaul criteria are described which will extend the operating life and allow each engine to be used efficiently. Author

A86-44919

WORLD AEROSPACE PROFILE 1986

London, Sterling Publications, Ltd., 1986, 352 p. No individual items are abstracted in this volume.

A comprehensive evaluation is made of state-of-the-art achievement and development trends for numerous fields in aerospace technology throughout the industrial world, with attention to airframe, engine and avionics manufacturers in the U.S., U.K., France, West Germany, and Japan. Both civilian and military programs are discussed in articles covering composite airframes for materials, anticorrosion design practices, tilt-rotor aircraft design, next-generation SSTs, supersonic STOL and V/STOL development trends, Unducted Fan engine design evolution, propeller design trends, and novel aviation fueling methods. Also discussed are avionics for all glass cockpits, HUDs, future ATC developments, RPVs, flight simulators, advanced components, safety systems, commercial aircraft interior design, airport and airline planning, and financial management. O.C.

A86-45300* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

TOUGH COMPOSITE MATERIALS: RECENT DEVELOPMENTS

L. F. VOSTEEN, ED., N. J. JOHNSTON, ED., L. A. TEICHMAN, ED., and C. P. BLANKENSHIP, ED. (NASA, Langley Research Center, Hampton, VA) Park Ridge, NJ, Noyes Publications, 1985, 484 p. No individual items are abstracted in this volume.

The present volume broadly considers topics in composite fracture toughness and impact behavior characterization, composite system constituent properties and their interrelationships, and matrix systems' synthesis and characterization. Attention is given to the characterization of interlaminar crack growth in composites by means of the double cantilever beam specimen, the characterization of delamination resistance in toughened resin composites, the effect of impact damage and open holes on the compressive strength of tough resin/high strain fiber laminates, the effect of matrix and fiber properties on compression failure mechanisms and impact resistance, the relation of toughened neat resin properties to advanced composite mechanical properties, and constituent and composite properties' relationships in thermosetting matrices. Also treated are the effect of cross-link density on the toughening mechanism of elastomer-modified epoxies, the chemistry of fiber/resin interfaces, novel carbon fibers and their properties, the development of a heterogeneous laminating resin, solvent-resistant thermoplastics, NASA Lewis research in advanced composites, and opportunities for the application of composites in commercial aircraft transport structures. O.C.

A86-46964*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

EOS PRODUCTION ON THE SPACE STATION

F. C. RUNGE (McDonnell Douglas Astronautics Co., Huntington Beach, CA) and M. GLEASON (McDonnell Douglas Astronautics Co., St. Louis, MO) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 6 p.
(Contract NAS8-36607)
(AIAA PAPER 86-2358)

The paper discusses a conceptual integration of the equipment for EOS (Electrophoresis Operations/Space) on the Space Station in the early 1990s. Electrophoresis is a fluid-constituent separation technique which uses forces created by an electrical field. Aspects covered include EOS equipment and operations, and Space Station installations involving a pressurized module, a resupply module, utility provisions and umbilicals and crew involvement. Accommodation feasibility is generally established, and interfaces are defined. Space Station production of EOS-derived pharmaceuticals will constitute a significant increase in capability compared to precursor flights on the Shuttle in the 1980s. Author

A86-47402#

THIRTY YEARS WITH THE JETS: COMMERCIAL TRANSPORT FLIGHT MANAGEMENT SYSTEMS - PAST, PRESENT, AND FUTURE

R. L. SCHOENMAN (Boeing Commercial Airplane Co., Seattle, WA) IN: Guidance, Navigation and Control Conference, Williamsburg, VA, August 18-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 1-10.
(AIAA PAPER 86-2289)

It has been almost thirty years since the first commercial jet transport entered airline service, and there have been many significant changes in flight-management systems during this period. A short historical review of these systems is presented for various time periods, followed by a discussion of the evolution of automatic-flight-control approaches and design techniques. This includes such areas as analysis, simulation, and laboratory and flight tests. The design of flight management systems for future aircraft is discussed, including such subjects as fly-by-wire, new display technology, flight-deck design, system integration, digital implementation of critical systems, etc. Finally, a discussion related to design issues and a view into the commercial transport environment of the future is offered. Author

A86-47603* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPOSITES IN TODAY'S AND TOMORROW'S U.S. AIRLINERS

H. L. BOHON (NASA, Langley Research Center, Hampton, VA) IN: AIRMEC '85 - Aviation equipment servicing: Aircraft and helicopter maintenance; International Exhibition and Conference, 4th, Duesseldorf, West Germany, February 26-March 3, 1985, Conference Reports . Duesseldorf, West Germany, Duesseldorfer Messegesellschaft mbH, 1985, 33 p. refs

The research conducted by NASA's Aircraft Energy Efficiency Composites program in developing essential technologies for the efficient utilization of composites in the airframe structures of transport aircraft is described. Current activities, present state-of-the-art, production trends in the U.S., and the outlook for major use of composites in primary structures are examined. Special attention is given to application of composites in transport wing and fuselage structures. The projections for the Advanced Tactical Fighter of the late eighties suggest application of composites in the airframe structures to the extent of 50 percent, an all-composite transport could become a reality in the mid-nineties. I.S.

A86-48995#

A REVIEW OF UNCONVENTIONAL AIRCRAFT DESIGN CONCEPTS

R. H. LANGE (Lockheed-Georgia Co., Marietta) IN: ICAS, Congress, 15th, London, England, September 7-12, 1986, Proceedings. Volume 1 . New York, American Institute of Aeronautics and Astronautics, Inc., 1986, p. 191-200. refs

The need for improved aircraft performance and efficiency has provided the motivation for consideration of unconventional design concepts for aircraft envisioned for operation in the 1990-2000 time period. Advances in technology permit continuing improvements in aircraft performance and economics but unconventional design concepts show the potential for larger incremental improvements in aircraft efficiency. The paper reviews preliminary design system studies of unconventional aircraft including span-distributed loading, multibody, wing-in-ground effect, flatbed and transonic biplane design concepts. The data include a comparison of the performance and economics of each concept to that for conventional designs. All of the design concepts reviewed incorporate appropriate advanced technologies. The aircraft design parameters include Mach numbers from 0.30 to 0.95, design payloads over 1 million pounds, and design ranges up to 5,500 nautical miles. Author

A86-49448

MANUFACTURERS SEEK REDUCED COSTS THROUGH NEW FABRICATION TECHNIQUES

S. W. KANDEBO Aviation Week and Space Technology (ISSN 0005-2175), vol. 125, July 21, 1986, p. 73, 76, 77.

Production and design cost reductions achieved by increasing reliance on automation, robotics and computer simulation and design are seen by aircraft manufacturers as the means to assure industrial growth in a future of anticipated spending level reductions and shrinking budgets. The technology of advanced composites is one area where cost reductions are being achieved. Grumman's integrated laminating center and automated integrated manufacturing system and McDonnell Aircraft Company's automated ply laminating system are considered. McDonnell is investigating mathematical modeling of composite curing, in order to eliminate slow, expensive, empirical data collection; modeling will permit production increases, improved autoclave utilization, and better quality. McDonnell-Douglas' automated drilling facilities for graphite/epoxy wings for the F/A-18 and the use of computational fluid dynamics codes to study pressures on the F/A-18 are described. Other technological innovations include: superplastic forming/diffusion bonding of titanium, computer simulations for logistic support, and computer-aided engineering/computer-integrated manufacturing (CAE/CIM) to tie all the production advances together. CAE/CIM, according to industry surveys, can permit 70-90 percent reduction in part rejection, 10-30 percent reduction in direct labor costs, 30-60 percent reduction in indirect labor costs, 30-50 percent reduction in floor space, and up to 90 percent reduction in inventory and lead times. D.H.

A86-49571#
THE COMPETITIVE AND COOPERATIVE OUTLOOK FOR AIRCRAFT PROPULSION SYSTEMS
J. M. SCHOFIELD (United Technologies Corp., Commercial Products Div., East Hartford, CT) AIAA, Annual Meeting and International Aerospace Exhibit, Arlington, VA, Apr. 29-May 1, 1986. 12 p.
(AIAA PAPER 86-1134)
The advantages and disadvantages of coproduction of propulsion systems are examined. The international cooperation programs allow the transfer of technical knowledge, and risk and revenue sharing. The potential competition that may result from joint R&D programs is considered. Examples of successful coproduction projects, in particular those of the International Aero Engine consortium, are discussed. I.F.

N86-11107# Perkin-Elmer Corp., Danbury, Conn.
FUTURE SPACE TELESCOPE DESIGN CONCEPTS
A. N. BUNNER *In* ESA Colloq. on Kilometric Opt. Arrays in Space p 71-76 Apr. 1985 refs
Avail: NTIS HC A09/MF A01
Five generically-different approaches to a high resolution, high sensitivity space telescope covering the options of focal and afocal collectors, filled apertures and dilute apertures and one-dimensional and two-dimensional arrays are described. These concepts are compared, given equal collecting area and equal observing time, on the basis of angular resolution and sensitivity to faint point sources and extended sources in the presence of photon statistics, zodical background light, and other sources in the field. Technology development issues involved in the realization of advanced telescopes are listed. Author (ESA)

N86-11216*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HEAVY LIFT LAUNCH VEHICLES FOR 1995 AND BEYOND
R. TOELLE, comp. Sep. 1985 149 p refs
(NASA-TM-86520; NAS 1.15:86520) Avail: NTIS HC A07/MF A01 CSCL 22B
A Heavy Lift Launch Vehicle (HLLV) designed to deliver 300,000 lb to a 540 n mi circular polar orbit may be required to meet national needs for 1995 and beyond. The vehicle described herein can accommodate payload envelopes up to 50 ft diameter by 200 ft in length. Design requirements include reusability for the more expensive components such as avionics and propulsion systems, rapid launch turnaround time, minimum hardware inventory, stage and component flexibility and commonality, and low operational costs. All ascent propulsion systems utilize liquid propellants, and overall launch vehicle stack height is minimized while maintaining a reasonable vehicle diameter. The ascent propulsion systems are based on the development of a new liquid oxygen/hydrocarbon booster engine and liquid oxygen/liquid hydrogen upper stage engine derived from today's SSME technology. Wherever possible, propulsion and avionics systems are contained in reusable propulsion/avionics modules that are recovered after each launch. Author

N86-11228*# LTV Aerospace and Defense Co., Dallas, Tex. Vought Aero Products Div.
THE FACTORY OF THE FUTURE
J. E. BYMAN *In* NASA. Langley Research Center Welding, Bonding and Fastening, 1984 p 1-9 Sep. 1985
Avail: NTIS HC A21/MF A01 CSCL 13H
A brief history of aircraft production techniques is given. A flexible machining cell is then described. It is a computer controlled system capable of performing 4-axis machining part cleaning, dimensional inspection and materials handling functions in an unmanned environment. The cell was designed to: allow processing of similar and dissimilar parts in random order without disrupting production; allow serial (one-shipset-at-a-time) manufacturing; reduce work-in-process inventory; maximize machine utilization through remote set-up; maximize throughput and minimize labor. R.J.F.

N86-11394# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
4 Sep. 1985 73 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-010) Avail: NTIS HC A04
Research advances in U.S.S.R. machine tools and metal working equipment are reported. Topics covered include automated lines and aggregated machining systems; robotics; and technology planning and management automation.

N86-11540*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPUTATIONAL STRUCTURAL MECHANICS: A NEW ACTIVITY AT THE NASA LANGLEY RESEARCH CENTER
N. F. KNIGHT, JR. and W. J. STROUD Sep. 1985 39 p refs
Presented at 22nd Ann. Tech. Meeting of the Soc. of Eng. Sci., University Park, Pa., 7-9 Oct. 1985
(NASA-TM-87612; NAS 1.15:87612) Avail: NTIS HC A03/MF A01 CSCL 20K
Complex structures considered for the late 1980's and early 1990's include composite primary aircraft structures and the space station. These structures are much more difficult to analyze than today's structures and necessitate a major upgrade in computerized structural analysis technology. A major research activity in computational structural mechanics (CSM) was initiated. The objective of the CSM activity is develop advanced structural analysis technology that will exploit modern and emerging computers such as computers with vector and/or parallel processing capabilities. The three main research activities underway in CSM include: (1) structural analysis methods development; (2) a software testbed for evaluating the methods; and (3) numerical techniques for parallel processing computers. The motivation and objectives of the CSM activity are presented and CSM activity is described. The current CSM research thrusts, and near and long term CSM research thrusts are outlined. E.A.K.

N86-13235*# National Academy of Sciences - National Research Council, Washington, D. C. Panel on Vehicle Applications.
AERONAUTICAL TECHNOLOGY 2000: A PROJECTION OF ADVANCED VEHICLE CONCEPTS
1985 116 p
(Contract NASW-3455)
(NASA-CR-176322; NAS 1.26:176322) Avail: NTIS HC A06/MF A01; also available from Aeronautics and Space Engineering Board, National Research Council, 2101 Constitution Ave., N.W., Washington, D.C. 20418 CSCL 05A
The Aeronautics and Space Engineering Board (ASEB) of the National Research Council conducted a Workshop on Aeronautical Technology: a Projection to the Year 2000 (Aerotech 2000 Workshop). The panels were asked to project advances in aeronautical technologies that could be available by the year 2000. As the workshop was drawing to a close, it became evident that a more comprehensive investigation of advanced air vehicle concepts than was possible in the limited time available at the workshop would be valuable. Thus, a special panel on vehicle applications was organized. In the course of two meetings, the panel identified and described representative types of aircraft judged possible with the workshop's technology projections. These representative aircraft types include: military aircraft; transport aircraft; rotorcraft; extremely high altitude aircraft; and transatmospheric aircraft. Improvements in performance, efficiency, and operational characteristics possible through the application of the workshop's year 2000 technology projections were discussed. The subgroups also identified the technologies considered essential and enhancing or supporting to achieve the projected aircraft improvements. B.W.

N86-13742# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
29 Oct. 1985 88 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-014) Avail: NTIS HC A05/MF A01

Articles from journals and other publications of the U.S.S.R. on machine tools and metalworking equipment are presented. They are divided into areas on industry planning and economics, metal cutting and metal forming machine tools, automated lines and aggregated machining systems, and robotics.

N86-13745# Joint Publications Research Service, Arlington, Va.
USSR REPORT: MACHINE TOOLS AND METALWORKING EQUIPMENT
16 Oct. 1985 95 p Transl. into ENGLISH from various Russian articles
(JPRS-UMM-85-013) Avail: NTIS HC A05

Industry planning and economics, metal cutting and metal forming machine tools, robots, process controls and automation electronics, and technology planning and management automation are some areas into which the articles from Soviet journals and other publications are divided. Some titles of articles presented are: New Efforts to Intensify Machine Tool Production; Machine Tools Made In-House to Modernize Production; Determination of Effective Placement of Equipment in Flexible Automated Production Systems; Robot Control System Modified for Precision Movement; and Active Monitoring of Tool Wear by Acoustical Emissions.

N86-14710*# ECON, Inc., Princeton, N.J.
COMMERCIALIZATION OF THE LAND REMOTE SENSING SYSTEM: AN EXAMINATION OF MECHANISMS AND ISSUES
J. K. CAULEY, C. GAELICK, J. S. GREENBERG, J. LOGSDON, and T. MONK 1 Apr. 1983 146 p refs ERTS
(Contract NASW-3339; NA-83-SAC-00658)
(E86-10008; NASA-CR-176337; NAS 1.26:176337; ECON-82-175) Avail: NTIS HC A07/MF A01 CSCL 05A

In September 1982 the Secretary of Commerce was authorized (by Title II of H.R. 5890 of the 97th Congress) to plan and provide for the management and operation of the civil land remote sensing satellite systems, to provide for user fees, and to plan for the transfer of the ownership and operation of future civil operational land remote sensing satellite systems to the private sector. As part of the planning for transfer, a number of approaches were to be compared including wholly private ownership and operation of the system by an entity competitively selected, mixed government/private ownership and operation, and a legislatively-chartered privately-owned corporation. The results of an analysis and comparison of a limited number of financial and organizational approaches for either transfer of the ownership and operation of the civil operational land remote sensing program to the private sector or government retention are presented.
Author

N86-15172*# Pennsylvania State Univ., University Park. Center for the Management of Technological and Organizational Change.
NEW TECHNOLOGY IMPLEMENTATION: TECHNICAL, ECONOMIC AND POLITICAL FACTORS
J. W. DEAN, JR., G. I. SUSMAN, and P. S. PORTER *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 165-175 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

An analysis is presented of the process of implementing advanced manufacturing technology, based on studies of numerous organizations. This process is seen as consisting of a series of decisions with technical, economic, and political objectives. Frequency decisions involve specifications, equipment, resources/organization, and location. Problems in implementation are viewed as resulting from tradeoffs among the objectives, the tendency of decision makers to emphasize some objectives at the expense of others, and the propensity of problems to spread from one area to another. Three sets of recommendations, based on this analysis, are presented. Author

N86-15197*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Descent Design Section.
SPACE SHUTTLE DESCENT DESIGN: FROM DEVELOPMENT TO OPERATIONS
T. J. CRULL and R. E. HITE, III *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 450-459 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

The descent guidance system, the descent trajectories design, and generating of the associated flight products are discussed. The programs which allow the successful transitions from development to STS operations, resulting in reduced manpower requirements and compressed schedules for flight design cycles are addressed. The topics include: (1) continually upgraded tools for the job, i.e., consolidating tools via electronic data transfers, tailoring general purpose software for needs, easy access to tools through an interactive approach, and appropriate flexibility to allow design changes and provide growth capability; (2) stabilizing the flight profile designs (I-loads) in an uncertain environment; and (3) standardizing external interfaces within performance and subsystems constraints of the Orbiter. E.A.K.

N86-16452*# Princeton Synergetics, Inc., N.J.
EVALUATION OF SPACECRAFT TECHNOLOGY PROGRAMS (EFFECTS ON COMMUNICATION SATELLITE BUSINESS VENTURES), VOLUME 2 Final Report
J. S. GREENBURG, M. KAPLAN (Spacetech, Inc.), J. FISHMAN, and C. HOPKINS (Econ, Inc., San Jose, Calif.) Sep. 1985 155 p 2 Vol.
(Contract NAS3-23886)
(NASA-CR-174979; NAS 1.26:174979) Avail: NTIS HC A08/MF A01 CSCL 17B

The computational procedures used in the evaluation of spacecraft technology programs that impact upon commercial communication satellite operations are discussed. Computer programs and data bases are described. R.J.F.

N86-17227*# Ecosystems International, Inc., Crofton, Md.
ASSESSMENT OF US INDUSTRY'S TECHNOLOGY TRENDS AND NEW TECHNOLOGY REQUIREMENTS Final Report
Oct. 1984 184 p
(Contract NASW-3674)
(NASA-CR-176479; NAS 1.26:176479) Avail: NTIS HC A09/MF A01 CSCL 05A

The utility and effectiveness of a novel approach (the Applications Development, or AD approach), intended to augment the efficiency of NASA's technology utilization (TU) through dissemination of NASA technologies and joint technology development efforts with U.S. industry is tested. The innovative AD approach consists of the following key elements: selection of NASA technologies appearing to have leading edge attributes; interaction with NASA researchers to assess the characteristics and quality of each selected technology; identification of industry's needs in the selected technology areas; structuring the selected technologies in terms of specifications and standards familiar to industry (industrial Spec. Sheets); identification and assessment of industry's interest in the specific selected NASA technologies, utilizing the greatly facilitated communication made possible by the availability of the industrial Spec. Sheets; and matching selected NASA technologies with the needs of selected industries.
Author

N86-19620# SRI International Corp., Menlo Park, Calif.
MODELING AND PLANNING ROBOTIC MANUFACTURING Final Report
P. C. CHEESEMAN and W. T. PARK Mar. 1985 34 p
(Contract N00014-83-C-0649)
(AD-A161014; AD-F620003) Avail: NTIS HC A03/MF A01 CSCL 13H

EXPLAN is a general-purpose automatic control system that uses domain-specific knowledge to guide its choices at every step. EXPLAN was debugged using an extended blocks world domain, which is a simplification of typical robot pick-and-place operations.

EXPLAN is based on a new knowledge representation that associates a symbolic time interval and a truth value of true or false with every proposition about the world. As it builds a plan, EXPLAN uses these truth values and time intervals to discover all harmful interactions that could occur between parallel actions and to order these actions to remove potential conflicts. EXPLAN uses this explicit representation of truth values and time intervals to describe preconditions for actions, as well as the actions themselves. This allows EXPLAN to reason efficiently about temporal relationships that occur during planning. This is a different approach from that used with state-change operator representations, which are the basis of many other artificial intelligence (A1) planning systems. GRA

N86-23482# National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
ACADEMIC SCIENCE/ENGINEERING: R AND D FUNDS, FISCAL YEAR 1983 (DETAILED STATISTICAL TABLES)
Apr. 1985 159 p
(PB86-120706; NSF-85-308) Avail: NTIS HC A08/MF A01 CSCL 05A

The report contains tabular data on 562 institutions of higher education regarding scientific and engineering (S/E) R and D expenditures that are separately budgeted. The survey includes institutions that offer a doctorate or master's degree in S/E programs, as well as those schools with $50,000 or more in separately budgeted R and D expenditures. The 19 federally financed R and D centers also are included. Data are tabulated by: (1) sources of funds; (2) S/E disciplines; (3) character of work; (4) control of institution (public/private); (5) largest performers' ranking; (6) highest degree offered; (7) total and federally financed current fund expenditures for research equipment; and (8) capital expenditures for facilities and equipment for research, development, and instruction. Trend tables are included for most elements. The methodology and response rate are described and a reproduction of the survey instrument is included. GRA

N86-23749*# National Aeronautics and Space Administration, Washington, D.C.
CHINESE SPACE AND AVIATION INDUSTRIES SCORE MAJOR BREAKTHROUGHS
R. HU Apr. 1986 16 p Transl. into ENGLISH from Xiandai Junshi (Conmilit) (Hong Kong), v. 9, no. 11, 1 Jan. 1986 p 88-91 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASW-4005)
(NASA-TM-87973; NAS 1.15:87973) Avail: NTIS HC A02/MF A01 CSCL 13H

An overview of the current status of China's aviation and aerospace industries is presented, as well as planned future development and areas of importance for China's future space programs. The development of China's CZ-1, CZ-2 and CZ-3 rocket program is discussed, as well as China's satellite launch capabilities. China's first geostationary communications satellite STW-1 is also mentioned, and further development of the second and third communications satellites to be launched in 1987 are shown. Other developments include a seventh low Earth orbiting photographic reconnaissance satellite, plans for an image transmitting remote sensing satellite to be launched in 1988 to 1990, and other satellite developments. The Chinese-designed Y-10 transport aircraft is discussed, as well as the TU-16 bomber aircraft and the co-production agreement with McDonnell Douglas for the MD-82 passenger aircraft. Author

N86-24589# Logistics Management Inst., Washington, D. C.
DISCOUNTED CASH FLOW MODEL FOR THE INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM
M. G. MYERS, P. R. MCCLENON, M. J. KONVALINKA, and G. GOTTSCHALK Nov. 1985 47 p
(Contract MDA903-85-C-0139)
(AD-A162968; LMI-RE301) Avail: NTIS HC A03/MF A01 CSCL 05C

Determining the appropriate productivity savings reward under an Industrial Modernization Incentives Program agreement requires identification of the total potential reduction in contract price. The contract price must be determined for each of two situations, one with business as usual and one after the proposed productivity enhancement. Finding these two sets of expected contract prices requires consideration of changes in direct and indirect cost and changes in profit objectives in each year of the period under analysis. Discounted cash flow analysis is the appropriate tool for evaluating the financial attractiveness to the contractor of a proposed investment. Contractor-related cash flow includes payments based on depreciation, imputed cost of money, and profit, which is influenced by cost and by facilities capital employed. Contractor return on investment is usually evaluated in after-tax terms, which implies a need to consider the accelerated cost recovery system and investment tax credit provisions of the Internal Revenue Code. The cash flow model documented in this report provides evaluations of proposed savings share provisions. It identifies the benefit to DOD and to the U.S. Government (including income tax effects). It measures the internal rate of return to the contractor. The parties are expected to evaluate several possible savings share arrangements in the process of developing an equitable contractural agreement. GRA

N86-26262# Oak Ridge National Lab., Tenn.
USE OF BROKER ORGANIZATIONS IN TECHNOLOGY TRANSFER AND RESEARCH UTILIZATION FOR THE BUILDINGS INDUSTRY
E. D. COPENHAVER Dec. 1985 133 p
(Contract DE-AC05-84OR-21400)
(DE86-004674; ORNL/TM-9581) Avail: NTIS HC A07/MF A01

Several broker organizations are already an active part of the technology transfer and research utilization activities of DOE's Building Systems Division. These interactions often take the form of service on broker organization or DOE task forces and review committees, joint sponsorship of meetings and workshops, subcontracts for research and/or information dissemination to brokers, publication of documents, code and standards setting activities, and congressional testimony. Recommendations for additional research on technology transfer utilizing brokers are also outlined. DOE

N86-26277*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMARY OF RESULTS OF NASA F-15 FLIGHT RESEARCH PROGRAM
F. W. BURCHAM, JR., G. A. TRIPPENSEE, D. F. FISHER, and T. W. PUTNAM Apr. 1986 34 p refs Presented at the AIAA 3rd Flight Testing Conference, Las Vegas, Nevada, 2-4 Apr. 1986
(NASA-TM-86811; H-1341; NAS 1.15:86811; AIAA-86-9761)
Avail: NTIS HC A03/MF A01 CSCL 01B

NASA conducted a multidisciplinary flight research program on the F-15 airplane. The program began in 1976 when two preproduction airplanes were obtained from the U.S. Air Force. Major projects involved stability and control, handling qualities, propulsion, aerodynamics, propulsion controls, and integrated propulsion-flight controls. Several government agencies and aerospace contractors were involved. In excess of 330 flights were flown, and over 85 papers and reports were published. This document describes the overall program, the projects, and the key results. The F-15 was demonstrated to be an excellent flight research vehicle, producing high-quality results. Author

N86-28326# Naval Ocean Systems Center, San Diego, Calif.
SUGGESTIONS FOR DESIGNERS OF NAVY ELECTRONIC EQUIPMENT. REVISION A. 1985 EDITION
May 1985 158 p
(AD-A165697; NOSC/TD-250-REV-A) Avail: NTIS HC A08/MF A01 CSCL 09E

The engineer is provided with common sense recommendations which will increase the reliability of a system in military environments and provides suggestions which will make operation and maintenance of these equipments easier for Navy personnel. GRA

N86-29871*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ADAPTIVE WALL WIND TUNNELS: A SELECTED, ANNOTATED BIBLIOGRAPHY
M. H. TUTTLE (Vigyan Research Associates, Inc., Hampton, Va.) and R. E. MINECK Aug. 1986 55 p
(NASA-TM-87639; L-16084; NAS 1.15:87639) Avail: NTIS HC A04/MF A01 CSCL 14B

This bibliography, with abstracts, consists of 257 citations arranged in chronological order. Selection of the citations was made for their value to researchers working to solve problems associated with reducing wall interference by the design, development, and operation of adaptive wall test sections. Author, source, and subject indexes are included. Author

N86-29872*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CRYOGENIC WIND TUNNELS FOR HIGH REYNOLDS NUMBER TESTING
P. L. LAWING, R. A. KILGORE, and P. D. MCGUIRE May 1986 95 p
(NASA-TM-87743; NAS 1.15:87743) Avail: NTIS HC A05/MF A01 CSCL 14B

A compilation of lectures presented at various Universities over a span of several years is discussed. A central theme of these lectures has been to present the research facility in terms of the service it provides to, and its potential effect on, the entire community, rather than just the research community. This theme is preserved in this paper which deals with the cryogenic transonic wind tunnels at Langley Research Center. Transonic aerodynamics is a focus both because of its crucial role in determining the success of aeronautical systems and because cryogenic wind tunnels are especially applicable to the transonics problem. The paper also provides historical perspective and technical background for cryogenic tunnels, culminating in a brief review of cryogenic wind tunnel projects around the world. An appendix is included to provide up to date information on testing techniques that have been developed for the cryogenic tunnels at Langley Research Center. In order to be as inclusive and as current as possible, the appendix is less formal than the main body of the paper. It is anticipated that this paper will be of particular value to the technical layman who is inquisitive as to the value of, and need for, cryogneic tunnels. Author

N86-30720*# National Aeronautics and Space Administration, Washington, D.C.
NASA AND GENERAL AVIATION
J. L. ETHELL 1986 140 p Original contains color illustrations
(NASA-SP-485; NAS 1.21:485) Avail: SOD HC $6.50 as 033-000-00984-4; NTIS MF A01 CSCL 01C

General aviation remains the single most misunderstood sector of aeronautics in the United States. A detailed look at how general aviation functions and how NASA helps keep it on the cutting edge of technology in airfoils, airframes, commuter travel, environmental concerns, engines, propellers, air traffic control, agricultural development, electronics, and safety is given. Author

N86-31563*# National Aeronautics and Space Administration, Washington, D.C.
MISSION ADAPTIVE WING SOARS AT NASA FACILITY
D. RAHN and L. REINERTSON (National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.) 29 Aug. 1986 2 p
(P86-10182) Avail: NTIS HC A02/MF A01 CSCL 01C

Research pilots have flown the Mission Adaptive Wing (MAW) aircraft, a highly modified F-111 jet fighter, from subsonic speeds up to Mach 1.4 in initial flight tests. The inital test flights are clearing the envelope with the wings flexed at various curvatures. This process allows further research data to be safely gathered so that designers of future variable camber wing aircraft have the best information possible. The altitude envelope was cleared from 27,500 down to 7,500 feet where denser air can cause more stress on the aircraft. Testing with the aircraft was conducted with wing sweep angles of 26 and 58 degrees. At the conclusion of the performance tests in the manual configuration, the system will be reconfigured for automatic mode tests. The limited automatic modes include maneuver camber control where the wings are deflected automatically to the best lift versus drag combination for a particular speed; cruise camber control which can help protect the aircraft from high G stresses; and maneuver enhancement/gust alleviation which is designed to improve the aircraft's up and down movement response to pilot commands and reduce the aircraft response to turbulence. B.G.

N86-31585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AEROPROPULSION OPPORTUNITIES FOR THE 21ST CENTURY
W. C. STRACK 1986 32 p Presented at the Scenario for 21st Century Aero Engine Design Seminar, Bristol, England, 16-17 May 1986; sponsored by the Institute of Mechanical Engineers
(NASA-TM-88817; E-3177; NAS 1.15:88817) Avail: NTIS HC A03/MF A01 CSCL 21E

A large number of novel aeropropulsion system concepts are presented for subsonic through hypersonic applications offering large potential improvements. Collectively, these examples illustrate the revolutionary opportunities and challenges that could enable truly revolutionary aircraft capabilities in the future. Certainly not all of these concepts will ultimately prove fruitful. Nevertheless, the sheer number of existing concepts, including many unmentioned herein, is so large and the applications so vast, that the prognosis for the future of aeropropulsion is very encouraging indeed. Author

N86-32327# Air Force Systems Command, Bolling AFB, Washington, D.C.
GUIDE TO CANADIAN AEROSPACE RELATED INDUSTRIES
D. J. PEARSON and J. R. NILES 28 Feb. 1986 131 p
(AD-A167794; AFSC-TR-86-001) Avail: NTIS HC A07/MF A01 CSCL 05C

Ths guide is a contracting source list of Canadian aerospace related industries to be used by USAF procurement offices, program manageres, project engineers, and scientists. It provides company profiles, a company keyword index, and contact points for each company. GRA

N86-32330# Technische Hogeschool, Eindhoven (Netherlands).
CALCULATING WORKLOAD NORMS FOR JOB SHOPS
J. W. M. BERTRAND Apr. 1984 5 p
(BDK/KBS/84-04; ETN-86-97689) Avail: NTIS HC A02/MF A01

A job scheduling and due date assignment rule that adapts the flow time allowance per operation to the time-aggregated remaining workload per work center is described. The method is valid for jobs requiring a linear sequence of operations as well as for single and multilevel assembly types of jobs. Flow time allowances are based on the remaining workload for the work center where the operation is to be performed. To determine an initial schedule, each operation of a job is given an operation due date, which is equal to the maximum operation due date of the previous operation(s), plus the flow time allowance. ESA

N86-32332# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
THE STRUCTURING OF PRODUCTION CONTROL SYSTEMS
J. W. M. BERTRAND and J. WIJNGAARD May 1984 46 p
(THE/BDK/ORS/84/10; ETN-86-97691) Avail: NTIS HC A03/MF A01

A qualitative methodology for designing hierarchically structured production control systems for complex production situations is presented. The methodology is based on the assumption that complexity should be reduced by defining self-contained subsystems with clear and well-defined operational characteristics. Interactions between the subsystems should be simple and restricted. The production unit (PU) is introduced as a basic control entity. From the perspective of goods flow control the PU's are black boxes having certain operational characteristics. The objective of goods flow control is to realize a delivery performance, taking into account the PU-operational constraints. The main elements in the goods flow control structure developed are master planning, material coordination, workload control and work order release. ESA

N86-32333# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
DUE-DATE RELIABILITY IN A REPAIR SHOP: IMPLICATIONS FOR ORGANIZATIONAL AND WORK DESIGN
H. KUIPER, P. REINKING, and J. C. WORTMANN Jul. 1984 29 p
(THE/BDK/KBS/84-14; ETN-86-97692) Avail: NTIS HC A03/MF A01

The design and introduction of a work-order control system in a repair shop to increase the shop's due-date reliability under conditions of uncertainty are discussed. The consequences of the control system for organizational structure and work design are illustrated. The system has far reaching implications for the responsibilities and tasks of employees at each level. Organizational changes, based on notions of the contingency approach are described. Task-design and group-design theory is used to analyze the task-content implications. ESA

N86-32334# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Science.
STRUCTURING THE PRODUCTION CONTROL PROBLEM IN A REPAIR SHOP
J. C. WORTMANN and K. TOL Aug. 1984 9 p
(THE/BDK/KBS/84-16; ETN-86-97693) Avail: NTIS HC A02/MF A01

The production control system in a repair shop was improved by structuring the control problem, i.e., decomposing the problem into a number of weakly interdependent subproblems. The proposed control structure distinguishes a master planning level, that sets due-dates for major phases of a repair order; a materials coordination level, that coordinates suborders; and a departmental control level to deal with suborders. A decomposition of the information system into a master planning system and a detailed planning system follow from the control structure. ESA

N86-32703*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED INSTRUMENTATION FOR AERONAUTICAL PROPULSION RESEARCH
M. J. HARTMANN 1986 23 p Presented at the Symposium on Propulsion Instrumentation, Jiangyou, China, 6-10 Oct. 1986; sponsored by NASA and Chinese Aeronautical Establishment
(NASA-TM-88853; E-3244; NAS 1.15:88853) Avail: NTIS HC A02/MF A01 CSCL 14B

The development and use of advanced instrumentation and measurement systems are key to extending the understanding of the physical phenomena that limit the advancement of aeropropulsion systems. The data collected by using these systems are necessary to verify numerical models and to increase the technologists' intuition into the physical phenomena. The systems must be versatile enough to allow their use with older technology measurement systems, with computer-based data reduction systems, and with existing test facilities. Researchers in all aeropropulsion fields contribute to the development of these systems. Author

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.

A86-10200#
AUTOMATION AND ROBOTICS FOR THE SPACE STATION - RECOMMENDATIONS
IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-21, Sept. 1985, p. 735-743.

An executive summary is given of the recommendations of the NASA advisory panel on robotics and automation technologies for the Space Station. Consideration is given to the technologies needed for the Initial Operational Capability (IOC) Space Station, including efficient man/machine interfaces for supervisory control of robots; problem oriented computer languages; integrated computer-aided engineering, and an on-site fabrication capability. A hypothetical time-line is given which describes the recommended funding guidelines of the Automation And Robotics Technology Advancement Program for the period 1985-1992. Some ways in which NASA can lead, leverage, and exploit the development of automation and robotics technologies for the IOC Space Station are briefly reviewed. I.H.

A86-10560
ROBOTICS FOR ENGINEERS
Y. KOREN (Technion - Israel Institute of Technology, Haifa) New York, McGraw-Hill Book Co., 1985. 365 p. refs

The basic concepts of robotics are reviewed along with the classification and structure of robotic systems. In particular, attention is given to the design of control loops, kinematics, trajectory interpolators, applications, programming methods, and sensors. A systematic method is then presented for selecting the most appropriate robot for a particular job in a plant. The link between robotics and related fields, such as computer-aided design and manufacturing, and the integration of robots into flexible manufacturing systems are discussed. Finally, some future trends in the development of industrial robots are examined. V.L.

A86-11407*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE BLACKBOARD MODEL - A FRAMEWORK FOR INTEGRATING MULTIPLE COOPERATING EXPERT SYSTEMS
W. K. ERICKSON (NASA, Ames Research Center, Moffett Field, CA) IN: Computers in Aerospace Conference, 5th, Long Beach, CA, October 21-23, 1985, Technical Papers . New York, AIAA, 1985, p. 33-40. refs
(AIAA PAPER 85-5045)

The use of an artificial intelligence (AI) architecture known as the blackboard model is examined as a framework for designing and building distributed systems requiring the integration of multiple cooperating expert systems (MCXS). Aerospace vehicles provide many examples of potential systems, ranging from commercial and military aircraft to spacecraft such as satellites, the Space Shuttle, and the Space Station. One such system, free-flying, spaceborne telerobots to be used in construction, servicing, inspection, and repair tasks around NASA's Space Station, is examined. The major difficulties found in designing and integrating the individual expert system components necessary to implement such a robot are outlined. The blackboard model, a general expert system architecture which seems to address many of the problems found in designing and building such a system, is discussed. A progress report on a prototype system under development called DBB (Distributed BlackBoard model) is given. The prototype will act as a testbed for investigating the feasibility, utility, and efficiency of MCXS-based designs developed under the blackboard model. Author

A86-13529
COMPUTER ARCHITECTURE FOR INTELLIGENT ROBOTS
Y. KANAYAMA and S. YUTA (Tsukuba, University, Sakura, Japan) Journal of Robotic Systems (ISSN 0741-2223), vol. 2, Fall 1985, p. 237-251. refs

This article proposes a computer architecture suitable for intelligent robots, especially for self-contained intelligent mobile robots. The robot should be a mulitprocessor system with a master, several slave modules and a console. A simple star connection is employed. The master carries user's programs written in a high level language with which a programmer is able to use all basic functions in the robots. It should have a special purpose operating system. Each module is an independent microcomputer system loosely coupled to the master and dedicated to an elementary function such as manipulation, locomotion, sensing, or planning. A serial TTL level or RS232C interface is employed between the master and each module. Two self-contained robots, Yamabico 9 and 10, constructed under these design principles have demonstrated the effectiveness of this proposed architecture. Author

A86-14434*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERT SYSTEMS AND THEIR USE IN AUGMENTING DESIGN OPTIMIZATION
G. H. KIDWELL and M. A. ESKEY (NASA, Ames Research Center, Moffett Field, CA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 16 p. refs
(AIAA PAPER 85-3095)

The challenging requirements that are evolving for future aircraft demand that each design be optimally integrated, for the penalties imposed by nonoptimal performance are significant. Classic numerical optimization algorithms have been and will continue to be important tools for aircraft designers. These methods are, however, limited to certain categories of aircraft design variables, leaving the remainder to be determined by the user. A method that makes use of knowledge-based expert systems offers the potential for aiding the conceptual design process in a way that is similar to that of numerical optimization, except that it would address discrete, discontinuous, abstract, or any other unoptimized aspect of vehicle design and integration. Other unique capabilities such as automatic discovery and learning in design may also be achievable in the near term. This paper discusses current practice in conceptual aircraft design and knowledge-based systems, and how knowledge-based systems can be used in conceptual design. Author

A86-14548* SRI International Corp., Menlo Park, Calif.
EXPERT SYSTEMS FOR SPACE STATION AUTOMATION
M. P. GEORGEFF and O. FIRSCHEIN (SRI International Artificial Intelligence Laboratory, Menlo Park, CA) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 5, Nov. 1985, p. 3-8. refs
(Contract NAS2-11864)

The expert systems required for automating key functions of the Manned Space Station (MSS) are explored. It is necessary that the expert systems developed be flexible, degrade gracefully in the case of a failure, and be able to work with incomplete data. The AI systems will have to perform interpretation and diagnosis, design, prediction and induction, and monitoring and control functions. Both quantitative and qualitative reasoning capabilities need improvements, as do automatic verification techniques, explanation and learning capabilities, and the use of metaknowledge, i. e., knowledge about the knowledge contained in the knowledge base. Information retrieval, fault isolation and manufacturing process control demonstrations are needed to validate expert systems for the MSS. M.S.K.

A86-14847
ENHANCED MAINTENANCE AND EXPLANATION OF EXPERT SYSTEMS THROUGH EXPLICIT MODELS OF THEIR DEVELOPMENT
R. NECHES, W. R. SWARTOUT, and J. D. MOORE (Southern California, University, Marina del Rey) IEEE Transactions on Software Engineering (ISSN 0098-5589), vol. SE-11, Nov. 1985, p. 1337-1351. refs
(Contract MDA903-81-C-0335)

Principled development techniques could greatly enhance the understandability of expert systems for both users and system developers. Current systems have limited explanatory capabilities and present maintenance problems because of a failure to explicitly represent the knowledge and reasoning that went into their design. This paper describes a paradigm for constructing expert systems which attempts to identify that tacit knowledge, provide means for capturing it in the knowledge bases of expert systems, and apply it towards more perspicuous machine-generated explanations and more consistent and maintainable system organization. Author

A86-14850
EXPERT SYSTEMS AND THE 'MYTH' OF SYMBOLIC REASONING
J. DOYLE (Carnegie-Mellon University, Pittsburgh, PA) IEEE Transactions on Software Engineering (ISSN 0098-5589), vol. SE-11, Nov. 1985, p. 1386-1390. refs
(Contract F33615-81-K-1539)

Elements of the artificial intelligence approach to expert systems offer great productivity advantages over traditional approaches to application systems development, even though the end result may be a program employing no AI techniques. These productivity advantages are the hidden truths behind the 'myth' that symbolic reasoning programs are better than ordinary ones. Author

A86-15278
APPLICATIONS OF ARTIFICIAL INTELLIGENCE; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, MAY 3, 4, 1984
J. F. GILMORE, ED. (Georgia Institute of Technology, Atlanta) Meeting sponsored by SPIE - The International Society for Optical Engineering. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 485), 1984, 243 p. For individual items see A86-15279 to A86-15285.
(SPIE-485)

Subjects related to expert systems are discussed, taking into account a context dependent automatic target recognition system, computer understanding of air traffic control displays, the role of the image analyst in computer vision, a demonstration of an ocean surveillance information fusion expert system, and the location of multiple faults by diagnostic expert systems. Other topics explored are concerned with knowledge-based systems, autonomous vehicles, and image understanding. Attention is given to aspects of interfacing an intelligent decision-maker to a real-time control system, a reasoning system for computer aided engineering, an 'intelligent' optical design program, an adaptive interpolator algorithm for area-array fine guidance sensors, terrain navigation concepts for autonomous vehicles, the autonomous helicopter system, an autonomous vehicle navigation algorithm, the planning of strategic paths through variable terrain data, the contextual analysis of tactical scenes, and a structural target analysis and recognition system. G.R.

A86-15623*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AUTOMATION AND ROBOTICS - KEY TO PRODUCTIVITY
A. COHEN (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 7 p.
(IAF PAPER 85-32)

The automated and robotic systems requirements of the NASA Space Station are prompted by maintenance, repair, servicing and assembly requirements. Trend analyses, fault diagnoses, and subsystem status assessments for the Station's electrical power, guidance, navigation, control, data management and environmental control subsystems will be undertaken by cybernetic expert systems; this will reduce or eliminate on-board or ground facility activities that would otherwise be essential, enhancing system productivity. Additional capabilities may also be obtained through the incorporation of even a limited amount of artificial intelligence in the controllers of the various Space Station systems. O.C.

A86-20426* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FUTURE USES OF MACHINE INTELLIGENCE AND ROBOTICS FOR THE SPACE STATION AND IMPLICATIONS FOR THE U.S. ECONOMY
A. COHEN and J. D. ERICKSON (NASA, Johnson Space Center, Houston, TX) (IEEE, International Conference on Robotics and Automation, St. Louis, MO, Mar. 25-28, 1985) IEEE Journal of Robotics and Automation (ISSN 0882-4967), vol. RA-1, Sept. 1985, p. 117-123. refs

The exciting possibilities for advancing the technologies of artificial intelligence, robotics, and automation on the Space Station is summarized. How these possibilities will be realized and how their realization can benefit the U.S. economy are described. Plans, research programs and preliminary designs that will lead to the realization of many of these possibilities are being formulated. Author

A86-20507
ROBOTICS AND THE SPACE STATION
J. N. GOWDY (Clemson University, SC) and R. S. WALLACE (Carnegie-Mellon University, Pittsburgh, PA) IN: SOUTHEASTCON '84; Proceedings of the Conference, Louisville, KY, April 8-11, 1984 . New York, Institute of Electrical and Electronics Engineers, 1984, p. 173-176.

This paper is based on the authors' activities associated with the NASA/ASEE summer study 'Autonomy and the Human Element in Space' at Stanford University in 1983. The paper considers proposed tasks for robots in connection with space station activities. Generic capabilities needed to execute these tasks are also discussed. It is argued that NASA should sponsor robotics research which is directly connected with space activities. Author

A86-21889
INTELLIGENT INTERFACES FOR HUMAN CONTROL OF ADVANCED AUTOMATION AND SMART SYSTEMS
A. M. MADNI and A. FREEDY (Perceptronics, Inc., Woodland Hills, CA) IN: EASCON '84; Proceedings of the Seventeenth Annual Electronics and Aerospace Conference, Washington, DC, September 10-12, 1984 . New York, Institute of Electrical and Electronics Engineers, 1984, p. 227-232. refs

Today, an important part of robotics research is directed toward the development of intelligent systems which are capable of performing and/or cooperating with the human operator in some of the higher level cognitive functions. The present paper is concerned with the need to incorporate an 'Intelligent Interface' (II) in the considered systems. It is the objective of the II to maximize the performance of an operator-robot system for a given degree of intelligence of the robot and a given level of operator capability. Attention is given to the specific goals of the II, its design architecture, information management aids, tailored feedback, high-level command and query languages, explanation facility, operator-robot task allocation, personalized responses, task performance monitoring and contingency handling, and default responses in structured situations. G.R.

A86-21895#
CAD/CAM DESIGNER - JACK OF ALL TRADES
C. F. HERNDON and R. L. GALLO (General Dynamics Corp., Fort Worth, TX) Aerospace America (ISSN 0740-722X), vol. 24, Jan. 1986, p. 52-54, 56.

Aerospace design engineers are increasingly required to have more extensive knowledge of CAD/CAM tooling and manufacturing methods, in order to ensure that datasets can yield error-free components and assemblies. For structural concept design, engineers will work at the same CAD/CAM workstation on which the final component will be defined, controlling methods that yield the optimum solution for each member of a structural system from the viewpoints of both weight (for given strength) and producibility. O.C.

A86-25033
ASSESSING THE ARTIFICIAL INTELLIGENCE CONTRIBUTION TO DECISION TECHNOLOGY
J. W. SUTHERLAND IEEE Transactions on Systems, Man, and Cybernetics (ISSN 0018-9472), vol. SMC-16, Jan.-Feb. 1986, p. 3-20. refs

The proposition that artificial intelligence (AI) technology is not in fact able to reach to any unique level of analytical authority is presented. Three propositions, in particular, will be elaborated and defended: (1) it has not been demonstrated in the field (nor can it be asserted axiomatically) that AI constructs can endogenously perform the sorts of inference operations that stochastic decision exercises demand; (2) lacking such a capability, AI constructs cannot transcend, but rather must compete with, instruments of the type available from the traditional decision disciplines; and (3) in many instances of such competition, certain properties common to AI constructs might often place them at an efficiency disadvantage relative to alternative technical approaches. On the positive side, however, it also is asserted that many of the more troublesome technical provisions built into AI constructs are merely paradigmatic preferences, not methodological imperatives. Author

A86-26070#
ARTIFICIAL INTELLIGENCE - THE EMERGING TECHNOLOGY
R. P. SHENOY (Electronics and Radar Development Establishment, Bangalore, India) Defence Science Journal (ISSN 0011-748X), vol. 35, April 1985, p. 135-149. refs

The concept of artificial intelligence (AI) is explained, and its potential uses are discussed, with emphasis on the defense applications. The present uses of AI in the areas of target classification and identification, information fusion, land-traversing mobile intelligent robots, and air defense networks are described. The principles and the technology involved in expert systems and computer vision are discussed in detail. I.S.

A86-27167
PERSPECTIVES ON ARTIFICIAL INTELLIGENCE PROGRAMMING
D. G. BOBROW and M. J. STEFIK (Xerox Research Center, Palo Alto, CA) Science (ISSN 0036-8075), vol. 231, Feb. 28, 1986, p. 951-957. refs

Issues influencing the choice of programming styles for artificial intelligence (AI) applications are discussed. Attention is given to programming language styles based on procedures, objects, logic, rules, and constraints. Programming styles which incorporate multiple-paradigm approach for complex data analysis in physical experiments are also discussed. The development of knowledge-based compilers for planning applications is briefly considered. I.H.

A86-28073* California Univ., La Jolla.
ROBOTICS FOR THE UNITED STATES SPACE STATION
J. R. ARNOLD, D. R. CRISWELL (California, University, La Jolla), R. CANNON (Stanford University, CA), R. CLIFF (DARPA, Arlington, VA), A. COHEN (NASA, Johnson Space Center, Houston, TX) et al. Robotics (ISSN 0167-8493), vol. 1, Dec. 1985, p. 205-222.

Advances in robotics technology that will be necessary for the NASA Space Station to achieve its optimal level of automation are examined. The present state and emerging trends in teleoperator systems, hybrid teleoperated robots, and autonomous robots are reviewed, and scenarios of assembly, inspection, satellite servicing, and manufacturing are presented in order to illustrate potential uses of automation and robotics on the Space Station. Individual important technology development areas for Space Station robotics are surveyed, including end effectors and mechanization, control systems, telepresence and human factors, preception, manipulation in space, operation planning and data bases, and hardware maintenance. C.D.

A86-28497#
EXPERT SYSTEMS FOR SATELLITE STATIONKEEPING
M. M. MEKARU (USAF, Institute of Technology, Wright-Patterson AFB, OH) and M. A. WRIGHT (Electronics Security Command, Fort Meade, MD) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1418-1424. refs

The feasibility of implementing artificial intelligence on satellites is evaluated, with the aim of using an onboard expert system to perform effective stationkeeping functions without assistance from the ground. The Defense Satellite Communication System (DSCS III) is used as an example. The cost for implementing a satellite stationkeeping expert system is analyzed. A ground-based expert system could reduce the current number of support personnel for the stationkeeping task. Results of analyzing a possible flight system are quite promising. An expert system for satellite stationkeeping seems feasible, appears cost-effective, and offers increased satellite endurance through autonomous operations. D.H.

A86-28498
KNOWLEDGE ENGINEERING FOR A FLIGHT MANAGEMENT EXPERT SYSTEM
B. M. ANDERSON, J. M. BEAL, C. MCNULTY, and R. C. STERN (Texas Instruments, Inc., Dallas) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1431-1435. refs

The development of an F-16 emergency procedures knowledge base for EPES (emergency procedures expert system) is described. A detailed view of the knowledge acquisition problems is presented, followed by a methodology for efficiently building a knowledge base for emergency procedures. A multiple emergency example is considered (loss of canopy and towershaft failure while cruising at 400 knots above 40,000 feet), where the inference engine resolves a conflict in procedures. D.H.

A86-28515
THE CREW STATION INFORMATION MANAGER - AN AVIONICS EXPERT SYSTEM
L. D. POHLMANN (Boeing Military Airplane Co., Wichita, KS), P. S. MARKS, and M. R. FEHLING (Advanced Information and Decision Systems, Mountain View, CA) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1576-1582. refs
(Contract F33615-83-C-1083)

Progress to date is reported on the development of CSIM, the Crew Station Information Manager, which is a prototype avionics expert system being designed and developed under contract to the Air Force Avionics Laboratory. The function of CSIM is to manage the interface between the pilot and the avionics suite of a future tactical aircraft. A review is given of program motivation and objectives, and a set of avionics expert system candidates is identified. Preliminary development and early simulation are discussed, and near-term plans are outlined in connection with a contract extension sponsored by DARPA. D.H.

A86-32538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ARTIFICIAL INTELLIGENCE - NASA
J. D. ERICKSON (NASA, Johnson Space Center, Houston, TX) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 145-150. refs

Artificial Intelligence (AI) represents a vital common space support element needed to enable the civil space program and commercial space program to perform their missions successfully. It is pointed out that advances in AI stimulated by the Space Station Program could benefit the U.S. in many ways. A fundamental challenge for the civil space program is to meet the needs of the customers and users of space with facilities enabling maximum productivity and having low start-up costs, and low annual operating costs. An effective way to meet this challenge may involve a man-machine system in which artificial intelligence, robotics, and advanced automation are integrated into high reliability organizations. Attention is given to the benefits, NASA strategy for AI, candidate space station systems, the Space Station as a stepping stone, and the commercialization of space. G.R.

A86-33188
EXPERT COMPUTER AIDED DECISION IN SUPERVISORY CONTROL
A. BISSERET (Institut National de Recherche en Informatique et en Automatique, Le Chesnay, France) IN: A bridge between control science and technology. Volume 5 . Oxford and New York, Pergamon Press, 1985, p. 2621-2626. refs

Supervisory control is changing from surveillance on large classical control panels to a surveillance on computer displays with the use of man-computer dialogues. The displayed information of course can be sophisticated, and interesting efforts currently pursued in this direction are presented. But moreover it should become possible to have the computer participate directly to the decision activities. The concept of expert system might be promising but only for already expert activity. This paper insists on the non-expert but necessary problem solving activity of the supervisors facing unforeseen situations. The development of research towards computer aid specific to this activity is stressed. Examples of recent advances in cognitive psychology and artificial intelligence are suggested as directions for this development. Author

A86-34986* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ARTIFICIAL INTELLIGENCE - NEW TOOLS FOR AEROSPACE PROJECT MANAGERS
D. C. MOJA (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 12-1 to 12-6. refs

Artificial Intelligence (AI) is currently being used for business-oriented, money-making applications, such as medical diagnosis, computer system configuration, and geological exploration. The present paper has the objective to assess new AI tools and techniques which will be available to assist aerospace managers in the accomplishment of their tasks. A study conducted by Brown and Cheeseman (1983) indicates that AI will be employed in all traditional management areas, taking into account goal setting, decision making, policy formulation, evaluation, planning, budgeting, auditing, personnel management, training, legal affairs, and procurement. Artificial intelligence/expert systems are discussed, giving attention to the three primary areas concerned with intelligent robots, natural language interfaces, and expert systems. Aspects of information retrieval are also considered along with the decision support system, and expert systems for project planning and scheduling. G.R.

A86-37047*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACE TELEROBOTICS - A FEW MORE HURDLES
J. E. PENNINGTON (NASA, Langley Research Center, Hampton, VA) IEEE, International Conference on Robotics and Automation, San Francisco, CA, Apr. 8-10, 1986, Paper. 5 p. refs

In the early 1990's, a telerobotic work system which can be used with the Mobile Remote Manipulator System (MRMS) on the Space Station is to become available. However, a number of difficulties have to be overcome before these plans can be realized. The word 'telerobotics' is used in connection with a system which can function as teleoperator, and which, in addition, has also autonomous functions. Thus, as a robot, the system would automatically perform selected operations using multisensory internal feedback for control. A role for telerobotics is defined, taking into account EVA servicing and repair work, remote satellite refueling, and operations during the Space Station development period. Attention is also given to the definition of a telerobotic system, the definition of the telerobotics technology set, and approaches related to the development of a telerobotic system. G.R.

A86-37624
SMART ROBOTS: A HANDBOOK OF INTELLIGENT ROBOTIC SYSTEMS
V. D. HUNT New York, Chapman and Hall, 1985, 396 p. refs

Smart robots, designed to improve the quality and increase both the productivity and profitability of manufactured goods, are discussed in detail. Attention is focused on: (1) artificial intelligence for smart robots, (2) smart robot systems, (3) sensor-controlled robots, (4) machine vision systems, (5) robot manipulators, (6) locomotion, (7) natural languagae processing, (8) expert systems, and (9) computer integrated manufacturing. Photographs, charts and diagrams illustrate the systems covered. Areas of successful application to date include the automobile industry, textiles, forging, die casting and electronics. K.K.

A86-38556
SPACECRAFT SOFTWARE COST ESTIMATION - STRIVING FOR EXCELLENCE THROUGH PARAMETRIC MODELS (A REVIEW)
R. SETZER (Rockwell International Corp., Space Transportation Systems Div., Downey, CA) IN: Spacecraft design and operational problems; Proceedings of the Aerospace Technology Conference and Exposition, Long Beach, CA, October 14-17, 1985 . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 47-55. Research supported by the Rockwell International Corp. refs
(SAE PAPER 851907)

This paper provides an overview of software cost estimation, with particular reference to the software of embedded computer systems in spacecraft. The paper provides access to literature on the subject, reviews the major software estimation models with commercially avaiable automated supporting tools, and indicates data indicates data items necessary for accurate estimation. A brief comment on the impact of the introduction of the Ada language on future software development costs and sources of continuing information on software costing conclude this presentation. Author

A86-40831#
SHARPENING THE SENSES OF INDUSTRIAL ROBOTS
P. K. WRIGHT and P. J. ENGLERT (Carnegie-Mellon University, Pittsburgh, PA) Mechanical Engineering (ISSN 0025-6501), vol. 108, May 1986, p. 58-63.

The capabilities of state-of-the art robotic systems are outlined as well as the improvements needed in the area of external sensing. The hierarchy of abilities for force/torque and tactile feedback is indicated schematically, and it is noted that a robot arm capable of repetitive pick-and-place operations is now well established in industry. Attention is given to these simple sensor and passive compliance robots as well as to active robots which require sensors that give data on local position at the wrist or finger. An active hand that can imitate a human three-fingered grip and allow its active reorientation based on local sensor information is currently the focus of attention. The characteristics, costs and applications of vision systems are also presented, and it is noted that a compromise must be reached between the performance index and processing speed. K.K.

A86-41000
EVALUATING SPACE STATION APPLICATIONS OF AUTOMATION AND ROBOTICS
J. F. BARD (Texas, University, Austin) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. EM-33, May 1986, p. 102-111. refs

A methodology is presented which can be used to evaluate and rank different approaches to the automation of functions and tasks planned for the NASA Space Station, giving attention to the impact of advanced automation on human productivity. The Analytic Hierarchy Process employed by the methodology allows the introduction of individual judgment to resolve the conflict that arises when incomparable criteria underlie the selection process. The problem is decomposed into simpler subproblems that focus on human productivity, economics, design, and operations. The results from each are then combined to yield final rankings. The selection of an on-orbit assembly system is treated as an illustrative example that encompasses five possible alternatives, yielding computation results and their implications. O.C.

A86-41648
WHY COMPUTERS MAY NEVER THINK LIKE PEOPLE
H. DREYFUS and S. DREYFUS (California, University, Berkeley) Technology Review (ISSN 0040-1692), vol. 89, Jan. 1986, p. 42-61.

The problems with computer expert systems based on artificial intelligence are studied. The inability of computers to use intuitive intelligence, which humans learn through experience, is examined. Human thinking with images (holograms) is described. Computers use rules to make logical inferences about facts and can not separate relevant operations from irrelevant ones, and can not compensate for changes. Many computer systems are useful for special functions (microworlds); however, they are not applicable universally. The development expert systems perform better than human beginners; however, they do not equal the skill level of human experts. The successful use of computers in fields such as telecommunications is discussed. The application of artificial intelligence computer systems to military equipment, business fields, and the classroom is analyzed. I.F.

A86-42983* Massachusetts Inst. of Tech., Cambridge.
TIME OPTIMAL ROBOTIC MANIPULATOR MOTIONS AND WORK PLACES FOR POINT TO POINT TASKS
S. DUBOWSKY (MIT, Cambridge, MA) and T. D. BLUBAUGH (General Motors Corp., Warren, OH) IN: Conference on Decision and Control, 24th, Fort Lauderdale, FL, December 11-13, 1985, Proceedings. Volume 3 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 1533-1538. refs
(Contract NAG1-489)

High productivity requires that manipulators perform complex tasks quickly. Recently, optimal control algorithms have been developed which enable manipulators to move quickly, but only for simple motions. A method is presented here which combines simple time optimal motions in an optimal manner to yield the minimum time motions for an important class of complex manipulator tasks composed of point to point moves, such as assembly, electronic component insertion and spot welding. This method can also be used to design manipulator actions and work places so that tasks can be completd in minimum time. The method has been implemented in a CAD software package. Examples are presented which show the methods effectiveness. Author

A86-43061
A STUDY ON ROBOT PATH PLANNING FROM A SOLID MODEL
Y. ITOH (Onoda Cement Co., Ltd., Tokyo, Japan), M. IDESAWA, and T. SOMA (Institute of Physical and Chemical Research, Wako, Japan) Journal of Robotic Systems (ISSN 0741-2223), vol. 3, Summer 1986, p. 191-203. refs

In an effort to improve current CAD/CAM circumstances, a trial CAE system which generates the operation path of a robot from a solid-model built-in CAD process, has been examined. In this system, solid models are built by performing set operations such as addition, subtraction, and intersection between several primitives or solid models. Processing is made for a solid model represented by B-rep (boundary representation). To ease the processing, curved faces such as spherical, cylindrical, or conical surfaces, are approximated by several flat planes. As a first step, by assuming Gaussian spatial distribution for a painting gun, path planning of a painting robot for a convex solid body has been examined. A scanning plane is defined for each flat plane and a path of robot effector is generated on this plane. Author

A86-43884
STATE OF THE ART IN INTELLIGENT/BRILLIANT ROBOTS
R. HONG (Grumman Aerospace Corp., Bethpage, NY) IN: AUTOTESTCON '85; Proceedings of the International Automatic Testing Conference, Uniondale, NY, October 22-24, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 75-80. refs

The state of the art of intelligent/brilliant robots of various types which will be in operation in the next decades is addressed. These are robots which will possess human-like capabilities and beyond. As such, they will generally be implemented with artificial intelligence technology such as knowledge based/expert systems. Learning and self adaptive capabilities are also being applied to these future robots. Author

N86-11194*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERT SYSTEMS DEVELOPMENT AND APPLICATION
E. L. DUKE and V. A. REGENIE Oct. 1985 8 p Presented at the IEEE Symp. on Expert Systems in Govt., McLean, Va., 23-25 Oct. 1985
(NASA-TM-86746; H-1310; NAS 1.15:86746) Avail: NTIS HC A02/MF A01 CSCL 01C

Current research in the application of expert systems to problems in the flight research environment is discussed. In what is anticipated to be a broad research area, a real time expert system flight status monitor has been identified as the initial project. This real time expert system flight status monitor is described in terms of concept, application, development, and schedule. Author

N86-11195*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESCRIPTION OF AN EXPERIMENTAL EXPERT SYSTEM FLIGHT STATUS MONITOR
E. L. DUKE and V. A. REGENIE Oct. 1985 11 p refs Presented at the 5th AIAA Computers in Aerospace Conf., Long Beach, Calif., 21-23 Oct. 1985
(NASA-TM-86791; H-1317; NAS 1.15:86791; AIAA-85-6042-CP) Avail: NTIS HC A02/MF A01 CSCL 01C

This paper describes an experimental version of an expert system flight status monitor being developed at the Dryden Flight Research Facility of the NASA Ames Research Center. This experimental expert system flight status monitor (ESSFSM) is supported by a specialized knowledge acquisition tool that provides the user with a powerful and easy-to-use documentation and rule construction tool. The EESFSM is designed to be a testbed for concepts in rules, inference mechanisms, and knowledge structures to be used in a real-time expert system flight status monitor that will monitor the health and status of the flight control system of state-of-the-art, high-performance, research aircraft. Author

N86-13027# Allied Bendix Corp., Kansas City, Mo.
KNOWLEDGE-BASED SYSTEMS: HOW WILL THEY AFFECT MANUFACTURING IN THE 80'S
M. S. KING, S. L. BROOKS, and R. M. SCHAEFER Apr. 1985 19 p refs Presented at the ASME Intern. Computers in Eng. Conf. and Exhibition, Boston, 4 Aug. 1985
(Contract DE-AC04-76DP-00613)
(DE85-010601; BDX-613-3185; CONF-850862-1) Avail: NTIS HC A02/MF A01

Knowledge-based or expert systems have been in various stages of development and use for a long time in the academic world. Some of these systems have come out of the lab in recent years in the fields of medicine, geology, and computer system design. The use of knowledge-based systems in conjunction with manufacturing process planning and the emerging CAD/CAM/CAE technologies promises significant increases in engineering productivity. Areas in manufacturing where knowledge-based systems could most benefit the engineer and industry are emphasized. DOE

N86-14611# Joint Publications Research Service, Arlington, Va.
IMPLEMENTATION OF COMPUTER-AIDED PRODUCTION SYSTEMS DETAILED
G. ZEMANN *In its* East Europe Report: Science and Technology (JPRS-ESA-85-034) p 34-40 18 Nov. 1985 Transl. into ENGLISH from Fertigungstechnik und Betrieb (East Berlin), v. 35, no. 6, 1985 p 329-331
Avail: NTIS HC A05/MF A01

Metal-forming combine technique, the material and technical basis of prouction was continually expanded and modernized. Today nearly every fifth machine tool involved in primary production is an numerical control(NC) or computer numerical control (CNC) machine. Complex, automated technological solutions, e.g., the cutting and precise machining of flat plate-type components in the production of large welded machine assemblies, can be compared with corresponding technologies of any manufacturer in this branch of industry. The software packages developed during the past 15 years, cover many different areas of application, such as graphics capability for design-related and technological problems, data base systems for managing technical source data, interactive work station for complex planning and balance sheet models, process data systems for production control problems and many more. Since the first electronic data processing systems were introduced at the end of the 1960's production volume has increased five times. Two generations of metal-forming machines are added in the meantime. E.A.K.

N86-18053# Los Alamos National Lab., N. Mex.
EXPERT SYSTEMS FOR DESIGN AND SIMULATION
J. ALDRIDGE, J. CERUTTI, W. DRAISIN, and M. STEUERWALT 1985 43 p Presented at the AIAA/NASA Symposium on Automation, Robotics and Advanced Computing for the National Space Program, Washington, D.C., 4 Sep. 1985
(Contract W-7405-ENG-36)
(DE85-017565; LA-UR-85-2838; CONF-8509149-1) Avail: NTIS HC A03/MF A01

We discuss work in progress on two expert systems. We are developing systems that use artificial intelligence techniques to simplify the use of large simulation codes and to help design complicated physical devices. The simulation codes are used in analyzing and designing weapons, and the devices are themselves part of weapon systems. But we focus not only on the particular applications, but also on the broader issues common to design problems: large solution spaces and tentative reasoning. We also discuss some practical difficulties encountered during the project. One expert system provides an interface between users and several simulation codes. It checks input for errors, builds input files for the codes, and submits jobs to a central computing facility. The other expert system helps turn a description of a device into a particular design. Currently this expert system includes three major parts: a translator of descriptions into designs, a graphics interface that presents the design to the user and allows him to manipulate it, and a refiner of designs. The latter is the smartest part of the system, and the target of much of our present efforts. DOE

N86-18736# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A ROBUST LAYERED CONTROL SYSTEM FOR A MOBILE ROBOT
R. A. BROOKS Sep. 1985 28 p
(Contract N00014-82-K-0334; N00014-80-C-0505)
(AD-A160833; AI-M-864) Avail: NTIS HC A03/MF A01 CSCL 09B

We describe a new architecture for controlling mobile robots. Layers of control system are built to let the robot operate at an increasing level of competence. Layers are made up of asynchronous modules which communicate over low bandwidth channels. Each module is an instance of a fairly simple computational machine. Higher level layers can subsume the roles of lower levels by suppressing their outputs. However, lower levels continue to function as higher levels are added. The result is a robust and flexible robot control system. The system is intended to control a robot that wanders the office areas of our laboratory, building maps of its surroundings. In this paper, we demonstrate the system controlling a detailed simulation of the robot. GRA

N86-19634# Royal Signals and Radar Establishment, Malvern (England). Integrated Air Defence Systems Div.
APPLICATIONS OF EXPERT SYSTEMS
P. R. WETHERALL *In* AGARD Artificial Intelligence and Robotics 17 p Sep. 1985 refs
Avail: NTIS HC A07/MF A01

An Expert System contains a knowledge base, an inference engine, an explanation system, a model of the real world and a man machine interface. The types of reasoning include interpretation, monitoring, prediction and design, together with specializations of these, such as diagnosis and planning, and aggregations, such as debugging, instruction and control. A range of possible applications are described to illustrate these general tasks. The nature of the knowledge available, and some implementation problems, are identified. The applications include examples in the area of tactical decision aids, specifically sensor data interpretation, data fusion, threat assessment and resource allocation. Other topics include cockpit environments and intelligent tutoring. Finally, some of the problems that limit the immediate widespread adoption of the technology are discussed. Author

N86-20014# IIT Research Inst., Chicago, Ill. Manufacturing Technology Information Analysis Center.
ARTIFICIAL INTELLIGENCE APPLICATIONS IN MANUFACTURING
R. H. COOK Oct. 1985 59 p
(Contract DLA900-84-C-1508)
(AD-A161161; MTIAC-TA-85-01) Avail: NTIS HC A04/MF A01 CSCL 09B

Developments in the field of artificial intelligence hold great promise for applications in the factory of the future. However, the technology and applications are still in an early stage of emergence. The literature of the last few years has been surveyed to develop a profile of the state of this emergence. This, coupled with interviews with workers heavily involved in the application of AI, shows that within the AI family of technologies expert systems dominate current applications. The next year promises to be very active as true production expert systems begin to appear. This won't be without problems, however. Several references are recommended for initial reading in AI, and lists of products, programs, and players in the field are included. Author (GRA)

N86-21220*# VAIR, Inc., Williamsburg, Va.
IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE RULES IN A DATA BASE MANAGEMENT SYSTEM
S. FEYOCK Feb. 1986 64 p refs
(Contract NAS1-18002)
(NASA-CR-178048; NAS 1.26:178048) Avail: NTIS HC A04/MF A01 CSCL 09B

The intelligent front end prototype was transformed into a RIM-integrated system. A RIM-based expert system was written which demonstrated the developed capability. The use of rules to produce extensibility of the intelligent front end, including the concept of demons and rule manipulation rules were investigated. Innovative approaches such as syntax programming were to be considered. B.G.

N86-22955# Sandia National Labs., Albuquerque, N. Mex.
ALLOCATION OF TASKS TO ROBOTS FOR IMPROVED SAFETY
D. S. KESSEL Oct. 1985 8 p refs Presented at the National Safety Council Congress, New Orleans, La., 30 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE86-002366; SAND-85-2386C; CONF-8510193-1) Avail: NTIS HC A02/MF A01

The paper points out the potential contributions of industrial robots to the improvement of safety in the workplace. Ergonomic evaluation techniques were identified which may be used to identify overly stressful tasks which may result in overexertion injuries. DOE

N86-23603*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT EXPERIENCE WITH A SIMPLE EXPERT SYSTEM DEMONSTRATOR FOR PILOT EMERGENCY PROCEDURES
M. VANNORMAN and D. A. MACKALL Feb. 1986 17 p refs
(NASA-TM-85919; H-1272; NAS 1.15:85919) Avail: NTIS HC A02/MF A01 CSCL 01C

Expert system techniques, a major application area of artificial intelligence (AI), are examined in the development of pilot associate to handle aircraft emergency procedures. The term pilot associate is used to describe research involving expert systems that can assist the pilot in the cockpit. The development of expert systems for the electrical system and flight control system emergency procedures are discussed. A simple, high-level expert system provides the means to choose which knowledge domain is needed. The expert systems were developed on a low-cost, FORTH-based package, using a personal computer. Author

N86-23954# New Mexico Univ., Albuquerque.
TASK PLANNING FOR CONTROL OF A SENSOR-BASED ROBOT
R. C. LENNOX, G. F. LUGER, and R. W. HARRIGAN Dec. 1985 36 p Prepared in cooperation with Sandia National Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(DE86-004225; SAND-85-0958) Avail: NTIS HC A03/MF A01

This paper is divided into four major sections. The first is an introduction to the research area. The second provides a brief overview of the history of planning in artificial intelligence (AI), while the third part of the paper describes the representational power of very-high-level computer languages and how this power may be brought to planning in robotics research. Finally, we describe our PROLOG-driven Planner for controlling a PUMA arm used for object manipulation and note the future directions of this work. DOE

N86-24687*# National Aeronautics and Space Administration. Dryden (Hugh L.) Flight Research Center, Edwards, Calif.
AN ENGINEERING APPROACH TO THE USE OF EXPERT SYSTEMS TECHNOLOGY IN AVIONICS APPLICATIONS
E. L. DUKE, V. A. REGENIE, M. BRAZEE, and R. W. BRUMBAUGH (PRC Kentron, Edwards, Calif.) May 1986 12 p refs Presented at the IEEE National Aerospace and Electronics Conference (NAECON), Dayton, Ohio, 19-23 May 1986
(NASA-TM-88263; H-1364; NAS 1.15:88263) Avail: NTIS HC A02/MF A01 CSCL 01D

The concept of using a knowledge compiler to transform the knowledge base and inference mechanism of an expert system into a conventional program is presented. The need to accommodate real-time systems requirements in applications such as embedded avionics is outlined. Expert systems and a brief comparison of expert systems and conventional programs are reviewed. Avionics applications of expert systems are discussed before the discussions of applying the proposed concept to example systems using forward and backward chaining. Author

N86-25173# Stanford Univ., Calif. Dept. of Computer Science.
DECISION PROCEDURES
M. I. GINSBERG May 1985 24 p
(Contract N00014-81-K-0004)
(AD-A163049; SU-STAN-CS-85-1064) Avail: NTIS HC A02/MF A01 CSCL 12A

Distributed artificial intelligence is the study of how a group of individual intelligent agents can combine to solve a difficult global problem; the usual approach is to split the original problem into simpler ones and to attack each of these independently. This paper discusses in very general terms the problems which arise if the subproblems are not independent, but instead interrelate in some way. We are led to a single assumption, which we call common rationality, that is provably optimal (in a formal sense) and which enables us to characterize precisely the communication needs of the participants in multi-agent interactions. An example of a distributed computation using these ideas is presented. GRA

N86-25808# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
ECONOMIC APPLICATIONS OF ASSEMPLY ROBOTS. ECONOMIC ANALYSIS AND CLASSIFICATION SYSTEMS FOR ROBOT ASSEMBLY
Y. S. HO and G. BOOTHROYD Feb. 1985 149 p refs
(Contract NSF MEA-81-11917)
(PB86-154465; NSF/ENG-85044; REPT-5) Avail: NTIS HC A07/MF A01 CSCL 13I

The report concerns production costs and focuses on the importance of giving proper consideration to manufacturing and assembly during the part and product design process. Types of robots and robot assembly systems are identified. Part design rules and corresponding classification systems for products to be assembled on these systems are described. Worksheets and equations for the draft design for robot assembly techniques are presented; their use is illustrated; and the effect of product redesign is discussed. A case study is included and a comparison of assembly costs and cycle times for various types of assembly systems is given. Author (GRA)

N86-26062# Joint Publications Research Service, Arlington, Va.
ROLE OF ROBOTICS IN SOLVING PRODUCTION, SOCIAL PROBLEMS
Y. P. POPOV *In its* USSR Report: Science and Technology Policy (JPRS-UST-86-011) p 60-71 31 Mar. 1986 refs
Avail: NTIS HC A04

The implementation of automation and information policies by robotic systems is discussed. The robotic systems are divided into four different groups: (1) manipulation; (2) mobility; (3) information; and (4) control. The use of industrial robots to replace people and also to solve the shortage of human resources is outlined. The use of special instrument complexes in the development of the information part of the control systems of adaptive robots and their software is outlined. The role of information science in the development of industrial robotics, in general, and in flexible machine systems, in particular, is enumerated. eak

N86-27663# Commerce Dept., Washington, D.C.
ROBOT END EFFECTOR Patent Application
A. SLOCOM, (inventors to Commerce) and P. JURGENS, (inventors to Commerce) 13 Feb. 1986 19 p
(PB86-166042; US-PATENT-APPL-SN-6-829052) Avail: NTIS HC A02/MF A01 CSCL 13I

The invention relates to manipulating devices, and in particular relates to an end effector or gripper attachable to a robot for mechanically grasping and orienting objects. GRA

N86-29120# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
EXPLOITING SEQUENTIAL PHONETIC CONSTRAINTS IN RECOGNIZING SPOKEN WORDS
D. P. HUTTENLOCHER Oct. 1985 28 p
(Contract N00014-80-C-0505)
(AD-A165913; AI-M-867) Avail: NTIS HC A03/MF A01 CSCL 05H

Machine recognition of spoken language requires developing more robust recognition algorithms. A recent study by Shipman and Zue suggest using partial descriptions of speech sounds to eliminate all but a handful of word candidates from a large lexicon. The current paper extends their work by investigating the power of partial phonetic descriptions for developing recognition algorithms. First, we demonstrate that sequences of manner of articulation classes are more reliable and provide more constraint than certain other classes. Alone these results are of limited utility, due to the high degree of variability in natural speech. This variability is not uniform however, as most modifications and deletions occur in unstressed syllables. Comparing the relative constraint provided by sounds in stressed versus unstressed syllables, we discover that the stressed syllables provide substantially more constraint. This indicates that recognition algorithms can be made more robust by exploiting the manner of articulation information in stressed syllables. GRA

N86-29220# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SENSING STRATEGIES FOR DISAMBIGUATING AMONG MULTIPLE OBJECTS IN KNOWN POSES
W. E. L. GRIMSON Aug. 1985 38 p
(Contract N00014-80-C-0505; N00014-82-K-0334)
(AD-A165912; AI-M-855) Avail: NTIS HC A03/MF A01 CSCL 12A

The need for intelligent interactions of a robot with its environment frequently requires sensing of the environment. Further, the need for rapid execution requires that the interaction between sensing and action take place using as little sensory data as possible, while still being reliable. Previous work has developed a technique for rapidly determining the feasible poses of an object from sparse, noisy, occluded sensory data. This paper examines techniques for acquiring position and surface orientation data about points on the surface of objects, with the intent of selecting sensory points that will force a unique interpretation of the pose of the object with as few data points as possible. Under some simple assumptions about the sensing geometry a technique for predicting optimal sensing positions is derived. The technique has been implemented and tested. To fully specify the algorithm, needed are estimates of the error in estimating the position and orientation of the object, and derived are analytic expressions for such error for the case of one particular approach to object recognition. Author (GRA)

N86-29229# Los Alamos National Lab., N. Mex.
APPLICATION OF TELEOPERATOR EXPERTISE TO ROBOTICS
D. L. GRISHAM and J. E. LAMBERT 1985 10 p Presented at the Robots Conference, Chicago, Ill., 20 Apr. 1986
(Contract W-7405-ENG-36)
(DE86-003659; LA-UR-85-4066; CONF-860487-3) Avail: NTIS HC A02/MF A01

The evolution, capabilities and accomplishments of the Monitor remote handling system are discussed. It is suggested that the equipment and operational expertise can be applied to robotic systems in radioactive and other hostile environments. The Monitor methods of operation, the tooling devised and employed and the applications of these methods to robotic systems are described. DOE

N86-29234# Lawrence Livermore National Lab., Calif.
VARIABLE STRUCTURE MODEL FOLLOWING CONTROL DESIGN FOR ROBOTICS APPLICATIONS
K. D. YOUNG Feb. 1986 17 p Presented at the IEEE International Conference on Robotics and Automation, San Francisco, Calif., 14 Apr. 1986
(Contract W-7405-ENG-48)
(DE86-008136; UCRL-94074; CONF-860434-6) Avail: NTIS HC A02/MF A01

The increased demand on robotic system performance leads to the use of advanced control strategies. In this paper a variable structure model following control design is proposed for robotics applications. DOE

N86-29513*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACE TELEOPERATION RESEARCH. AMERICAN NUCLEAR SOCIETY EXECUTIVE CONFERENCE: REMOTE OPERATIONS AND ROBOTICS IN THE NUCLEAR INDUSTRY; REMOTE MAINTENANCE IN OTHER HOSTILE ENVIRONMENTS
A. J. MEINTEL, JR. and R. W. WILL 1985 51 p Presented at the Executive Conference on Remote Operations and Robotics in the Nuclear Industry, Pine Mountain, Ga., 21 Apr. 1985
(NASA-TM-89234; NAS 1.15:89234; DE85-902186; CONF-850425-5) Avail: NTIS HC A04/MF A01 CSCL 05H

This presentation consists of four sections. The first section is a brief introduction to the NASA Space Program. The second portion summarized the results of a congressionally mandated study of automation and robotics for space station. The third portion presents a number of concepts for space teleoperator systems. The remainder of the presentation describes Langley Research Center's teleoperator/robotic research to support remote space operations. DOE

N86-29557# Los Alamos National Lab., N. Mex.
EXPERT ASSISTANTS FOR DESIGN
J. ALDRIDGE, J. CERUTTI, W. DRAISIN, and M. STEUERWALT 1986 12 p Presented at the 1st International Conference on Applications of AI to Engineering Problems, Southhampton, England, 1 Apr. 1986
(Contract W-7405-ENG-36)
(DE86-003679; LA-UR-85-3970; CONF-860472-1) Avail: NTIS HC A02/MF A01

Two expert programs currently under development at the Los Alamos National Laboratory, PROCON and the Designer's Apprentice, are briefly described. Both codes define interface to simulations that provide a wide variety of information about the performance of complex devices. DOE

N86-30387# Allied Bendix Corp., Kansas City, Mo.
INTELLIGENT N/C CONTROLLERS
V. E. GROSS Oct. 1985 4 p Presented at the Joint Meeting of the CAM-I Advance Numerical Control (ANC), Process Planning (PP), and Quality Assurance Programs, Arlington, Tex., 30 Oct. 1985
(Contract DE-AC04-76DP-00613)
(DE86-003132; BDX-613-3398; CONF-8510211-1) Avail: NTIS HC A02/MF A01

The objective of this presentation is to initiate the discussion for the eventual preparation of a specification for intelligent numerical control N/C controllers. The items in this presentation are not intended to be all inclusive. This is a starting point for the research and preparation required to develop a specification. The intelligent N/C controller is defined and requirements, standards, and benefits are discussed. Development of specifications is recommended. DOE

N86-30390# Allied Bendix Corp., Kansas City, Mo.
ROBOTIC SIMULATION
B. L. PECK Feb. 1986 9 p
(Contract DE-AC04-76DP-00613)
(DE86-006517; BDX-613-3410) Avail: NTIS HC A02/MF A01

Simulation software offers great potential for cost savings and added assurance of maximum efficiency in manufacturing operations. It is estimated that 60 to 80% of a total robotic work cell implementation effort is involved in layout, equipment design, robot selection, and hardware mock up of the cell. The remainder of the effort is taken up with programming and final refinements made on the shop floor. Simulation techniques are also contributing significantly to development of offline programming. Simulation programs can offer a major cost savings. DOE

N86-30397# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Mathematics and Computer Science.
REPORT ON THE AI TRIP
R. P. VANDERIET Mar. 1984 51 p
(IR-82; ETN-86-97320) Avail: NTIS HC A04/MF A01

The imbedding of AI in the whole of computer science; equipment; communication; and VLSI in the UK, USA, and Canada are discussed. Contacts between universities and industry are treated. ESA

N86-30412# Sandia National Labs., Albuquerque, N. Mex.
SENSOR DRIVEN ROBOT SYSTEMS TESTBED
R. W. HARRIGAN 1986 18 p Presented at the SPIE Technical Symposium on Applications of Artificial Intelligence, Orlando, Fla., 31 Mar. 1986
(Contract DE-AC04-76DP-00789)
(DE86-005892; SAND-85-2032C; CONF-860366-1) Avail: NTIS HC A02/MF A01

Intelligent robot systems which operate in a semiautonomous fashion (i.e., the operator serves only as a high level supervisor) require the integration of sensors and mechanisms coupled by intelligent software. Since robot systems operate in the real world with imperfect knowledge of that world, error recovery is an important aspect of any control strategy. Configured with a 6 degree-of-freedom robot manipulator, two dimensional vision and force sensing, the Sensor Driven Robot Systems Testbed offers an environment for the development of control concepts for intelligent machine systems. The Sensor Driven Robot Systems Testbed has led to the development of active sensing concepts using complementary sensors and a highly modular control software concept. Both concepts are currently being implemented within the testbed environment. DOE

N86-30581# Essex Corp., Goleta, Calif. Human Factors Research Div.
TECHNOLOGY TRANSFER AND ARTIFICIAL INTELLIGENCE
R. R. MACKIE and C. D. WYLIE Dec. 1985 147 p
(Contract N62269-83-D-0115)
(AD-A166035; TR-51231-1) Avail: NTIS HC A07/MF A01
CSCL 05A

The purpose of this study was to identify critical user acceptance issues in applying artificial intelligence (AI) technology (e.g., expert systems) to military decision aids, and to develop a technology transfer plan. The application of new technology does not necessarily yield a good product, and even good products do not necessarily succeed on their own merits. Product development and introduction must consider the perspectives of potential users, especially when use of the innovation can be regarded as optional. The officers generally expressed optimism about the potential value of AI. However, negative beliefs held by many officers need to be considered carefully. A number of general design issues were identified, and several man-machine interface preferences were determined, including the desire for: display of historical data on request; use of probability estimates; embedded training and on-line tutorial; auto mode settings with user override; easy updating; suggestive rather than authoritative output; and brief rather than conversational output. A technology transfer plan based on the findings of this study is presented which stresses communications with potential users, involvement of users in design, design for acceptance, and demonstration. GRA

N86-31270# Argonne National Lab., Ill.
AUTOMATED REASONING: BASIC RESEARCH PROBLEMS
L. WOS Mar. 1986 40 p
(Contract W-31-109-ENG-38)
(DE86-009214; ANL/MCS-TM-67) Avail: NTIS HC A03/MF A01

In this paper, we present some of the open research problems in the field of automated reasoning. By collecting these problems in one place, we intend to stimulate research and thus reduce the time required to reach one of the primary objectives of the field. That objective is to design and implement a computer program that functions as a high-level automated reasoning assistant. This paper is intended for new researchers as well as those who have been active in the field. We therefore include an overview of automated reasoning itself, touching on the basic elements, various examples and some of its applications. The existence of single automated reasoning programs that have provided valuable assistance in answering open questions in mathematics and logic, designing superior circuits, validating existing circuit designs, and proving properties of computer programs establishes the usefulness and versatility of such programs. The degree of assistance future automated reasoning programs will offer depends on which of the open problems cited in this paper are solved. DOE

N86-31271# Oak Ridge National Lab., Tenn.
REAL-TIME PRODUCTION SYSTEM FOR INTELLIGENT ROBOT CONTROL
G. DESAUSSURE, D. KAMMER, and C. R. WEISBIN 1986 13 p Presented at the National Conference on Artificial Intelligence, Philadelphia, Pa., 11 Aug. 1986
(Contract DE-AC05-84OR-21400)
(DE86-008501; CONF-860848-1) Avail: NTIS HC A02/MF A01

The use of a production system for the control of an autonomous robot presents several attractive features: the explicitness and homogeneity of the knowledge representation facilitates explaining, verifying and modifying the rules which determine the robot's behavior; it also permits the intremental extension of the domain of competence. However, real-time operation poses a number of challenges due to the dynamic nature of the data and because the system must frequently deal with a large knowledge base in a limited time. An implementation of a knowledge base is discussed where a large commercial real-time expert system originally designed for industrial process diagnostic was adapted to the control of an autonomous mobile robot planning, executing and monitoring a set of navigational tasks. DOE

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.

A86-10948#
CONSIDERATIONS FOR THE IMPLEMENTATION OF INTELLIGENT WORKSTATION NETWORKS
H. JACOBSON and A. GORDON (Boeing Aerospace Co., Seattle, WA) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 6 p.
(AIAA PAPER 85-4001)

Intelligent workstations linked together in Local Area Networks (LANS) are ushering in a new era in engineering/scientific computing. Powerful interactive graphics software and high resolution output presentation capabilities can now be provided economically at the engineer's desk. Paperless electronic data flows between functions and departments are technically feasible. This paper describes the Boeing Aerospace Company's experiences with the initial deployment of intelligent workstations in LANS. The issues discussed include in-house customer relations, software vendors, user experiences, potential pitfalls, and future plans. Author

A86-11412#
THE DISCIPLINE OF SOFTWARE ACQUISITION
R. J. SYLVESTER (Mitre Corp., Bedford, MA) IN: Computers in Aerospace Conference, 5th, Long Beach, CA, October 21-23, 1985, Technical Papers . New York, AIAA, 1985, p. 92-95.
(AIAA PAPER 85-5056)

This paper advocates the recognition of software acquisition within the context of system acquisition as a budding discipline worthy of specific study, research and promulgation. The paper focuses on the software related qualifications, tasks and responsibilities of an acquisition agent (either in government or industry) to assure a successful, contracted development. Issues of user expectation, requirements impacts, initial trade studies, project specification, and source selection are explored at a fundamental level. The need for 'in-house' and 'in-application' experience on the part of the acquisition agent is explored. The paper further discusses the relationship between the acquisition agent and the developing contractor from the perspective of software acquisition. The paper concludes with the definition of specific research needs in the areas of tools for predicting software efforts based on high level system requirements, methods for achieving low-risk and high performance designs, and guidelines for determining appropriate levels of testing during development and at acceptance. Author

A86-11445#
USING AUTOMATED TOOLS TO REDUCE SOFTWARE COSTS AND INSURE SYSTEM INTEGRITY
S. P. FRIED, D. R. STIRTZ, and B. DEVITT (General Electric Co., Space Systems Div., Philadelphia, PA) IN: Computers in Aerospace Conference, 5th, Long Beach, CA, October 21-23, 1985, Technical Papers . New York, AIAA, 1985, p. 333-348. refs
(AIAA PAPER 85-6013)

The paper examines how software development productivity can be increased with cost reductions, while generating easily maintainable/reliable software. The traditional software development life cycle is examined, and a sampling is presented of automated tools currently on the market which are categorized by their functionality within the phases of the software life cycle.

Finally, the concept, requirements, and implementation considerations are presented for an automated tool which incorporates the positive features of currently used development tools with additional features to enhance its general functionality. It is noted that this tool (termed the Total System Development Tool) will be fully able to incorporate the standards of contemporary large-scale projects and fourth-generation languages. B.J.

A86-17769
SYSTEM ARCHITECTURE FOR PARTITION-TOLERANT DISTRIBUTED DATABASES
S. K. SARIN, C. W. KAUFMAN (Computer Corporation of America, Cambridge, MA), and B. T. BLAUSTEIN (Computer Corporation of America, Alexandria, VA) IEEE Transactions on Computers (ISSN 0018-9340), vol. C-34, Dec. 1985, p. 1158-1163. DARPA-supported research. refs
(Contract F30602-84-C-0112)

An overview is presented of an approach to distributed database design that emphasizes high availability in the face of network partitions and other communication failures. This approach is appropriate for applications that require continued operation and can tolerate some loss of integrity of the data. Each site presents its users and application programs with the best possible view of the data that it can, based on those updates that it has received so far. Mutual consistency of replicated copies of data is ensured by using timestamps to establish a known total ordering on all updates issued, and by a mechanism that ensures the same final result regardless of the order in which a site actually receives these updates. A mechanism is proposed, based on alerters and triggers, by which applications can deal with exception conditions that may arise as a consequence of the high-availability architecture. A prototype system that demonstrate this approach is near completion. Author

A86-21317
NEXT-GENERATION COMPUTERS
E. A. TORRERO, ED. New York, IEEE Press, 1985, 359 p. No individual items are abstracted in this volume.

Developments related to tomorrow's computers are discussed, taking into account advances toward the fifth generation in Japan, the challenge to U.S. supercomputers, plans concerning the creation of supersmart computers for the U.S. military, a U.S. industry response to the Japanese challenge, a survey of U.S. and European research, Great Britain, the European Common Market, codifying human knowledge for machine reading, software engineering, the next-generation softwave, plans for obtaining the million-transistor chip, and fabrication issues for next-generation circuits. Other topics explored are related to a status report regarding artificial intelligence, an assessment of the technical challenges, aspects of sociotechnology, and defense advanced research projects. Attention is also given to expert systems, speech recognition, computer vision, function-level programming and automated programming, computing at the speed limit, VLSI, and 'superpower' computers. G.R.

A86-21973* Honeywell, Inc., Bloomington, Minn.
OPTICAL PROCESSING FOR FUTURE COMPUTER NETWORKS
A. HUSAIN, P. R. HAUGEN, L. D. HUTCHESON (Honeywell Physical Sciences Center, Bloomington, MN), J. WARRIOR (Honeywell Technology Strategy Center, Roseville, MN), N. MURRAY, and M. BEATTY (NASA, Langley Research Center, Hampton, VA) Optical Engineering (ISSN 0091-3286), vol. 25, Jan. 1986, p. 108-116. refs
(Contract NAS1-17657)

In the development of future data management systems, such as the NASA Space Station, a major problem represents the design and implementation of a high performance communication network which is self-correcting and repairing, flexible, and evolvable. To obtain the goal of designing such a network, it will be essential to incorporate distributed adaptive network control techniques. The present paper provides an outline of the functional and communication network requirements for the Space Station data management system. Attention is given to the mathematical representation of the operations being carried out to provide the required functionality at each layer of communication protocol on the model. The possible implementation of specific communication functions in optics is also considered. G.R.

A86-25999
SADDLE - A COMPUTER-AIDED STRUCTURAL ANALYSIS AND DYNAMIC DESIGN LANGUAGE. I - DESIGN SYSTEM. II - DATABASE MANAGEMENT SYSTEM
S. D. RAJAN (Arizona State University, Tempe) and M. A. BHATTI (Iowa, University, Iowa City) Computers and Structures (ISSN 0045-7949), vol. 22, no. 2, 1986, p. 185-212. refs

This paper is concerned with the general-purpose, FEM-based optimal design system SADDLE. SADDLE stands for Structural Analysis and Dynamic Design LanguagE. The term 'Dynamic' signifies that changes in design concepts can be reflected in the design system with a minimum of effort. The design system uses powerful features of database management, numerical techniques, computer graphics, finite element analysis, and nonlinear programming methods. The system is linked to preprocessors and postprocessors which ease input and display of user and computed data. Attention is given to system arrangement and capabilities, the execution modes, the user-interface for design, utility libraries, the creation of the design module, the optimization technique, numerical examples, and the shape optimal design of trusses. G.R.

A86-26005
AUTOMATION IN THE COCKPIT - WHO'S IN CHARGE?
R. W. MOSS, J. M. REISING, and N. R. HUDSON (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN: Aerospace Behavioral Engineering Technology Conference, 3rd, Long Beach, CA, October 15-18, 1984, Proceedings . Warrendale, PA, Society of Automotive Engineers, Inc., 1984, p. 25-29. refs
(SAE PAPER 841534)

This paper discusses levels of automation and decision making and arrives at an overall design philosophy for allocating tasks to the pilot and the computer. In order to produce a levels of automation matrix three categories of pilot-computer interface (pilot only, blended, and computer only) and three types of goals, (mission, functional and task), are identified. These two dimensions are then used to create a matrix which can be employed as a means of comparing automated systems. The options that the matrix produces are discussed and examples given. The overall design philosophy is to have the mission goals accomplished in a blended manner with both the pilot and computer contributing. Lower level goals are handled exclusively by the computer. The reasoning for this philosophy is to allow the pilot to operate in a rule-based environment so that he can optimally cope with the greatly increased amounts of information he will face in future missions. Author

A86-27166
COMPUTER NETWORKING FOR SCIENTISTS
D. M. JENNINGS, W. R. ADRION (NSF, Washington, DC), L. H. LANDWEBER (Wisconsin, University, Madison), I. H. FUCHS (Princeton University, NJ), and D. J. FARBER (Delaware, University, Newark) Science (ISSN 0036-8075), vol. 231, Feb. 28, 1986, p. 943-950. refs

The development of integrated computer networks for scientific computing and communications applications is described. Emphasis is given to efforts by the NASF Office of Advanced Scientific Computing (OASC) to develop a national supercomputer access network called NSFnet. NSFnet will incorporate existing local computing networks and a common set of networking protocol standards, which are based on the DARPA ARPANET protocol. ARPANET is an advanced networking R&D testbed for DARPA and an operational network supporting DARPA-sponsored researchers in universities, national laboratories, and industry. Computer networking for academic institutions not participating in ARPANET is provided by BITNET, a store-and-forward network which uses standard telephone links and has a capacity of 9600 bps. Specialized wide-area networks include the Magnetic Fusion Energy Research Network (MFENET) and the UUCP network, which provides electronic mail and file transfer between graphics workstations in the UNIX BSD 4.2 operating system. The development of state-wide and campus networks to connect microcomputers to distant supercomputing facilities is also discussed. I.H.

A86-28409
ADA INSTRUCTIONAL TECHNIQUES FOR MANAGERS AND PROGRAMMERS
B. NEBEN (SofTech, Inc., Fairborn, OH) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 691-698. refs

In February 1983, the military standard for Ada was adopted as an American National Standard, and DOD intends to accelerate its use of Ada. In this context, it is estimated that at least 400,000 persons in DOD need some software engineering with Ada awareness. The objective of Ada education and training is to ensure that quality software engineering is accomplished within DOD in order to reduce the life cycle cost of software development. Attention is given to the high and escalating cost of software, the histories of Higher Order Languages (HOLs) and differences related to Ada, software engineering issues, aspects of program construction, the transition to Ada and the need to use a special approach when teaching Ada, traditional software coding, the development of a complete recommended Ada curriculum, and the U.S. Army Model Ada Training Curriculum which defines a comprehensive set of training modules. G.R.

A86-28415
SOFTWARE QUALITY AND SOFTWARE PRODUCTIVITY
J. TSAI (Boeing Computer Services Co., Professional Services Group, Renton, WA) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 734-737. USAF-supported research. refs

The use of software quality metrics technology may permit an improved software products quality and lower its life-cycle costs. A software quality model was established in which hierarchical, user-oriented quality factors are at the top level, with more software-oriented criteria and metrics at the second and third levels, respectively. Metrics worksheets were designed for use in gathering the metrics data. Actual project data were gathered, and the resultant metrics data were analyzed. The reusability quality factor was evaluated on four major projects. Productivity figures from the projects were used to estimate the effort spent to reuse software; and good correlation between these productivity measures and system reusability metric scores were obtained. The effects of software quality on the software development are further analyzed. In conclusion, following the quality metrics methodology may not only reduce future software maintenance costs and produce better software products, but it can also improve software development productivity. Author

A86-28416
SOFTWARE AUTOMATION
W. J. BROWNLOW and J. R. ELSTON (Boeing Aerospace Co., Seattle, WA) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 738-744.

On the basis of trends regarding software supply and demand conditions, it appears imperative to implement overall software productivity improvement programs. Such programs are now needed by DOD and defense contractors. In this context, efforts should be undertaken to reduce the amount of manual involvement in the development of software. Improvements are needed with respect to the standardization of the development effort, the expanded use of automation, rapid prototyping, the employment of reusable software, and increased quality. An initiative established by senior management of an American aerospace company commits this company to a ten year program with the objective to increase productivity in the development of mission-critical and related software. A description is given of an automated software engineering (base) project. G.R.

A86-28422#
PLANNING FOR COST/SCHEDULE CONTROL IN A SOFTWARE DEVELOPMENT PROJECT
O. MACK, JR. (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 778-785. refs

The transition from an estimate of the size, cost, and schedule of a software development project to a manageable contract is examined with reference to a case study of a hypothetical company's proposal. The discussion covers the implications of the Cost/Schedule Control Systems Criteria and the impacts of the Price-S and COCOMO models. The processes presented here are based on the experiences of many current avionics software projects. V.L.

A86-28423
A SOFTWARE MANAGEMENT TOOL
H. VILLARREAL, JR. (Honeywell, Inc., Minneapolis, MN) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 786-793.

This paper describes a software management tool that enhances the Software Engineering Manager's ability to properly plan and control a software development project and properly report its progress. This tool has evolved as a result of experience on the Air Data, Fuel Quantity Indicating System and 737 IRS Digital-to-Analog Adapter projects at Honeywell's Commercial Aviation Division. The software management tool is: (1) easily automated using a microcomputer and modern spreadsheet program, (2) flexible for easy modification as it evolves during the project, and (3) readily adaptable to other types of development projects. Author

A86-28424
A NEW PERSPECTIVE ON SOFTWARE MANAGEMENT
K. B. HAWKS (General Electric Co., Aerospace Electronic Systems Dept., Utica, NY) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 794-797.

Typical problems associated with software development management are briefly reviewed, and an approach is proposed whereby software is viewed as a continuum of development. The allocation of requirements to software from overall system perspective, systems analysis, software scheduling, software design and coding, software testing, and maintenance are then discussed from the standpoint of the continuum concept. It is shown that the application of the continuum concept can significantly reduce the cost of software development and maintenance, while increasing its reliability. V.L.

A86-28425
SOFTWARE MANAGEMENT FOR INTEGRATED AVIONICS SYSTEMS
K. C. EDWARDS (Harris Corp., Government Aerospace Systems Div., Melbourne, FL) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 798-805. refs

Software engineering methodologies providing the level of control necessary to achieve cost effective software development for an integrated avionics software system are discussed with particular reference to the integrated software system for the

Agusta A-129 Light Attack Helicopter. The high level of control is required to maintain the functional independence of the different software elements (e.g., Automated Flight Controls, Engine Monitor, Operator Interface, Navigation, and others) in order to avoid unnecessary couplings that will drive the cost of the system development and maintenance up while reducing the reliability of the system. As a result of an implementation of this approach, the software development costs for the Agusta A-129 project have been comparable to less complex ground-based systems. V.L.

A86-28427
A PROVEN SOFTWARE PROJECT AUDIT METHODOLOGY
M. C. BRIDGES (General Dynamics Corp., St. Louis, MO) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 822-825. refs

Information is presented on how to conduct a software audit and report the current status and effectiveness of a software development project. Some of the more commonly observed problems in software development are outlined, and four sub-audit categories are described, including documentation audit, in-depth examination of software configuration management activities, evaluation of the code mechanization process, and assessment of the effectiveness of test planning and implementation. A schedule of a software audit and a sample report are described. The information presented in this paper can be used as a guide in performing a comprehensive yet concise software audit at any stage of software development. V.L.

A86-28482
THE ENGINEERING DATA MANAGEMENT AND ANALYSIS SYSTEM (EDMAS)
T. W. LEZNIAK (Boeing Military Airplane Co., Wichita, KS) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 2 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1277-1284. USAF-supported research.

A large (several tens of thousands of program statements), integrated collection of computer programs, written primarily in Fortran 77, has been developed in connection with a program to flight test the Offensive Avionics Systems Block 0 improvements to the B-52 aircraft. This Engineering Data Management and Analysis System (EDMAS) was needed to provide timely data analysis when the testing schedule was accelerated to as many as three flights per week. The system turnaround interval from the time a routine data product is requested until it is recieved is less than 30 minutes. Primary functions are performed interactively with the user at a computer terminal. A library of general-purpose analysis programs is provided. Author

A86-28578* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHUTTLE ENVIRONMENT DATABASE
M. LAURIENTE (NASA, Goddard Space Flight Center, Greenbelt, MD) and G. W. SHARP (Eyring Research Institute, Provo, UT) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 25-36.
(AAS 85-103)

The proceedings of a workshop on the development of a data base for the Space Shuttle environment are summarized. The data base is intended for use by experimenters in designing scientific payloads for Shuttle missions. The status of currently available data on the Shuttle environment is reviewed, with emphasis given to ten specific topics which are believed to be of concern to Shuttle experiment designers. These topics include: flight dynamics, vibration and acoustics, orbiter motion effects, EMI, and thermal and humidity effects. Attention is also given to: the Shuttle particulate environment; surface interactions inside and on the exterior of the spacecraft, and the natural Shuttle environment. Recent experimental results concerning Vehicle Glow on the spacecraft surface material are discussed in detail. A schematic diagram describing the functional organization of computer hardware for the Shuttle environment data base is provided. I.H.

A86-34981
INFORMATION SYSTEMS IN SPACE
D. S. WEHRLY (IBM Corp., Endicott, NY) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 9-11 to 9-13.

The application of information management techniques to space is proposed. Examples of ground-based industrial information systems are described. The development of space information system from existing ground-based designs, and the formation of a space-earth interface are examined. I.F.

A86-35657
ESTABLISHING SOFTWARE QA - AN EXERCISE IN FRUSTRATION
K. W. FROBERG (Bell Helicopter Textron, Fort Worth, TX) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 769-775. refs

A discussion is presented on experience obtained to date concerning the establishment of Software Quality Assurance (SQA) disciplines in new computer software-related ventures. Attention is given to guidelines established for the organization of personnel recruitment and the apportionment of responsibilities. SQA policies and procedures are outlined which may result in the prevention of serious cost and schedule overruns in software development efforts. O.C.

A86-38807#
ASTROS - AN ADVANCED SOFTWARE ENVIRONMENT FOR AUTOMATED DESIGN
D. L. HERENDEEN, R. L. HOESLY (Universal Analytics, Inc., Playa del Rey, CA), E. H. JOHNSON (Northrop Corp., Hawthorne, CA), and V. B. VENKAYYA (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) IN: Structures, Structural Dynamics and Materials Conference, 27th, San Antonio, TX, May 19-21, 1986, Technical Papers. Part 1 . New York, American Institute of Aeronautics and Astronautics, 1986, p. 59-66. refs
(Contract F33615-83-C-3232)
(AIAA PAPER 86-0856)

The 'ASTROS' Automated Structural Optimization System combines a general purpose executive, a scientific data base management system, and a problem-oriented control language into a powerful and flexible tool for the design of engineering application software. The primary function of such software is the integration of specific functional modules from existing sources into a cohesive system for automated aerospace structure design; this encompasses, in addition to finite element methods, static and dynamic structural characteristics, aerodynamics, sensitivity analysis, optimization, and control systems. O.C.

A86-38868#
INTEGRATED STRUCTURAL ANALYSIS FOR RAPID DESIGN SUPPORT
D. G. WONG and C. R. FULLER (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Structures, Structural Dynamics and Materials Conference, 27th, San Antonio, TX, May 19-21, 1986, Technical Papers. Part 1 . New York, American Institute of Aeronautics and Astronautics, 1986, p. 638-645. refs
(AIAA PAPER 86-1010)

A system incorporating the latest developments in computer hardware and software has been implemented for the design support of advanced launch vehicle programs. The system requirements, hardware, and system and application software attributes are discussed in detail, and evidence demonstrating the effectiveness of the integrated structural analysis system is presented. The discussion includes a specific list of equipment, network communication links, system architecture, codings standards, and data structures for application software. The system has been operating successfully for two years. V.L.

A86-40845

ARTIFICIAL INTELLIGENCE APPLICATIONS ON SUPERCOMPUTERS

R. J. DOUGLASS (Martin Marietta Corp., Denver, CO) Telematics and Informatics (ISSN 0736-5853), vol. 2, no. 4, 1985, p. 289-292. DOE-sponsored research. refs

In contrast to many scientific applications that perform computations on fixed-size arrays, symbolic programs process complex data structures represented as lists, sets, and graphs that are allocated and deallocated in a variable pattern during execution. Much of the processing in symbolic computation involves following linked lists by tracing chains of pointers through scattered locations in memory. Execution speeds for single serial processors are therefore limited by the time it takes to make random retrievals of individual words of data from memory. Author

A86-43905

THE IMPACT OF FIFTH GENERATION TECHNOLOGY ON TEST SOFTWARE

R. P. PATROVIC (Grumman Aerospace Corp., Bethpage, NY) IN: AUTOTESTCON '85; Proceedings of the International Automatic Testing Conference, Uniondale, NY, October 22-24, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 432-445. refs

Major advances in technology are occurring at a geometric rate. The so called 'Fifth Generation' will see superfast systems with new and very divergent architectures, at the heart of which will be highly dense chips of greater than one million semiconductors. Programming these systems and testing UUTs that incorporate this technology will become an increasingly complex challenge. A greater emphasis and reliance will be placed on software: concurrent programming, efficient algorithm development, and Artificial Intelligence. This paper discusses some of the implications Fifth Generation technology is having and will have on test software, both at the application level and at the system level. Author

A86-45470

ADVANCES IN SOFTWARE INSPECTIONS

M. E. FAGAN (IBM Thomas J. Watson Research Center, Yorktown Heights, NY) IEEE Transactions on Software Engineering (ISSN 0098-5589), vol. SE-12, July 1986, p. 744-751. refs

This paper presents new studies and experiences that enhance the use of the inspection process and improve its contribution to development of defect-free software on time and at lower costs. Examples of benefits are cited followed by descriptions of the process and some methods of obtaining the enhanced results. Software inspection is a method of static testing to verify that software meets its requirements. It engages the developers and others in a formal process of investigation that usually detects more defects in the product - and at lower cost - than does machine testing. Users of the method report very significant improvements in quality that are accompanied by lowwer development costs and greatly reduced maintenance efforts. Excellent results have been obtained by small and large organizations in all aspects of new development as well as in maintenance. There is some evidence that developers who participate in the inspection of their own product actually create fewer defects in future work. Because inspections formalize the development process, productivity and quality enhancing tools can be adopted more easily and rapidly. Author

A86-46104

PLANNING DESIGN AND IMPLEMENTATION OF A STATEWIDE GEOGRAPHIC INFORMATION SYSTEM

G. S. SMITH and W. G. HENDRIX (Vermont, University, Burlington) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 576-584.

The planning, design, and implementation of a geographically referenced database are described. A geographic information system (GIS) is designed to store, retrieve, manipulate, analyze, and display spatial data; the advantages of a GIS are discussed. The procedures involved in the design of a GIS are: (1) an analysis of the information needs, (2) the categorization and evaluation of existing databases, (3) the specifications of the new database to be developed, (4) the selection of the system's hardware and software, and (5) the development of an implementation plan. The selection of data layers, base map parameters, and a georeferencing system is examined. Methods of data entry such as manual digitizing, raster scanning or video digitizing, the incorporation of existing computer data, and image processing are studied. A GIS for the state of Vermont with a database consisting of seven data layers (soil maps, land cover, transportation networks, political boundaries, stream and river courses, topography and watershed) was developed. I.F.

A86-46952#

AN OPERATIONS MANAGEMENT SYSTEM FOR THE SPACE STATION

H. G. ROSENTHAL (TRW, Inc., Redondo Beach, CA) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 10 p.
(AIAA PAPER 86-2329)

This paper presents an overview of the conceptual design of an integrated onboard Operations Management System (OMS). Both hardware and software concepts are presented and the integrated space station network is discussed. It is shown that using currently available software technology, an integrated software solution for Space Station management and control, implemented with OMS software, is feasible. Author

A86-49488* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TOWARDS A SCIENCE OF EXPERT SYSTEMS

P. J. DENNING (NASA, Ames Research Center, Moffett Field, CA) IEEE Expert (ISSN 0885-9000), vol. 1, Summer 1986, p. 80-83. refs
(Contract NAS2-11530)

Developments in the field of AI are discussed. The components and applications of expert systems, which are computer systems designed to simulate the problem-solving behavior of a person expert in a narrow field, are examined. Two types of expert systems, shallow and deep, are described and examples are given. A logic programming system, rule-based system, and framed-based system are utilized as means of representing the expert system's data base. The limitations of expert systems are considered. I.F.

A86-49552*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AUTOMATION AND ROBOTICS FOR SPACE STATION IN THE TWENTY-FIRST CENTURY

K. F. WILLSHIRE (NASA, Langley Research Center, Hampton, VA) and D. L. PIVIROTTO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 7 p. refs
(AIAA PAPER 86-2300)

Space Station telerobotics will evolve beyond the initial capability into a smarter and more capable system as we enter the twenty-first century. Current technology programs including several proposed ground and flight experiments to enable development of this system are described. Advancements in the areas of machine vision, smart sensors, advanced control architecture, manipulator joint design, end effector design, and artificial intelligence will provide increasingly more autonomous telerobotic systems. Author

A86-49872
THE RIGHT STUFF
J. S. ZIMMERMAN (OAO Corp., Hampton, VA) Datamation (ISSN 0011-6963), vol. 32, Jan. 15, 1986, p. 75-80.
Some of the lessons learned from working on the development of the software system for NASA's Earth Radiation Budget Experiment are discussed. The design strategy finally adopted during the system development included phased system releases, the use of rapid prototyping, and continuous and readily accepted changes in system specification. Based on the experience gained in the course of development, 16 recommendations are offered for future workers in the software development for projects of similar complexity. I.S.

A86-50280
FIFTH GENERATION COMPUTERS: CONCEPTS, IMPLEMENTATIONS AND USES
P. BISHOP (Peter Bishop Associates, Richmond, England) Chichester, England/New York, Ellis Horwood, Ltd./John Wiley and Sons, 1986, 166 p. refs
The advanced computers, incorporating artificial-intelligence and parallel-processing technologies, which are being developed in Japan, the U.S., and Europe for the 1990s are characterized in an introductory survey intended for students and users of information technology. Topics examined include artificial intelligence, fifth-generation programs, overall architectures, hardware, software engineering, programming languages, and intelligent knowledge-based systems. Consideration is given to intelligent user interfaces; the economic and military impact of fifth-generation computers; and their potential industrial, military, commercial, design, and educational applications. Diagrams, flow charts, sample command sequences, and a glossary of terms are provided. T.K.

N86-10841# Los Alamos Scientific Lab., N. Mex.
FRAMEWORK FOR GENERATING EXPERT SYSTEMS TO PERFORM COMPUTER SECURITY RISK ANALYSIS
S. T. SMITH and J. J. LIM 1985 8 p Presented at the 1st Ann. AFCEA Symp. and Exposition on Phys. and Electron. Security, Philadelphia, 19 Aug. 1985
(Contract W-7405-ENG-36)
(DE85-014134; LA-UR-85-1933; CONF-850885-2) Avail: NTIS HC A02/MF A01
A framework to generate knowledge based expert systems for performing automated risk analyses upon a subject system was developed. The expert system is a computer program that models experts' knowledge about A topic, including facts, assumptions, insights, and decision rationale. The subject system is a member of the class of systems with three identifying characteristics: (1) a set of desirable assets (or targets); (2) a set of adversaries (or threats) desiring to obtain or to do harm to the assets; and (3) a set of protective mechanisms to safeguard the assets from the adversaries. Risk analysis evaluates both vulnerability to and the impact of successful threats against the targets by determining the overall effectiveness of the subject system safeguards, identifying vulnerabilities in that set of safeguards, and determining cost effective improvements to the safeguards. The inherent vulnerabilities and risks in a system of computer security safeguards are evaluated. The method considers safeguards protecting four generic targets. The automated procedure to assess the effectiveness of computer security safeguards differs from traditional risk analysis methods. DOE

N86-13224*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA NEWS RELEASES AND SPEECHES, 1984
1985 163 p
(NASA-TM-87514; NAS 1.15:87514) Avail: NTIS HC A08/MF A01 CSCL 05B
The Index to NASA News Releases and Speeches (1984) contains selected speeches and news releases issued by NASA Headquarters during the year 1984. The index was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautical and Space Administration by PRC Government Information Systems. F.M.R.

N86-15171*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
TECHNICAL AND MANAGEMENT INFORMATION SYSTEM: THE TOOL FOR PROFESSIONAL PRODUCTIVITY ON THE SPACE STATION PROGRAM
G. MONTOYA and P. BOLDON *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 149-164 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
The Space Station Program is highly complex not only in its technological goals and requirements but also in its organizational structure. Eight Contractor teams supporting four NASA centers plus Headquarters must depend on effective exchange of information--the lifeblood of the program. The Technical and Management Information System (TMIS) is the means by which this exchange can take place. Value of the TMIS in increasing productivity comes primarily from its ability to make the right information available to whomever needs it when it is needed. Productivity of the aerospace professional and how it can be enhanced by the use of specifically recommended techniques and procedures for information management using the TMIS are discussed. Author

N86-15173*# Mitre Corp., Houston, Tex.
COMPUTER SYSTEMS MEASURES
F. T. CRUCIAN *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 177-191 1985
Avail: NTIS HC A25/MF A01 CSCL 09B
In determining the productivity of a computing capacity, two of the costs to be considered are: the cost of lost productivity (user lost time) due to inadequate computer resources; and the cost of increasing the capacity of the computer system to reduce user's lost time. This document presents the results of a study conducted at NASA/JSC. The purpose of the study was to relate the cost of users' lost time to the cost of increased computer resources. The goal of the study was to identify the overall least cost to the computing facility. The document describes a survey designed to identify the user's lost time and the computer resource requirement to the reduce lost time. The results of the survey are presented showing the trade off between user's lost time and cost of increasing system capacity. Author

N86-15174*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
OFFICE AUTOMATION: THE ADMINISTRATIVE WINDOW INTO THE INTEGRATED DBMS
G. H. BROCK *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 192-201 1985
Avail: NTIS HC A25/MF A01 CSCL 05B
In parallel to the evolution of Management Information Systems from simple data files to complex data bases, the stand-alone computer systems have been migrating toward fully integrated systems serving the work force. The next major productivity gain may very well be to make these highly sophisticated working level Data Base Management Systems (DMBS) serve all levels of management with reports of varying levels of detail. Most attempts by the DBMS development organization to provide useful information to management seem to bog down in the quagmire of

competing working level requirements. Most large DBMS development organizations possess three to five year backlogs. Perhaps Office Automation is the vehicle that brings to pass the Management Information System that really serves management. A good office automation system manned by a team of facilitators seeking opportunities to serve end-users could go a long way toward defining a DBMS that serves management. This paper will briefly discuss the problems of the DBMS organization, alternative approaches to solving some of the major problems, a debate about problems that may have no solution, and finally how office automation fits into the development of the Manager's Management Information System. Author

N86-15180*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SOFTWARE PRODUCTIVITY IMPROVEMENT THROUGH SOFTWARE ENGINEERING TECHNOLOGY
F. E. MCGARRY *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 249-263 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 09B

It has been estimated that NASA expends anywhere from 6 to 10 percent of its annual budget on the acquisition, implementation and maintenance of computer software. Although researchers have produced numerous software engineering approaches over the past 5-10 years; each claiming to be more effective than the other, there is very limited quantitative information verifying the measurable impact that any of these technologies may have in a production environment. At NASA/GSFC, an extended research effort aimed at identifying and measuring software techniques that favorably impact productivity of software development, has been active over the past 8 years. Specific, measurable, software development technologies have been applied and measured in a production environment. Resulting software development approaches have been shown to be effective in both improving quality as well as productivity in this one environment. Author

N86-15183*# Arizona State Univ., Tempe. School of Public Affairs.
INFORMATION FLOW AND WORK PRODUCTIVITY THROUGH INTEGRATED INFORMATION TECHNOLOGY
R. T. WIGAND *In* NASA. Johnson (Lyndon B.) R and D Productivity: New Challenges for the US Space Program p 289-309 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05B

The work environment surrounding integrated office systems is reviewed. The known effects of automated office technologies is synthesized and their known impact on work efficiency is reviewed. These effects are explored with regard to their impact on networks, work flow/processes, as well as organizational structure and power. Particular emphasis is given to structural changes due to the introduction of newer information technologies in organizations. The new information technologies have restructed the average organization's middle banks and, as a consequence, they have shrunk drastically. Organizational pyramids have flattened with fewer levels since executives have realized that they can get ahold of the needed information via the new technologies quicker and directly and do not have to rely on middle-level managers. Power shifts are typically accompanied with the introduction of these technologies resulting in the generation of a new form of organizational power. B.W.

N86-18246# Oak Ridge National Lab., Tenn.
INFORMATION SYSTEMS DEVELOPMENT AIDS
M. L. EMRICH and R. BRYANT Aug. 1985 117 p
(Contract DE-AC05-84OR-21400)
(DE85-018161; ORNL/TM-9647) Avail: NTIS HC A06/MF A01

Information engineers use a variety of techniques, procedures and methodologies to specify, design, program, test, and maintain Information Systems. Various automated tools are available for assisting the information engineer in this work. This document seeks to provide a general overview of the development life-cycle process and of tools available for assisting in that process. DOE

N86-19022*# Maryland Univ., College Park. Dept. of Computer Science.
QUANTITATIVE EVALUATION OF SOFTWARE METHODOLOGY
V. R. BASILI Jul. 1985 22 p
(Contract NSG-5123; F49620-80-C-0001)
(NASA-CR-176522; NAS 1.26:176522; AD-A160202; CS-TR-1519; AFOSR-85-0803TR) Avail: NTIS HC A02/MF A01 CSCL 09B

This paper presented a paradigm for evaluating software development methods and tools. The basic idea is to generate a set of goals which are defined into quantifiable questions which specify metrics to be collected on the software development and maintenance process and product. These metrics can be used to characterize, evaluate, predict and motivate. They can be used in an active as well as passive way by learning from analyzing the data and improving the methods and tools based upon what is learned from that analysis. Several examples were given representing each of the different approaches to evaluation. Author (GRA)

N86-19251# Sandia National Labs., Albuquerque, N. Mex.
ESTABLISHING A SUCCESSFUL MANAGEMENT INFORMATION SYSTEM FOR PROJECT MANAGEMENT
D. M. JOHNSTON 1985 8 p Presented at the Project Management Institute Seminar, Denver, Colo., 7 Oct. 1985
(Contract DE-AC04-76DP-00789)
(DE85-018543; SAND-84-2401C; CONF-8510154-2) Avail: NTIS HC A02/MF A01

This paper presents the process we followed to achieve a successful management information system. Like many other organizations who decide to utilize a computer system to provide usable management information to aid in decision making, we found ourselves instead entangled in myriad of data items and details and complex and convoluted software programs, but no achievement of any management information, i.e., that which could be applied to aid in decision making. Since I have observed that this condition occurs in many organizations, our experience may provide insight to others struggling with nonexistent or cumbersome management information systems and guide them in the formulation of an effective MIS. DOE

N86-19630# Lehigh Univ., Bethlehem, Pa. Inst. for Robotics.
ROBOT SOFTWARE: CURRENT STATE-OF-THE-ART, AND FUTURE CHALLENGES
R. N. NAGEL and S. R. GARRIGAN *In* AGARD Artificial Intelligence and Robotics 9 p Sep. 1985
Avail: NTIS HC A07/MF A01

Robot software system and their complexity currently are growing at an incredible rate. A complexity hierarchy covering the simplest methods of robot programming up through first and second generation robot programming languages is defined. Methods o' graphical robot programming are described, and an assessment is made of the current state of the art of robotic software systems. The next generation of robot software systems which will be task level languages is described. That is, the elements of the programming language will be statements of tasks to be accomplished rather than statements with regard to robot motions. Technical challenges in achieving task level languages and current research approaches to overcoming these challenges are also described. Author

N86-19955# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.
COMPUTER TECHNIQUES FOR PRODUCING COLOR MAPS Final Report
A. N. WILLIAMSON, JR. Aug. 1985 43 p Original contains color illustrations
(Contract DA PROJ. 4A1-62719-AT-40)
(AD-A161159; WES/MP/GL-85-13) Avail: NTIS HC A03/MF A01 CSCL 08B

This report discusses a technique for encoding maps in a manner that permits rapid production of window maps and color separations. The discussion includes a description of equipment, data processing procedures, and an example of their use for verifying quantitative terrain information for input to an analytical model. A derivation used to portray the output of the Army Mobility Model as a vehicle performance map is described in an appendix. Author (GRA)

N86-19965*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF SOFTWARE VERIFICATION TECHNIQUES
Apr. 1985 116 p refs
(NASA-TM-88585; NAS 1.15:88585; SEL-85-001) Avail: NTIS HC A06/MF A01 CSCL 09B

A controlled experiment performed by the Software Engineering Laboratory (SEL) to compare the effectiveness of code reading, functional testing, and structural testing as software verification techniques is described. The experiment results indicate that code reading provides the greatest error detection capability at the lowest cost, whereas structural testing is the least effective technique. The experiment plan is explained, the experiment results are described, related results from other studies are discussed. The application of these results to the development of software in the flight dynamics environment is considered. Appendices summarize the experiment data and list the test programs. Author

N86-19966*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOFTWARE VERIFICATION AND TESTING
Dec. 1985 65 p refs
(NASA-TM-88587; NAS 1.15:88587; SEL-85-005) Avail: NTIS HC A04/MF A01 CSCL 09B

General procedures for software verification and validation are provided as a guide for managers, programmers, and analysts involved in software development. The verification and validation procedures described are based primarily on testing techniques. Testing refers to the execution of all or part of a software system for the purpose of detecting errors. Planning, execution, and analysis of tests are outlined in this document. Code reading and static analysis techniques for software verification are also described. Author

N86-22168# Defense Systems Management School, Fort Belvoir, Va.
ARTIFICIAL INTELLIGENCE AND ITS USE IN COST TYPE ANALYSES WITH AND EXAMPLE IN COST PERFORMANCE MEASUREMENT
B. BERKOWITZ 1985 40 p Presented at the Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161817) Avail: NTIS HC A03/MF A01 CSCL 14A

With the advent of ARTIFICIAL INTELLIGENCE (AI), we are entering into a new age of man/machine/software combined effectiveness. AIL offers us, not only, user friendly application packages and interfaces, but a major boost in our effectiveness planes. The user friendliness is one aspect of AI, but there are other elements that make this technology a major extension of the human mind. This paper will explore just two applications and their use in the analysis world. The first aspect examined is: user friendliness. The other aspect discussed is expert systems. GRA

N86-23315*# National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION: THE ROLE OF SOFTWARE
D. HALL *In* NASA. Langley Research Center Space Station Software Recommendations p 3-38 Dec. 1985
Avail: NTIS HC A07/MF A01 CSCL 09B

Software will play a critical role throughout the Space Station Program. This presentation sets the stage and prompts participant interaction at the Software Issues Forum. The presentation is structured into three major topics: (1) an overview of the concept and status of the Space Station Program; (2) several charts designed to lay out the scope and role of software; and (3) information addressing the four specific areas selected for focus at the forum, specifically: software management, the software development environment, languages, and standards. NASA's current thinking is highlighted and some of the relevant critical issues are raised. Author

N86-24278# Administrative Sciences Corp., Alexandria, Va.
RISK ASSESSMENT PREPROCESSOR (RAPP)
C. HAMMON, J. AUGUSTA, and S. FITZGERALD 1985 14 p Presented at the 19th Annual Dept. of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161914) Avail: NTIS HC A02/MF A01 CSCL 09B

The Navy's Office for Acquisition Research tasked Administrative Sciences Corporation to develop a management oriented procedure to simplify the selection of the most appropriate risk assessment technique(s) so that project managers will use them to improve management of their programs. Under this tasking the different techniques available for risk assessment were examined and it was concluded that network simulation is both cost effective and feasible for use in almost all acquisition programs. As a result of a critical review of the existing procedures and available software packages, it was concluded that front-end help in getting started was necessary - specifically, assistance in network creation and data preparation and input. The risk assessment preprocessor (RAPP) was created to provide this help. The RAPP is a computer-based procedure for simplifying the process of creating networks and preparing the data for use with a network simulator. RAPP is interactive, easy to use software which will help the user create a network of program activities and input distribution parameters. It does not actually do the risk assessment. The RAPP's output is a data file which is input to one of the several currently available network simulators. It is a tool that makes risk assessment using Monte Carlo simulation easier and less expensive because it reduces the need for senior analysts to structure the network and prepare the data file for input to a risk assessment package. The RAPP allows risk assessment to be used more easily as a tool for project management. GRA

N86-24285# Lawrence Livermore National Lab., Calif.
PASSCAL FIELD DATA MANAGEMENT PLAN (PFDMP)
J. SCHEIMER, G. PAVLIS, D. BLANKENSHIP, R. PHINNEY, S. MALONE, B. KARSH, C. JOHNSON, and W. PROTHERO Aug. 1985 28 p
(Contract W-7405-ENG-48)
(DE86-003192; UCID-20575) Avail: NTIS HC A03/MF A01

The PFDMP is the official planning document for PASSCAL in the area of field data management. It is to be revised and updated from time to time to reflect up-to-date status of the effort. This planning document is concerned less with hardware than with the functional requirements for the field computer systems. Given the rapid changes now happening in the technology of microcomputers and peripherals, it may be safety assumed that systems procured at diferent times will involve different vendors and have different capabilities, costs and specifications. A salient goal is to define the software and database environments with enough flexibility to allow these different models of field computers to function well in the overall data management environment. DOE

N86-24737*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A COMPUTER MODELING METHODOLOGY AND TOOL FOR ASSESSING DESIGN CONCEPTS FOR THE SPACE STATION DATA MANAGEMENT SYSTEM
W. R. JONES Apr. 1986 45 p refs
(NASA-TM-87647; NAS 1.15:87647) Avail: NTIS HC A03/MF A01 CSCL 22B

A computer modeling tool is being developed to assess candidate designs for the Space Station Data Management System (DMS). The DMS is to be a complex distributed computer system including the processor, storage devices, local area networks, and software that will support all processing functions onboard the Space Station. The modeling tool will allow a candidate design for the DMS, or for other subsystems that use the DMS, to be evaluated in terms of parameters. The tool and its associated modeling methodology are intended for use by DMS and subsystem designers to perform tradeoff analyses between design concepts using varied architectures and technologies. Author

N86-25999# Stanford Univ., Calif. Dept. of Statistics.
DATA BASE MANAGEMENT: PROCEEDINGS OF A CONFERENCE
31 Jul. 1985 307 p refs Conference held in Monterey, Calif., 1-2 Nov. 1984
(Contract N00014-76-C-0476; NR PROJ. 042-267)
(AD-A158285) Avail: NTIS HC A14/MF A01 CSCL 09B

Data base management systems were discussed. Topics included data base organization for statistical analysis; machine learning; information retrieval; information management; and computer architecture.

N86-26005# Pacific Northwest Labs., Richland, Wash.
MANAGING THE DATA ANALYSIS PROGRESS
W. L. NICHOLSON, P. J. COWLEY, D. B. CARR, and M. A. WHITING *In* Stanford Univ. Data Base Management p 141-166 31 Jul. 1985 refs
Avail: NTIS HC A14/MF A01 CSCL 09B

Advances in statistical computing allowed data analyses to handle increasingly complex problems. The complex data analyses that are required with complex problems proliferate derived data structures and create evolving analysis states. A system that helps the data analyst manage the analysis process through use of data analysis save-states was designed. The system also makes use of graphical interaction, provides organization of command logs and encourages extensive annotation. It is clear that this collaborative effort of data analysts and computer scientists is making progress toward freeing the data analyst from much mundane, but necessary, organization bookkeeping. Author

N86-26006# Computer Horizons, Inc., Cherry Hill, N. J.
LINKING SCIENCE, TECHNOLOGY AND ECONOMICS DATA
F. NARIN *In* Stanford Univ. Data Base Management p 167-214 31 Jul. 1985 refs
Avail: NTIS HC A14/MF A01 CSCL 09B

Some of the state-of-the-art of linking science, technology and economics data are summarized. The linkage between technology and science is analyzed by analyzing the citations (references). It is concluded that: (1) funds and scientific publication are tightly linked at national and institutional levels; (2) cross-national, cross-institutional, geographic and subject-to-subject science linkages are quantifiable and mappable and reveal that the spectrum of activity from funds, to pubs, to patents, to productivity is reflected in highly correlated statistics; (3) citations from patents to papers document a close day-to-day relationship between science and technology; (4) the science used by patented technology is very recent - implying little or no lag between discovery and utilization; and (5) technology, like science, may be driven by a small number of key highly cited events. Author

N86-26007# Institute for Scientific Information, Inc., Philadelphia, Pa.
THE WORLD BRAIN TODAY: SCIENTOGRAPHIC DATABASES. WHAT ARE THEY, HOW ARE THEY CREATED AND WHAT ARE THEY USED FOR?
G. VLADUTZ *In* Stanford Univ. Data Base Management p 215-299 31 Jul. 1985 refs
Avail: NTIS HC A14/MF A01 CSCL 09B

The creation of automatized intelligent systems which could contribute to increasing the overall productivity of scientific research requires knowledge representation tools of global scale. The automatic compilation from existing databases of an intermediary type of knowledge representation is proposed in the form of a detailed concept dependency diagram of global scope. The relationships are outlined between concept dependency diagrams and detailed knowledge representations based on predicate calculus language and full formalization. The efforts aimed at the representation of the structure of scientific fields, mainly on the basis of citation data, are reviewed. The prospects for the development of related methods for the computerized compilation of regional and global concept maps in the form of concept dependency diagrams are discussed. Author

N86-26241# National Bureau of Standards, Gaithersburg, Md. Center for Programming Science and Technology.
GUIDE ON SELECTING ADP (AUTOMATIC DATA PROCESSING)BACKUP PROCESSING ALTERNATIVES Final Report
I. E. ISAAC Nov. 1985 43 p refs
(PB86-154820; NBS/SP-500/134; LC-85-600618) Avail: NTIS HC A03/MF A01; also available SOD HC $1.75 as SN003-003-02701-4 CSCL 05A

The publication addresses the issue of selecting ADP backup processing support in advance of events that cause the loss of data processing capability. The document emphasizes the need for managers at all levels of the organization to support the planning, funding, and testing of an alternate processing strategy. It provides a general description of the alternatives, and recommends criteria for selecting the most suitable alternate processing method. GRA

N86-27121# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND ANALYSIS OF A NETWORK INTERFACE FOR THE MULTI-LINGUAL DATABASE SYSTEM M.S. Thesis
C. R. WORTHERLY Dec. 1985 127 p
(AD-A164756) Avail: NTIS HC A07/MF A01 CSCL 09B

Traditionally, the design and implementation of a conventional database system begins with the choice of a data model followed by the specifications of a model-based data language. Thus, the database system is restricted to a single data model and a specific data language. An alternative to this traditional approach to database-system development is the multi-lingual database system (MLDS). This alternative approach affords the user the ability to access and manage a large collection of databases, via several data models and their corresponding data languages, without the aforementioned restriction. In this thesis, we present a methodology for supporting network (CODASYL) database management on the MLDS. Specifically, we design an interface which translates CODASYL-DML statements into ABDL requests. We describe the data structures, the control mechanisms, and the functions/procedures necessary to implement such a system. GRA

N86-28067# Mitre Corp., McLean, Va.
PROCEDURES FOR CAUSE ORIENTED ANALYSIS AND CONSEQUENCE ORIENTED ANALYSIS
A. L. MCFARLAND, Y. S. HOH, and G. A. DORFMAN Jun. 1986 26 p
(Contract DTFA01-84-C-0001)
(DOT/FAA/PM-86/21) Avail: NTIS HC A03/MF A01

Cause and consequence oriented analyses are techniques for safety analysis of software. They are particularly important for analyzing software whose inadequate performance could result in hazard to life or property. This report presents procedures for performing these analyses. Author

N86-28628*# National Aeronautics and Space Administration, Washington, D.C.
NASA SUPERCOMPUTER SYSTEM TO BECOME AVAILABLE NATIONALLY
D. J. RAHN and P. W. WALLTER (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.) 21 Jul. 1986 2 p
(NASA-NEWS-RELEASE-86-92; P86-10152) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8752, B.W.I. Airport, Md. 21240 CSCL 09B

The most powerful supercomputer facility in the world, the Numerical Aerodynamic Simulation (NAS) system, will go on-line to scientists and engineers throughout the country on July 21, 1986. The NAS supercomputer complex will be linked with 27 remote locations across the country through a combination of high-speed terrestrail and satellite links. The Cray-2 supercomputer was installed as the main computational engine. The NAS CRAY-2 has a 256 million word memory (largest yet available) and can perform 250 million computations a second. The next generation superfast computer currently referred to as the HSP-2 (High Speed Processor-2) is expected to perform a billion computation a second. This will bring the NAS system closer to its near-term goal of having computer with a billion word memory and computational power of 4 billion calculations a second. The NAS system will be relocated to a new computational facility in late 1986 and will be fully operational in March 1987. B.G.

N86-28694# Joint Publications Research Service, Arlington, Va.
USSR REPORT: CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY
25 Apr. 1986 62 p Transl. into ENGLISH from various Russian articles
(JPRS-UCC-86-004) Avail: NTIS HC A04/MF A01

Topics on cybernetics, computers, and automation technology include: hardware, software, applications, and education.

N86-28793# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Technical Information Panel.
THE VALUE OF INFORMATION AS AN INTEGRAL PART OF AEROSPACE AND DEFENCE R AND D PROGRAMMES
Loughton, England Jan. 1986 96 p Meeting held in Cheltenham, England, 4-5 Sep. 1985
(AGARD-CP-385; ISBN-92-835-0389-9; AD-A166641) Avail: NTIS HC A05/MF A01

The management and use of scientific and technical information in the R and D process is examined from the perspective of policy makers, program managers, and researchers. Aspects considered at the meeting included the need to incorporate information as an integral part of the R and D process, the value of information in reducing the cost and preventing the duplication of research, improvements in the sharing of information resources among the NATO countries, and requirements for the future.

N86-28794# British Aerospace Public Ltd. Co., Weybridge (England). Divisional Technical Directorate.
THE POLICY MAKER LOOKS AT INFORMATION
J. B. SCOTT-WILSON and J. P. HASINSKI *In its* The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 9 p Jan. 1986
Avail: NTIS HC A05/MF A01

The policy making heirarchy within British Aerospace is described and the information routes to and from an intermediate level policy maker (Divisional Technical Director) are examined. The information paths for two typical research projects are considered as examples: the use of aluminum/lithium alloys as structural materials and the initiation and development of a new aircraft project. Information quality and the use of automated techniques by policy makers are also discussed. M.G.

N86-28795# NATO Integrated Communications System Management Agency, Brussels (Belgium).
A PROGRAMME MANAGER'S NEEDS FOR INFORMATION
I. MASON-SMITH *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 8 p Jan. 1986
Avail: NTIS HC A05/MF A01

The underlying basis for the information need of the program manager within the NATO Integrated Communications System Agency (NICSMA) is examined in some detail, in terms of the role of that agency as exemplified by its current charter. The various specific needs of the program planner working within this framework are then identified and critically reviewed. Finally, the paper notes the expanding role of the remodelled agency (NACISA) to include the development of both communications and information systems for NATO; in this context, the urgent need to re-examine the basic information requirements of the Agency is encouraged and proposals sought. Author

N86-28796# Raitt (D. I.), Den Haag (Netherlands).
THE INFORMATION NEEDS OF SCIENTISTS AND ENGINEERS IN AEROSPACE
D. I. RAITT *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 5 p Jan. 1986
Avail: NTIS HC A05/MF A01

A brief description of a recent research project to ascertain the communication and information-seeking and use habits of scientists and engineers working in aerospace research establishments and other organizations is given. Relevant organizations studied include DFVLR, NLR, CNES and ESA. Following an overview of the basic characteristics of scientists and engineers, a review of the project's major findings as they relate to the type of information required by scientists and engineers, its availability, the sources - both oral and written - from which the information is obtained and the scientists and engineers awareness of them, how they keep up-to-date, the time spent seeking information, the use made of the library and the communication patterns of scientists and engineers, is then given. Some general suggestions for improving the communication and information flow within organizations to the satisfaction of practicing scientists and engineers are made. Author

N86-28798# Engineering Sciences Data Unit, London (England).
THE COSTS OF NOT HAVING REFINED INFORMATION
A. J. BARRETT *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 9 p Jan. 1986
Avail: NTIS HC A05/MF A01

The adequacy of the information resources, which are called upon for support at decision points in the research-design-production-marketing process, can in part be measured by their scope, the presence or absence of information within that scope and, increasingly, by the extent to which they offer refinement in terms of the timeliness and quality of the information which can be retrieved. Timeliness in the present context relates not so much to the response time of the information system as to the extent to which that system is tuned to the volatility of the information which it contains. Likewise, the quality of information is not to be judged only by its relevance and authenticity but also by the convenience of its form of presentation in the view of the decision maker who has need of it. The main focal points of the paper are the costs, disruption and other losses which arise from a lack of knowledge of previous work, the use of out-of-date technical information and, in particular, the extent to which the use of insufficiently refined numerical data leads to the under-, or over-, design of hardware. These are illustrated by a number of quantified examples. The transition from an industrially based to an information or service based society highlights the growing needs of the R&D decision maker and others for systems which will provide high quality numerical and factual data. However, substantiation of these needs may never be available in terms of evidence of direct future benefits as distinct from evidence of historic losses. More dynamic means of demonstrating the impact of information quality upon the interests of the decision maker must be devised and guidelines for two such projects are suggested. Author

N86-28799# King Research, Inc., Rockville, Md.
MEASURING THE VALUE OF INFORMATION AND INFORMATION SYSTEMS, SERVICES AND PRODUCTS
D. W. KING and J. M. GRIFFITHS *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 15 p Jan. 1986
Avail: NTIS HC A05/MF A01

An approach for measuring the value of information and information systems, services and products is presented. Results of four research projects that have measured value of recorded information used by professional such as scientists, engineers, managers, etc. are also discussed. Furthermore, data are given on the value of such systems and services as a bibliographic database of international publications, online search systems and libraries. The approach used to measure value includes several perspectives. The first perspective is what users are willing to pay for information in terms of money (if exchanged) and the price paid by users in terms of their time and effort to get and read the information. Once information is read and assimilated, there are many purposes for which it might be used such as in one's work, to educate oneself or others, to satisfy one's curiosity, etc. The consequential value resulting from information use is partially measured by the savings that are derived from information use. Higher order values are how the consequential value affects the user's organization and, in turn, society. Author

N86-28803# Fachinformationszentrum fuer Energie, Physik, Mathematik G.m.b.H., Eggenstein-Leopoldshafen (West Germany). Energy and Technology Div.

INFORMATION RESOURCES MANAGEMENT IN THE R AND D ENVIRONMENT

K. BUERK *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 4 p Jan. 1986

Avail: NTIS HC A05/MF A01

Efficient management of highly specialized information is a permanent task of optimization, whereby framework conditions may constantly change on account of various influencing factors. Owing to their special significance, the following has to be considered in particular: user needs, available resources, and information techniques. The task of optimization, due to its complexity, cannot be solved model-like, but only approximately and pragmatically. Illustrated by the example of the Federal Republic of Germany and the Fachinformationszentrum Energie Physik Mathematik (FIZ) the attempt to find a practical solution is demonstrated. In this context it is shown which role a National Information Center plays within international and national cooperation including worksharing, and how information supply and dissemination of information works in the case of central information services by FIZ, and decentral dissemination of information in research centers. Illustrated by the examples of database production, online services of bibliographic, numeric and full-text databases and the concept of the International Information Network for Science and Technology (STN International), the importance of the use of the most modern information techiques is demonstrated. Author

N86-29294*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CENTRAL ON-LINE DATA DIRECTORY

J. THIEMAN *In its* Proceedings of the Second Pilot Climate Data System Workshop 3 p 1986

Avail: NTIS HC A12/MF A01 CSCL 04B

The National Space Science Data Center (NSSDC) Central On-Line Data Directory (CODD), which allows the general scientist remote access to information about data sets available not only at NSSDC, but throughout the scientific community, is discussed. A user may search for data set information within CODD by specifying spacecraft name, experiment name, investigator name, and/or keywords. CODD will include information on atmospheric science data sets contained not only within the PCDS, but also within other data sets that are deemed important. Keywords to be used in locating these data sets are currently being formulated. The main type of keyword to be used for categorization of data sets will be discipline related. The primary discipline keyword for PCDS-type data sets would be ATMOSPHERIC SCIENCE. A good set of subdiscipline keywords is needed under this discipline to subdivide the data sets. A sheet containing a strawman set of subdiscipline keywords was distributed, and a request was made for the knowledgeable scientists to modify or replace the proposed keywords. Author

N86-29535*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PARALLEL STRUCTURES IN HUMAN AND COMPUTER MEMORY

P. KANERVA Jan. 1986 8 p Proposed for presentation at COGNITIVA 85, Paris, France Sponsored by System Development Foundation

(NASA-TM-89402; RIACS-TR-86.2; NAS 1.15:89402) Avail: NTIS HC A02/MF A01 CSCL 09B

If one thinks of our experiences as being recorded continuously on film, then human memory can be compared to a film library that is indexed by the contents of the film strips stored in it. Moreover, approximate retrieval cues suffice to retrieve information stored in this library. One recognizes a familiar person in a fuzzy photograph or a familiar tune played on a strange instrument. A computer memory that would allow a computer to recognize patterns and to recall sequences the way humans do is constructed. Such a memory is remarkably similiar in structure to a conventional computer memory and also to the neural circuits in the cortex of the cerebellum of the human brain. It is concluded that the frame problem of artificial intelligence could be solved by the use of such a memory if one were able to encode information about the world properly. Author

N86-29568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ACCESS CONTROL AND PRIVACY IN LARGE DISTRIBUTED SYSTEMS

B. M. LEINER and M. BISHOP 7 Mar. 1986 18 p

(Contract NCC2-387)

(NASA-TM-89397; RIACS-TR-86.6; NAS 1.15:89397) Avail: NTIS HC A02/MF A01 CSCL 09B

Large scale distributed systems consists of workstations, mainframe computers, supercomputers and other types of servers, all connected by a computer network. These systems are being used in a variety of applications including the support of collaborative scientific research. In such an environment, issues of access control and privacy arise. Access control is required for several reasons, including the protection of sensitive resources and cost control. Privacy is also required for similar reasons, including the protection of a researcher's proprietary results. A possible architecture for integrating available computer and communications security technologies into a system that meet these requirements is described. This architecture is meant as a starting point for discussion, rather that the final answer. Author

N86-29569*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

WHITE PAPER: A PLAN FOR COOPERATION BETWEEN NASA AND DARPA TO ESTABLISH A CENTER FOR ADVANCED ARCHITECTURES

P. J. DENNING, G. B. ADAMS, III, R. L. BROWN, P. KANERVA, B. M. LEINER, and M. R. RAUGH 25 Apr. 1986 14 p

(Contract NCC2-387)

(NASA-TM-89388; RIACS-TR-86.10; NAS 1.15:89388) Avail: NTIS HC A02/MF A01 CSCL 09B

Large, complex computer systems require many years of development. It is recognized that large scale systems are unlikely to be delivered in useful condition unless users are intimately involved throughout the design process. A mechanism is described that will involve users in the design of advanced computing systems and will accelerate the insertion of new systems into scientific research. This mechanism is embodied in a facility called the Center for Advanced Architectures (CAA). CAA would be a division of RIACS (Research Institute for Advanced Computer Science) and would receive its technical direction from a Scientific Advisory Board established by RIACS. The CAA described here is a possible implementation of a center envisaged in a proposed cooperation between NASA and DARPA. Author

N86-29591# New York Univ., New York. Mathematics and Computing Lab.
NUMERICAL ANALYSIS AND THE SCIENTIFIC METHOD
J. GLIMM and D. H. SHARP Jan. 1986 29 p
(Contract DE-AC02-76ER03077; W-7405-ENG-36)
(DE86-005404; DOE/ER-03077/270) Avail: NTIS HC A03/MF A01

The computer has given rise to a new mode of scientific practice, and today computational science stands beside theory and experiment as a fundamental methodology. The impact of the computer revolution on science can be projected from current trends. The demands to be made on computing methodologies will be reviewed. One of the demands is an ongoing need for excellence in computational methodologies. Generic difficulties encountered in meeting these challenges will be discussed. Recent work of the authors and others will be reviewed in this context. DOE

N86-29720* National Aeronautics and Space Administration, Washington, D.C.
NASA THESAURUS SUPPLEMENT: A 4-PART CUMULATIVE SUPPLEMENT TO THE 1985 EDITION OF THE NASA THESAURUS
May 1986 155 p
(NASA-SP-7053(SUPP-1); NAS 1.21:7053(SUPP-1)) Avail: NTIS HC A08 CSCL 05B

The four part cumulative NASA Thesaurus Supplement to the 1985 edition ofthe NASA Thesaurus includes Part 1, Hierarchical Listing, Part 2, Access Vocabulary, Part 3, NASA Thesaurus Definitions, and Part 4, Changes. The semiannual supplement gives complete hierarchies for new terms. Author

N86-29721# University of Southern California, Marina del Rey. Information Sciences Inst.
DESIGN OF A MASTER LEXICON
S. CUMMING Feb. 1986 28 p
(Contract MDA903-81-C-0335)
(AD-A165999; ISI/RR-85-163) Avail: NTIS HC A03/MF A01 CSCL 05G

This document describes the design for a 'Master Lexicon' which is intended to serve all the lexical needs of the two grammars (RUS, an ATN parser, and Nigel, a systemic production grammar) of the JANUS natural language project. Each grammar had previously been using its own lexicon, and these two lexicons were significantly different, both in terms of content and in terms of design. The Master Lexicon incorporates features of each of the previous lexicons, significantly Nigel's feature hierarchy and RUS's treatment of morphology and cross-indexing; plus it includes several novel features, most notably a new lexical acquisition interface which allows the non-specialist user to add lexical items. Nigel is able to access the Master Lexicon directly, while a set of translation rules (given in the appendix) transform ML lexical entries to lexical entries of the style used by RUS. igel, Penman, RUS, Syntax, Systemic Linguistics, Text generation, Vocabulary, Word acquisition, Wordclass hierarchy, Wordclasses. GRA

N86-30360*# Reifer Consultants, Inc., Torrance, Calif.
SOFTWARE MANAGEMENT TOOLS: LESSONS LEARNED FROM USE
D. J. REIFER, J. VALETT (National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.), J. KNIGHT (Virginia Univ., Charlottesville), and G. WENNESON (Informatics General Corp., Palo Alto, Calif.) *In* NASA. Goddard Space Flight Center Proceedings of Tenth Annual Software Engineering Workshop 23 p Dec. 1985
Avail: NTIS HC A16/MF A01 CSCL 09B

Experience in inserting software project planning tools into more than 100 projects producing mission critical software are discussed. The problems the software project manager faces are listed along with methods and tools available to handle them. Experience is reported with the Project Manager's Workstation (PMW) and the SoftCost-R cost estimating package. Finally, the results of a survey, which looked at what could be done in the future to overcome the problems experienced and build a set of truly useful tools, are presented. J.P.B.

N86-30361*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEASEL: AN EXPERT SYSTEM FOR SOFTWARE ENGINEERING
J. D. VALETT and A. RASKIN *In its* Proceedings of Tenth Annual Software Engineering Workshop 21 p Dec. 1985
Avail: NTIS HC A16/MF A01 CSCL 09B

For the past ten year, the Software Engineering Laboratory (SEL) has been collecting data on software projects carried out in the Systems Development Branch of the Flight Dynamics Division at NASA's Goddard Space Flight Center. Through a series of studies using this data, much knowledge has been gained on how software is developed within this environment. Two years ago work began on a software tool which would make this knowledge readily available to software managers. Ideally, the Dynamic Management Information Tool (DynaMITe) will aid managers in comparison across projects, prediction of a project's future, and assessment of a project's current state. This paper describes an effort to create the assessment portion of DynaMITe, called the DynaMITe Expert Advisor for the SEL (DEASEL). Author

N86-30365*# Planning Research Corp., Washington, D. C.
EXPERIENCE WITH A SOFTWARE ENGINEERING ENVIRONMENT FRAMEWORK
R. BLUMBERG, A. REEDY, and E. YODIS *In* NASA. Goddard Space Flight Center Proceedings of Tenth Annual Software Engineering Workshop 25 p Dec. 1985
Avail: NTIS HC A16/MF A01 CSCL 09B

Experience with a software engineering environment framework tool called the Automated Product Control Environment (APCE) is described. The goals of the framework design, an overview of the major functions and features of the framework, and implementation and use of the framework are presented. Aspects of the framework discussed include automation and control; portability, distributability, and interoperability; cost/benefit analysis; and productivity. Results of using the framework are discussed and the framework approach is briefly compared to other software development environment approaches. J.P.B.

N86-30398# Vrije Universiteit, Amsterdam (Netherlands). Dept. of Mathematics and Computer Science.
A RELATIONAL DATABASE ENVIRONMENT FOR SOFTWARE DEVELOPMENT
A. I. WASSERMAN and M. L. KERSTEN May 1984 20 p
Sponsored by Netherlands Organization for the Advancement of Pure Research
(IR-86; ETN-86-97322) Avail: NTIS HC A02/MF A01

The software tool environment for the User Software Engineering (USE) methodology is built around a compact relational database management system (Troll/USE). Within this environment, called the Unified Support Environment, tools communicate with Troll/USE through message passing. Tools include a database browser and editor, a rapid prototyping system, and interactive database design aid, a data dictionary system, a programming language, and a version control/configuration management system. The way in which these tools support the USE methodology is described. The resulting environment is highly flexible and well suited for development of software systems and additional tools. ESA

N86-31220*# Georgia Inst. of Tech., Atlanta.
A DISCRETE CONTROL MODEL OF PLANT
C. M. MITCHELL *In its* Pilot Interaction With Automated Airborne Decision Making Systems 31 p Jul. 1985
Avail: NTIS HC A03/MF A01 CSCL 05H

A model of the PLANT system using the discrete control modeling techniques developed by Miller is described. Discrete control models attempt to represent in a mathematical form how a human operator might decompose a complex system into simpler parts and how the control actions and system configuration are coordinated so that acceptable overall system performance is achieved. Basic questions include knowledge representation, information flow, and decision making in complex systems. The structure of the model is a general hierarchical/heterarchical scheme which structurally accounts for coordination and dynamic focus of attention. Mathematically, the discrete control model is defined in terms of a network of finite state systems. Specifically, the discrete control model accounts for how specific control actions are selected from information about the controlled system, the environment, and the context of the situation. The objective is to provide a plausible and empirically testable accounting and, if possible, explanation of control behavior. B.G.

N86-31248# Los Alamos National Lab., N. Mex.
LOS ALAMOS SOFTWARE DEVELOPMENT TOOLS
G. CORT and R. O. NELSON 1985 10 p Presented at the US DECUS Symposium, Anaheim, Calif., 9 Dec. 1985
(Contract W-7405-ENG-36)
(DE86-006024; LA-UR-86-214; CONF-851264-4) Avail: NTIS HC A02/MF A01

We present the details of a strategy for acquiring a comprehensive set of software tools to support a life-cycle-based software development methodology. Specific criteria for evaluating software tools are presented with examples from the Los Alamos tool kit. The importance of an environment to support both the tools and the methodology is discussed. DOE

N86-31777# Oak Ridge National Lab., Tenn.
STANDARD GENERALIZED MARKUP LANGUAGE: A TECHNIQUE FOR DOCUMENT INTERCHANGE
J. D. MASON 1985 6 p
(Contract DE-AC05-84OR-21400)
(DE86-011504; DOE/OR-21400/T265) Avail: NTIS HC A02/MF A01

Technical communicators find themselves increasingly in need of communicating text electronically. Efforts were directed to providing a standardized mechanism for doing generic coding. The Standard Generalized Markup Language (SGML) has been developed for document interchange. It is a Drift International Standard and should become a full standard in 1986. SGML provides not only a basis for coding and interchange, but also a means for complete descriptions of documents to support other processes. DOE

N86-32338# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
DATABASE CAPACITY PLANNING AND MANAGEMENT
K. LINSENMANN 1986 24 p Presented at the 15th International Software AG Users Conference, San Diego, Calif., 11 May 1986
(Contract DE-AC07-76ID-01570)
(DE86-009076; EGG-M-03286; CONF-860593-1) Avail: NTIS HC A02/MF A01

The DATABASE ADMINISTRATION (DBA) has developed a utility process that performs three functions utilizing the ADABAS general control block (GCB) and the ADABAS file control block (FCB). The three functions are file space management, automated file unload/load and physical file placement and management. ADABAS cost per command, ADABAS command durations and labor cost have been examined. DOE

N86-32340# Argonne National Lab., Ill.
COMPUTING SERVICES SOFTWARE LIBRARY
L. M. CLARK and W. H. JONES Mar. 1986 52 p
(Contract W-31-109-ENG-38)
(DE86-009491; ANL/TM-436) Avail: NTIS HC A04/MF A01

This technical memorandum serves as a practical guide for managers, supervisors, programmers, analysts, and other data processing personnel who need to consult the documentation or use the software available in the Software Library. Policies and procedures necessary to preserve the software documentation and protect the Laboratory's investment in software are presented. Included are sections on responsibilities of the Software Librarian and Software Coordinators, software change control policy, systems programming section software maintenance tools, information systems section software maintenance tools and use of the LIBRARY exec. The LIBRARY exec, which serves as the Master Index, provides on-line information about documents. DOE

N86-33048# Lawrence Livermore National Lab., Calif.
USER SYSTEMS GUIDELINES FOR SOFTWARE PROJECTS
L. ABRAHAMSON, ed. 1 Apr. 1986 157 p
(Contract W-7405-ENG-48)
(DE86-010490; UCID-20643) Avail: NTIS HC A08/MF A01

This manual presents guidelines for software standards which were developed so that software project development teams and management involved in approving the software could have a generalized view of all phases in the software production procedure and the steps involved in completing each phase. Guidelines are presented for six phases of software development: project definition, building a user interface, designing software, writing code, testing code, and preparing software documentation. The discussions for each phase include examples illustrating the recommended guidelines. DOE

N86-33200# Texas A&M Univ., College Station. College of Business Administration.
ORGANIZATION AS INFORMATION PROCESSING SYSTEMS: TOWARD A MODEL OF THE RESEARCH FACTORS ASSOCIATED WITH SIGNIFICANT RESEARCH OUTCOMES
R. L. DAFT, R. W. GRIFFIN, and V. YATES Apr. 1986 59 p
(Contract N00014-83-C-0025)
(AD-A168018; TR-DG-19-ONR) Avail: NTIS HC A04/MF A01 CSCL 05B

Three models with the potential to explain significant organizational research outcomes were proposed and tested. Fifty-six organizational scholars were surveyed about one significant and one not-so-significant research project. The findings identified several reported factors that occurred prior to and during research projects that were related to research outcomes. The Ambidextrous model, which includes both organic and mechanistic research characteristics, differentiated significant from not-so-significant research better than the Davis and Antecedents models.
Author (GRA)

N86-33206# Department of Energy, Washington, D. C. Office of Computer Ser. and Telecommunications.
INFORMATION TECHNOLOGY RESOURCES LONG-RANGE PLAN, FY 1987-FY 1991
Dec. 1985 228 p
(DE86-010457; DOE/MA-0048-4) Avail: NTIS HC A11/MF A01

The objective of this 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 objective of the Plan is to promote better understanding, both within and external to the Department, of its information technology environment, requirements, problems, and recommended solutions. The Plan covers the five-year period from fiscal year 1987 through 1991. It takes into consideration the information technology resource requirements of more than 52 different Departmental components and contractors. The IS section and resource identification is limited to business and project management type applications used by Departmental components. DOE

N86-33207# Sandia National Labs., Albuquerque, N. Mex.
STATE OF THE ART OF GEOSCIENCE LIBRARIES AND INFORMATION SERVICES
N. J. PRUETT 1986 16 p Presented at the 3rd International Conference on Geoscience Information, Adelaide, Australia, 1 Jun., 1986
(Contract DE-AC04-76DP-00789)
(DE86-011188; SAND-86-1284C; CONF-8606122-1) Avail: NTIS HC A02/MF A01

Geoscience libraries and geoscience information services are closely related. Both are trying to meet the needs of the geoscientists for information and data. Both are also being affected by many trends: increased availability of personal computers; decreased costs of machine readable storage; increased availability of maps in digital format (Pallatto, 1986); progress in graphic displays and in developing Geographic Information System, (GIS) (Kelly and Phillips, 1986); development in artificial intelligence; and the availability of new formats (e.g., CD-ROM). Some additional factors are at work at changing the role of libraries: libraries are coming to recognize the impossibility of collecting everything and the validity of Bradford's Law. Unobtrustive studies of library reference services have pointed out that only 50% of the questions are answered correctly. It is clear that the number of databases is increasing although good figures for specifically geoscience databases are not available; lists of numeric database are beginning to appear; evaluative (as opposed to purely descriptive) reviews of available bibliographic databases are beginning to appear; more and more libraries are getting online catalogs. DOE

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.

A86-10403
PLAN FOR THE IMPLEMENTATION OF THE WORLD CLIMATE RESEARCH PROGRAMME
P. MOREL (World Meteorological Organization, Geneva, Switzerland) (COSPAR, WMO, IAMAP, UNEP, SCOR, URSI, and S.C.A.R., Plenary Meeting, 25th, Symposium on Space Observations for Climate Studies, 4th, Graz, Austria, June 25-July 7, 1984) Advances in Space Research (ISSN 0273-1177), vol. 5, no. 6, 1985, p. 15-20.

The objectives of the World Climate Research Programme (WCRP) are expressed in terms of increasing time scales, from several weeks to several decades. The Programme calls for substantial developments in modelling the interaction of the global atmosphere with the ocean, land surface and sea-ice, as well as improved computations of radiation transfer in the presence of clouds, aerosols and absorbing gases. These developments require a large variety of space as well as surface based observations, and especially, additional efforts for systematic processing of available data to produce consistent records of significant climatological variables. The forthcoming development of a new generation of ocean observing satellites will be an essential component of the WCRP, as they will provide the data base for the large-scale oceanographic projects, the World Ocean Circulation Experiment (WOCE) and the study of the Tropical Ocean and the Global Atmosphere (TOGA). Author

A86-11602*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUTURE DIRECTIONS IN AEROPROPULSION TECHNOLOGY
N. T. SAUNDERS and A. J. GLASSMAN (NASA, Lewis Research Center, Cleveland, OH) IN: International Symposium on Air Breathing Engines, 7th, Beijing, People's Republic of China, September 2-6, 1985, Proceedings . New York, AIAA, 1985, p. 3-22. Previously announced in STAR as N85-23685.

Future directions in aeropropulsion technology that have been identified in a series of studies recently sponsored by the U.S. Government are discussed. Advanced vehicle concepts that could become possible by the turn of the century are presented along with some of their projected capabilities. Key building-block propulsion technologies that will contribute to making these vehicle concepts a reality are discussed along with projections of their status by the year 2000. Some pertinent highlights of the NASA aeropropulsion program are included in the discussion. Author

A86-12361#
FUTURE U.S. METEOROLOGICAL SATELLITE SYSTEMS
D. B. MILLER and J. K. SPARKMAN (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: International developments in space stations and space technologies; Proceedings of the Thirty-fifth Congress, Lausanne, Switzerland, October 7-13, 1984 . New York, AIAA, 1985, p. 103-110.
(IAF PAPER 84-96)

It is pointed out that the present U.S. meteorological satellite system is an array of spacecraft including both geostationary and low-orbit polar orbiting platforms. The system is designed to provide necessary minimum data for global numerical weather prediction, and to supply frequent observations in the western hemisphere of natural hazards, including tornadoes, hurricanes, flash floods, and spring-thaw flooding. The present paper provides a survey of the current array of spacecraft and sensor suites flown by the U.S., taking into account also details regarding the next series of sensing hardware. Polar imagers and sounders are examined, and geostationary sensors are discussed. Attention is given to the functions of the 'Advanced Very High Resolution Radiometer' (AVHRR/2), microwave sensors, radiation detectors, polar subsystems, polar spacecraft broadcast services, near future satellites, and future satellite systems. G.R.

A86-12935#
THE SPACE STATION POLAR PLATFORMS - INTEGRATING RESEARCH AND OPERATIONAL MISSIONS
J. H. MCELROY and S. R. SCHNEIDER (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) AIAA, Earth Observing Systems: EOS - A Subset of Space Station Conference, Virginia Beach, VA, Oct. 8-10, 1985. 12 p. refs
(AIAA PAPER 85-3000)

The instrumentation planned for the polar-orbiting segment of the Space Station will provide both real-time and long-term archival data. It is expected that the instrumentation will include an X-ray imager, total energy and electron detectors, a proton-electron spectrometer, a plasma monitor and a gamma ray detector. Data will also be gathered on the earth radiation budget, upper atmosphere activities and constituent species, ocean spectra and atmospheric absorption lines. SAR, scatterometer, imaging and altimeter applications will be found for radar units. The multiple-instrumented polar-orbiting platforms will permit correlations to be calculated on the radiation environment and atmosphere, ocean, weather, land and biosphere phenomena. M.S.K.

A86-13823#
ERS-1 - MISSION OBJECTIVES AND SYSTEM DESCRIPTION
G. DUCHOSSOIS (ESA, Paris, France) IN: Monitoring earth's ocean, land, and atmosphere from space - Sensors, systems, and applications . New York, AIAA, 1985, p. 536-553.

Anticipating a launch date in mid-1989, an industrial consortium of European and Canadian companies is developing and manufacturing the first ESA remote sensing satellite, known as ERS-1. The overall ERS-1 system and the various potential applications which may benefit from the ERS-1 data are described. D.H.

A86-14095#

THE ERS-1 PROGRAM AND ITS FUTURE APPLICATIONS

H.-J. LABUDDA (Dornier System GmbH, Friedrichshafen, West Germany) IN: International Symposium on Remote Sensing of Environment, Third Thematic Conference: Remote Sensing for Exploration Geology, Colorado Springs, CO, April 16-19, 1984, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 889-898. refs

At the end of the 80's and in the early 90's the European Space Agency (ESA) will launch a series of ESA Remote Sensing Satellites (ERS). It is expected that the Synthetic Aperture Radar (SAR) in combination with the Radar Altimeter will play a significant role in the acquisition of earth surface data. ERS-1's capability to generate SAR all-weather high resolution images over land may also be used to complement optical data provided by other satellites (Landsat-D, SPOT) for a number of land applications. Users of various disciplines grouped around socalled prime centers will be provided with thematically processed images and data sets referring to oceanography, glaciology, climatology, oil platform management, ship routing, fishery and surface pollution. Extending that range of marine surface applications, a further mission will mainly contribute in sensing and analyzing terrestrial imagery with emphasis on geology, agriculture and hydrology. Author

A86-14272* National Aeronautics and Space Administration, Washington, D.C.

SPACE - THE LONG RANGE FUTURE

J. VON PUTTKAMER (NASA, Office of Space Flight, Washington, DC) Spaceflight (ISSN 0038-6340), vol. 27, Nov. 1985, p. 395-400. refs

Space exploration goals for NASA in the year 2000 time frame are examined. A lunar base would offer the opportunity for continuous earth viewing, further cosmogeochemical exploration and rudimentary steps at self-sufficiency in space. The latter two factors are also compelling reasons to plan a manned Mars base. Furthermore, competition and cooperation in a Mars mission and further interplanetary exploration is an attractive substitute for war. The hardware requirements for various configurations of Mars missions are briefly addressed, along with other, unmanned missions to the asteroid belt, Mercury, Venus, Jupiter and the moons of Jupiter and Saturn. Finally, long-range technological requirements for providing adequate living/working facilities for larger human populations in Space Station environments are summarized. M.S.K.

A86-15611*# National Aeronautics and Space Administration, Washington, D.C.

THE SPACE STATION PROGRAM DEFINITION AND PRELIMINARY SYSTEMS DESIGN - RECENT DEVELOPMENTS

R. F. FREITAG (NASA, Office of Space Station, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 12 p.

(IAF PAPER 85-18)

It is pointed out that space stations represent a major vehicle for accomplishing many things mankind envisions for space activities. Thus, space stations have become necessary stepping-off points for deep-space expeditions, and it is expected that they will lead eventually to the permanent occupancy of another planet. The present paper provides a report regarding planning activities in the U.S. and in other countries which have made significant progress in making a permanent Space Station a reality. The Space Station will consist of a manned base and associated platforms, as well as collateral support equipment. The purpose of the program definition and preliminary design activities (Phase B) is to arrive at the baseline configuration before initiating actual hardware development. Details of the program plan are discussed along with user considerations in design, the commercialization of space, design issues, operations, and Space Station evolution. G.R.

A86-15636*# National Aeronautics and Space Administration, Washington, D.C.

SPACE STATION UTILIZATION FOR TECHNOLOGY PURPOSES

J. L. ANDERSON and J. ROMERO (NASA, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p.

(IAF PAPER 85-50)

The role of the Space Station in in-space technology research and development is discussed. The categorizing of research and technology experiments, which is required in order to provide the proper facilities for the experiments, is described. The use of the Space Station, itself, as an experiment is studied; instrumented large space structure experiments, environmental interactions, human-machine interface, and evolutionary technology validation can be conducted by the Space Station. The necessary conditions for the Space Station to function as a research and technology facility are analyzed. The Space Station design and planning considerations, in order to meet research and technology objectives and support requirements, are investigated. I.F.

A86-15902#

COMMERCIALIZATION OF SPACE - A COMPREHENSIVE APPROACH

R. C. MAEHL (RCA, Astro-Electronics Div., Princeton, NJ) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 6 p.

(IAF PAPER 85-431)

The role of the government and private industries in the commercialization of space is investigated. The government needs to provide funding, stimulate research and development, and establish regulations, and industries need to develop areas which will provide profitable investments. The three phases of the evolution of space activities, which are high tech R and D, the development of infrastructure, and the establishment of the industry, are described. The relationship between NASA's policies, the joint endeavor agreement, and the stages of the evolution of space activities is analyzed; a balance between investment and profit needs to be established. Two examples of existing space commercialization, the American commercial Landsat venture, and developments in the low altitude commercial platforms for material processing and scientific missions are presented. I.F.

A86-15914*# National Aeronautics and Space Administration, Washington, D.C.

FUNCTION, FORM, AND TECHNOLOGY - THE EVOLUTION OF SPACE STATION IN NASA

S. D. FRIES (NASA, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 11 p. refs

(IAF PAPER 85-454)

The history of major Space Station designs over the last twenty-five years is reviewed. The evolution of design concepts is analyzed with respect to the changing functions of Space Stations; and available or anticipated technology capabilities. Emphasis is given to the current NASA Space Station reference configuration, the 'power tower'. Detailed schematic drawings of the different Space Station designs are provided. I.H.

A86-15949#

A DESIGN FOR FLUID MANAGEMENT IN SPACE

N. E. SEARBY IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 9 p. refs

(IAF PAPER ST-85-04)

A fluid management system has been developed for space applications. The system design was based on three specific requirements of the microgravity environment in a manned space vehicle: solid-liquid-gas degassification; solid-liquid-gas separation; and algae growth and harvesting. Fluid separation is achieved using a divergent, truncated-cone separation chamber coupled with density-dependent valving. Degassification of fluids and separation of multi-level media is carried out at a high pressure level in order to move the separated media to storage areas. Operational tests of the system in a simulated low-g environment and on board Shuttle are described. A schematic diagram of the fluid management system is provided. I.H.

A86-17301* National Aeronautics and Space Administration, Washington, D.C.

SPACE STATIONS AND SPACE PLATFORMS - CONCEPTS, DESIGN, INFRASTRUCTURE, AND USES

I. BEKEY, ED. and D. HERMAN, ED. (NASA, Washington, DC) New York, American Institute of Aeronautics and Astronautics (Progress in Astronautics and Aeronautics. Volume 99), 1985, 402 p. For individual items see A86-17302 to A86-17314.

Topics discussed include space infrastructures and early Space Station and platform planning. Consideration is given to the supportive role of the Space Station and platform in future astronomy, earth observation, planetary, and communication space missions. Papers are presented on the history of the Space Station and space platform concepts, potential designs of space stations and space platforms, and long-range plans for space research. I.F.

A86-17307*# National Aeronautics and Space Administration, Washington, D.C.

INTRODUCTION - SPACE STATION AND PLATFORM ROLES IN SUPPORTING FUTURE SPACE ENDEAVORS

D. H. HERMAN (NASA, Office of Space Station, Washington, DC) IN: Space stations and space platforms - Concepts, design, infrastructure and uses . New York, American Institute of Aeronautics and Astronautics, 1985, p. 85-88.

The function of the Space Station and a platform is studied. The development of an earth observing instrument platform in a near-polar geosynchronous orbit to provide data about the earth is examined. The establishment of a permanently manned Space Station will allow development of commercial laboratories. Architectural requirements for servicing, transportation, and assembly on the Space Station are analyzed. The study of physiological and psychological effects due to weightlessness can be conducted on the Space Station. Developments in space knowledge and technology that are possible with the Space Station are discussed. I.F.

A86-17308#

ASTRONOMY AND THE SPACE STATION

H. GURSKY (U.S. Navy, E. O. Hulburt Center for Space Research, Washington, DC) IN: Space stations and space platforms - Concepts, design, infrastructure and uses . New York, American Institute of Aeronautics and Astronautics, 1985, p. 89-107.

The utilization of the Space Station for astronomical missions is studied. A review of the advances in astronomy because of the ability to observe from space and a description of previous astronomical missions are provided. The requirements for astronomical observation are improved sensitivity, angular resolution, and spectral resolution. The use of the Space Station as an observing site, a service base, and an assembly base for astronomical missions is examined. Examples of astronomical observing facilities, assembly in space, and construction in space, made possible by the Space Station are presented. I.F.

A86-17672

IDENTIFYING TECHNICAL INNOVATIONS

R. MUESER (AT&T Bell Laboratories, Short Hills, NJ) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. EM-32, Nov. 1985, p. 158-176. refs

Technical innovation is a concept proposed by economist Joseph Schumpeter almost 50 years ago. Initially ignored, it is now considered the key to improving high-tech productivity. Most writers agree on a definition which identifies the start as a novel creative step, and the end as the time of commercial availability or general use. There appear to be two basic categories of technical innovation: the first stems from research or exploration, starts with some kind of breakthrough, and requires a long period to bring to market. The second is the result of a new planned effort and usually reaches the market in a fraction of the time required for a research innovation. Author

A86-19526* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE ROLE OF SCIENTISTS IN DEVELOPING HUBBLE SPACE TELESCOPE

R. A. BROWN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: The National Symposium and Workshop on Optical Platforms, Huntsville, AL, June 12-14, 1984, Proceedings . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 19-21.

The objective of the Hubble Space Telescope Program is to build and operate a high-performance, fully-instrumented and long-lived optical observatory in earth orbit. Key Program elements are (1) a logistic strategy of Shuttle launch/maintenance and TDRSS communications, (2) overall responsibility at the MSFC Project for developing both the flight and ground systems, and (3) scientific participation in ST development and responsibility after launch for conducting the observing program. The ST Project is a management structure with a budget and schedule for delivering an ST system capable of achieving its established scientific objectives. The Project distributes through contracts the responsibility for supplying particular components, but retains the responsibility for system-level integrity. Scientists have set the performance objectives and now support the Project during the development stage by providing (1) PI management of the five Science Instruments, (2) continuing translations of scientific requirements into engineering specifications, (3) oversight of designs and performance tests, and (4) specific expertise on technical concerns. Author

A86-20921

A SHARED SATELLITE SYSTEM WOULD SATISFY MANY FUTURE AVIATION NEEDS

J. D. KIESLING and R. E. ANDERSON ICAO Bulletin, vol. 40, Nov. 1985, p. 15-20.

The development of a continental mobile satellite system for aircraft communication is proposed. The system is to provide communication and surveillance for air traffic control and aeronautical operational control. The two-satellite ranging and position fixing of the satellite system are analyzed. The system architecture requires consideration of satellite earth coverage, a frequency and polarization plan, satellite and mobile power and power density, and modulation standards. The use of spot beams and frequency reuse is examined, and diagrams of coverage areas and frequency reuse are presented. Examples of aviation system and mobile satellite system frequency plans are provided. Differences in satellite characteristics, such as antenna gain, transmitter powers and receiver sensitivities, and mobile antenna gains and powers are discussed. The components and requirements for a typical satellite transponder concept, in particular an aircraft-mounted antenna, are described. I.F.

A86-21519* National Aeronautics and Space Administration, Washington, D.C.

NASA DEVELOPS SPACE STATION

R. F. FREITAG (NASA, Washington, DC) Space (ISSN 0267-954X), vol. 1, June 1985, p. 18-20.

The NASA Space Station program's planning stage began in 1982, with a view to development funding in FY1987 and initial operations within a decade. An initial cost of $8 billion is projected for the continuously habitable, Space Shuttle-dependent system, not including either operational or scientific and commercial payload-development costs. As a customer-oriented facility, the Space Station will be available to foreign countries irrespective of their participation in the development phase. O.C.

A86-21524
EUROPE GOES INDEPENDENT
S. KING Space (ISSN 0267-954X), vol. 1, June 1985, p. 56-59.

A development history, design features and performance capabilities account is presented for the Ariane unmanned spacecraft launch systems 1-4, as well as for the Ariane 5 project, which will loft the Hermes manned orbiter in 1993 and furnish enhanced payload flexibility. Over 20 configurational possibilities were studied for Ariane 5's design. Attention is presently given to the design and performance characteristics of the HM60 LH2/LOX engine used for the first booster stage of Ariane 5, whose first operation is scheduled for mid-1989. Two solid rocket boosters will also be employed. O.C.

A86-23552
SCIENCE REQUIREMENTS FOR SPACE STATION LABORATORY
B. LICHTENBERG AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 15th, San Francisco, CA, July 15-17, 1985. 7 p.
(SAE PAPER 851368)

Life science research to be conducted on the Space Station is to include applied research which is needed to sustain the well being, health, and functioning of humans in space. Studies related to gaining an understanding of medical problems and basic physiological phenomena in space are also to be conducted. Other basic research is concerned with studies of gravitational and radiation biological phenomena, and investigations related to the origin and evolution of life. The facilities needed to conduct the required experiments for the considered investigations are discussed, taking into account equipment for conducting experiments with animals, a variable-g centrifuge, a high performance linear accelerator capable of delivering controlled motion to humans or animals, instrumentation for muscle studies, and equipment for cellular physiology studies. G.R.

A86-23553* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE STATION LIFE SCIENCES GUIDELINES FOR NONHUMAN EXPERIMENT ACCOMMODATION
R. ARNO (NASA, Ames Research Center, Moffett Field, CA) and J. HILCHEY (NASA, Marshall Space Flight Center, Huntsville, AL) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 15th, San Francisco, CA, July 15-17, 1985. 13 p. refs
(SAE PAPER 851370)

Life scientists will utilize one of four habitable modules which constitute the initial Space Station configuration. This module will be initially employed for studies related to nonhuman and human life sciences. At a later date, a new module, devoted entirely to nonhuman life sciences will be launched. This report presents a description of the characteristics of a Space Station laboratory facility from the standpoint of nonhuman research requirements. Attention is given to the science rationale for experiments which support applied medical research and basic gravitational biology, mission profiles and typical equipment and subsystem descriptions, issues associated with the accommodation of nonhuman life sciences on the Space Station, and conceptual designs for the initial operational capability configuration and later Space Station life-sciences research facilities. G.R.

A86-24672
SATELLITE COMMUNICATIONS FOR DEVELOPING COUNTRIES - FROM CONJECTURE TO REALITY
H. E. HUDSON (Texas, University, Austin) Space Communication and Broadcasting (ISSN 0167-9368), vol. 3, Dec. 1985, p. 289-295. refs

Satellites now play an important role in developing countries where key applications are for education, health care, other social services, agriculture, rural development, and cultural enrichment. This paper traces the evolution of developing world utilization of satellites from early studies through to present-day applications, assisted by details of various case studies. An analytical framework is provided to aid prediction of the benefits and influences of satellite usage on a country's development. Author

A86-24836* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE POWER SYSTEMS - 'SPACECRAFT 2000'
K. A. FAYMON (NASA, Lewis Research Center, Cleveland, OH) IN: Intersociety Energy Conversion Engineering Conference, 20th, Miami Beach, FL, August 18-23, 1985, Proceedings. Volume 1 . Warrendale, PA, Society of Automotive Engineers, Inc., 1985, p. 1.422-1.424.

The program 'Spacecraft 2000' has the objective to identify critical, high-payoff, potential spacecraft technologies, taking into account the formulation, advocation, and the management of the requisite technology development programs. This program represents a joint NASA-industry program. The technology areas addressed by 'Spacecraft 2000' are related to spacecraft power/energy storage, thermal control/thermal management, power management and distribution, autonomous operation-control, on-board system integration, spacecraft environmental interactions, secondary propulsion, communications technologies, a total system response approach, and system-subsystem technology verification. The expected benefits of a development of advanced technologies include decreased spacecraft bus system weights, decreased mission costs, increased reliability/lifetimes, and increased operational flexibility. G.R.

A86-27896#
A 3M/NASA BASIC RESEARCH PROGRAM IN SPACE
C. J. PODSIADLY (3M Co., St. Paul, MN) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 318-321.

An account is given of emerging plans for a 10-year, NASA/industry joint research program to be conducted in space for the development of organic chemistry products, and their production techniques, in microgravity environments. Phase I of this research effort will encompass two experiments in organic crystal growth and one in the manufacture of proprietary organic thin films. Phase II experiments will involve the additional organic crystal growth efforts employing different techniques from those of Phase I, as well as a third thin film production experiment employing various coating techniques. Phase II experiments are more complex than those of Phase I. O.C.

A86-28055
CONCURRENT AND SEQUENTIAL NETWORKS - IMPLICATIONS FOR PROJECT MANAGEMENT
L. A. SMITH and J. MILLS (Florida International University, North Miami) Engineering Management International (ISSN 0167-5419), vol. 3, Jan. 1986, p. 279-282.

Timely completion of projects is one of the essential goals of project management. The present authors have developed a probability-based explanation of the lateness phenomenon as it relates to network complexity. Concurrent activities within a network are greater determinants of the delay than are comparable sequential activites. The implications for project management are discussed. Author

A86-28593
THE SPACE INDUSTRY FOR COMMUNICATIONS AND REMOTE SENSING
P. MASARATI and G. BIANCHI (Selenia Spazio S.p.A., Rome, Italy) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 287-311.
(AAS 85-136)

A general outline of trends in the evolution of satellite systems for telecommunications and remote sensing applications, is given. Attention is given to several specific improvements in satellite designs which will be necessary to accommodate hypothesized traffic growths up to the year 2000. Among the improvements considered are: bandwidth compression; spot beam switching; k(a)-band transponders; and permanent space communications platforms. Trends in the development of remote sensing and meteorological satellites are also considered, with emphasis given to applications in the fields of oceanography, geology, agriculture, and resource management. I.H.

A86-28725
SPACECAB II - A LOW-COST SMALL SHUTTLE FOR BRITAIN
D. M. ASHFORD (British Aerospace, PLC, Naval Weapons Div., Bristol, England) Aerospace (UK) (ISSN 0305-0831), vol. 13, Feb. 1986, p. 33-40.

The present article reports the results of a preliminary study regarding a concept which could make it possible to achieve a very substantial reduction in the cost required to place a payload into orbit. The key to such a reduction is the employment of fully reusable launch vehicles, taking into account the fact that so far all satellites and spacecraft (including the Shuttle) have involved throw-away launcher elements. A study has, therefore, been conducted concerning a small, manned, two-stage, fully reusable, aircraft-like launcher. 'Spacecab II' consists of a booster stage and an orbiter stage. The Orbiter is partially buried in the Booster. The combined vehicle takes off from a conventional airport, climbs to Mach 2 with the aid of turbojets, and is accelerated to Mach 4 by means of the Booster rocket motors. After separation, the Booster flies back to base and lands, while the Orbiter proceeds to orbit. The development costs of Spacecab II are comparatively low because existing technology is largely utilized. Thus, Concorde technology can be employed for the booster. G.R.

A86-28777
A MILLENNIUM PROJECT - MARS 2000
H. H. SCHMITT IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 23-31.
(AAS 84-151)

A rationale is given for greatly expanded space exploration over the next decades, leading to a manned landing on and ultimate colonization of the planet Mars. The scenario calls for greater utilization of the resources of near-earth space (uninterrupted views of earth, sun and space; unlimited clean vacuum; absence of gravity), followed by establishment of a permanent lunar base, and then a manned mission to Mars to establish a settlement. Benefits and technical difficulties are addressed. D.H.

A86-28787* National Aeronautics and Space Administration, Washington, D.C.
BEYOND THE SPACE STATION
J. VON PUTTKAMER (NASA, Office of Space Flight, Washington, DC) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 171-206. refs
(AAS 84-161)

The significance of the Space Station is examined with regard to the possibilities it will open. The Space Station, as a unique R&D facility, operation base, and transportation node, will not only enhance deeper-space ventures but also enable entirely new initiatives for man's advancement in space not possible before. One large goal enabled by the Space Station could be a manned Mars landing mission as a major national objective some time beyond the year 2000. Since its principal themes would be joint exploration and advancement of mankind in space, its scientific, technical and sociological benefits would be of unprecedented scope and magnitude. The Space Station should be regarded as having a 'beachhead' role in supporting multiple goals and multiple users. Commonalities and possible synergisms between program and mission systems, elements, and technologies of large new initiatives beyond the Space Station should be assessed. D.H.

A86-28792
SCIENTIFIC PROGRAM FOR A MARS BASE
C. R. STOKER, P. J. BOSTON (National Center for Atmospheric Research, Boulder, CO), J. M. MOORE (Arizona State University, Tempe), and R. L. GROSSMAN (Cooperative Institute for Research in Environmental Sciences, Boulder, CO) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 255-285. refs
(AAS 84-166)

A program is presented for long-term Mars exploration beginning with unmanned missions and extending to the establishment of a permanent research station on Mars. Scientific objectives are identified for each phase of the program and the means of accomplishing these objectives are suggested. The science goals of unmanned missions include: selecting an optimal location for the Mars base, finding resources on Mars and facilitating their exploitation, and learning enough about the Martian environment to ensure that the base can be safely operated. The Mars exploration program proposed by the Solar System Exploration Committee (SSEC), if modified to include orbital imaging of cloud features and high resolution imaging of base candidates, will achieve these goals. After the base is established, crews occupying it will study the Mars atmosphere and surface. They will explore remote sites and collect samples for analysis at base laboratories. Climate and atmospheric dynamics and chemistry will be studied. Equipment necessary for geoscience and life science research is considered. D.H.

A86-28795
MISSION STRATEGY AND SPACECRAFT DESIGN FOR A MARS BASE PROGRAM
S. WELCH (Boulder Center for Science and Policy, CO) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 345-375.
(AAS 84-169)

Mission strategies and vehicle designs for a Mars landing are considered. The mission strategy is directed toward support of a permanently inhabited Mars base with crew rotation and resupply at every earth-to-Mars launch opportunity. The types of vehicles required for the Mars landing mission include a heavy lift launch vehicle (HLLV); aerocapture vehicles for transporting crew and cargo to the surface of Mars; interplanetary spacecraft; and a trans-Mars injection stage. The aerocapture vehicle may be converted for use as surface habitat for crews on the Martian surface. A detailed description of the three-part mission sequence is given. I.H.

A86-28796
CONCEPTS FOR THE EARLY REALIZATION OF A MANNED MISSION TO MARS
S. J. HOFFMAN and J. K. SOLDNER (Science Applications International Corp., Schaumburg, IL) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 377-390. Research supported by the Planetary Society.
(AAS 84-170)

A concept for a first manned mission to the planet Mars, embarking in the early-2000's time frame is presented. For this analysis no new technology other than what would conservatively be expected in the next 20 years, e.g., aerocapture technology, is assumed to exist. A four person crew consisting of a three person surface exploration team, and one orbiting crewmember, is proposed. Thirty days will be spent exploring the Martian surface and near-Mars space. A dual launch mission concept is proposed, assuming all the required mass, including OTV's and their propellant, would be carried to orbit via the present Shuttle fleet. A performance summary shows that 10 OTV's are required to inject both spacecraft on their respective trajectories to Mars, and that a total of 18 Shuttle launches are necessary to deliver the mass to the near-earth orbit staging area. Author

A86-29496
HOTOL SPACEPLANE IS DESIGNED TO SLASH LAUNCH COSTS BY 80 PERCENT
D. A. BROWN Commercial Space (ISSN 8756-4831), vol. 1, Winter 1986, p. 55, 57.

'Hotol' (horizontal takeoff and landing) is a single stage to orbit aerospace vehicle, incorporating a dual airbreathing/rocket propulsion system, by means of which Britain intends to cut satellite launch costs by at least 80 percent. The hydrogen-fueled propulsion system envisioned will take its oxygen from the atmosphere at lower altitudes, as turbojets currently do, and then revert to onboard liquid oxygen during exoatmospheric operation. Hotol will, moreover, be entirely computer controlled in order to obviate crews and their life support systems. The Hotol payload bay may, nevertheless, be at some future time used to carry a passenger module seating as many as 60, thereby serving as an intercontinental transport aircraft. O.C.

A86-29581*# National Aeronautics and Space Administration, Washington, D.C.
GLOBAL INTERCONNECTIVITY IN THE NEXT TWO DECADES - A SCENARIO
R. LOVELL and C. L. CUCCIA (NASA, Communications Div., Washington, DC) IN: Communication Satellite Systems Conference, 11th, San Diego, CA, March 17-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 39-49.
(AIAA PAPER 86-0605)

The present paper provides a description of a part of NASA's current long range plans, taking into account the development of hierarchal space switching centers and laser intersatellite links which can interconnect the globe. It is pointed out that a special objective involves the development of technology and satellite architecture for reducing the cost of an end-to-end voice message per minute from the present average value of around $.40 now realized by terrestrial telephone systems to less than $.10. The next decade of NASA communications activity (1985-1995) is discussed, giving attention to the Advanced Communications Technology Satellite ACTS (July 1984) which will test the technology of space switchboard and signal processing in space. The environment of the decade 1985-1995 is considered along with the roles of communications satellites, the hierarchies of terrestrial public switched networks, cost comparisons of terrestrial and space point-to-point links, and concomitant technology developments related to supercomputers. G.R.

A86-29750
SELECTING INTERRELATED R&D PROJECTS IN SPACE TECHNOLOGY PLANNING
A. F. CZAJKOWSKI and S. JONES (Clemson University, SC) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. EM-33, Feb. 1986, p. 17-24. refs

In this paper a decision support model and solution procedure is presented for selecting interrelated R&D projects in space technology planning. Technical and benefit interactions among projects are explicitly considered. The problem addressed is that of selecting among technologically enabling and value enhancing projects. A 0-1 integer programming model is formulated and solution technique presented that places technology project sets into two categories: (1) those the decision maker should consider, and (2) those that are dominated by sets in the first category. Use of the model and solution techniques is demonstrated in the context of a NASA case example pertaining to earth resources space programs. The efficiency of the model (with the solution technique) in reducing an unmanageably large number of possible technology project sets to a small tractable number of feasible and efficient sets is demonstrated in the example problem. Author

A86-31218
MANAGEMENT OF OUTER SPACE FOR THE BENEFIT OF MANKIND
J. G. ROEDERER (Alaska, University, Fairbanks) CIDA, vol. 8, no. 8, 1983, p. 23-36.

Explicit form is given to recommendations implicit in the United Nations Report from the Second (1982) UN Conference on the Exploration and Peaceful Uses of Outer Space. These recommendations have as their aim the bridging of an existing gap in space research and technology benefits between the space-active developed countries and developing nations. Attention is given to such matters as space militarization, debris removal from orbit, space project environmental impacts, geostationary orbit management, and the development of means for the transfer of space-related knowledge and expertise to developing nations. The primary viewpoint in these deliberations is that of nations of Latin America and the Caribbean. O.C.

A86-32450
TOMORROW'S WEATHER - NEW ACCURACY IN FORECASTING
G. GRAFF High Technology (ISSN 0277-2981), vol. 6, April 1986, p. 27-35.

Projects designed to enhance the accuracy of routine and long-range forecasts and to guarantee early detection of such hazards as tornadoes and wind shear are presented. The Program for Regional Observing and Forecasting Services (PFOFS) aims to overcome conventional forecasting barriers by covering a limited geographical region and by processing the available data more rapidly. One component of PROFS, the advanced Doppler radar, is incorporated into a weather detection effort called Nexrad, whose purpose is to spot severe storms far earlier than is possible with conventional radar. Tornadoes can be spotted well in advance, as well as wind shear. The weather tracking system McIDAS is discussed together with projects designed to enhance air safety, such as the Airport Weather Observing System and the Airport Surface Observing System. Satellite-borne lasers will be used to monitor upper-air activity, and increased accuracy in long-range forecasting will be provided by the Tropical Oceans and Global Atmosphere project. By the turn of the century, it is predicted that two-week forecasts will have the kind of specificity now associated with two-day forecasts. K.K.

A86-32527*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NATIONAL SPACE TRANSPORTATION SYSTEMS PLANNING
W. R. LUCAS (NASA, Marshall Space Flight Center, Huntsville, AL) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 3-8.

In the fall of 1984, the DOD and NASA had been asked to identify launch vehicle technologies which could be made available for use in 1995 to 2010. The results of the studies of the two groups were integrated, and a consumer report, dated December 1984, was forwarded to the President. Aspects of mission planning and analysis are discussed along with a combined mission model, future launch system requirements, a launch vehicle planning background, Shuttle derivative vehicle program options, payload modularization, launch vehicle technology implications, a new engine program for the mid-1990's. Future launch systems goals are to achieve an order of magnitude reduction in future launch cost and meet the lift requirements and launch rates. Attention is given to an advanced cryogenic engine, advanced LOX/hydrocarbon engine, advanced power systems, aerodynamics/flight mechanics, reentry/recovery systems, avionics/software, advanced manufacturing techniques, autonomous ground and mission operations, advanced structures/materials, and air breathing propulsion. G.R.

A86-32530

ADVANCED COMMUNICATIONS TECHNOLOGY SATELLITE

J. A. FROHBIETER (RCA, Astro-Electronics Div., Princeton, NJ) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 23-27.

The Advanced Communications Technology Satellite (ACTS) scheduled for launch in 1989 is the latest in a series of NASA experimental communications satellites. Designed for Ka-Band operation, ACTS features both a high burst rate (220 mbps) trunking system incorporating IF switching, and fixed but configurable spot beams; together with a low burst rate (27.5-110 mbps) mode that provides individual 64 kbps message sorting and routing on the spacecraft, using a baseband processor. The low burst rate mode provides extended area coverage through the use of two scanning spot beams. Advanced features to be incorporated into this experimental system include: high burst rate TDMA operations, on-board baseband and IF switching automatic rain fade detection and compensation, Ka-Band transmitter, receiver and multibeam antenna technology, and Ka-Band TT&C. NASA is encouraging business, government agencies, universities and the military to participate as experimenters with the ACTS program. Author

A86-32543*# National Aeronautics and Space Administration, Washington, D.C.

SPACE STATION ADVANCED DEVELOPMENT PROGRAM

R. F. CARLISLE (NASA, Office of Space Station, Washington, DC) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 183-191.

The Space Station Advanced Development Program has the objective to transform promising new techniques into mature proven concepts to enable design options for the initial Space Station. It is pointed out that the options should improve system performance and reduce operational costs. Attention is given to the approach employed in the implementation of the program, the technology issues, aspects of Space Station evolution and growth, a Space Station technology overview, and subsystem technologies. The Advanced Development Power Program is considered along with the advanced development of auxiliary propulsion, the program dealing with attitude control and stabilization, and developments related to data management. Other developments are concerned with communication, system operation, manned systems technology, structures, and environmental control and life support. G.R.

A86-32904

MAN'S PERMANENT PRESENCE IN SPACE; PROCEEDINGS OF THE THIRD ANNUAL AEROSPACE TECHNOLOGY SYMPOSIUM, UNIVERSITY OF NEW ORLEANS, LA, NOVEMBER 7, 8, 1985

Symposium sponsored by AIAA. New Orleans, LA, American Institute of Aeronautics and Astronautics, 1985, 813 p. For individual items see A86-32905 to A86-32934.

Papers are presented on the need, and capabilities of the Space Station, managing fluids in space, propellant supply for space operations, and the effect of the space environment on spacecraft materials. Topics discussed include docking concepts, a launch system, the designs and planning of a lunar base/lunar city, space applications of composite structures, and the fabrication of composite tooling. Consideration is given to FAA air traffic control program management technology applications, the application of thermal analysis to polyurethane prepolymeric materials, surface sensitive techniques for the analysis of ET polymers, nondestructive measurements of residual stress, integrated logistics support, and mobile gantry robots for large structures. I.F.

A86-32913#

LOW COST ACCESS TO SPACE - A SECOND-GENERATION SHUTTLE CONCEPT

K. J. P. KELLEHER (Martin Marietta Corp., New Orleans, LA) IN: Man's permanent presence in space; Proceedings of the Third Annual Aerospace Technology Symposium, New Orleans, LA, November 7, 8, 1985 . New Orleans, LA, American Institute of Aeronautics and Astronautics, 1985, 24 p. refs

The use of a caret wing on single-stage-to-orbit vehicles, which delivers payloads to earth orbit, is proposed. The hypersonic lift and drag for a vehicle with a caret wing and another craft with a conventional flat-delta wing are compared. The application of the thin shock theory to the calculation of lift and drag forces is examined. Flow characteristics were evaluated in a hypersonic gun tunnel at a Mach number of 9.7. It is observed that the caret wing increases the lift coefficient and lift/drag ratio. I.F.

A86-33544

SYSTEMATIC GROUND-BASED MEASUREMENTS OF MESOSPHERIC WATER VAPOR

C. L. CROSKEY, J. J. OLIVERO, L. C. HALE (Pennsylvania State University, University Park), and P. J. MOSER (Bloomsburg University, PA) IN: 1985 International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, October 7-9, 1985, Digest. Volume 1 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 327-332. refs

(Contract N00014-79-C-0610)

Spectral height, area, absorption, and sunspot data of atmospheric water vapor are analyzed. The measurements are obtained by observing spectral absorption against a source, such as the sun, or by studying the spectral radiation in emissions; the experimental procedures are described. The analysis reveals that there are cyclic variations in the spectral height and spectral area produced by mesospheric water vapor. I.F.

A86-34195

CAN WE DEVELOP THE 1.5 MILLION POUND AEROSPACE PLANE?

D. J. HOLT Aerospace Engineering (ISSN 0736-2536), vol. 6, April 1986, p. 26-30.

A technology readiness and economic feasibility evaluation is made of hypersonic, 'transatmospheric' aerospace vehicles; attention is given to the prospects for propulsion systems capable of attaining the Mach 25 escape velocity needed to reach low earth orbits and duplicating many of the functions currently undertaken by the Space Shuttle. Either two integrated propulsion systems or two 'staged' vehicles may be employed to yield the requisite operational capabilities. The claims of competing airbreathing and nonairbreathing (rocket) propulsion systems are evaluated. O.C.

A86-34963* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MOTIVATIONAL CONTRACTING IN SPACE PROGRAMS - GOVERNMENT AND INDUSTRY PROSPECTIVES

D. R. CLOUGH (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 3-5 to 3-20.

NASA's Marshall Space Flight Center has used incentive-free policies in contracting for Apollo's Saturn Launch vehicle hardware, as well as award-fee contracts for major development and early production programs in the case of the Space Shuttle Program. These programs have evolved to a point at which multiple incentive fees are useful in motivating cost reductions and assuring timely achievement of delivery requirements and flight mission goals. An examination is presently conducted of the relative success of these motivation-oriented techniques, drawing on the comments of both government and industry personnel. O.C.

A86-34965* Wyle Labs., Inc., Huntsville, Ala.
COMMERCE LAB - A PROGRAM OF COMMERCIAL FLIGHT OPPORTUNITIES
J. ROBERTSON (Wyle Laboratories, Huntsville, AL), H. L. ATKINS, and J. R. WILLIAMS (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 4-2 to 4-14.

Commerce Lab is conceived as an adjunct to the National Space Transportation System (NSTS) by providing a focal point for commercial missions which could utilize existing NSTS carrier and resource capabilities for on-orbit experimentation in the microgravity sciences. In this context, the Commerce Lab program provides mission planning for private sector involvement in the space program, in general, and the commercial exploitation of the microgravity environment for materials processing research and development. It is expected that Commerce Lab will provide a logical transition between currently planned NSTS missions and future microgravity science and commercial R&D missions centered around the Space Station. The present study identifies candidate Commerce Lab flight experiments and their development status and projects a mission traffic model that can be used in commercial mission planning. Author

A86-34967* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACELAB 3 MISSION - BROADENING HORIZONS IN SPACE RESEARCH
G. H. FICHTL, C. K. HILL, and O. H. VAUGHAN (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 5-2 to 5-8. refs

The Spacelab 3 mission involves research in materials sciences, fluid mechanics, atmospheric science, astrophysics, and life sciences with emphasis on materials sciences. In this regard the mission will provide the best low-gravity environment possible within the hardware and operational constraints of the Shuttle/Spacelab system. This is truly a major milestone in space research. The paper describes the scientific goals of this important Spacelab mission and discusses how the mission was planned relative to the low-gravity aspects of the mission. Author

A86-34974* National Aeronautics and Space Administration, Washington, D.C.
INTERNATIONALIZATION OF THE SPACE STATION
R. V. LOTTMANN (NASA, Office of Space Station, Washington, DC) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 8-1 to 8-9.

Attention is given to the NASA Space Station system elements whose production is under consideration by potential foreign partners. The ESA's Columbus Program declaration encompasses studies of pressurized modules, unmanned payload carriers, and ground support facilities. Canada has expressed interest in construction and servicing facilities, solar arrays, and remote sensing facilities. Japanese studies concern a multipurpose experimental module concept. Each of these foreign investments would expand Space Station capabilities and lay the groundwork for long term partnerships. O.C.

A86-34991*# National Aeronautics and Space Administration, Washington, D.C.
SPACELAB HITCHHIKER, FOR RAPID, LOW COST ORBITAL RESOURCES
E. JAMES and R. L. LOHMAN (NASA, Spacelab Div., Washington, DC) Canaveral Council of Technical Societies, Space Congress, 22nd, Cocoa Beach, FL, Apr. 23-26, 1985, Paper. 8 p.

A carrier system called the Hitchhiker is being developed by NASA to bridge the gap between the limited capabilites of the Get Away Special (GAS) and the full support capabilities of the Spacelab. The Hitchhiker offers economy class flight for experiments which need little in the way of support services. The concept behind this carrier system is to use existing hardware in two basic configurations and to provide several sets of fixed service interfaces to the payload. One version of the Hitchhiker was designed to hang on the right side of the bay and the other to span the bay. Aside from cargo bay sill-level mounting positions for experiments, both Hitchhiker configurations provide modest power, command, and data management, and no active cooling services. The Hitchhiker is a payload of opportunity system utilizing the volume and weight remaining in the cargo bay after primary-payload needs are satisfied. Pointing and other time line requirements are limited to those established by the primary payload. The paper descibes the experiments of the first two Hitchhiker flights, together with future applications. K.K.

A86-34992*# National Aeronautics and Space Administration, Washington, D.C.
ENABLING TECHNOLOGIES FOR TRANSITION TO UTILIZATION OF SPACE-BASED RESOURCES AND OPERATIONS
S. R. SADIN (NASA, Office of Aeronautics and Space Technology, Washington, DC) and J. D. LITTY (General Research Corp., Space Systems Div., McLean, VA) Canaveral Council of Technical Societies, Space Congress, 22nd, Cocoa Beach, FL, Apr. 23-26, 1985, Paper. 10 p.

This article explores a potential scenario for the further development of space infrastructure resources and operations management. It is a scenario that transitions from the current ground-based system to an architecture that is predominantly space-based by exploiting key mission systems in an operational support role. If this view is accurate, an examination of the range of potential infrastructure elements and how they might interact in a maximally productive space-based operations complex is needed, innovative technologies beyond the current Shuttle and Space Station legacy need to be identified, and research programs pursued. Development of technologies within the areas of telerobotics, machine autonomy, human autonomy, in-space manufacturing and construction, propulsion and energy is discussed. Author

A86-35526
PRESCRIPTION FOR PROFITS
T. FURNISS Space (ISSN 0267-954X), vol. 2, Mar.-May 1986, p. 56-58.

The first attempts at pharmaceutical production in microgravity are described, together with prospects for the future. It was discovered that body-produced enzymes and proteins needed to cure such diseases as hemophilia, anemia and diabetes can be produced in greater quantities and higher purities through electrophoresis in microgravity. The first space manufacturing unit (CFES), launched in 1982, was mounted in the SS lower mid-deck and consisted of a fluid systems module, a microcomputer, and a water-cooling module. The CFES achieved the separation of 700 times more material, at a purity level 4 times greater than is possible on earth. Three subsequent attempts made by McDonnell Douglas at the purification of live insulin-producing beta cells are presented in detail. Undertakings planned by other companies include urea crystal production and the study of crystals used in nylon production and electronics. K.K.

A86-37187* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERACTIVE MISSION PLANNING FOR A SPACE SHUTTLE FLIGHT EXPERIMENT - A CASE HISTORY
H. M. HARRIS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Aerospace simulation II; Proceedings of the Second Conference, San Diego, CA, January 23-25, 1986 . San Diego, CA, Society for Computer Simulation, 1986, p. 143-151. NASA-supported research.

Scientific experiments which use the Space Shuttle as a platform require the development of new operations techniques for the command and control of the instrument. Principal among these is the ability to simulate the complex maneuvers of the orbiter's path realistically. Computer generated graphics provide a window into the actual and predicted performance of the instrument and allow sophisticated control of the instrument under varying conditions. In October of 1984 the Shuttle carried a synthetic aperture radar built by JPL for the purpose of recording images of the earth surface. The mission deviated from planned operation in almost every conceivable way and provided an exacting test bed for concepts of interactive mission planning. Author

A86-37428
MANAGEMENT OF HIGH-TECHNOLOGY RESEARCH AND DEVELOPMENT
J. H. DUMBLETON (Howmedica, Rutherford, NJ) Amsterdam and New York, Elsevier, 1986, 411 p. refs

R & D is discussed in terms of its position in the strategy-structure relationship of the firm. The discussion covers the following five areas: the nature of R & D, strategy and structure relationships, creativity, the R & D process, and the R & D interface. In particular, attention is given to models of the R & D process, success factors in R & D, the measurement of the R & D activity, the organizational structure of research and development, creative problem solving, project planning and control, personal factors in the R & D process, and trends in research and development. V.L.

A86-37853*# National Aeronautics and Space Administration, Washington, D.C.
THE U.S. SPACE STATION PROGRAM
P. E. CULBERTSON (NASA, Office of Space Station, Washington, DC) IN: International Conference on Space, 25th, Rome, Italy, March 26-28, 1985, Proceedings . Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1985, p. 11-22.

An overview is given of the U.S. Space Station program, beginning with President Reagan's directive to NASA 'to develop a permanently manned Space Station and to do it within a decade'. The international aspects of the project are emphasized, and fruitful cooperation between Italy and the U.S. in past and present space research is noted. The Station is to serve diverse functions, including that of a laboratory in space, a permanent observatory, a servicing facility, a transportation node, and assembly and manufacturing facility, a storage depot, and a staging base for future endeavors. Management-related and engineering-related guidelines are laid out. The plan is to make the Space Station a legacy from this century to the next, with the help of and to the benefit of all who share our goals. D.H.

A86-37870#
PRESENT AND FUTURE PROSPECTS OF MICROGRAVITY
L. G. NAPOLITANO (European Low Gravity Research Association, Munich, West Germany) IN: International Conference on Space, 25th, Rome, Italy, March 26-28, 1985, Proceedings . Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1985, p. 265-309.

An overview is given of the current status of microgravity research and related disciplines, with respect to the Space Station. The broad-field list of topics with microgravity relevance includes material sciences, fluid sciences, life sciences, engineering sciences, technology and processes. Areas and disciplines with the material sciences and fluid sciences are examined in some detail, and the expected requirements and evolutionary development of the sciences aboard the Space Station are considered. The report includes a position paper covering the situation in Europe with regard to microgravity research, covering ESA's microgravity experiments and the work of the organization known as ELGRA (European Low Gravity Research Association), founded in June 1979. D.H.

A86-38623
NUCLEAR POWER FOR EARTH ORBIT AND BEYOND
B. NOLLEY Space World (ISSN 0038-6332), vol. W-5-269, May 1986, p. 18-20.

The development of space-based thermoelectric nuclear power generators for such future applications as the propulsion of an Orbital Transfer Vehicle or planetary exploration is discussed. Nuclear fission reactors have a higher power/mass ratio than radioisotope or chemical generators, less atmospheric drag, and will not be dependent on attitude control. The NASA in-core thermionics SP-100 nuclear fission reactor prototype is expected in the mid-1990s. A low mass 6.4 percent efficient multimegawatt capability reactor is described with a fast spectrum reactor in the cone's apex, separate from the two silicon-germanium element thermoelectric conversion system. Liquid lithium transports heat from the 1970-C reactor to heat exchanges that convey it to the heat pipe array, and heat rejection occurs at the deployable radiator panels. R.R.

A86-38718#
ERS-1 - OUR NEW WINDOW ON THE OCEANS FOR THE 1990S
D. T. LLEWELLYN-JONES (SERC, Rutherford Appleton Laboratory, Didcot, England) British Interplanetary Society, Journal (Space Science) (ISSN 0007-084X), vol. 39, May 1986, p. 228-234.

ESA's First Remote Sensing Satellite (ERS-1) due for launch in 1989 will monitor a carefully selected set of geophysical parameters in an effort to describe the state of the sea-surface. The payload instruments of ERS-1, how they make their measurements, and how the data will be dealt with, are described and discussed. The payload consists of three microwave radars: (1) a wind and wave scatterometer, (2) a synthetic aperture radar, and (3) a radar altimeter. These instruments are complemented by an Along Track Scanning Radiometer and a Precise Range and Range-Rate Experiment. The concept of fast delivery data products is an essential element of the ERS-1 system, meaning that the processed ERS-1 data will be distributed to designated points of contact within three hours of being obtained by the spacecraft. It is concluded that these measurements will lead to a better scientific understanding of ocean-atmosphere interactions; moreover, they will pave the way to the application of such data products to a large range of commercial activities. K.K.

A86-38959
ADVANCED PROJECT MANAGEMENT (2ND EDITION)
F. L. HARRISON Aldershost, England/New York, Gower Publishing Co. Ltd./John Wiley and Sons, 1985, 390 p. refs

A 'project' is definable as a nonroutine and nonrepetitive undertaking that is conducted on a large scale under unique time-to-completion, financial, and technical performance goals. Management, organization and information systems have to be newly established for each project, and there can therefore be only a very limited learning curve for those involved. Great emphasis must be given to planning and control activities, especially for the financial management of the large capital expenditures often entailed. Attention is given to the estimation of project costs, cash flow forecasting, network analyses and bar charts, S-curves, milestone charts, performance analysis methods, and computer-based project management systems. O.C.

A86-40999* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A TECHNIQUE FOR LOWERING RISKS DURING CONTRACT NEGOTIATIONS
D. H. LEHMAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. EM-33, May 1986, p. 79-81. refs

In this day and age of sophisticated weapon and space system procurements, negotiations of the statement of work, technical requirements, and schedule may be as protracted as the negotiation of costs and profit. A major problem facing the program manager during contract negotiations is what affect changes in schedule, technical requirements, and contract terms have on the price. In many instances, after the statement of work has been redrafted, the contractor will be obliged to reprice the work, either on the spot or after a short recess in the negotiations. In this paper, a method for organizing the negotiation process is presented to reduce the risks incurred by the seller. The method is built upon regression analysis and two illustrative examples of its use are provided. Author

A86-41154* Alabama Univ., Huntsville.

COMMERCIAL USE OF SPACE - STATUS AND PROSPECTS

C. A. LUNDQUIST (Alabama, University, Huntsville) and W. C. SNODDY (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Winter National Design Engineering Show and Conference, Anaheim, CA, December 11-13, 1985, Conference Talks . Stamford, CT, Cahners Exposition Group, 1985, p. 225-239. refs

The development of commercial enterprises in space is discussed. The convenience and cost-effectiveness of satellites for communications are examined; satellite communications is an established industry and continues to grow. Meteorological satellites and remote sensing satellite systems (Landsat and SPOT) are being utilized to collect earth resources data. The development of materials processing facilities in space is studied. Current and proposed systems for transporting payloads to space and space lab facilities are investigated. The advantages a space station will provide to communications, earth resources, and materials processing are analyzed. The role of governments in the commercialization of space is described. I.F.

A86-41981

SPACE TECHNOLOGY AND RESOURCE MANAGEMENT

P. S. THACHER Journal of International Affairs (ISSN 0022-197X), vol. 39, Summer 1985, p. 151-166. refs

The applications of space technology to the management of natural resources are examined. Meteorological and oceanographic satellite data, MSS and thematic mapper images, and Space Shuttle recorded images are useful for monitoring resources; these satellite data are utilized for determining weather conditions (droughts) and vegetation indices, especially in Africa. Long-range research on the global processes of the earth, in order to understand biogeochemical cycles and the links between geophysical and biospheric processes is described. The relationship between desertification, famine, and droughts are analyzed. The development of the Global Environmental Monitoring System which collects and analyzes meteorological data related to global resources and environmental issues is discussed. The objectives of NASA's earth science research programs and the Global Resources Information Database are considered. The need for international cooperation for resource management and the role of the UN in monitoring natural resources are studied. I.F.

A86-43229* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EARTH OBSERVING SYSTEM

R. E. HARTLE (NASA, Goddard Space Flight Center, Greenbelt, MD) and A. TUYAHOV (NASA, Washington, DC) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 529-550.
(AAS PAPER 85-397)

This paper summarizes concepts for an Earth Observing System (EOS) for the 1990s that will provide the observational capabilities and an information system needed to understand how the earth works as a system. The concept diverges somewhat from past practices in that it considers EOS as an information system, where mission operation, EOS data bases and information about other relevant data sets are tied together by an information network. Three EOS instrument packages were chosen on the basis of synergistic groupings of instruments to make simultaneous observations of selected phenomena over a variety of wavelengths. Author

A86-43341

CONTRACTS OF AND WITH PRIVATE ENTERPRISES CONCERNING THE DEVELOPMENT, THE CONSTRUCTION, AND THE ASSEMBLY OF SPACE VEHICLES [VERTRAEGE VON UND MIT PRIVATUNTERNEHMEN BETR. DIE ENTWICKLUNG, DEN BAU UND DIE MONTAGE VON RAUMFLUGKOERPERN]

E. WOLFF (Dornier System GmbH, Friedrichshafen, West Germany) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 89-99. In German. refs

This paper provides a representation of some special features which characterize development contracts that governmental agencies award to industrial enterprises. Particular attention is given to conditions in West Germany. However, approaches used in connection with contracts involving ESA and NASA are also considered. The origin of the development contract is discussed along with the objective of the development contract, questions regarding the legal qualification of the development contract, regulations regarding compensation in development contracts, assurances concerning the quality of the performed work, and the rights of the party awarding the contract with respect to information, participation, and control. G.R.

A86-44404

THE DECISION TO DEVELOP THE SPACE SHUTTLE

J. M. LOGSDON (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 2, May 1986, p. 103-119. refs

In connection with the tragic destruction of the Challenger, questions regarding the origin of the Shuttle itself are considered, taking into account the decision, announced on 5 January 1972, to develop a particular Shuttle design on a limited budget. It is felt that the situation surrounding this decision has had a great deal of influence on the inability of that design to deliver routine and inexpensive space transportation. According to NASA plans in 1969, the Space Shuttle was to consist of two reusable components. After launch, the 'booster stage' would be flown by its crew to a landing near its launch site, while the 'Orbiter' would rendezvous with a Space Station. As a result of budgetary restrictions, these plans had to be abandoned. The final result, after very extended evaluations and negotiations, was the Space Shuttle design in its current form, which is characterized by much smaller development costs, but substantially larger operating costs. G.R.

A86-44526

SPACE - TECHNOLOGY AND OPPORTUNITY; PROCEEDINGS OF THE CONFERENCE, GENEVA, SWITZERLAND, MAY 28-30, 1985

Pinner, England, Online Publications, 1985, 356 p. For individual items see A86-44527 to A86-44551.

The technologies, organizations, hardware and plans for the commercialization of space activities in the near future are detailed. Financing schemes for manufacturing, leasing, sharing, or owning all or part of a spacecraft or a potential space-based industrial process are delineated, along with the problems facing the space insurance business. Although emphasis is placed on ESA and other European programs, the NASA Manned Space Station plays a pivotal role in the space development plans of most western nations, experimenters, and corporations. Attention is also devoted to unmanned platforms, their potential commercial applications, and to the necessary hardware infrastructure to support their operations. The capabilities of the Ariane 5 launch vehicle, the Hermes space plane, and a series of Chinese launch vehicles are described. Comparisons are made of the economics of various types of partially and fully reusable launch vehicles with diverse payload capabilities, of which the STS has the largest capacity. M.S.K.

A86-44530
STATUS OF ESA'S PLANNING FOR THE SPACE STATION
G. ALTMANN (ESA, Manned and Retrievable Systems Dept., Noordwijk, Netherlands) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 17-33.

The present status of preparation for the European Space Station Programme (COLUMBUS) is reviewed. A description of the COLUMBUS Programme concept placed in the context of ESA's long term space plane is presented and all facets of the COLUMBUS Preparatory Programme are outlined to provide an overview of ESA's planning for the Space Station Programme. Author

A86-44543
A FULLY REUSABLE LAUNCH VEHICLE FOR EUROPE?
A. BOND (Commercial Space Technologies, Ltd.; U.K. Atomic Energy Authority, Culham Laboratory, England) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 221-229.

It is argued in this paper that Europe should make a serious attempt to lead the commercial launcher field by building a fully reusable space transporter based on advanced propulsion concepts and structures. By analogy with the history of commercial aircraft it is postulated that such a development would not only enable traffic growth to be forced but also guarantee a major fraction of the 21st century world market for Europe, initially in spacecraft launches and later in launch vehicle sales. Author

A86-44548
ELECTROPHORESIS OPERATIONS IN SPACE - A PROMISING NEW COMMERCIAL VENTURE
J. T. ROSE (McDonnell Douglas Astronautics Co., Saint Louis, MO) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 281-284.

Space-based electrophoresis biological materials processing (EBMP) is being developed on Shuttle flights. EBMP takes advantage of the incipient electrical charge possessed by every biological and chemical substance. When the substances pass through an electrical field, they separate into distinct streams which can be collected. The efficiency of the process is hundreds of times more efficient in space than on the ground because of the microgravity in space. Biological substances such as enzymes and hormones, if produced in quantity, could have significant medical applications in the treatment of diseases such as diabetes, emphysema, dwarfism, thrombosis, etc. Mass production is thus far only a possibility in space, not on the ground. The technology is being developed as a Joint Endeavor between NASA and a corporation, and two other companies are bidding for building orbiting platforms for the industrial-scale operations to follow. M.S.K.

A86-45643
HORIZON 2000 AND ITS RELATION TO THE COLUMBUS PROGRAMME
V. MANNO (ESA, Directorate of the Scientific Programme, Paris, France) (Columbus Workshop, 1st, Capri, Italy, June 17-21, 1985) Earth-Oriented Applications of Space Technology (ISSN 0277-4488), vol. 6, no. 1, 1986, p. 101-104.

The ministers representing the different nation members of ESA agreed to an initial 5 percent/yr increase in the ESA science budget for the period 1985-90 as a show of support for the Horizon 200 plan. Projects started during the plan period have the flexibility for optimum utilization of all available launch facilities, including interfacing with the Columbus segment of the Manned Space Station (MSS). This interface would permit maintenance of a planned space-based submillimeter radiotelescope and the retrieval and storage of cometary samples gathered by a unmanned spacecraft. Other experiments, considered minor, could be carried on the Eureca free-flying platform, which will be launched, serviced and retrieved from the MSS base. M.S.K.

A86-45709#
TECHNOLOGY BASE FOR THE FUTURE OF SPACE
R. A. DAVIS Aerospace America (ISSN 0740-722X), vol. 24, July 1986, p. 44-47.

A summary is given of the detailed report of the AIAA's Ad Hoc Technical Committee on Space Systems, presented in November 1985 to the National Commission on Space. Among the key technologies detailed in the AIAA report that were highlighted by the Commission are high-performance electric propulsion systems, processing of lunar and other nonterrestrial materials, autonomous fault-tolerant machinery, aerospaceplane propulsion, advanced rocketry, aerobraking, long-duration closed ecosystems, nuclear-electric power plants, space tethers, and high-performance materials. Themes for civil space agendas are considered: cooperative international ventures, space commercialization, manned space stations leading to the protocolony, a Moon base, a Mars base during the third decade of the next century, and development and refinement of all the necessary support technologies. Author

A86-46763* National Aeronautics and Space Administration, Washington, D.C.
NASA PLANS FOR SPACEBORNE LIDAR - THE EARTH OBSERVING SYSTEM
R. J. CURRAN (NASA, Washington, DC) IN: Tunable solid state lasers for remote sensing; Proceedings of the Conference, Stanford, CA, October 1-3, 1984 . Berlin and New York, Springer-Verlag, 1985, p. 4-12. refs

The use of laser techniques to observe the earth's atmosphere and surface from space is examined. An Earth Observing System is proposed as the platform for performing lidar observations. The objectives and capabilities of the Lidar Atmospheric Sounder and Altimeter (LASA) are described. The measurement techniques for collecting temperature, pressure, and water vapor profiles, the vertical distribution of ozone in the stratosphere and troposphere, and atmospheric particulates profiles are discussed. The LASA requirements for altimetry and retroranging are considered. The Doppler Lidar Wind Sensor which provides data on wind velocity is analyzed. These laser systems with increased spatial resolution and accuracy form an efficient information system for studying earth science developments. I.F.

A86-46938#
AN UPDATED MODEL FOR A SPACE STATION HEALTH MAINTENANCE FACILITY
W. T. HARVEY, S. M. FARRELL, A. J. HOWARD, and F. C. PEARLMAN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 7 p.
(AIAA PAPER 86-2303)

The Space Station Health Maintenance Facility (HMF) is required to provide 'critical care' capability for one crew-nember for 28 days. The HMF must also provide routine monitoring and care for the Space Station crew for the duration of the mission. The equipment necessary to meet these requirements has been defined and an estimate of the physical characteristics of each piece of equipment has been completed. The equipment has been integrated into two Space Station standard outfitting packages, one which contains the laboratory and data management equipment and one which holds the critical care equipment and X-ray reader. The front panel configuration has been designed for optimum crew interface. The total system weight, volume and power requirements have been estimated at 1500 lbs, 140 cubic feet, and 0.5/2 kilowatts (routine/ critical care). The HMF Medical Data Management System hardware and architecture has been designed to complement the Space Station Data Management System. Author

A86-46960#
SPACE STATION - LIFE SCIENCES
R. S. YOUNG (Management and Technical Services Co., Washington, DC) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 4 p.
(AIAA PAPER 86-2346)

The use of the Space Station for biomedical research and the study of biological cellular and subcellular processes is described. The research will require: (1) a health maintenance facility, (2) a life science research facility, and (3) instruments and platforms for automatic experiments. Experiments analyzing physiological changes induced by microgravity and the relationship between gravity, cellular and organismal physiology, and biochemistry are to be performed on the Station. The development of closed ecological life support systems is to be studied on the Space Station. The Station's facilities are also to be utilized to examine the interaction of the earth's biota with the planet environment, and the origin, evolution, and distribution of life throughout the universe. I.F.

A86-47052* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE TECHNOLOGY TODAY
A. COHEN (NASA, Johnson Space Center, Houston, TX) Journal of Vacuum Science and Technology A (ISSN 0734-2101), vol. 4, May-June 1986, pt. I, p. 263-267.

The current status of major NASA programs and planning efforts is surveyed. Consideration is given to space-sciences programs (IRAS, SIRTF, Space Telescope, and planetary probes), applications programs (terrestrial remote sensing, communication, and meteorology), manned spacecraft, the STS, the Space Station, space commercialization efforts (materials processing and bioprocessing), and the feasibility of permanent lunar bases and manned Mars expeditions. Photographs and drawings are included. T.K.

A86-47648#
THE U.S. CIVIL SPACE PROGRAM: A REVIEW OF THE MAJOR ISSUES REPORT OF AN AIAA WORKSHOP, ALEXANDRIA, VA, JULY 22, 23, 1986
New York, American Institute of Aeronautics and Astronautics, 1986, 85 p. refs

Urgent and long-term issues affecting the U.S. civil space program are defined and recommendations are made. These issues include: (1) access to space (i.e., Shuttle redesign and requalification, launch and spacecraft insurance, and new launcher development); (2) space program management (ie., budget rationale and implementation, NASA's relation to other agencies, and military-civil interaction); (3) international involvement (ie., interactional civil space leadership, international cooperation and competition and international space year 1992); and (4) human motivations, resources and perceptions. It is noted that U.S. leadership in space can be restored only by vigorous action backed by firm commitments. The first requirement is a unified national policy which sets along terms objectives, and the second is a civil space budget which is approximately double what it is at the present time. K.K.

A86-47960*# RCA Astro-Electronics Div., Princeton, N. J.
SPACE STATION POLAR ORBITING PLATFORM - MISSION ANALYSIS AND PLANNING
P. A. MILLER (RCA, Astro-Electronics Div., Princeton, NJ) AIAA and AAS, Astrodynamics Conference, Williamsburg, VA, Aug. 18-20, 1986. 8 p. refs
(Contract NAS5-29400)
(AIAA PAPER 86-2178)

The Space Station Polar Orbiting Platform will be a serviceable spacecraft supporting a range of missions. The planning and analysis of these missions is investigated. The subjects of STS compatibility, rendezvous strategy, and requisite launch windows are addressed. General, as well as, two specific cases are detailed with respect to their incremental velocity requirements. Author

A86-48100
MISSIONS TO MARS
A. WILSON Flight International (ISSN 0015-3710), vol. 130, July 12, 1986, p. 35-37.

The two Mars missions which have been planned include NASA's Mars Observer and the Soviet Phobos project. Phobos, which is to use the new-generation Venera spacecraft, is scheduled to be launched on July 15, 1988. It is expected to arrive in Mars orbit during January 1989. NASA's Mars Observer is the first of the Planetary Observer series. The series will employ modified existing earth-orbiting satellites for inner solar system missions. Mars Observer will not be launched until August/September 1990. This mission will possibly be followed by the launch of the Mars Aeronomy Orbiter (MAO) in 1993/4. It is pointed out that, unless the Soviets undertake a manned Mars expedition before the turn of the century, the next logical step would be an unmanned sample return mission. The results of studies of such a mission are discussed, taking into account the conduction of such an enterprise in the time period from 1996 to 2005. G.R.

A86-48373
SPACE STATION EVOLUTION - THE UNCERTAINTY PRINCIPLE PREVAILS
C. BULLOCH Interavia (ISSN 0020-5168), July 1986, p. 779-782.

NASA planners have repeatedly reduced the scope of initial Space Station design concepts in order to realistically respond to financial stringencies. The number of U.S.-operated pressurized modules has been reduced to two, not counting the Space Station's logistics module. A decision has been made to rely on a solar dynamic electrical generation system based on a closed thermodynamic cycle that is powered by a solar concentrator-reflector. Attention is given to Canadian, European and Japanese plans for participation, and the ownership/legal status consequences that various collaborative arrangements can have. O.C.

A86-48451#
PROJECTIONS OF SPACE SYSTEMS OPPORTUNITIES AND TECHNOLOGIES FOR THE 2000 TO 2030 TIME PERIOD
New York, American Institute of Aeronautics and Astronautics, 1985, 101 p. refs

The present work is a report compiled by an Ad Hoc Committee of AIAA and subsequently presented to AIAA for submittal to the National Commission on Space. Particular emphasis is placed on the establishment of a technology base which would be crucial to civil space endeavors in the 2000-2030 time period. It considers the impact of technologically relevant events of the last five years, discusses future space system missions and opportunities, highlights critical technology developments, and outlines the steps necessary to the enhancement of the technology base over the next few decades. Space system technologies for the following areas are discussed in detail: information processing; guidance navigation and control; autonomy and automation; sensors; communications; materials; propulsion, power and energy; atmospheric flight; thermal management; environment; human support manufacturing; test and evaluation; and economics. K.K.

A86-49453
THE FLOWERING OF JAPAN'S SPACE PROGRAM
R. YARED Space World (ISSN 0038-6332), vol. W-7-271, July 1986, p. 15, 16.

Recent accomplishments and upcoming planned missions in Japan's space program are described. The Japanese space program is now one of the largest in the world. There have been 31 launchings to date of made-in-Japan satellites, including two spacecraft used recently for the international study of Halley's Comet, and there is talk, and drawing board designs, of a Japanese manned shuttle for early in the next century. Japan has space centers at Kagoshima on Kyushu island and also on Tanegashima island. The government budget is relatively modest: 0.02 percent of the national budget or about $600 million. The National Space Development Agency (NASDA) gets more than three quarters of this amount. NASDA is scheduling a launch into sun-synchronous orbit in early 1987 of Japan's first remote sensing spacecraft, a marine observation satellite; it will aid in determining weather conditions and forecasts as well as monitor fishing grounds, currents, red tides and other pollution; three sensors will be used: a multi-spectral electronic radiometer, a mechanical scanning radiometer with one visible and three IR channels, and a microwave scanning radiometer to pick up data transmitted from a collection platform on the sea surface. The Institute of Space and Astronautical Science (ISAS) is planning for a reflight of a Spacelab package on a January 1988 Shuttle flight. X-ray astronomy, microgravity, NASA Space Station participation (along with the U.S., ESA, and Canada), and the training of three Japanese astronauts are other areas being actively pursued. D.H.

N86-11657*# National Academy of Sciences - National Research Council, Washington, D. C.
GEODESY: A LOOK TO THE FUTURE
1985 193 p refs Sponsored in part by NASA, Defense Mapping Agency, NOAA and Geological Survey
(NASA-CR-176283; NAS 1.26:176283; PB85-199578) Avail: NTIS HC A09/MF A01 CSCL 08E

The report deals with the current and future uses of contemporary geodetic data and poses some questions and possibilities for the future. It is anticipated that the document will generate interest in present and future geodetic data for the solution of problems in Earth, ocean, and atmospheric sciences. GRA

N86-12158*# National Academy of Sciences - National Research Council, Washington, D. C.
NASA-UNIVERSITIES RELATIONSHIPS IN AERO/SPACE ENGINEERING: A REVIEW OF NASA'S PROGRAM
1985 33 p refs
(NASA-CR-176307; NAS 1.26:176307) Avail: NTIS HC A03/MF A01 CSCL 05I

NASA is concerned about the health of aerospace engineering departments at U.S. universities. The number of advanced degrees in aerospace engineering has declined. There is concern that universities' facilities, research equipment, and instrumentation may be aging or outmoded and therefore affect the quality of research and education. NASA requested that the National Research Council's Aeronautics and Space Engineering Board (ASEB) review NASA's support of universities and make recommendations to improve the program's effectiveness. G.L.C.

N86-12976# Oak Ridge National Lab., Tenn.
FUTURE DIRECTIONS IN MOBILE TELEOPERATION
W. R. HAMEL 1985 22 p Presented at the Workshop on Requirements of Mobile Teleoperators for Radiol. Emergency Response and Recovery, Dallas, 23 Jun. 1985
(Contract DE-AC05-84OR-21400)
(DE85-014308; CONF-8506148-3) Avail: NTIS HC A02/MF A01

Mobile teleoperator systems are the subject of an increasing amount of research and development. This work is motivated by general problems of remote operations in hazardous environments, some of which are very similar to the challenges of radiological emergency response and recovery. Current work appears to fall into two broad economic classes, one in the $100 K range and the other in the $1000 K range. Both are believed to be important for technology development and deployment. Recent developments confirm that we are at the technical doorstep of next-generation mobile systems which integrate dexterous manipulation, high mobility, and telerobotic operation. DOE

N86-13221*# ECON, Inc., Princeton, N.J.
R AND D LIMITED PARTNERSHIPS (POSSIBLE APPLICATIONS IN ADVANCED COMMUNICATIONS SATELLITE TECHNOLOGY EXPERIMENT PROGRAM)
22 Jun. 1985 75 p refs
(Contract NASW-3339)
(NASA-CR-176333; NAS 1.26:176333; ECON-80-111) Avail: NTIS HC A04/MF A01 CSCL 05A

Typical R&D limited partnership arrangements, advantages and disadvantages of R&D limited partnership (RDLPs) and antitrust and tax implications are described. A number of typical forms of RDLPs are described that may be applicable for use in stimulating R&D and experimental programs using the advanced communications technology satellite. The ultimate goal is to increase the rate of market penetration of goods and/or services based upon advanced satellite communications technology. The conditions necessary for these RDLP forms to be advantageous are outlined. E.A.K.

N86-13343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REPORT ON ACTIVE AND PLANNED SPACECRAFT AND EXPERIMENTS
N. J. SCHOFIELD, JR., R. G. LITTLEFIELD, and M. F. ELSEN Feb. 1985 337 p
(NASA-TM-87499; NSSDC/WDC-A-R/S-85-01; NAS 1.15:87499) Avail: NTIS HC A15/MF A01 CSCL 22A

This report provides the professional community with information on current and planned spacecraft activity (including both free-flying spacecraft and Shuttle-attached payloads) for a broad range of scientific disciplines. By providing a brief description of each spacecraft and experiment as well as its current status, it is hoped that this document will be useful to many people interested in the scientific, applied, and operational uses of the data collected. Furthermore, for those investigators who are planning or coordinating future observational programs employing a number of different techniques such as rockets, balloons, aircraft, ships, and buoys, this document can provide some insight into the contributions that may be provided by orbiting instruments. The document includes information concerning active and planned spacecraft and experiments. The information covers a wide range of scientific disciplines: astronomy, earth sciences, meteorology, planetary sciences, aeronomy, particles and fields, solar physics, life sciences, and material sciences. These spacecraft projects represent the efforts and funding of individual countries, as well as cooperative arrangements among different countries. Author

N86-15157*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
R AND D PRODUCTIVITY: NEW CHALLENGES FOR THE US SPACE PROGRAM
O. W. BASKIN, ed. (Houston Univ., Clear Lake) and L. J. SULLIVAN, ed. 1985 596 p refs Conference held in Houston, Tex., 10-11 Sep. 1985; sponsored in cooperation with NASA. Johnson Space Center, Houston Univ., AIAA, and the American Productivity Center
(NASA-TM-87520; NAS 1.15:87520) Avail: NTIS HC A25/MF A01 CSCL 05A

Various topics related to research and development activities applicable to their U.S. space program are discussed. Project management, automatic control technology, human resources, management information systems, computer aided design, systems engineering, and personnel management were among the topics covered.

N86-15165*# Harvard Univ., Cambridge, Mass. Business School.
MANAGING COOPERATIVE RESEARCH AND DEVELOPMENT VENTURES
W. J. MURPHY *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 75-87 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A

As cooperative ventures to conduct research and development become increasingly attractive, management of these collective undertakings poses new challenges to executives. In selecting the most appropriate organizational structure and strategy the author suggests that the collective enterprise executive must strike the best balance among three distinct but related elements: contribution of the participants; creation of benefits; and transfer of benefits to contributors. Eight types of cooperative R&D ventures are proposed with discussion of the unique management tasks associated with each type. R.J.F.

N86-15168*# Purdue Univ., West Lafayette, Ind.
EFFICIENCY AND INNOVATION: STEPS TOWARD COLLABORATIVE INTERACTIONS
C. A. LENGNICK-HALL and D. C. KING *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 121-131 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A

Research and development units are faced with the challenging objective of being cost effective while developing high quality, innovative products. Advanced technology is only part of the solution. It is increasingly clear that organization structures and managerial processes must also be designed and structured to meet the dual objectives of quality and efficiency. The results of an empirical case analysis of a large R & D division which is attempting to meet this challenge is presented. Author

N86-17225*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESEARCH AND TECHNOLOGY FISCAL YEAR 1985 REPORT Annual Report
F. SPEER Nov. 1985 136 p
(NASA-TM-86532; NAS 1.15:86532) Avail: NTIS HC A07/MF A01 CSCL 05A

A quarter of a century is but a moment on the cosmic calendar. Now that Marshall Space Flight Center has reached its 25th Anniversary, it seems just moments ago that President Dwight D. Eisenhower stood on these grounds and formally dedicated the George C. Marshall Space Flight Center in Huntsville, Alabama. The Fiscal Year 1985 Research and Technology Report reflects the wide spectrum of activities closely linked with the Center's mainstream spaceflight developments. Past accomplishments testify to the success of getting deeply involved in the science and technology of its projects - 32 Saturn launches, Pegasus, the Skylab missions, three High Energy Astronomy Observatory missions, the Apollo - Soyuz mission, and an accelerating schedule of successful Shuttle, Spacelab, and Shuttle payload missions. The Center continues to be involved in engineering development, scientific research, and technology. At the beginning of the second quarter century, the experience and dedication of the engineers and scientists, and the success of the collaboration with industry and academia will now be aimed at the next great endeavor, the Space Station. Author

N86-17230# Pacific Northwest Labs., Richland, Wash.
TECHNOLOGY TRANSFER IS OPPORTUNITY TRANSFER
T. M. LEVINSON, L. C. SCHMID, and R. L. WATTS Jun. 1985 11 p Presented at the 10th Annual Meeting of the Technology Transfer Society, San Francisco, Calif., 24 Jun. 1985
(Contract DE-AC06-76RL-01830)
(DE85-016622; PNL-SA-12976; CONF-8506175-1) Avail: NTIS HC A02/MF A01

The management of intellectual property and the decision process of selecting federal technologies for transfer is approached from the perspective of how they can be packaged as business opportunities. The package is usually provided by a technologist who is the technology provider and the opportunity must be perceived as such by the business person. Thoughts are provided on the different perspectives of the technology provider and the technology seeker and the environment in which the transfer process occurs. The different perspectives and the environment can cause a disconnect between the research result and its uses. By using selection criteria based on the business person's perspective and by presenting the technology in terms of what it can become helps to mitigate this disconnect. DOE

N86-17265*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
RESEARCH AND TECHNOLOGY Annual Report, 1985
Nov. 1985 62 p
(NASA-TM-83099; NAS 1.15:83099) Avail: NTIS HC A04/MF A01 CSCL 05A

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 increasing emphasis on the Center's research and technology program. In addition to strengthening those areas of engineering and operations technology that contribute to safe, 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 Space Station and other 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 1985 Annual Report. The report contains brief descriptions of research and technology projects in major areas of Kennedy Space Center's disciplinary expertise. Author

N86-17595*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGY ACHIEVEMENTS AND PROJECTIONS FOR COMMUNICATION SATELLITES OF THE FUTURE
J. W. BAGWELL 1986 13 p refs Proposed for presentation at the 11th Communications Satellite Systems Conference, San Diego, Calif., 16-20 Mar. 1986; sponsored by AIAA
(NASA-TM-87201; E-2856; NAS 1.15:87201) Avail: NTIS HC A02/MF A01 CSCL 17B

Multibeam systems of the future using monolithic microwave integrated circuits to provide phase control and power gain are contrasted with discrete microwave power amplifiers from 10 to 75 W and their associated waveguide feeds, phase shifters and power splitters. Challenging new enabling technology areas include advanced electrooptical control and signal feeds. Large scale MMIC's will be used incorporating on chip control interfaces, latching, and phase and amplitude control with power levels of a few watts each. Beam forming algorithms for 80 to 90 deg. wide angle scanning and precise beam forming under wide ranging environments will be required. Satelllite systems using these dynamically reconfigured multibeam antenna systems will demand greater degrees of beam interconnectivity. Multiband and multiservice users will be interconnected through the same space platform. Monolithic switching arrays operating over a wide range of RF and IF frequencies are contrasted with current IF switch technology implemented discretely. Size, weight, and performance improvements by an order of magnitude are projected. Author

N86-18379# European Space Agency, Paris (France).
SPACE STATION: ESA VIEWS ON REQUIREMENTS FOR EXPERIMENTAL AND OPERATIONAL EARTH OBSERVATION MISSIONS
G. DUCHOSSOIS *In its* Proceedings of EARSeL/ESA Symposium on European Remote Sensing Opportunities: Systems, Sensors, and Applications p 189-199 Jun. 1985 refs
Avail: NTIS HC A12/MF A01

The requirements of spaceborne experimental and operational Earth observations are reviewed, and an unmanned polar platform element, composed preferably of two platforms in adequately phased orbits is recommended as part of the European contribution to the US Space Station. Possible configuration and resources capabilities for such platforms are provided, together with candidate payloads. Author (ESA)

N86-19943*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DEVELOPMENT OF SPACE TECHNOLOGY FOR ECOLOGICAL HABITATS
N. V. MARTELLO *In* NASA. Ames Research Center Controlled Ecological Life Support Systems p 613-625 Jan. 1986 refs
Avail: NTIS HC A99/MF A01 CSCL 06K

The development of closed ecological systems for space stations is discussed. Growth chambers, control systems, microgravity, ecosystem stability, lighting equipment, and waste processing systems are among the topics discussed. R.J.F.

N86-21420*# National Aeronautics and Space Administration, Washington, D.C.
NASA: 1986 LONG-RANGE PROGRAM PLAN
Aug. 1985 269 p
(NASA-TM-87560; NAS 1.15:87560) Avail: NTIS HC A12/MF A01 CSCL 05A

For the years beyond FY 1986, the plan consists of activities that are technologically possible and considered to be in the national interest. Its implementation will ensure logical and continued progress in reaching the Nation's goals in aeronautics and space, consistent with the responsibilities assigned NASA by the National Aeronautics and Space Act of 1958, as amended. The major features of the programs are described in detail and the nature of the aeronautics and space programs beyond the year 2000 are projected. The abbreviations and acronyms that appear in this report are listed. The status of NASA's plans are summarized at the time of its preparation. Author

N86-23184# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGICAL SERVICES OF THE WORLD
1985 367 p refs
(WMO-2; ISBN-92-63-03002-2) Avail: NTIS MF A01; print copy available at WMO, Geneva

For World Meteorological Organization members, details of the state meteorological service; other state meteorological organizations dependent on the service; other state meteorological organizations independent of the service; meteorological institutes forming part of the service; meteorological institutes not forming part of the service; publications; and responsible authority for aeronautical meteorological services are listed. Author (ESA)

N86-24712*# Essex Corp., Huntsville, Ala.
THE GREAT OBSERVATORIES FOR SPACE ASTROPHYSICS
M. HARWIT (Cornell Univ., Ithaca, N.Y.) and V. NEAL 9 Jan. 1986 51 p Original contains color illustrations
(Contract NASA ORDER H-78175-B)
(NASA-CR-176754; NAS 1.26:176754) Avail: NTIS HC A04/MF A01 CSCL 22A

Motivated by the ancient urge to observe, measure, compute, and understand the nature of the Universe, the available advanced technology is used to place entire observatories into space for investigations across the spectrum. Stellar evolution, development and nature of the Universe, planetary exploration, technology, NASA's role, and careers in asronomy are displayed. B.G.

N86-25290# National Planning Association, Washington, D. C.
TRENDS IN INDUSTRIAL R AND D ACTIVITIES IN THE UNITED STATES, EUROPE AND JAPAN, 1963-83
D. M. LEVY and N. E. TERLECKYJ 26 Sep. 1985 53 p refs
Presented at the Conference on Productivity Growth in Japan and The United States, Cambridge, Mass., 26-28 Aug. 1985
(Contract NSF SRS-83-07769)
(PB86-141371) Avail: NTIS HC A04/MF A01 Prepared in cooperation with George Mason Univ., Fairfax, Va. CSCL 05A

The growth in industrial R and D activity in the United States in relation to R and D expenditures in Western Europe and Japan is examined. The effects of foreign industrial R and D expenditures on private R and D expenditures in the United States are considered, with R and D expenditures performed under contract for the United States Government taken into account. A clear and positive relationship is shown between private R and D expenditures and R and D expenditures performed under government contract. In addition, the influence of foreign industrial R and D expenditures on U.S. expenditures is explored econometrically. GRA

N86-26249# Massachusetts Inst. of Tech., Cambridge. Sea Grant Program.
MARINE-RELATED RESEARCH AT MIT (MASSACHUSETTS INSTITUTE OF TECHNOLOGY): A DIRECTORY OF RESEARCH PROJECTS, 1985-1986
S. D. STOLZ Sep. 1985 104 p Sponsored by NOAA
(PB86-158102; MITSG-85-31) Avail: NTIS HC A06/MF A01 CSCL 05B

A report on marine-related research at MIT contains items in the following areas: fisheries and food and drugs from the sea; marine biology; marine mineral resources; alternative energy sources; pollution; oceanography; ocean engineering; ship design and operations; shipping and transportation systems; and marine education. GRA

N86-26355*# National Aeronautics and Space Administration, Washington, D.C.
ENVIROSAT-2000 REPORT: FEDERAL AGENCY SATELLITE REQUIREMENTS
D. COTTER, ed., I. WOLZER, ed., N. BLAKE, J. JARMAN, D. LICHY, T. PANGBURN, R. MCARDLE, C. PAUL, L. SHAFFER, G. THORLEY et al. NOAA Jul. 1985 156 p refs
(NASA-TM-88752; NAS 1.15:88752) Avail: NTIS HC A08/MF A01 CSCL 22B

The requirement of Federal agencies, other than NOAA, for the data and services of civil operational environmental satellites (both polar orbiting and geostationary) are summarized. Agency plans for taking advantage of proposed future Earth sensing space systems, domestic and foreign, are cited also. Current data uses and future requirements are addressed as identified by each agency. B.G.

N86-27109# Los Alamos National Lab., N. Mex.
CREATIVITY IN SCIENCE - A SYMPOSIUM
M. R. RAJU, ed., J. A. PHILLIPS, ed., and F. HARLOW, ed. Aug. 1985 143 p Presented at the Creativity in Science Symposium, Los Alamos, N. Mex., 13-14 Aug. 1984
(Contract W-7405-ENG-36)
(DE86-003289; LA-10490-C; CONF-8408177) Avail: NTIS HC A07/MF A01

This conference proceeding is a collection of the talks and panel discussions for the symposium, Creativity in Science, held at Los Alamos National Laboratory August 13 and 14, 1984. Also included is a related colloquium and dialogue by J. Krishnamurti, which took place at Los Alamos National Laboratory on March 20 and 21, 1984. The symposium addressed issues concerning individual creativity and management for creativity. DOE

N86-27306*# San Jose State Univ., Calif. Space Research and Development Organization.
THE DEVELOPMENT OF A PROJECT PLAN FOR THE GET AWAY SPECIAL PROGRAM
S. J. BUTOW *In* NASA. Goddard Space Flight Center The 1985 Get Away Special Experimenter's Symposium p 65-72 May 1986
Avail: NTIS HC A13/MF A01 CSCL 22A

Trying to get a project started? Well, since the introduction of the Get Away Special Program, there have been 451 reservations placed by people who, just like yourself, are eager to send a small payload into space; and yet only 33 of them have actually succeeded. Even more staggering, many of those who have flown have done so more than once; meaning that less than 10% of all GAS users have actually sent something into space. Some of the problems that face GAS users are approached and it is hoped that they will be helpful, especially to those new to the program. Some of the subject areas include selecting a project, and payload management. Author

N86-27409*# National Aeronautics and Space Administration, Washington, D.C.
THE SUITABILITY OF VARIOUS SPACECRAFT FOR FUTURE SPACE APPLICATIONS MISSIONS
C. W. MATHEWS, R. BERNSTEIN (International Business Machines Corp., Palo Alto, Calif.), and D. C. MACLELLAN (Massachusetts Inst. of Tech., Cambridge.) Jul. 1986 18 p
(NASA-TM-88986; NAS 1.15:88986) Avail: NTIS HC A02/MF A01 CSCL 22B

The Space Applications Advisory Committee (SAAC) of NASA's Advisory Council was asked by the Associate Administrator for Space Science and Applications to consider the most suitable future means for accomplishing space application missions. To comply with this request, SAAC formed a Task Force whose report is contained in this document. In their considerations, the Task Force looked into the suitability of likely future spacecraft options for supporting various types of application mission payloads. These options encompass a permanent manned space station, the Space Shuttle operating in a sortie mode, unmanned platforms that integrate a wide variety of instruments or other devices, and smaller free fliers that accommodate at most a few functions. The Task Force also recognized that the various elements could be combined to form a larger space infrastructure. This report summarizes the results obtained by the Task Force. It describes the approach utilized, the findings and their analysis, and the conclusions. Author

N86-28805# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
A PROFILE OF SELECTED FIRMS AWARDED SMALL BUSINESS INNOVATION RESEARCH FUNDS
Mar. 1986 15 p
(AD-A165664; GAO/RCED-86-113FS) Avail: NTIS HC A02/MF A01 CSCL 05C

The General Accounting Office conducted interviews and developed a profile of the 19 firms, obtained a description of their research work and experiences with the SBIR (Small Business Innovative Research) program, and identified efforts these firms were making to commercialize products or services developed with SBIR funding. The information collected was from firms receiving awards in fiscal years 1983 and 1984. To obtain additional information about commercialization of products developed with SBIR funding, we interviewed officials at eight venture capital firms and three experts on small business innovation. GRA

N86-28907# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ACTIVITIES REPORT IN AEROSPACE RESEARCH Annual Report, 1984
24 Apr. 1985 195 p
(ETN-86-97190) Avail: NTIS HC A09/MF A01

Research in aerodynamics; test facilities; spacecraft and aircraft construction materials; spacecraft and aircraft structures; computer science; fluid mechanics; energetics; physics; and aerospace systems is summarized. ESA

N86-29463# Delaware Univ., Lewes.
THE OVERALL PLAN: A SCIENTIFIC STRATEGY
F. WEBSTER *In* WMO International Conference on the TOGA Scientific Program 5 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The aims of the Tropical Ocean Global Atmosphere project are to assess knowledge of the interannual variability of the tropical ocean and the global atmosphere. Program objectives are: to determine to what extent the time-dependent behavior of the tropical ocean and global atmosphere system is predictable on time scales of months to years and to understand the mechanism of this behavior; to study the feasibility of modeling the coupled ocean-atmosphere system for predicting its variations on time scales of months to years; and to provide the scientific background for designing an observing and data transmission system for operational prediction if this capability is demonstrated by coupled ocean-atmosphere models. ESA

N86-29477# World Meteorological Organization, Geneva (Switzerland).
FIRST IMPLEMENTATION PLAN FOR THE WORLD CLIMATE RESEARCH PROGRAM
Nov. 1985 151 p
(WCRP-5; ETN-86-97076) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

The World Climate Research Program activities are organized according to six subprograms whose objectives are to establish the physical basis of long range weather forecasting; understand the predictable aspects of global climate variations over periods of several months to several years, and assess the response of climate to natural or man-made influences over periods of several decades. The subprograms are: Atmospheric Climate Prediction; Coupled Atmosphere-Ocean Boundary Layer; Tropical Ocean and Global Atmosphere project; World Ocean Circulation Experiment; Cryosphere; and Climatic Sensitivity Assessment. ESA

N86-29888*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PROCEEDINGS OF THE 2ND ANNUAL CONFERENCE ON NASA/UNIVERSITY ADVANCED SPACE DESIGN PROGRAM
Jun. 1986 31 p Conference held at Cocoa Beach, Fla., 18-20 Jun. 1986
(Contract NGT21-002-080)
(NASA-TM-89399; NAS 1.15:89399) Avail: NTIS HC A03/MF A01 CSCL 22B

Topics discussed include: lunar transportation system, Mars rover, lunar fiberglass production, geosynchronous space stations, regenerative system for growing plants, lunar mining devices, lunar oxygen transporation system, mobile remote manipulator system, Mars exploration, launch/landing facility for a lunar base, and multi-megawatt nuclear power system. B.G.

N86-30302*# National Aeronautics and Space Administration, Washington, D.C.
LIFE SCIENCES SPACE STATION PLANNING DOCUMENT: A REFERENCE PAYLOAD FOR THE LIFE SCIENCES RESEARCH FACILITY
Aug. 1986 132 p
(NASA-TM-89188; NAS 1.15:89188) Avail: NTIS HC A07/MF A01 CSCL 06B

The Space Station, projected for construction in the early 1990s, will be an orbiting, low-gravity, permanently manned facility providing unprecedented opportunities for scientific research. Facilities for Life Sciences research will include a pressurized research laboratory, attached payloads, and platforms which will allow investigators to perform experiments in the crucial areas of Space Medicine, Space Biology, Exobiology, Biospherics and Controlled Ecological Life Support System (CELSS). These studies are designed to determine the consequences of long-term exposure to space conditions, with particular emphasis on assuring the permanent presence of humans in space. The applied and basic research to be performed, using humans, animals, and plants, will increase our understanding of the effects of the space environment on basic life processes. Facilities being planned for remote observations from platforms and attached payloads of biologically important elements and compounds in space and on other planets (Exobiology) will permit exploration of the relationship between the evolution of life and the universe. Space-based, global scale observations of terrestrial biology (Biospherics) will provide data critical for understanding and ultimately managing changes in the Earth's ecosystem. The life sciences community is encouraged to participate in the research potential the Space Station facilities will make possible. This document provides the range and scope of typical life sciences experiments which could be performed within a pressurized laboratory module on Space Station. Author

N86-30470*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SONIC-BOOM RESEARCH: SELECTED BIBLIOGRAPHY WITH ANNOTATION
H. H. HUBBARD (Bionetics Corp., Hampton, Va.), D. J. MAGLIERI, and D. G. STEPHENS Sep. 1986 44 p
(NASA-TM-87685; L-16127; NAS 1.15:87685) Avail: NTIS HC A03/MF A01 CSCL 20A

Citations of selected documents are included which represent the state of the art of technology in each of the following subject areas: prediction, measurement, and minimization of steady-flight sonic booms; prediction and measurement of accelerating-flight sonic booms; sonic-boom propagation; the effects of sonic booms on people, communities, structures, animals, birds, and terrain; and sonic-boom simulator technology. Documents are listed in chronological order in each section of the paper, with key documents and associated annotation listed first. The sources are given along with acquisition numbers, when available, to expedite the acquisition of copies of the documents. Author

N86-30583# Los Alamos National Lab., N. Mex.
INSTITUTIONAL SUPPORTING RESEARCH AND DEVELOPMENT, 1985
H. MOTZ, comp. Feb. 1986 83 p
(Contract W-7405-ENG-36)
(DE86-008580; LA-10600) Avail: NTIS HC A05/MF A01

This report presents 25 articles on projects currently supported by the Institutional Supporting Research and Development Program at Los Alamos National Laboratory. Articles are grouped into several categories: chemistry and materials sciences, life sciences, geosciences and space physics, techniques/instrumentation/devices, and physics. Much of the work reported here relies on multidisciplinary approaches; it encompasses not only basic research but also important, technically challenging applied research relevant to the Laboratory's mission. DOE

N86-30602*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE STATION
D. R. THOMPSON *In* Lunar and Planetary Inst. IN Trajectory Determination and Collection of Micrometeoroids on the Space Station p 83-84 1986
Avail: NTIS HC A06/MF A01 CSCL 03B

The Space Station is being defined as a multi-purpose facility with emphasis in the following areas: scientific and technology research laboratory; permanent observatory; spacecraft servicing facility; construction and assembly facility; manufacturing facility; transportation node; and staging base for future space endeavors. The Station complex, in its initial operating capability configuration, includes a continuously habitable manned element, a polar orbiting unmanned platform, and a second unmanned platform co-orbiting with the manned element. All elements are dependent on the Space Transportation System (STS) for initial placement on-orbit and for subsequent logistical services. The manned element will be designed for long duration operations with systems maintainable on-orbit and operationally autonomous from ground control. A major feature of the Station will be its adaptability to evolutionary technology upgrades; and the Space Station, as a system, is to be designed for maximum ease of use by its users. Author

N86-31340*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTICS DIVISION RECENT ACCOMPLISHMENTS AND RESEARCH PLANS
L. R. CLARK and H. G. MORGAN Jul. 1986 144 p
(NASA-TM-89012; NAS 1.15:89012) Avail: NTIS HC A07/MF A01 CSCL 20A

The research program currently being implemented by the Acoustics Division of NASA Langley Research Center is described. The scope, focus, and thrusts of the research are discussed and illustrated for each technical area by examples of recent technical accomplishments. Included is a list of publications for the last two calendar years. The organization, staff, and facilities are also briefly described. Author

N86-31451*# National Aeronautics and Space Administration, Washington, D.C.
SPINOFF 1985
J. J. HAGGERTY 1986 131 p
(NASA-TM-89240; NAS 1.15:89240) Avail: NTIS HC A07/MF A01 CSCL 05A

Mainline NASA programs, whose challenging objectives necessitate advances across a diverse scientific/technological spectrum are summarized. A representative selection of spinoff products and processes are presented and the NASA technology from which these transfers are derived, are described. The mechanisms NASA employs to foster technology utilization and stimulate interest among prospective users of the technology are detailed. B.G.

N86-31461# Amsterdam Univ. (Netherlands). Dept. of Science Dynamics.
EVALUATION OF RESEARCH: EXPERIENCES AND PERSPECTIVES IN THE NETHERLANDS
S. BLUME, H. DITS, P. GROENEWEGEN, L. LEYDESDORFF, A. PRINS, J. W. SMEENK, J. SPAAPEN, and S. ZELDENRUST Dec. 1984 47 p
(ESA-86-96709) Avail: NTIS HC A03/MF A01

Dutch research is evaluated in relation to government science and technology policy. Universities and special research institutes are covered. ESA

N86-31489*# California Univ., San Diego. Center for Astrophysics and Space Sciences.
EXTRAGALACTIC ASTRONOMY
E. M. BURBIDGE *In* NASA. Goddard Space Flight Center Nineteenth International Cosmic Ray Conference. Conference Papers: Invited Rapporteur, Highlight, Miscellaneous, Volume 9 6 p Feb. 1986
Avail: NTIS HC as boxed set only $200/MF A01 per volume or E99 per entire set CSCL 03B

Components of the active extragalactic universe are examined to discover what extragalactic objects exhibit physical processes of the same kind as those thought to be important within the galaxy. Radio galaxies; quasars; bulk ejection from galactic objects such as novae supernovae, and other galactic nuclei; the red shifts of quasars; and the possibility of non-cosmological red shifts are among the topics discussed. It is concluded that the highest energy cosmic rays may have an extragalactic or extragalactic origin. R.J.F.

N86-32849# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ESA AND ITS EARTH OBSERVATION PROGRAMS
J. N. DEVILLIERS *In its* Remote Sensing Applications in Civil Engineering p 19-28 Mar. 1985
Avail: NTIS HC A06/MF A01

The ESA Earth Observation Programs in meteorology (Meteosat) precise time transfer (LASSO), remote sensing of the oceans (ERS-1), and cartographic mapping from Spacelab are described. Reception, processing and distribution of satellite remote sensing data are outlined. The requirements for advanced satellite missions in land observation and solid Earth physics, and studies undertaken to define and determine the feasibility of such missions are summarized. ESA

N86-32950*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA WORKSHOP ON ANIMAL GRAVITY-SENSING SYSTEMS
M. L. CORCORAN, ed. Aug. 1986 52 p Held at Pacific Grove, Calif., Feb. 1985
(NASA-TM-88249; A-86233; NAS 1.15:88249) Avail: NTIS HC A04/MF A01 CSCL 06C

The opportunity for space flight has brought about the need for well-planned research programs that recognize the significance of space flight as a scientific research tool for advancing knowledge of life on Earth, and that utilize each flight opportunity to its fullest. For the first time in history, gravity can be almost completely eliminated. Thus, studies can be undertaken that will help to elucidate the importance of gravity to the normal functioning of living organisms, and to determine the effects microgravity may have on an organism. This workshop was convened to organize a plan for space research on animal gravity-sensing systems and the role that gravity plays in the development and normal functioning of these systems. Scientists working in the field of animal gravity-sensing systems use a wide variety of organisms in their research. The workshop presentations dealt with topics which ranged from the indirect gravity receptor of the water flea, Daphnia (whose antennal setae apparently act as current-sensing receptors as the animal moves up and down in water), through specialized statocyst structures found in jellyfish and gastropods, to the more complex vestibular systems that are characteristic of amphibians, avians, and mammals. Author

N86-33212# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
UNIVERSITY FUNDING: FEDERAL FUNDING MECHANISMS IN SUPPORT OF UNIVERSITY RESEARCH
Feb. 1986 187 p
(AD-A168023; GAO/RCED-86-53) Avail: NTIS HC A09/MF A01 CSCL 05A

The nation's universities play a vital role in advancing U.S. economic health by performing nearly half of its basic research that provides the foundation for technological progress. Federal funds support approximately two-thirds of this university-based basic research. As reported by the National Science Foundation, the federal government, in fiscal year 1984, expended approximately $5.5 billion at universities for research and development, of which approximately $4 billion was for basic research. The federal government transfer funds to universities and colleges through various funding mechanisms support both research and the infrastructure of research (major equipment and facilities, special training needs, and institutional support). A funding mechanism is a category of federal financial support or scientific research performed at and by U.S. universities. With the last decade concern has grown that the current array of funding mechanisms may not adequately provide for the continuity and stability of research, the modernized equipment, and the human resourcs needed to maintain the vital role the universities play in the nation's research effort. This report provides information on federal funding of university research by presenting the array of funding mechanisms used by Federal agencies in funding such research. GRA

07

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.

A86-10568
TURBOPROP AIRLINERS GET BIGGER - WILL THEY HAVE A MARKET?
B. REK Interavia (ISSN 0020-5168), vol. 40, Sept. 1985, p. 995-998.

New turboprop aircraft seating over 40 passengers are being built by European manufacturers to satisfy the demands of feeder, regional and commuter traffic. The new aircraft include the ATR42-200 44-seater, the F26 50-seater, the ATP 64-seater and the Dash 8 Series 300 50-seater. Variants of all the aircraft are also being planned, some in stretch versions and some with pressurized cabins. Much of the manufacturing activity is spurred by the growth of U.S. regional markets since deregulation. The size of the stretch turboprop aircraft is inherently limited by the overlap with small jet aircraft and their speed advantages. M.S.K.

A86-15857#
THE CANADIAN MOBILE SATELLITE SERVICE AND ITS SOCIO-ECONOMIC ASSESSMENT
P. M. BOUDREAU and J. H. C. BRADEN (Department of Communications, Ottawa, Canada) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 11 p.
(IAF PAPER 85-364)

The Mobile Satellite (MSAT) program of Canada, established for the purpose of developing mobile-satellite services by 1990, and its associated services are discussed, together with the program's definition studies for evaluating the financial and socioeconomic impact. The economic concept and the methodology used to perform the socioeconomic assessment are described in detail. The results of the analysis indicate that the total socioeconomic benefits of the MSAT are very large for both the baseline ($1159 millions) and pessimistic ($513 millions) market scenarios, with most of the benefits accrued by the net users (in land, maritime, aeronautical, communications, and space services and the manufacturing industries), and high returns to private investors and the government, including sizable indirect social benefits. I.S.

A86-15893#
THE ECONOMICS OF SPACE LAUNCHERS - OUTLOOK FOR THE FUTURE
D. MUGNIER (CNES, Evry, France) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 6 p.
(IAF PAPER 85-420)

It is noted that, at present, the fees charged by both NASA for Space Shuttle launchings and ESA for Ariane launches do not reflect the actual cost of such operations; they are instead defined by the need of the U.S. and Western Europe to establish and expand markets for future commercial exploitation. The recovery of launch system development costs cannot, however, be indefinitely postponed, especially in view of the coming development of the reusable upper stage, Hermes. Projections are made in the present economic study which indicate that the Ariane 5 launch vehicle or a derivative will continue to profitably launch commercial satellites until the year 2010. O.C.

A86-15895*# National Aeronautics and Space Administration, Washington, D.C.
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) TRACKING AND DATA RELAY SATELLITE SYSTEM (TDRSS) PROGRAM ECONOMIC AND PROGRAMMATIC, CONSIDERATIONS
R. O. ALLER (NASA, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 10 p.
(IAF PAPER 85-422)
The Tracking and Data Relay Satellite System (TDRSS) represents the principal element of a new space-based tracking and communication network which will support NASA spaceflight missions in low earth orbit. In its complete configuration, the TDRSS network will include a space segment consisting of three highly specialized communication satellites in geosynchronous orbit, a ground segment consisting of an earth terminal, and associated data handling and control facilities. The TDRSS network has the objective to provide communication and data relay services between the earth-orbiting spacecraft and their ground-based mission control and data handling centers. The first TDRSS spacecraft has been now in service for two years. The present paper is concerned with the TDRSS experience from the perspective of the various programmatic and economic considerations which relate to the program. G.R.

A86-17673
ESTIMATING - THE INPUT INTO GOOD PROJECT PLANNING
L. A. SMITH and T. MANDAKOVIC (Florida International University, North Miami) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. EM-32, Nov. 1985, p. 181-185. refs
The application of project management systems has grown rapidly in all economic sectors and industries. The growth is expected to continue with the implementation of new and more complex computerized planning and control systems. However, these systems are only as good as the input or estimates of time, cost, and resources. In this paper, the literature on the procedures and techniques used to develop good estimates are reviewed. These techniques are generically summarized to be applicable to any project. Some considerations are broken down which should be understood prior to estimating. It is concluded that not all estimates should be evaluated with the same level of effort and concern. Finally, an estimate is defined, rules for developing better estimates are summarized, and a checklist of constraints and considerations is developed. Author

A86-18385
COMMERCIALIZATION OF SPACE - THE INVESTMENT OPPORTUNITIES
R. A. WILLIAMSON (Office of Technology Assessment, Washington, DC) Space Policy (ISSN 0265-9646), vol. 1, May 1985, p. 210-214. refs
The prospects for space commercialization into the 21st century are discussed, with emphasis given to the benefits of private investment. The major factors encouraging and inhibiting the growth of private investments in space activities are considered, including technological uncertainties; insurance costs; government support; and tax benefits. A model agreement between government and industry to share in the development of a space venture, the NASA Joint Endeavor Agreement (JEA) is described in detail. I.H.

A86-18539
FINANCE OF INTERNATIONAL CARRIERS
C. TILLINGHAST, JR. Northrop University Law Journal of Aerospace, Energy, and the Environment (ISSN 0196-1489), vol. 5, Winter 1984, p. 25-30.
An assessment is made of the economic basis for the operation of international air carriers, with attention to the differences that inhere in private and government ownership status. Emphasis is put on the danger that privately owned carriers lacking the credit, earnings, or government support required to keep fleets at a high level of competitive efficiency will be crowded out of markets by foreign airlines having government support. Nevertheless, capital markets have historically demonstrated an exceptional ability to adapt to changes in the economic environment. O.C.

A86-21886
ECONOMIC CONSIDERATIONS OF SPACE MANUFACTURING
W. A. JOHNSTON, JR. and B. G. MONTGOMERY (Fairchild Space Co., Germantown, MD) IN: EASCON '84; Proceedings of the Seventeenth Annual Electronics and Aerospace Conference, Washington, DC, September 10-12, 1984 . New York, Institute of Electrical and Electronics Engineers, 1984, p. 181-185.
Materials processing in space (MPS) offers an opportunity to produce dramatic new products in pharmaceuticals, electronics, and metals. But the cost of access to space forces prospective manufacturers to select products whose market value is exceptionally high. This paper addresses the factors influencing the costs of transporting and operating factories in space and offers approaches for minimizing the effect of these costs on the finished product. In particular, the trade-off between operating entirely on the shuttle versus setting up on a free-flying platform is explored, with examples given for hypothetical pharmaceutical and crystal manufacturing processes. Author

A86-24102
WASHINGTON BROADENS ITS EFFORTS TO AID SMALL BUSINESS
P. MANN Commercial Space (ISSN 8756-4831), vol. 1, Summer 1985, p. 21, 24, 25.
Efforts by NASA to develop interest in the small business community for commercial space ventures are discussed. Activities undertaken by NASA's Office of Commercial Programs to facilitate Joint Endeavor Agreements (JEAs) between small business and NASA are described in detail. Emphasis is given to the need for a broad array of potential investors in capital-intensive space R&D programs, including: electronic materials research; pharmaceuticals processing; remote sensing; and satellite communications. A list of U.S. government centers for space business information is provided. I.H.

A86-24104
SHUTTLE LAUNCHES OF SATELLITES ARE MAKING SPACE A BOTTOMLINE BUSINESS
G. MIGLICCO (Peat, Marwick, Mitchell and Co., Houston, TX) Commercial Space (ISSN 8756-4831), vol. 1, Summer 1985, p. 36-39.
Factors affecting the levels of private investment in commercial projects in space are considered. Attention is given to tax uncertainties; the long lag time between investment and payoff; and government regulation costs. Some of the attributes of an attractive space venture are discussed including: high investment/return ratio; investment-to-payoff lag time of 1-5 years; and relaxed tax requirements. The opportunities for limited partnerships in R&D for space projects are briefly outlined. I.H.

A86-24110
SPACE STATION MANAGER'S NEXT BIG JOB IS TO DRUM UP BUSINESS
E. H. KOLCUM Commercial Space (ISSN 8756-4831), vol. 1, Summer 1985, p. 81, 83-85.
A progress report on the development of Space Station is given. The Phase B design definition study now under way is described in detail. Phase B consists of four separate mission design studies involving the selection of designs for the command modules structural framework, power sources and free-flying servicing vehicles. Contracts will be awarded for the development of Space Station hardware during Phase C, and Phase D will be the assembly of the Station in orbit. A photograph of a full scale mock-up of a Space Station command module is provided. I.H.

A86-24123
COMMERCIAL MARKETING OF LANDSAT DATA BEGINS
B. M. GREELEY, JR. Commercial Space (ISSN 8756-4831), vol. 1, Fall 1985, p. 66-69.

The marketing of the data made available from Landsat 4 and 5 is examined. The proposed design and functions of Landsat 6 and 7 are described. Agreements with data users concerning the prices, ordering, reproduction, and dissemination of data are discussed. The policies on remarketing of enhanced and unenhanced digital and photographic data are analyzed. The educational use of Landsat data is studied. A price schedule for Landsat data, effective November 1, 1985, is provided. I.F.

A86-26451
SPACE: THE COMMERCIAL OPPORTUNITIES; PROCEEDINGS OF THE INTERNATIONAL BUSINESS STRATEGY CONFERENCE, LONDON, ENGLAND, OCTOBER 31, NOVEMBER 1, 1984
Pinner, England, Online Publications, 1984, 191 p. For individual items see A86-26452 to A86-26465.

Among the topics discussed are: insurance in space risk management; legal issues in planning commercial space activities; and the potential market for commercial launch vehicles. Consideration is also given to: the position of Ariane in the world launch vehicle market; the economic advantages of reusable systems like Shuttle; and the growth of the satellite communications market; and European perspectives on the U.S. Space Station proposal. Additional topics include spin-off investments in space for small and medium-size investors; the market potential of remote sensing imagery; a general overview of risks and rewards in space investments. I.H.

A86-26453
INSURANCE IN SPACE RISK MANAGEMENT
D. S. THOMPSON (Stewart Wrightson International Group, Ltd., Space and Satellite Div., England) IN: Space: The commercial opportunities; Proceedings of the International Business Strategy Conference, London, England, October 31, November 1, 1984 . Pinner, England, Online Publications, 1984, p. 15-27.

Risk management concepts are presently applied to parties intimately involved with the commercialization of space activities, encompassing financiers, system manufacturers, spacecraft owners, spacecraft component transporters and shippers, spacecraft users, and consultants to all the aforementioned. Attention is given to the ways in which risks can be transferred to international insurance markets, on the basis of assessments of financing, assets, personnel, and general market conditions. Actions typical in risk financing are discussed, with emphasis on satellite-related practices. O.C.

A86-26464
SATELLITE COMMUNICATIONS - A RAPIDLY EXPANDING MARKET?
R. FILEP (Communications 21 Corp., Redondo Beach, CA) IN: Space: The commercial opportunities; Proceedings of the International Business Strategy Conference, London, England, October 31, November 1, 1984 . Pinner, England, Online Publications, 1984, p. 153-163.

The worldwide commercial communication satellite market has experienced phenomenal growth during the past five years and is expected to grow at an irregular rate through 2000. This paper discusses current and planned expenditures, procurements, and launches, as well as key factors affecting the market. Author

A86-26465
EARTH OBSERVATION SATELLITES - FROM TECHNOLOGY PUSH TO MARKET PULL
G. BRACHET (SPOT Image, Toulouse, France) IN: Space: The commercial opportunities; Proceedings of the International Business Strategy Conference, London, England, October 31, November 1, 1984 . Pinner, England, Online Publications, 1984, p. 165-183.

The present trend towards commercial operation of high resolution observation satellites of the earth's surface will have a profound effect on the market for remote sensing data as well as on the industry for data enhancement and interpretation. The present situation is described, including satellites programs planned for the medium term, and the role of hardware, software and service industry is stressed. Author

A86-27885#
COST IN SPACE - THE PRICE OF GOVERNMENT CONTROL
R. W. POOLE, JR. (Reason Foundation, Santa Barbara, CA) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 151-165. refs

This paper advances the thesis that government space projects are inherently more costly that privately conceived and financed space projects. Both the Shuttle and the proposed Space Station are cases in point. Government space projects end up being costly for a number of reasons: (1) NASA has built-in incentives to prefer large budget projects, and so do NASA contractors; (2) political pressures lead to more costly multipurpose designs to satisfy different constituencies; (3) government lacks a marketing orientation, and therefore prices things incorrectly; (4) government spends excessively to minmize risk, rather than taking prudent gambles on potential breakthroughs; and (5) NASA also presumes that central planning is the best way to manage R&D, failing to understand how venture capital markets and entrepreneurship foster real innovation. Thus, government space programs have created a highly misleading impression that space development is more costly than it needs to be. If venture capital is to be attracted to space, it is important that government's central role be drastically reduced. Author

A86-27886#
FOUR IMPORTANT ISSUES IN THE CIVIL SPACE AREA
T. F. ROGERS (Office of Technology Assessment, Washington, DC) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 242-245.

A discussion is presented concerning the U.S. civilian space program's policy concern with such problems as the future reduction of currently high unit costs of space infrastructure and activities, and the determination of those ways in which the resources available to government institutions can be made available to private sector commercial and industrial interests. It is strongly recommended that NASA redouble its efforts to enlist, train, and carry citizens from nonscientific backgrounds into orbit, in order to disseminate enthusiasm for space exploration and exploitation. O.C.

A86-28418
PRODUCTIVITY IMPACTS OF SOFTWARE AUTOMATION
T. G. BINDER (Boeing Aerospace Co., Seattle, WA) IN: NAECON 1985; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 20-24, 1985. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 750-754.

Software automation activities are being initiated throughout industry on the basis of expected payoffs in terms of productivity. This paper discusses the productivity improvement impacts that can be expected when software automation is introduced into a software development organization. A software cost modeling approach is used to attempt to quantify productivity improvement impacts in terms of reduced labor expenditures to develop and maintain embedded software systems. The impacts of individual tools as well as increased availability of the computing resources are considered. The sources of software costs are described and related to a life cycle model and to the cost model. The key features of the Boeing Automated Software Engineering (BASE) project are related to the sources of software cost. A description is presented that estimates the productivity impact of the BASE project through the use of a simple cost model and conclusions and recommendations for future work are made. Author

A86-29494
PRIVATE FUNDS WILL BOLSTER TAX DOLLARS IN THE JOB OF FINANCING THE STATION
D. C. WALKLET (Terra-Mar, Mountain View, CA) Commercial Space (ISSN 8756-4831), vol. 1, Winter 1986, p. 41-43, 46-48.

The NASA Space Station, although originally intended solely as a research facility, is now committed to commercial activity as well and thereby invites consideration as a substantially privately funded industrial park in space. Investors must assess risks posed by technical, financial, and political uncertainties. Possible financing methods include venture capital, limited partnership, and project financing; each of these is appropriate under different circumstances, as detailed in the present discussion. Assuming that commercial applications become a significant factor in the planning process, a strategy must be implemented that will accomodate differing user requirements for orbiting facilities. Space Station design and financing should accordingly be structured around its individual components, rather than the facility as a whole. O.C.

A86-29607#
IMPROVED SYSTEM COST AND PERFORMANCE ACTS USING MULTI-BEAM PROCESSING SATELLITES
H. S. BRAHAM (TRW, Inc., Redondo Beach, CA) IN: Communication Satellite Systems Conference, 11th, San Diego, CA, March 17-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 259-265. refs (AIAA PAPER 86-0645)

ACTS, a NASA flight program featuring an experimental, multibeam, processing spacecraft, is discussed. ACTS represents the first space use of several advanced technologies, and will permit major system advantages in follow-on operational systems, including: (1) multiple T-1 capacity in low-cost Customer Premise Service (CPS) stations that can affordably be proliferated in thousands throughout the U.S.; (2) full network interconnectivity among CPS stations of all customers, where single-string hardware can be used in each station to maintain its low cost; (3) single hop through the satellite, permitting toll-grade voice in a mesh network of low-cost CPS stations; (4) optimum echo cancelation, because each station is collocated with the end user; and (5) low-cost interconnectivity to each local telco switch. In this paper, the ACTS architecture and its routing and interconnectivity are described, and the benefits of the ACTS multibeam processing satellite are discussed. C.D.

A86-29699* Princeton Synergetics, Inc., N.J.
COMMUNICATIONS SATELLITE BUSINESS VENTURES - MEASURING THE IMPACT OF TECHNOLOGY PROGRAMMES AND RELATED POLICIES
J. S. GREENBERG (Princeton Synergetics, Inc., NJ) Space Policy (ISSN 0265-9646), vol. 2, Feb. 1986, p. 37-51. NASA-supported research.

An economic evaluation and planning procedure which assesses the effects of various policies on fixed satellite business ventures is described. The procedure is based on a stochastic financial simulation model, the Domsat II, which evaluates spacecraft reliability, market performance, and cost uncertainties. The application of the Domsat II model to the assessment of NASA's ion thrusters for on-orbit propulsion and GaAs solar cell technology is discussed. The effects of insurance rates and the self-insurance option on the financial performance of communication satellite business ventures are investigated. The selection of a transportation system for placing the satellites into GEO is analyzed. I.F.

A86-41037#
WHICH TRANSPORT TECHNOLOGIES WILL FLY?
J. M. SWIHART (Boeing Co., Seattle, WA) Aerospace America (ISSN 0740-722X), vol. 24, May 1986, p. 56-58.

The cost of ownership of commercial aircraft is seen as a factor that will limit which new technologies will be adopted. Today, for a 10 percent fuel saving, an airline can bear a premium of only 2.5 percent. Thus, some technologies that look promising technically will not pay off big enough to fly. Technologies that can be expected to pay off include: using computers to design improved wings; lighter materials such as aluminum-lithium alloys and composites (if labor and material costs for composite structures are not too great); computer-aided design/computer-aided manufacturing; microprocessor technology; fiber optics (to potentially reduce the heavy electromagnetic shielding required for electronics); and improved engines such as the counterrotating pusher turboprop. Fly-by-wire and fly-by-light systems, which might replace mechanical cable controlled flight systems, need to be studied further. Various of these technologies in combination may within a decade make possible a transport delivering over 150 seat-miles per gallon. Such an airliner would make most of today's aircraft obsolete - if the cost of ownership can be kept down. D.H.

A86-41681
NEW JOB FOR NASA IS MARKETING MANAGEMENT
M. MACMILLIAN Commercial Space (ISSN 8756-4831), vol. 2, Spring 1986, p. 66-68.

The growing internationalization of the space business has resulted in NASA's need to develop new commercial markets, while at the same time advancing space technological evolution and being responsive to the congressional funding process. The NASA Office of Commercial programs will develop future markets in space, and NASA Centers for Commercial Development are being created to encourage industrial participation in space R&D. Privatization of the space transportation system is considered. The possibility of the establishment of a separate government agency to market the Shuttle's capabilities, and the idea of space-based industry in general, are also discussed. It is suggested that easing the process of applying for a Joint Endeavor Agreement with NASA will enhance the relationship with the private sector. R.R.

A86-44537
COUNTERTRADE - A NECESSARY PART OF MARKETING, OR AN EXPENSIVE DIVERSION?
M. W. BRACKENREED JOHNSTON (Jardine Glanvill (Interplanetary), Ltd., England) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 133-144.

Satellite sales throughout the developing world are constrained by the lack of hard currency. Countertrade can assist by providing exporters with payments, but this in turn can lead to new and unfamiliar risks. In this paper the role of trading houses and the insurance market in this rediscovered aspect of world trade is discussed. Author

A86-44538
FINANCIAL STRUCTURE FOR PARTICIPATION IN INDUSTRIAL SPACE PROJECTS
R. S. SOWTER (Airlease International Management, Ltd., London, England) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 145-154.

Financial techniques for engaging profitably in a space industrial project are discussed. Investment in a space project can be done through equity or by installments. The former is normally arranged with consideration of the tax benefits, and can be done through a subsidiary which will find further partners if the expenses become too burdensome. Loans are an option, subject to lending institution views of the value of space hardware, the terms, the payment schedule. The types of international, credit, domestic, export, World Bank, and European Investment Bank loan arrangements which can be made are discussed briefly. Attention is given to the benefits of leasing hardware from the manufacturer, and to time and finance leases for amortising the hardware cost. Factors which may affect any lease, i.e., tax credits, corporate tax rates, rental payments, charges against taxes, and equipment obsolescence are reviewed. M.S.K.

A86-44549
MORE PRECIOUS THAN GOLD - THE ECONOMICS OF MATERIALS PROCESSING IN SPACE
J. J. EGAN (Coopers and Lybrand, Space Consulting Div., Washington, DC) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 285-295.

This paper examines the fundamental economic factors affecting emerging space processing ventures. It assesses how thay apply in the context of current activities in the areas of semiconductor materials, pharmaceuticals, protein crystals and biotechnology, metals and glasses, and polymer and organic chemistry. Finally, it addresses the economic impact of developments in space transportation and workplaces on the future of these ventures. Author

A86-45636
ECONOMIC ASPECTS OF SPACE INDUSTRIALIZATION
G. VIRIGLIO (Aeritalia S.p.A., Gruppo Sistemi Spaziali, Turin, Italy) (Columbus Workshop, 1st, Capri, Italy, June 17-21, 1985) Earth-Oriented Applications of Space Technology (ISSN 0277-4488), vol. 6, no. 1, 1986, p. 61-63.

The prospects for commercialization of space in the near-term are discussed. It is estimated that $65 billion in space ventures could be realized by the year 2000 AD, which would include $27 billion for pharmaceuticals, $15 billion for advanced space communications, and $11.5 billion for space-processed glasses. Initiatives are underway to develop semiconductor processor facilities for space to obtain, e.g., high-purity GaAs chips at a cost 25 percent lower than possible on earth. Private companies are engaging in joint projects with NASA to develop commercial space manufacturing techniques and to educate non-aerospace industries in the potential benefits of space manufacturing. Several measures can further the process, e.g., tax credits for space investments, the treatment of profits as long-term capital gains, and continual follow-ups on companies which profess interest in space manufacturing. M.S.K.

A86-46961#
AN ECONOMICS PERSPECTIVE OF THE 21ST CENTURY SPACE STATION
M. K. MACAULEY (Resources for the Future, Washington, DC) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 5 p. refs
(AIAA PAPER 86-2348)

This paper offers an admonition for effective Space Station growth in the next century. Short of ability either to forecast or influence levels of economic activity, there nonetheless remains one aspect of near-term station use that can be implemented by station planners and that has direct consequences for the longer term. This aspect is the role of pricing policy for station access and use. Pricing can be crucial in determining where technical change and new developments in station design and operation will be needed. Furthermore, if past experience with technical change in the use of nonpriced resources is a guide to the future (as with the geostationary orbit and electromagnetic spectrum), the absence of prices can invite the presence of stringent, costly technical rules to accommodate scarcity, as well as emotive debate. Given the large amount of international collaboration envisioned for the Space Station, efficient pricing established early on in the program may perpetuate the most objective long-run allocation of scarce station resources. Author

N86-12243*# ECON, Inc., Alexandria, Va.
MARKETING THE USE OF THE SPACE ENVIRONMENT FOR THE PROCESSING OF BIOLOGICAL AND PHARMACEUTICAL MATERIALS Final Report
13 Apr. 1984 162 p refs
(Contract NASW-3339)
(NASA-CR-176334; NAS 1.26:176334; ECON-81-110) Avail: NTIS HC A08/MF A01 CSCL 22A

The perceptions of U.S. biotechnology and pharmaceutical companies concerning the potential use of the space environment for the processing of biological substances was examined. Physical phenomena that may be important in space-base processing of biological materials are identified and discussed in the context of past and current experiment programs. The capabilities of NASA to support future research and development, and to engage in cooperative risk sharing programs with industry are discussed. Meetings were held with several biotechnology and pharmaceutical companies to provide data for an analysis of the attitudes and perceptions of these industries toward the use of the space environment. Recommendations are made for actions that might be taken by NASA to facilitate the marketing of the use of the space environment, and in particular the Space Shuttle, to the biotechnology and pharmaceutical industries. Author

N86-12390# Rockwell International Corp., Golden, Colo.
OPTIONS FOR OPERATIONAL RISK ASSESSMENTS
S. A. DOVER 1985 12 p Presented at the 7th Intern. System Safety Conf., San Jose, Calif., 25 Jul. 1985
(Contract DE-AC04-76DP-03533)
(DE85-014904; RFP-3855; CONF-850723-4) Avail: NTIS HC A02/MF A01

Risk assessment is a set of analytical tools that can be used to clarify possible outcomes of decisions where the two different courses of action are indicated or different values are in conflict. These conflicts often arise in the management of any production or support facility. This paper outlines the options for performing risk assessments of any scope and the parameters that determine their effectiveness. It highlights the relative costs of each option, useful information developed, and limitations of the information. The paper concludes with the types of decisions that are routinely made in an operating facility and could benefit from the information generated in a risk assessment. DOE

N86-16451*# Princeton Synergetics, Inc., N.J.
EVALUATION OF SPACECRAFT TECHNOLOGY PROGRAMS (EFFECTS ON COMMUNICATION SATELLITE BUSINESS VENTURES), VOLUME 1 Final Report
J. S. GREENBURG, C. GAELICK, M. KAPLAN (Spacetech, Inc.), J. FISHMAN, and C. HOPKINS (Econ, Inc., San Jose, Calif.) Sep. 1985 186 p refs 2 Vol.
(Contract NAS3-23886)
(NASA-CR-174978; NAS 1.26:174978) Avail: NTIS HC A09/MF A01 CSCL 17B

Commercial organizations as well as government agencies invest in spacecraft (S/C) technology programs that are aimed at increasing the performance of communications satellites. The value of these programs must be measured in terms of their impacts on the financial performane of the business ventures that may ultimately utilize the communications satellites. An economic evaluation and planning capability was developed and used to assess the impact of NASA on-orbit propulsion and space power programs on typical fixed satellite service (FSS) and direct broadcast service (DBS) communications satellite business ventures. Typical FSS and DBS spin and three-axis stabilized spacecraft were configured in the absence of NASA technology programs. These spacecraft were reconfigured taking into account the anticipated results of NASA specified on-orbit propulsion and space power programs. In general, the NASA technology programs resulted in spacecraft with increased capability. The developed methodology for assessing the value of spacecraft technology programs in terms of their impact on the financial performance of communication satellite business ventures is described. Results of the assessment of NASA specified on-orbit propulsion and space power technology programs are presented for typical FSS and DBS business ventures. R.J.F.

N86-23630# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A COST ANALYST'S GUIDE TO SATELLITE AUTONOMY AND FAULT-TOLERANT COMPUTING
P. S. KILLINGSWORTH 1985 22 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161853) Avail: NTIS HC A02/MF A01 CSCL 12A

The trend in satellite design is toward greater autonomy in satellite functions, particularly in attitude determination and navigation. Fault-tolerant computing is a necessary condition for autonomy, and incurs costs in terms of computer memory, throughput, power and weight. Fault-tolerance and reliability issues need to be looked at and estimated early in the system development. This could prevent cost overruns due to lengthened test programs and unexpected redesigns. Finally, space logistics is becoming an area of increasing interest and study. The costs of space transportation and modular designs for on-orbit replacement of components need to be weighed against the cost of building increasingly intelligent and autonomous satellites. GRA

N86-24574# Defense Systems Management School, Fort Belvoir, Va.
AIDS IN VALIDATING A CONTRACTOR'S COST ESTIMATE
B. H. RUDWICK 1985 20 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161871) Avail: NTIS HC A02/MF A01 CSCL 05A

One method that a government reviewer can use in validating a contractor's cost estimate is to motivate the contractor to generate the cost estimate properly, and to forward the entire analysis, including all of the data used, to the government for review. If the analysis has been done properly, the government's effort is reduced to one of checking, rather than independent cost estimating. Furthermore, if several contractors are providing estimates, the government review team can check corresponding parts of the analysis against one another, draw their own conclusions of what the CER input values should be (including the range of uncertainty of each input characteristic), and obtain a good bounded range of the estimated cost. This paper describes and illustrates the type of instructions which can be given to the contractors to provide such motivations, and how the government can use the contractor's data to obtain its own estimate. GRA

N86-24575# Clemson Univ., S.C.
COST UNCERTAINTY ASSESSMENT METHODOLOGY: A CRITICAL OVERVIEW
K. T. WALLENIUS Sep. 1985 19 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A161920) Avail: NTIS HC A02/MF A01 CSCL 14A

An appraisal of the quality of methodology and software for performing cost uncertainty analysis will be given. It will be argued that the standard practice of developing a most likely cost and then generating an uncertainty distribution associated with that figure is a consequence of historical precedent and places the cart before the horse. It will also be argued that methodology for encoding subjective probability distributions are out of date, being, for the most part, modifications of the PERT techniques of the sixties. Additionally, methodology for processing elemental uncertainty assessments into uncertainty distributions over higher order structures (e.g., subsystem CER's or total system cost) often ignores important sources of variability, and extent computer software designed to implement cost uncertainty analysis methodology is often poorly written and, in some cases, may lead to conclusions which are inconsistent with the inputs. This is a paper presented at a cost analysis symposium. GRA

N86-24588# Space Command, Peterson AFB, Colo. Cost and Economic Analysis Div.
PRIMER ON OPERATING AND SUPPORT (O AND S) COSTS FOR SPACE SYSTEMS
R. H. LAMONTAGNE Sep. 1985 16 p Presented at the 19th Annual Department of Defense Cost Analysis Symposium, Leesburg, Va., 17-20 Sep. 1985
(AD-A162381) Avail: NTIS HC A02/MF A01 CSCL 14A

Currently, the most common space system is the satellite with its associated ground-based support facilities. However, other systems are currently being developed such as the Strategic Defense Initiative (SDI), Space Station, space based radar, anti-satellite weapon, and others. Our difficulty in the cost community is in developing O&S cost estimates for all these systems. As a result HQ Space Command/ACM is in the process of developing a primer on O&S costs for Space Systems. It is intended to provide some guidelines and fundamentals for estimating the O&S cost for space systems; to address the O&S costs associated with space systems; and to present methodologies and factors to estimate the O&S costs. An O&S cost element structure will be developed for space systems. The primer will result in providing cost visibility for space systems for developing budget and life cycle cost estimates and analyses. GRA

N86-27115# Naval Postgraduate School, Monterey, Calif.
AN APPLICATION OF COST RISK IN INCENTIVE CONTRACTS M.S. Thesis
C. M. MCGRATH Dec. 1985 96 p
(AD-A165177) Avail: NTIS HC A05/MF A01 CSCL 14A

This thesis begins with an examination of the literature concerning incentive contract effectiveness and contractor motivation. Citing the most frequently supported conclusions, the researcher integrates these with a cost risk analysis methodology based upon the Beta distribution. The result is a share curve that automatically adjusts the share ratio based upon estimated cost variance. The researcher suggests that this approach is better at reflecting cost risk than the standard linear design. The share curve provides more risk sharing, especially at higher levels of cost variance, and provides both significant rewards and penalties only for significant deviations from target cost. The final conclusion is that the share curve mitigates the defense contractors' risk averse nature, thus allowing the profit motive to become operative in incentivizing the contractor to control or reduce costs. GRA

N86-28783# Mohawk Research Corp., Lake Forest, Ill.
FINANCING APPLIED R AND D IN SMALLER COMPANIES
M. L. RORKE, H. C. LIVESAY, H. KIERULFF, and A. RAMSEUR Oct. 1985 14 p
(PB86-196987) Avail: NTIS HC $11.50/MF A01 CSCL 05A

The authors have been interested in the issues surrounding financing for small firms since 1977. This series of research projects conducted in the U.S. and abroad included a series of workshops held in the period 1982 to 84. These workshops involved a broad spectrum of financiers ranging from passive investors of small amounts of money to professional venture capital firms investing millions of dollars in syndication with other venture capital firms. GRA

N86-31758# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Sciences.
SEMIMANUFACTURED PRODUCTS MADE OF COPPER AND COPPER ALLOYS: AN ANALYSIS OF PRODUCTION AND SALE IN A WORLD PERSPECTIVE [HALFFABRIKATEN VAN KOPER EN KOPERLEGERINGEN: EEN ANALYSE VAN PRODUKTIE EN AFZET IN MONDIAAL PERSPEKTIEF]
A. SANNEN 1984 69 p In DUTCH
(EUT/BDK/15; ISBN-90-6757-015-X; ETN-86-97687) Avail: NTIS HC A04/MF A01

Semimanufactured products based on copper or copper alloys were investigated with a view to an economical and technically justified production in copper-exporting developing countries. The structure of the world copper industry is presented. The recycling of copper for industrial applications is discussed. The market for semimanufactured products and the copper market in developing countries is presented. 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.

A86-10928#
LOGISTICS SUPPORTABILITY CONSIDERATIONS DURING CONCEPTUAL AND PRELIMINARY DESIGN
D. P. SCHRAGE and S. A. MEYER (Georgia Institute of Technology, Atlanta) AIAA, AHS, and ASEE, Aircraft Design Systems and Operations Meeting, Colorado Springs, CO, Oct. 14-16, 1985. 9 p.
(AIAA PAPER 85-3052)

Big payoffs in aircraft life cycle costs and mission effectiveness can be achieved if logistic supportability considerations are adequately addressed during conceptual and preliminary design. Logistic supportability considerations must be sensitized and traded off like other quantifiable design parameters. With current aircraft design practices this has been difficult. This paper discusses methods to address logistic supportability trade-offs. The concept formulation effort for the U.S. Army's Light Helicopter Experimental (LHX) program is used to illustrate these methods. Author

A86-15632*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE STATION OPERATIONS
R. H. GRAY (NASA, Kennedy Space Center, Cocoa Beach, FL) IAF, *International Astronautical Congress, 36th, Stockholm,* Sweden, Oct. 7-12, 1985. 10 p.
(IAF PAPER 85-45)

An evaluation of the success of the Space Station will be based on the service provided to the customers by the Station crew, the productivity of the crew, and the costs of operation. Attention is given to details regarding Space Station operations, a summary of operational philosophies and requirements, logistics and resupply operations, prelaunch processing and launch operations, on-orbit operations, aspects of maintainability and maintenance, habitability, and questions of medical care. A logistics module concept is considered along with a logistics module processing timeline, a habitability module concept, and a Space Station rescue mission. G.R.

A86-17318* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
SPACE STATION PROGRAM OPERATIONS - MAKING IT WORK
G. R. PARKER (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Permanent presence - Making it work; Proceedings of the Twenty-second Goddard Memorial Symposium, Greenbelt, MD, March 15, 16, 1984 . San Diego, CA, Univelt, Inc., 1985, p. 31-35.
(AAS PAPER 84-112)

The Space Station Program (SSP) will consist, in part, of a permanently orbiting facility composed of a mix of manned and unmanned elements. To insure that such a facility will be an operationally viable and productive one, capable of performing a myriad of assigned missions, special attention must be given to the following operational disciplines during the design and development of the SSP systems and subsystems: (1) Automation/Autonomy, (2) Customer Interfaces/Operations, (3) Habitability/Crew Productivity, (4) Maintainability, and (5) Logistics. In order to properly address these disciplines, from an operations point of view, the Director of the Space Station Task Force (SSTF) formed the Operations Working Group (OWG) in July 1982, and chartered this group to develop the top level operational technical and management-approach philosophies and requirements for the SSP. This paper attempts to summarize the results and conclusions reached by the OWG after an 18 month intensive study effort. Author

A86-19524* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SCIENCE OPERATIONS MANAGEMENT
G. F. SQUIBB (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: The National Symposium and Workshop on Optical Platforms, Huntsville, AL, June 12-14, 1984, *Proceedings* . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 4-9. NASA-supported research. refs

The operation teams engaged in the IR Astronomical Satellite (IRAS) project included scientists from the IRAS International Science Team. The detailed involvement of these scientists in the design, testing, validation, and operations phases of the IRAS mission contributed to the success of this project. The Project Management Group spent a substantial amount of time discussing science-related issues, because science team coleaders were members from the outset. A single scientific point-of-contact for the Management Group enhanced the depth and continuity of agreement reached in decision-making. O.C.

A86-19685*# National Aeronautics and Space Administration, Washington, D.C.
FUTURE OPERATIONAL PLANS FOR THE NATIONAL SPACE TRANSPORTATION SYSTEM
C. H. NEUBAUER, JR. (NASA, Washington, DC) AIAA, Aerospace Sciences Meeting, 24th, Reno, NV, Jan. 6-9, 1986. 4 p.
(AIAA PAPER 86-0090)

In March 1985, the NASA/DOD Space Transportation System Master Plan was published. This document establishes objectives and plans for operating the Space Transportation System (STS) for the next decade. In the present paper, some key points are discussed, and the significance of the weather forecasting capability is indicated. The STS is to become fully operational by the later 1980's and is to support fully the national needs into the mid-1990's. Attention is given to NASA/DOD STS coordination, NASA/DOD STS Master Plan Traffic Models, the Orbiter Launch-Rate Capability, Launch-Rate Capabilities for Shuttle Processing Facilities at Kennedy Space Center, and Launch-Rate Capabilities for Shuttle Processing Facilities at Vandenberg Air Force Base. G.R.

A86-21055
AVIATION MAINTENANCE MANAGEMENT
E. H. KING (Southern Illinois University, Carbondale, IL) Carbondale, IL, Southern Illinois University Press, 1986. 221 p. refs

The maintenance management concerns that confront the various levels of aviation supervision are discussed. The topics addressed include: the FAA's organizational structure, FAA publications pertaining to maintenance, aviation maintenance procedures, the application of aviation maintenance concepts, and budgeting, cost controls, and cost reduction. Also considered are: training and professional development in aviation maintenance, safety and maintenance, electronic data processing, and aviation maintenance management problem areas. C.D.

A86-22267
SATELLITE LEASING - CHEAP ACCESS TO SPACE
R. MAEHL (RCA, Astro-Electronics Div., Princeton, NJ) Space (ISSN 0267-954X), vol. 1, Dec. 1985-Feb. 1986, p. 10, 11, 17.

The role of satellite leasing arrangements in marketing commercial ventures in space is considered. The most recent examples of leased space platforms are described, including Leasat: ESA's EURECA; Omnistar; and Leasecraft. It is shown that because of NASA Shuttle pricing policies, leasing room for commercial payloads on board space platforms will become an increasingly attractive way of financing space ventures in which capital investments are often at risk. The development of the first large-scale commercial space platform for the Electrophoresis in Space (EOS) program is also discussed. I.H.

A86-22379
NEW MAINTAINABILITY PREDICTION TECHNIQUE
R. L. VANNATTER (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Annual Reliability and Maintainability Symposium, Philadelphia, PA, January 22-24, 1985, Proceedings . New York, Institute of Electrical and Electronics Engineers, 1985, p. 39-43.

This paper describes a unique computerized (including graphics) modeling technique for performing maintainability predictions. The model features simplicity, broad application, and visibility of equipment diagnostic characteristics. It also provides visibility of assumptions used in creating the model. It can be used directly or in support of many logistics support functions. This technique is applicable to all phases of equipment development and for all maintenance levels. It can be expanded to include multiple maintenance levels, as well as logistics flow, using the same basic data elements. Author

A86-24128
NASA CENTERS WILL STIMULATE INDUSTRY R & D
D. DOOLING (Essex Corp., Huntsville, AL) Commercial Space (ISSN 8756-4831), vol. 1, Fall 1985, p. 95-98.

Four prototype centers supported by NASA in order to stimulate research and development, and encourage individual investment in space are described. The crystallography program of the Center for Macromolecular Crystallization is examined; the center will grow the crystals in space and analyze the usefulness of the products. The benefits and problems of these protein experiments are investigated. The Consortium for Materials Development is to study the applications of physical chemistry and material transport through fluids in space. The processes by which metals, alloys, ceramics, and glasses are formed will be analyzed by the Center for Space Processing of Engineering Materials in order to improve production on earth. The interpretation and commercialization of Landsat data is conducted at the Space Remote Sensing Center. The production of materials which will be easily commercialized, such as piezoelectric transducers and glass microspheres, is the objective of the Multi-Phase Materials Center. I.F.

A86-26525
SPACE REMOTE SENSING SYSTEMS: AN INTRODUCTION
H. S. CHEN (Rockwell International Corp., Downey, CA; California, University, Los Angeles) Orlando, FL, Academic Press, Inc., 1985, 269 p. refs

An introductory primer on space remote sensing technologies and their applications is presented. Among the specific technologies discussed are: spaceborne radiation collector systems; space detectors; and passive space radiometers. Consideration is also given to: passive space spectrometer systems; passive space microwave radiometers; active space lidar systems; and active synthetic aperture radar and scatterometer systems. Some of the atmospheric phenomena which influence the reliability of remote sensing data are also discussed. I.H.

A86-27897#
SPACE MATERIALS RESOURCES AND PROCESSING OPTIONS - THEIR INFLUENCE ON FUTURE SPACE OPERATIONS
R. WALDRON (Rockwell International Corp., Space Div., Downey, CA) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 325-328.

The feasibility and consequentiality for future space operations of four distinct routes toward space materials resources processing are evaluated. The first of these options involves the orbital processing of high-tech, high specific value products, and the third is predicated on the development of lower access-cost materials in space itself. The second and fourth options, proposed as alternatives to the first and third, encompass methods of transporting hardware to space for orbital use. Energy as well as materials requirements are considered for the four options. O.C.

A86-28581* National Aeronautics and Space Administration, Washington, D.C.
SPACE STATION PLANNING
R. F. FREITAG (NASA, Office of Space Station, Washington, DC) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 85-96.
(AAS 85-111)

An overview of NASA Space Station planning activities is given. Among the specific topics addressed are: the role of private contractors in the construction and operation of Space Station; international cooperation in planning Space Station configurations; and optimum management strategies for Space Station planning activities. The division of work packages for the preliminary design definition phase of the Space Station program is described. I.H.

A86-30549
HELICOPTER MAINTENANCE IN THE REAL WORLD
G. R. VANSLYKE (Okanagan Helicopters, Ltd., Richmond, Canada) Vertiflite (ISSN 0042-4455), vol. 32, Mar.-Apr. 1986, p. 24-28.

The need to minimize helicopter operating and maintenance costs and improve reliability and durability is examined. It is estimated that large current generation helicopters cost $1,000/flying hour; the largest cost is engine repair followed by accessory repair. The improvements required in field maintenance, repair shop maintenance, and helicopter and engine design and developments are described. The use of in-house repair services and overhaul capabilities has reduced maintenance costs. The elimination of helicopter design problems such as vibrations, corrosion, water leaking, and the removal of finite-lifted components, by the manufacturer is studied. I.F.

A86-32095*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MAINTAINABILITY PLANNING FOR THE SPACE STATION
G. R. EGAN (NASA, Johnson Space Center, Houston, TX) AIAA, AHS, CASI, DGLR, IES, ISA, ITEA, SETP, and SFTE, Flight Testing Conference, 3rd, Las Vegas, NV, Apr. 2-4, 1986. 5 p.
(AIAA PAPER 86-9754)

The planned NASA Space Station, which is expected to have many years of on-orbit operation, for the first time confronts spacecraft designers with major questions of maintainability in design. A Maintainability Guidelines Document has been distributed to all Space Station Definition and Preliminary Design personnel of the Space Station Program Office. Trade studies are being performed to determine the most economical balance between initial (reliability) cost and life cycle cost (crew time and replacement hardware) costs. O.C.

A86-32930#
INTEGRATED LOGISTICS SUPPORT - FIVE KEY AREAS OF ENGINEERING TECHNOLOGY IN SPACE
J. M. DRAKE (Martin Marietta Corp., Michoud Div., New Orleans, LA) IN: Man's permanent presence in space; Proceedings of the Third Annual Aerospace Technology Symposium, New Orleans, LA, November 7, 8, 1985 . New Orleans, LA, American Institute of Aeronautics and Astronautics, 1985, 19 p. refs

The purpose of this paper is to discuss the concept and elements of integrated logistics support as it applies to the manned space program. Five key areas of technology which are critical in making needed improvements in the support and development of the space transportation systems are identified and discussed in detail. These five areas are: materials, infrastructure, life support systems, operations, and human factors. Each of these areas is presented in relation to how improvements in terrestrial applications and methodology will lead to advances in extraterrestrial systems. Author

A86-34956* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LOGISTICS SUPPORT ECONOMY AND EFFICIENCY THROUGH CONSOLIDATION AND AUTOMATION
G. R. SAVAGE, C. J. FONTANA, and J. D. CUSTER (NASA, Kennedy Space Center; Lockheed Space Operations Co., Cocoa Beach, FL) IN: Space and society - Progress and promise; Proceedings of the Twenty-second Space Congress, Cocoa Beach, FL, April 23-26, 1985 . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1985, p. 1-57 to 1-59.

An integrated logistics support system, which would provide routine access to space and be cost-competitive as an operational space transportation system, was planned and implemented to support the NSTS program launch-on-time goal of 95 percent. A decision was made to centralize the Shuttle logistics functions in a modern facility that would provide office and training space and an efficient warehouse area. In this warehouse, the emphasis is on automation of the storage and retrieval function, while utilizing state-of-the-art warehousing and inventory management technology. This consolidation, together with the automation capabilities being provided, will allow for more effective utilization of personnel and improved responsiveness. In addition, this facility will be the prime support for the fully integrated logistics support of the operations era NSTS and reduce the program's management, procurement, transportation, and supply costs in the operations era. K.K.

A86-35646
COMPUTER SIMULATION AND MODELING - A TOOL FOR INVENTORY MANAGEMENT
J. G. WILLIAMS (Bell Helicopter Textron, Fort Worth, TX) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 629-634. refs

The use of computer simulation and modeling to aid decision-making in inventory management is illustrated by means of four actual cases: raw materials/capital investment tradeoffs, buffering against uncertainty concerning a material, demand-forecasting technique evaluation, and inventory and service level simulation. It is noted that such simulation methods involve few limiting assumptions, by comparison with optimization techniques; in addition, the incorporation of uncertainties is straightforward, and complex situations can be easily modeled. O.C.

A86-35647
SPARE PARTS PRICING - IMPACT ON LOGISTICS SUPPORT
J. K. HANCOCK (Boeing Vertol Co., Ridley Park, PA) IN: American Helicopter Society, Annual Forum, 41st, Fort Worth, TX, May 15-17, 1985, Proceedings . Alexandria, VA, American Helicopter Society, 1985, p. 635-637.

A task force composed of management-level representatives from all major organizations of a military helicopter manufacturer was formed in response to a 10-point program, promulgated in July 1983 by the Secretary of Defense, in order to reform spare parts procurement practices. A corporate spares policy was duly formulated by October 1983. Attention is given to the effects of this policy on price lists, recommended minimum quantities, combined buy practices, low intrinsic value spares, ground support equipment, spare parts data tracking, and cost avoidance. O.C.

A86-43333#
DEVELOPING A MAINTENANCE CONCEPT FOR FUTURE ELECTRONIC SYSTEMS
R. O. BLEAU (USAF, Electronic Systems Div., Bedford, MA) AIAA and SOLE, Aerospace Maintenance Conference, 2nd, San Antonio, TX, May 21-23, 1986. 6 p.
(AIAA PAPER 86-1145)

A team composed of U.S. Air Force acquisitions logisticians and prime contractor logistics and design engineers has used several analytical approaches to identify improvements in maintenance support, design, and logistics contracting strategies. The combination of design and support concepts thus achieved increased system supportability at reduced life cycle cost, and yielded a more combat-capable system. Major focuses of the analytic method used were life cycle costs, capabilities, and flexibility. O.C.

A86-43881
SYSTEMS MODELING AND DBMS APPLICATION IN TEST ASSETS MANAGEMENT
D. D. RHODES, S. HSU, and N. W. FRUSH (Sperry Corp., Microwave and Support Systems Div., Clearwater, FL) IN: AUTOTESTCON '85; Proceedings of the International Automatic Testing Conference, Uniondale, NY, October 22-24, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 37-42. refs

This paper addresses 'management of test assets' over the full range of maintenance support system management phases from inception through operation to system evolution. The paper discusses the versatile utilities of some innovative system models and the supporting DBMS as test assets management tools. These models are used to augment both development and operations management capabilities. The paper mentions the successful applications to on-going large scale programs of CSS (USN) and IFTE (USA). Author

A86-44935
THE SELECTION AND ACQUISITION OF COMMERCIAL AIRCRAFT FLEETS
W. PETERS (South African Airways, Johannesburg, Republic of South Africa) Aeronautica Meridiana (ISSN 0257-8573), vol. 6, no. 1, 1985, p. 43-50.

Fleet planning, aircraft selection and aircraft acquisition processes must be constantly undertaken by airlines irrespective of their size, and will have as their primary concern the matching of aircraft performance characteristics with market route networks, on the one hand, and on the other the large amounts and high cost of capital for fleet refurbishment. Other considerations encompass market analyses, the purchase of new or used aircraft, aircraft performance suitability for certain route sectors, and the guarantee of engine and airframe manufacturers' performance specifications. O.C.

A86-46951#
SPACE STATION OPERATIONS IN THE TWENTY-FIRST CENTURY
G. R. BENNETT (McDonnell Douglas Astronautics Co., Houston, TX) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NY, Sept. 3-5, 1986. 10 p. refs
(AIAA PAPER 86-2328)

A model outlining the requirements for achieving manned space operations is presented. Several Space Stations, each serving specific functions are proposed for effective use of space. The components of the Stations are to be designed for modularity and flexibility. The advantages of a multi-Space-Station system are discussed. The transportation system necessary for accomplishing the proposed space operations is described. The implementations of robotics to assist in operations, due to a limit on crew size, and of a computer system to schedule the use of limited resources are examined. The effect of the National Aerospace Plane on Space Station operations is investigated. The participation of industry in Space Station operations is considered. I.F.

A86-46954#
SPACE STATION ON-ORBIT OPERATIONS FOR THE TWENTY FIRST CENTURY
R. H. SCHAEFER and A. C. BEARDSLEY (Grumman Corp., Bethpage, NY) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 8 p.
(AIAA PAPER 86-2331)

The three areas of Space Station operations, mission, maintenance, and coordination, are considered. The operational activities of the Space Station consist of assembling the equipment necessary for specific missions and conducting the experiments.

The maintenance operations which involve monitoring system operations and supplying resources are described. The proximity operations and ground-based support (coordination activities) are examined. The Space Station is to have a crew of 18-20 station specialists, a mobile work station, satellite servicing bays, and maneuvering vehicles for conducting orbit operations; the functions of each component are studied. I.F.

A86-46963#
GROWTH OF ELECTRONIC MATERIALS IN MICROGRAVITY
B. L. HOEKSTRA (USAF, Materials Laboratory, Wright-Patterson AFB, OH) and W. R. WILCOX (Clarkson University, Potsdam, NY) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 6 p.
(AIAA PAPER 86-2356)

This paper reviews the advantages of processing electronic materials in the microgravity environment. Emphasis is placed on commercially viable processes for high value-added crystals and the development of scientific knowledge for improving crystals growth on earth. This will be done by reviewing past flight experiments as well as ground-based experiments and theory. This will all be discussed in the context of future electronic materials research needs as well as the potential for commercial production on the Space Station in the 21st century. Author

A86-47139#
THE ROLE OF LASER TECHNOLOGY IN MATERIALS PROCESSING AND NONDESTRUCTIVE TESTING IN THE 21ST CENTURY
B. M. SHEINBERG (BMS Consultants, Houston, TX) IN: Symposium on Nondestructive Evaluation, 15th, San Antonio, TX, April 23-25, 1985, Proceedings . San Antonio, TX, Nondestructive Testing Information Analysis Center, 1986, p. 147-157. refs

Some of the potential applications of laser technology in the 21st century are explored, and the proposed role of this technology in relation to materials processing, nondestructive testing, and quality control are discussed. Examples illustrating the implementation of this techology include the proposed construction of vehicles and platforms in near and deep space, and construction of underwater platforms. The direction in which today's technology should evolve to pursue the achievement of such goals is indicated. Included in the discussion is an evaluation of laser, robotics, and fiber optics technologies with respect to their ability to achieve a synergistic level of operation. Author

A86-47616
PLANNING FOR MINIMUM OVERHAUL TIME
E. MUELLER (Swissair-Schweizerischer Luftverkehr AG, Zurich, Switzerland) IN: AIRMEC '85 - Aviation equipment servicing: Aircraft and helicopter maintenance; International Exhibition and Conference, 4th, Duesseldorf, West Germany, February 26-March 3, 1985, Conference Reports . Duesseldorf, West Germany, Duesseldorfer Messegesellschaft mbH, 1985, 15 p.

The experiences of planning and managing an aircraft overhaul program, aimed at achieving maximal aircraft utilization with minimal maintenance, are presented. Maintenance concepts, work schedules, steps in planning advance preparations, job documentation, workshop organization, and deployment of personnel resources are discussed. Advance preparations include drawing up a detailed program of all jobs involved for each heavy maintenance visit and a flow chart comprising about 500 individual activities subdivided into ten aircraft areas and skill categories, which plots the performance of the various individual assignments over two-week periods. The operation of a computerized maintenance control system for planning and implementing the maintenance activities is described. I.S.

N86-22065# National Weather Service, Silver Spring, Md. Engineering Div.
MAINTENANCE PLANNING FOR THE 1990'S (INITIAL PLANNING)
W. J. VANFELDT, R. R. KNIBB, D. M. ENTRIKIN, A. KERNER, and R. I. RACER Jul. 1985 51 p refs
(PB86-106010; NOAA-TM-NWS-ENG-11) Avail: NTIS HC A04/MF A01 CSCL 04B

New equipment programs, changing technologies, staffing constraints, and restrictive budgets are but a few of the reasons why the National Weather Service (NWS) must strive for greater efficiency and productivity in its maintenance and logistics programs. Comprehensive maintenance and logistics planning is necessary to allow smooth transition and integration of new systems into the NWS meteorological and hydrological operations. To initiate this planning, a Maintenance and Logistics Steering Group (MLSG) was formed to study and recommend action necessary to ensure appropriate NWS maintenance and logistics programs in the 1990's. NOAA technical memorandum NWS ENG-11 describes the MLSG analyses and contains the resulting recommendations. GRA

N86-23556# RAND Corp., Santa Monica, Calif.
DEPOT MAINTENANCE OF AVIATION COMPONENTS: CONTRACTOR VERSUS ORGANIC REPAIR
L. B. EMBRY, N. Y. MOORE, J. CAVE, and F. LABRUNE Mar. 1985 116 p
(Contract N00014-83-C-0100)
(AD-A162071; RAND/N-2225-NAVY) Avail: NTIS HC A06/MF A01 CSCL 01C

Aviation and engine component repair requirements make up over half of the projected wartime depot-level maintenance workload. Organic (service-owned) ability to support this workload is particularly limited; at present, nearly half of the Navy's depot-level component repair is performed in contractor or other service facilities. Before major investments are made in the facilities and equipment needed to accomplish these repairs, it will be necessary to determine the appropriate mix of organic and contractor repair sources. This note addresses the economic and operational implications of alternative source-of-repair decisions. Based on analyses of the distribution of projected wartime demands, technical data limitations, the structure of the repair industry, the operational payoff of facilities characterized by broad scope of repair, and airline industry practices, it postulates a strategy for providing depot-level component support that can be used to specify the appropriate source of repair at different points in the weapon system and subsystem life cycle. GRA

N86-24005# DMEA Ltd., Scottsdale, Ariz.
EXPLORATION FOR STRATEGIC MATERIALS
B. F. DICKERSON and C. A. OBRIEN 1985 210 p refs
Sponsored by the Office of Technology Assessment
(PB86-126463) Avail: NTIS HC A10/MF A01 CSCL 08I

The report by the Office of Technology Assessment discusses technologies, methodologies, and the effects of technical and nontechnical factors on exploration for on-shore deposits of strategic materials. Author

N86-24586# Defense General Supply Center, Richmond, Va.
LOGMARS (LOGISTICS APPLICATIONS OF AUTOMATED MARKING AND READING SYMBOLS) CLEARINGHOUSE, APPLICATIONS DIRECTORY
Sep. 1985 134 p
(AD-A162327) Avail: NTIS HC A07/MF A01 CSCL 15E

The DOD challenge is to improve material readiness, while also seeking ways to lower overall costs. The Logistics Applications of Automated Marking and Reading Symbols (LOGMARS) Program, using bar code technology in automated logistics systems, is ideally suited to achieve these objectives. Implementation of LOGMARS will increase productivity, reduce error rates, and improve the responsiveness of automated systems. This directory lists applications initiated by the various DOD components and the status of each. It is intended to eliminate duplicative development efforts within the components where application efforts are similiar. GRA

N86-25321*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESEARCH AND COMPETITION: BEST PARTNERS
J. M. SHAW 1986 12 p Presented at the 90th Casting Congress, Minneapolis, Minnesota, 11-15 May 1986; sponsored by the American Foundrymen's Society
(NASA-TM-87313; E-3044; NAS 1.15:87313) Avail: NTIS HC A02/MF A01 CSCL 05A

NASA's Microgravity Science and Applications Program is directed toward research in the science and technology of processing materials under conditions of low gravity. The objective is to make a detailed examination of the constraints imposed by gravitational forces on Earth. The program is expected to lead ultimately to the development of new materials and processes in Earth-based commercial applications, adding to this nation's technological base. An important resource that U.S. researchers have readily available to them is the new Microgravity Materials Science Laboratory (MMSL) at NASA Lewis Research Center in Cleveland. A typical scenario for a microgravity materials experiment at Lewis would begin by establishing 1-g baseline data in the MMSL and then proceeding, if it is indicated, to a drop tower or to simulated microgravity conditions in a research aircraft to qualify the project for space flight. A major component of Lewis microgravity materials research work involves the study of metal and alloy solidification fundamentals. Author

N86-28012# Department of Energy, Washington, D. C. Office of Civilian Radioactive Waste Management.
PROGRAM MANAGEMENT SYSTEM MANUAL
Jan. 1986 95 p
(DE86-005396; DOE/RW-0043) Avail: NTIS HC A05/MF A01

The Program Management System (PMS), as detailed in this manual, consists of all the plans, policies, procedure, systems, and processes that, taken together, serve as a mechanism for managing the various subprograms and program elements in a cohesive, cost effective manner. The PMS is consistent with the requirements of the Nuclear Waste Policy Act of 1982 and the Mission Plan for the Civilian Radioactive Waste Management Program (DOE/RW-0005). It is based on, but goes beyond, the DOE management policies and procedures applicable to all DOE programs by adapting these directives to the specific needs of the Civilian Radioactive Waste Management program. This PMS Manual describes the hierarchy of plans required to develop and maintain the cost, schedule, and technical baselines at the various organizational levels of the Civilian Radioactive Management Program. It also established the management policies and procedures used in the implementation of the program. These include requirements for internal reports, data, and other information; systems engineering management; regulatory compliance; safety; quality assurance; and institutional affairs. Although expanded versions of many of these plans, policies, and procedures are found in separate documents, they are an integral part of this manual. The PMS provides the basis for the effective management that is needed to ensure that the Civilian Radioactive Waste Management Program fulfills the mandate of the Nuclear Waste Policy Act of 1982. DOE

N86-28418*# Martin Marietta Aerospace, Denver, Colo.
TETHER APPLICATIONS FOR SPACE STATION
W. NOBLES *In* NASA, Washington Applications of Tethers in Space: Workshop Proceedings, Volume 1 p 239-267 Jun. 1986
Avail: NTIS HC A25/MF A01 CSCL 13I

A wide variety of space station applications for tethers were reviewed. Many will affect the operation of the station itself while others are in the category of research or scientific platforms. One of the most expensive aspects of operating the space station will be the continuing shuttle traffic to transport logistic supplies and payloads to the space station. If a means can be found to use tethers to improve the efficiency of that transportation operation, it will increase the operating efficiency of the system and reduce the overall cost of the space station. The concept studied consists of using a tether to lower the shuttle from the space station. This results in a transfer of angular momentum and energy from the orbiter to the space station. The consequences of this transfer is studied and how beneficial use can be made of it. E.R.

N86-28972*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE PROCESSING APPLICATIONS ROCKET (SPAR) PROJECT: SPAR 10
R. POORMAN, comp. Jun. 1986 92 p
(NASA-TM-86548; NAS 1.15:86548) Avail: NTIS HC A05/MF A01 CSCL 20H

The Space Processing Applications Rocket Project (SPAR) X Final Report contains the compilation of the post-flight reports from each of the Principal Investigators (PIs) on the four selected science payloads, in addition to the engineering report as documented by the Marshall Space Flight Center (MSFC). This combined effort also describes pertinent portions of ground-based research leading to the ultimate selection of the flight sample composition, including design, fabrication and testing, all of which are expected to contribute to an improved comprehension of materials processing in space. The SPAR project was coordinated and managed by MSFC as part of the Microgravity Science and Applications (MSA) program of the Office of Space Science and Applications (OSSA) of NASA Headquarters. This technical memorandum is directed entirely to the payload manifest flown in the tenth of a series of SPAR flights conducted at the White Sands Missile Range (WSMR) and includes the experiments entitled, Containerless Processing Technology, SPAR Experiment 76-20/3; Directional Solidification of Magnetic Composites, SPAR Experiment 76-22/3; Comparative Alloy Solidification, SPAR Experiment 76-36/3; and Foam Copper, SPAR Experiment 77-9/1R. Author

N86-30568*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SCIENTIFIC AND TECHNICAL PAPERS PRESENTED OR PUBLISHED BY JSC AUTHORS IN 1985
Aug. 1986 111 p
(NASA-TM-58273; S-553; NAS 1.15:58273) Avail: NTIS HC A06/MF A01 CSCL 05B

The Lyndon B. Johnson Space Center contributions to the scientific and technical literature in aerospace and life sciences made during calendar year 1985 are described. Citations include NASA formal series reports, journal articles, conference and symposium presentations, papers published in proceedings or other collective works, and seminar and workshop results. Author

N86-30759# Fulmer Research Inst. Ltd., Stoke Poges (England).
THE APPLICATION OF COMPOSITES TO SPACE STRUCTURES: GUIDELINES ON IMPORTANT ASPECTS FOR THE DESIGNER
D. P. BASHFORD *In* ESA Proceedings of a Workshop on Composites Design for Space Applications p 9-16 Feb. 1986
Avail: NTIS HC A16/MF A01

Guidelines and surveys on the state of composites as structural aerospace materials were produced. The guidelines give a detailed background on composites for spacecraft and are intended for designers and engineers unfamiliar with composites. Topics covered include: selection of composite materials; aramid composites; prepreg and resin procurement specifications; nondestructive tests polymeric matrices; mechanical test methods for composites; joining techniques; and moisture absorption/thermal cycling response. ESA

N86-30898# Selenia Industrie Associate S.p.A., Rome (Italy). Engineering Support Dept.
AN EXAMPLE OF INTEGRATED LOGISTIC SUPPORT APPLIED ALSO TO PRODUCTION TESTING
V. BUONTEMPO *In its* Rivista Tecnica Selenia, v. 9, no. 4, p 26-45 1985
Avail: NTIS HC A03/MF A01

The basic concepts of an aerospace industry integrated logistic support plan are presented. An example shows that as well as achieving overall economy on system life cycle support cost, it reduces production costs by designing support means and production test in harmony with the logistic support means. A life cycle computation model related to the logistic support is provided. The model is also applicable to on board avionic systems such as Tornado and AMX aircraft and EH 101 helicopter. ESA

N86-32328# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Sci.
PRODUCTION AND INVENTORY CONTROL WITH THE BASE STOCK SYSTEM
J. P. J. TIMMER, W. MONHEMIUS, and J. W. M. BERTRAND May 1984 39 p
(EUT/BDK/12; ISBN-90-6757-012-5; ETN-86-97686) Avail: NTIS HC A03/MF A01

Base stock control (BSC), of safety stocks in a multiproduct multiphase production system is compared with techniques such as master product scheduling. It is shown that BSC results in good control with a low level of safety stocks and reduced control effort. ESA

N86-32329# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Industrial Engineering and Management Sci.
BALANCING PRODUCTION LEVEL VARIATIONS AND INVENTORY VARIATIONS IN COMPLEX PRODUCTION SYSTEMS
J. W. M. BERTRAND Apr. 1984 18 p
(THE/BDK/84; ETN-86-97688) Avail: NTIS HC A02/MF A01

The behavior of production levels and stocks in an integrally controlled multiproduct multiphase production system is analyzed. It is shown that certain types of variations in the master production schedule (MPS) may lead to large short term variations in production. To reduce the costs of these variations production smoothing is introduced; a modification of well-known integral production decision rules is derived to realize smoothed production behavior. The quantitative effects of the production smoothing rule on the variations in stocks and production levels are demonstrated. A cost model to determine appropriate values for the smoothing parameters, given a specific production structure, a given capacity structure, and a given variability of the MPS is outlined. ESA

N86-32471*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HISTORICAL DATA AND ANALYSIS FOR THE FIRST FIVE YEARS OF KSC STS PAYLOAD PROCESSING
J. M. RAGUSA Sep. 1986 124 p
(NASA-TM-83105; NAS 1.15:83105) Avail: NTIS HC A06/MF A01 CSCL 22A

General and specific quantitative and qualitative results were identified from a study of actual operational experience while processing 186 science, applications, and commercial payloads for the first 5 years of Space Transportation System (STS) operations at the National Aeronautics and Space Administration's (NASA) John F. Kennedy Space Center (KSC). All non-Department of Defense payloads from STS-2 through STS-33 were part of the study. Historical data and cumulative program experiences from key personnel were used extensively. Emphasis was placed on various program planning and events that affected KSC processing, payload experiences and improvements, payload hardware condition after arrival, services to customers, and the impact of STS operations and delays. From these initial considerations, operational drivers were identified, data for selected processing parameters collected and analyzed, processing criteria and options determined, and STS payload results and conclusions reached. The study showed a significant reduction in time and effort needed by STS customers and KSC to process a wide variety of payload configurations. Also of significance is the fact that even the simplest payloads required more processing resources than were initially assumed. The success to date of payload integration, testing, and mission operations, however, indicates the soundness of the approach taken and the methods used. Author

N86-32584# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance Div.
DATA FOR SELECTION OF SPACE MATERIALS
Nov. 1985 211 p
(ESA-PSS-01-701-ISSUE-1; ISSN-0379-4059; ETN-86-97796)
Avail: NTIS HC A10/MF A01

Data on adhesives, adhesive tapes, coatings and varnishes, glasses, lubricants, metals, paints, plastic films, potting compounds, reinforced and thermosetting resins, rubbers, and thermoplastics for space applications are presented. The materials were used by ESA. ESA

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.

A86-15833*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
EARTH BASED APPROACHES TO ENHANCING THE HEALTH AND SAFETY OF SPACE OPERATIONS
A. M. KOLLER, JR. (NASA, Kennedy Space Center, Cocoa Beach, FL) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 7 p. refs
(IAF PAPER 85-330)

This paper provides an overview of the current state of our earth based knowledge of space safety hazards; identification of several key areas of concern for space operations; and proposed approaches to providing technology enhancement and information needed to improve the health and safety to those conducting space operations. Included are a review of the identified hazards for space oeprations by hazard classification; a summarization of the information currently available on space experiences and an assessment of potential hazards for long duration spaceflight; a discussion of potential failure modes and their significance for Space Station work: and an assessment of current work which indicates additional research and experimentation which can only be accomplished in actual space missions. Author

A86-15839#
DEVELOPMENT AND IMPLEMENTATION OF THE FUTURE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (FGMDSS)
V. BOGDANOV (International Maritime Organization, London, England) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 15 p.
(IAF PAPER 85-338)

The present maritime distress and safety system is briefly reviewed, and plans for the Future Global Maritime Distress and Safety System (FGMDSS), which is expected to be introduced by the International Maritime Organization in 1990, are outlined. In particular, attention is given to SAR coordinating communications, on-scene communications, preventive actions, and carriage requirements for the future system. The satellite systems that are to be used in the FGMDSS are discussed. V.L.

A86-15840#
INMARSAT ROLE IN THE FUTURE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM
J. L. FEAR IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 10 p.
(IAF PAPER 85-339)

The Future Global Maritime Distress and Safety System (FGMDSS) is discussed. The FGMDSS through the Inmarsat system is to provide ship-to-shore alerting of distress. The procedures and functions of the Inmarsat distress and safety service are described. The function of the devices used to provide FGMDSS communications, which include the enhanced group call receiver, distress message generator, L-band emergency position indicating radio beacon, and standard-C ship earth station, are examined. The response of the FGMDSS to the gradual buildup of distress incident, and to sudden distress signals from unforeseen disasters is explained. I.F.

A86-17472
QUALITY CONTROL, RELIABILITY, AND ENGINEERING DESIGN
B. S. DHILLON (Ottawa, University, Canada) New York, Marcel Dekker, Inc. (Industrial Engineering. Volume 10), 1985, 308 p. refs

An introductory test on quality control, reliability, and engineering design is presented. The topics discussed include: basic mathematical concepts, economic considerations, introduction to quality control, management for quality control, quality costs and procurement quality control, statistical quality control, applied quality control, introduction to reliability, design for reliability, time-dependent reliability models, and reliability estimation. Also addressed are: introduction to engineering design, the design process, engineering design reviews, reliability and maintainability in systems design, human factors in engineering design, and design optimization methods. C.D.

A86-17602#
ENVIRONMENTAL MANAGEMENT OF PAYLOAD PROCESSING FACILITIES
F. B. WENKSTERN (McDonnell Douglas Astronautics Co., Cocoa Beach, FL) AIAA, Shuttle Environment and Operations Conference, 2nd, Houston, TX, Nov. 13-15, 1985. 7 p. refs
(AIAA PAPER 85-6067)

Space Transportation System (STS) Orbiters and Payloads require environmentally controlled facilities for prelaunch testing and integration activities. John F. Kennedy Space Center (KSC) Cargo processing facilities are controlled by a KSC Cargo Facility Contamination Control Plan. This plan addresses the four mandatory elements for environmentally controlled facilities: environmental monitoring, visual inspection, work rules, and operational controls. The KSC environmental program implements the plan and seeks to define and quantify the various levels of the four elements necessary to achieve required levels of cleanliness. Details of the program are presented to provide an understanding of contamination control at KSC in terms of processing facility capability. Author

A86-21878
ENCRYPTION PROTECTION FOR COMMUNICATION SATELLITES
D. R. SOOD and O. W. HOERNIG, JR. (American Satellite Co., Rockville, MD) IN: EASCON '84; Proceedings of the Seventeenth Annual Electronics and Aerospace Conference, Washington, DC, September 10-12, 1984 . New York, Institute of Electrical and Electronics Engineers, 1984, p. 83-88.

In connection with the growing importance of the commercial communication satellite systems and the introduction of new technological developments, users and operators of these systems become increasingly concerned with aspects of security. The user community is concerned with maintaining confidentiality and integrity of the information being transmitted over the satellite links, while the satellite operators are concerned about the safety of their assets in space. In response to these concerns, the commercial satellite operators are now taking steps to protect the communication information and the satellites. Thus, communication information is being protected by end-to-end encryption of the customer communication traffic. Attention is given to the selection of the NBS DES algorithm, the command protection systems, and the communication protection systems. G.R.

A86-22178
IMPLICATIONS OF NEW AIRCRAFT AVIONICS RELIABILITY PERFORMANCE
M. E. MOORHEAD (Rockwell International Corp., Collins Div., Melbourne, FL) IN: Environmental integration technology today for a quality tomorrow; Proceedings of the Thirtieth Annual Technical Meeting, Orlando, FL, May 1-3, 1984 . Mount Prospect, IL, Institute of Environmental Sciences, 1984, p. 232-235.

An evaluation is made of MTBF values projected for avionics operating under environmental conditions typical of state-of-the-art 'digital' aircraft. Equipment reliability levels obtained during the fist year of operational experience with the B 767 and B 757 airliners are presented and compared with levels characteristic of previous avionic failure rates. Theoretical reliability levels based on existing MIL-HDBK-217 failure rate curves and acceleration factors are related to demonstrated performance levels, in order to identify points of correlation as well as discrepancies. O.C.

A86-22185
INNOVATIVE STIMULUS TESTING AT THE LOWEST LEVEL OF ASSEMBLY TO REDUCE COSTS AND INDUCE RELIABILITY
J. L. CAPITANO (Gould, Inc., Nav Com Systems Div., El Monte, CA) IN: Environmental integration technology today for a quality tomorrow; Proceedings of the Thirtieth Annual Technical Meeting, Orlando, Fl, May 1-3, 1984 . Mount Prospect, IL, Institute of Environmental Sciences, 1984, p. 303-305.

Stimulus Testing is the application of stimuli to electronic systems, assemblies, or parts to precipitate failures before the product reaches the customer. This can be in the form of Repetitive changes to temperature, random vibration spectrums, or other applicable conditions as necessary to force-fail infant and latent defects at an appropriate point in the evolution of the product. The end product reliability then shall be improved beyond that normally achieved with standard methods of manufacturing and quality control. Author

A86-22377
RELIABILITY REQUIREMENTS AND CONTRACTUAL PROVISIONS
B. S. LIEBESMAN (Bell Communications Research, Inc., Holmdel, NJ) IN: Annual Reliability and Maintainability Symposium, Philadelphia, PA, January 22-24, 1985, Proceedings . New York, Institute of Electrical and Electronics Engineers, 1985, p. 1-5. refs

The specification of reliability requirements for complex commercial systems is a formidable process which should include consideration of the total quality and reliability assurance program during the entire product life cycle. Specifying the management of this program is as important as specifying the values of the reliability parameters. This paper deals with the total reliability specification problem and concludes with a summary of contractual quality and reliability provisions which are important to an effective reliability assurance program. Author

A86-22394
DECISION MAKING IN PRODUCT ASSURANCE
R. NEOGY (INTELSAT, Palo Alto, CA) IN: Annual Reliability and Maintainability Symposium, Philadelphia, PA, January 22-24, 1985, Proceedings . New York, Institute of Electrical and Electronics Engineers, 1985, p. 203-207. refs

A decision-making method based on quantifying the risk assessment and cost of various options to assure product quality is discussed. The utilization of a failure data base and a cost-to-fail data base in the decision-making process is examined. A model scenario describing the analysis of a failure, cost assessment, and evaluation of alternatives, and revealing the applicability of the process is presented. I.F.

A86-22402

IS THERE LIFE AFTER 10,000 FLIGHT HOURS?

T. M. EVANS and D. L. MERKORD (LTV Aerospace and Defense Co., Dallas, TX) IN: Annual Reliability and Maintainability Symposium, Philadelphia, PA, January 22-24, 1985, Proceedings . New York, Institute of Electrical and Electronics Engineers, 1985, p. 396-401.
(Contract N00019-80-G-0033; NAVY ORDER 0002)

The possibility of keeping an aircraft in service beyond the predetermined fatigue life limits of its structures is considered, with particular reference to the fleet of A-3 aircraft, which exceeded their wing design fatigue life of 10,000 flight hours. Fatigue test/analysis on an A-3 trainer model is described, including discussions of test requirements, development of the fatigue test loading spectrum, the test setup, and testing procedure. It was found that service life of A-3 fleet aircraft can be extended to 18,000 flight hours and 2000 catapults. The test data verified that theoretical analyses for service life extension are reliable when fatigue-test-derived maintainability items are applied. I.S.

A86-23009

PLANNING AND MONITORING RELIABILITY GROWTH IN ACCORDANCE WITH MIL-STDS AND HANDBOOKS

J. M. FINKELSTEIN (Hughes Aircraft Co., Fullerton, CA) IN: Institute of Environmental Sciences, Annual Technical Meeting, 31st, Las Vegas, NV, April 30-May 2, 1985, Proceedings . Mount Prospect, IL, Institute of Environmental Sciences, 1985, p. 283-287. refs

Reliability growth has become a regulated process for military systems developments. MIL-STD-785B and the proposed D revision to MIL-STD-781C place requirements on the planning, monitoring, and allocation of resources of reliability development growth tests (RDGT). Guidance for planning and monitoring of the RDGT is given in the proposed MIL-HDBK-781 and in MIL-HDBK-189. The most important requirements to be met by the plan for RDGT, are to integrate the RDGT into the overall system test plan and to achieve the specified reliability value in a specific calendar period. The handbooks provide guidance on using the AMSAA model for reliability growth to design the RDGT and analyze the data that results from the conduct of the RDGT. Additional methodology for incorporating a limiting reliability into the AMSAA model and planning and monitoring discrete trail RDGT programs are discussed. Author

A86-25866

HOW NASA PREPARED TO COPE WITH DISASTER

K. ESCH IEEE Spectrum (ISSN 0018-9235), vol. 23, March 1986, p. 32-36.

The present paper provides excerpts from an interview, conducted in March of 1982, taking into account two of the worst-case disaster scenarios which had been projected by NASA and Air Force planners for the Space Shuttle since the beginning of the program. Some insight is provided regarding the magnitude of the risks, giving attention to NASA's plans for coping with them. It was considered that the worst case would involve the event in which the Shuttle lifts off, and then at some higher altitude for some reason one of the solid rocket motors fails, and the vehicle pitches over toward the ground. G.R.

A86-32947#

THREAT-STRATEGY TECHNIQUE - A SYSTEM SAFETY TOOL FOR ADVANCED DESIGN

R. L. PEERCY, JR. and R. F. RAASCH (Rockwell International Corp., Space Transortation Systems Div., Downey, CA) Journal of Spacecraft and Rockets (ISSN 0022-4650), vol. 23, Mar.-Apr. 1986, p. 200-206. Previously cited in issue 07, p. 868, Accession no. A85-19723.

A86-37479* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NASA STORM HAZARDS RESEARCH IN LIGHTNING STRIKES TO AIRCRAFT

B. D. FISHER, P. W. BROWN (NASA, Langley Research Center, Hampton, VA), and J. A. PLUMER (Lightning Technologies, Inc., Pittsfield, MA) IN: International Conference on the Aviation Weather System, 2nd, Montreal, Canada, June 19-21, 1985, Preprints . Boston, MA, American Meteorological Society, 1985, p. 152-160. refs

The lightning strike condition data gathered in the 1980-1984 period are presented, together with the lightning attachment point analysis for the NASA F-106B research aircraft are presented. The analysis of the experienced 637 direct lightning strikes shows that the highest strike rates (2.1 strikes/min and 13 strikes/penetration) occurred at altitudes between 38,000 and 40,000 ft. The regions of highest risk for an aircraft to experience a direct lightning strike were the areas of thunderstorms where the ambient temperature was colder than -40 C and where the relative turbulence and precipitation intensities were characterized as negligible to light. The presence and location of lightning, therefore, did not necessarily indicate the presence and location of hazardous precipitation and turbulence. The total onboard data show that the lightning attachment patterns on this aircraft fall into four general categories, although the 1984 data suggest that the entire surface of the F-106B may be susceptible to lightning attachment. I.S.

A86-38317

AIRCRAFT GROUND SUPPORT EQUIPMENT STANDARDIZATION - THE PROS AND CONS OF 'FUNCTIONAL' VS 'TECHNICAL' STANDARDIZATION

J. J. MACHON (Air France, Paris) SAE, Aerospace Technology Conference and Exposition, Long Beach, CA, Oct. 14-17, 1985. 14 p.
(SAE PAPER 851794)

The main international bodies currently active in the fields of aircraft Ground Support Equipment (GSE) standardization are discussed, and an attempt is made to define what standardization should or should not be in this field. The activities of the ISO, SAE, and IATA are described, and their interlinks are shown. The classes of 'technical' standardization, which concerns design type specifications and purchasing type specifications, are addressed. The meaning of 'functional' specification, and how in practice it leads to a fairly effective worldwide GSE standardization, is considered. The way in which the market may respond to technical and functional standardization is discussed. C.D.

A86-38324* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RETROFITTING AVIONICS - CLOSING THE PERFORMANCE 'GENERATION GAP'

C. R. SPITZER (NASA, Langley Research Center, Hampton, VA) SAE, Aerospace Technology Conference and Exposition, Long Beach, CA, Oct. 14-17, 1985. 7 p. refs
(SAE PAPER 851813)

The retrofitting of advanced avionics to in-service aircraft in order to increase operational safety and flexibility, and reduce operating costs is analyzed. Research in flight management planning and airborne guidance for full-and cost-effective flight is examined. The use of CRTs and thin film electroluminescent displays in aircraft is described. The development of more accurate and reliable fuel gauges using nuclear-based techniques or volumetric measurements to evaluate fluid levels is studied. Advances in airspace systems, such as the Microwave Landing System, and Air Traffic Control Beacon System/Select Mode, the Traffic Advisory and Collision Advance System, and satellite-based communications, navigation, and surveillance are discussed. I.F.

A86-43901#
TESTABILITY MANAGEMENT THROUGH MIL-STD-2165
W. L. KEINER (U.S. Navy, Naval Surface Weapons Center, Dahlgren, VA) IN: AUTOTESTCON '85; Proceedings of the International Automatic Testing Conference, Uniondale, NY, October 22-24, 1985 . New York, Institute of Electrical and Electronics Engineers, 1985, p. 383-388.
MIL-STD-2165, 'Testability Program for Electronic Systems and Equipments', was issued on January 26, 1985. This new standard may be applied to all electronics developments within the Department of Defense. This paper discusses the role of the new military standard as a management tool for the development of testable electronic systems and equipments. A framework is presented for managing testability requirements tradeoffs, design tradeoffs, and testability evaluations. Author

A86-48371
AIRPORTS BUILD FOR FUTURE TRAFFIC AMID NEW SECURITY CONCERN
D. WOOLLEY Interavia (ISSN 0020-5168), July 1986, p. 763, 764, 767-770.
An evaluation is made of the financial, technical, commercial, and security-related factors currently influencing major international airport construction, renovation and expansion programs. Attention is given to such new technologies as mobile X-ray equipment for baggage inspection by the side of aircraft, automated handling of containerized baggage and freight, ground-movement radars, and large departures/arrivals display technology. Progress toward the detection of explosives and fire-arms by pencil-beam and two-beam X-ray machines is assessed. O.C.

A86-49084#
THE AIRLINE ENGINEERING ROLE IN THE MANAGEMENT OF SAFETY
D. K. CRAIG (British Airways, London, England) IN: ICAS, Congress, 15th, London, England, September 7-12, 1986, Proceedings. Volume 2 . New York, American Institute of Aeronautics and Astronautics, Inc., 1986, p. 1010-1016.
The paper outlines the contribution the Engineering Department of a major International Airline makes in the maintenance and enhancement of Safety Standards. The areas to be covered are: the innovaitive approaches to the identification of maintenance requirements; the progressive maintenance programmes for the future; the introduction of enhanced safety standards through the airlines; development of techniques such as Engine Health Monitoring, NDT and AIDS; and the improvements in quality standards of staff. Author

A86-49478
LONG ENDURANCE AIRCRAFT PERFORMANCE
P. MACCREADY (AeroVironment, Inc., Monrovia, CA) Unmanned Systems, vol. 4, Summer 1985, p. 31-33.
A comprehensive evaluation is made of the factors governing the design and achievable performance of ultralight long-endurance, unmanned aircraft for various vehicle sizes and mission profiles. The calculations and tabulations presented are based on a particular vehicle configuration tailored to long duration missions, whose glide ratio at the selected design speed is 27.6. Fossil fuel combustion is used by the powerplant, together with a variable-pitch propeller. It is noted that, for the case of a 100-lb payload, the vehicle would resemble a light, slightly enlarged sailplane; operations at 90,000 ft stress the importance of powerplant design, and call for exceptionally low wing loading. O.C.

N86-15158*# McDonnell-Douglas Astronautics Co., Houston, Tex.
IMPLEMENTING QUALITY/PRODUCTIVITY IMPROVEMENT INITIATIVES IN AN ENGINEERING ENVIRONMENT
R. R. RUDA *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 1-9 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 05A
Quality/Productivity Improvement (QPI) initiatives in the engineering environment at McDonnell Douglas-Houston include several different, distinct activities, each having its own application, yet all targeted toward one common goal - making continuous improvement a way of life. The chief executive and the next two levels of management demonstrate their commitment to QPI with hands-on involvement in several activities. Each is a member of a QPI Council which consists of six panels - Participative Management, Communications, Training, Performance/Productivity, Human Resources Management and Strategic Management. In addition, each manager conducts Workplace Visits and Bosstalks, to enhance communications with employees and to provide a forum for the identification of problems - both real and perceived. Quality Circles and Project Teams are well established within McConnel Douglas as useful and desirable employee involvement teams. The continued growth of voluntary membership in the circles program is strong evidence of the employee interest and management support that have developed within the organization. Author

N86-15160*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SELF-RENEWAL: A STRATEGY FOR QUALITY AND PRODUCTIVITY IMPROVEMENT
D. H. HUTCHINSON *In* NASA. Johnson (Lyndon B.) Space Center R and D Productivity: New Challenges for the US Space Program p 18-31 1985 refs
Avail: NTIS HC A25/MF A01 CSCL 14D
Productivity improvement is discussed. The concept of productivity improvement is supplemented with two additional concepts of productivity improvement: effectiveness and innovation. Case studies are provided to illustrate concepts. R.J.F.

N86-19636*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NONDESTRUCTIVE TECHNIQUES FOR CHARACTERIZING MECHANICAL PROPERTIES OF STRUCTURAL MATERIALS: AN OVERVIEW
A. VARY and S. J. KLIMA Dec. 1985 21 p refs Proposed for presentation at the 31st International Gas Turbine Conference, Dusseldorf, West Germany, 8-12 Jun. 1986; sponsored by ASME (NASA-TM-87203; E-2858; NAS 1.15:87203) Avail: NTIS HC A02/MF A01 CSCL 14D
An overview of nondestructive evaluation (NDE) is presented to indicate the availability and application potentials of techniques for quantitative characterization of the mechanical properties of structural materials. The purpose is to review NDE techniques that go beyond the usual emphasis on flaw detection and characterization. Discussed are current and emerging NDE techniques that can verify and monitor entrinsic properties (e.g., tensile, shear, and yield strengths; fracture toughness, hardness, ductility; elastic moduli) and underlying microstructural and morphological factors. Most of the techniques described are, at present, neither widely applied nor widely accepted in commerce and industry because they are still emerging from the laboratory. The limitations of the techniques may be overcome by advances in applications research and instrumentation technology and perhaps by accommodations for their use in the design of structural parts. Author

N86-19638# Technische Hogeschool, Delft (Netherlands). Dept. of Mechanical Engineering.
DEVELOPMENTS IN QUALITY CONTROL [DE ONTWIKKELING VAN DE KWALITEITSBEHEERSING]
M. A. A. KOOTER 31 Oct. 1983 51 p refs In DUTCH
(REPT-186) Avail: NTIS HC A04/MF A01

Developments of quality control and in particular the role of workers and quality managers in it, were surveyed. An increase in demands for quality from the outside (market shift), preventive quality care efficiency, and employee requests for more responsibility are discerned. A motivation improvement by decentralization, consciousness awakening, participation, and self-(quality)control in the production sector is pursued. Quality section tasks are shifted to the control and support of this self-control. Results are cost reduction and product improvement. Certification as a result of acknowledged quality control consolidates competitivity. Author (ESA)

N86-20047# Stanford Univ., Calif. Lab. for Computational Statistics.
THE BOOTSTRAP METHOD FOR ASSESSING STATISTICAL ACCURACY
B. EFRON and R. TIBSHIRANI Oct. 1985 57 p
(Contract N00014-83-K-0472)
(AD-A161257; LCS-TR-19) Avail: NTIS HC A04/MF A01 CSCL 12A

This is an invited review of bootstrap methods. It begins with an exposition of the bootstrap estimate of standard error for one-sample situations. Several examples, some involving quite complicated statistical procedures, are given. The bootstrap is then extended to other measures of statistical accuracy, like bias and prediction error, and to complicated data structures such as time series, censored data, and regression models. Several more examples are presented illustrating these ideas. The last third of the paper deals mainly with bootstrap confidence intervals. The paper ends with a FORTRAN program for bootstrap standard errors. GRA

N86-24256# Northwestern Univ., Evanston, Ill. Dept. of Mechanical and Nuclear Engineering.
COMPUTER-AIDED ENGINEERING
H. H. FONG, F. M. SKALAK, W. K. LIU, J. Y. LEUNG, and K. H. HSU 26 Jun. 1985 6 p Presented at Pressure Vessels and Piping Conference and Exhibition, New Orleans, La 23-26 Jun. 1985
(AD-A162811; AFOSR-85-1108TR) Avail: NTIS HC A02/MF A01 CSCL 09B

The procedures for analog Monte Carlo simulation of Markov processes are examined. Two variance reduction techniques are then included in a nonanalog formulation to increase the sampling efficiency for highly reliable systems, and a method for incorporating uncertainty in failure and repair rate data is outlined. Models for three classes of component dependencies appearing in reliability and availability problems are incorporated into the Markov formulation. They are: (1) shared repair crews between components, (2) load sharing between components, and (3) standby mode. Results are given for a series of model problems to demonstrate the efficiency of the methods as well as the effects of the dependencies on system unreliability and unavailability. GRA

N86-26239# National Bureau of Standards, Gaithersburg, Md. Center for Basic Standards.
TECHNICAL ACTIVITIES 1983, CENTER FOR BASIC STANDARDS
K. G. KESSLER Oct. 1985 331 p
(PB86-140043; NBSIR-85/3254) Avail: NTIS HC A15/MF A01 CSCL 14B

The research and technical activities of the Center for Basic Standards during the Fiscal Year 1985 are summarized. These activities include work in the areas of electricity, temperature and pressure, mass and length, time and frequency, quantum metrology, and quantum physics. GRA

N86-26276*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LANGLEY AEROSPACE TEST HIGHLIGHTS, 1985
May 1986 100 p
(NASA-TM-87703; NAS 1.15:87703) Avail: NTIS HC A05/MF A01 CSCL 05A

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. Significant tests which were performed during calendar year 1985 in Langley test facilities, 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. Other highlights of Langley research and technology for 1985 are described in Research and Technology-1985 Annual Report of the Langley Research Center. Author

N86-26359# SoHaR, Inc., Los Angeles, Calif.
RELIABILITY PREDICTION FOR SPACECRAFT Final Report, Mar. 1983 - Jan. 1985
H. HECHT and M. HECHT Dec. 1985 152 p
(Contract F30602-83-C-0018)
(AD-A164747; RADC-TR-85-229) Avail: NTIS HC A08/MF A01 CSCL 22B

This study provides the basis for improving the utility of Mil-Hdbk-217 for reliability prediction of spacecraft components and systems. The reliability performance histories of 300 satellite vehicles, which were launched between the early 1960's through Jan. 84, were reviewed and analyzed during the course of the study. Analysis of over 2500 reports of malfunctions indicated strong evidence of a decreasing failure rate with time in orbit. The cause for the decreasing hazard was found to be traceable primarily to design and environmental causes. In general, however, it was found that current predictions overestimate the failure rate by at least a factor of two and that the excess of predicted over observed failures increases with time in orbit. Three methods are provided for spacecraft reliability prediction. In order to account for the decreasing hazard, two of the procedures use a Weibull model with parameters based upon similar spacecraft mission types. A third method uses modifications of Mil-Hdbk-217 procedures to account for the overestimation of failure rates which result when current procedures are used. GRA

N86-26409# National Bureau of Standards, Gaithersburg, Md. Office of Standard Reference Data.
STANDARD REFERENCE DATA PUBLICATIONS, 1964-1984
J. C. SAUERWEIN and G. R. DALTON Dec. 1985 147 p
(PB86-155587; NBS-SP-708; LC-85-600607) Avail: NTIS HC A07/MF A01; also available SOD $5.00 as SN003-003-02705-7 CSCL 07D

The National Bureau of Standards' Office of Standard Reference Data manages a network of data centers that prepare evaluated data bases of physical and chemical properties of substances. Data bases are available in printed form, on magnetic tapes and through on-line computer networks. This document provides a comprehensive list of the products available from the National Standard Reference Data System (NSRDS) for the years 1964 to 1984, including indexes qualified by author, material, and property terms. Ordering information and current prices can be found at the end of this document. GRA

N86-31548*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA'S AIRCRAFT ICING ANALYSIS PROGRAM
R. J. SHAW 1986 26 p Presented at the International Conference of the Aeronautical Sciences (ICAS), London, England, 7-12 Sept. 1986
(NASA-TM-88791; E-3121; NAS 1.15:88791) Avail: NTIS HC A03/MF A01 CSCL 01C

An overview of the NASA ongoing efforts to develop an aircraft icing analysis capability is presented. Discussions are included of the overall and long term objectives of the program as well as current capabilities and limitations of the various computer codes being developed. Descriptions are given of codes being developed to analyze two and three dimensional trajectories of water droplets, airfoil ice accretion, aerodynamic performance degradation of components and complete aircraft configurations, electrothermal deicer, fluid freezing point depressant antideicer and electro-impulse deicer. The need for bench mark and verification data to support the code development is also discussed, and selected results of experimental programs are presented. Author

N86-32418# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
AIR SAFETY: FEDERAL AVIATION ADMINISTRATION'S ROLE IN DEVELOPING MID-AIR COLLISION AVOIDANCE BACK-UP SYSTEMS
Apr. 1986 19 p
(PB86-197506; GAO/RCED-86-105FS; B-222851) Avail: NTIS HC A02/MF A01 CSCL 01B

This FAA report on the development of mid-air collision avoidance back-up systems contains the following: Airborne collision avoidance system availability; Difference between the traffic alert and collision avoidance system and the beacon collision avoidance system; Traffic alert and collision avoidance system projected commercial availability date; Airborne collision avoidance system and threat alert and collision avoidance system cost and effectiveness. GRA

N86-32660# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Product Assurance Div.
THE QUALIFICATION AND PROCUREMENT OF TWO-SIDED PRINTED CIRCUIT BOARDS (FUSED TIN-LEAD OR GOLD PLATED FINISH)
Oct. 1985 81 p
(ESA-PSS-01-710-ISSUE-1; ISSN-0379-4059; ETN-86-97797) Avail: NTIS HC A05/MF A01

Requirements for evaluation, qualification, and procurement of two-sided printed-circuit boards with fused tin-lead or gold-plated finish by ESA are defined. The mandatory test methods are described, and details of accept/reject criteria are given. ESA

N86-32766# Stanford Univ., Calif. Dept. of Statistics.
SURVEY OF SOVIET WORK IN RELIABILITY
A. L. RUKHIN 29 Apr. 1986 21 p
(Contract N00014-76-C-0475)
(AD-A167607; TR-373) Avail: NTIS HC A02/MF A01 CSCL 14D

We review the research of the Soviet school in reliability theory for the last twenty years. The main subjects under review are complex systems and their reliability, families with monotone failure rate, optimal maintenance and control, and statistical problems of reliability theory (121 defs.). 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.

A86-11023
SPACE WARC '85 - A LOOK BACK
A. L. MOORE and H. RADIN (Satellite Systems Engineering, Inc., Bethesda, MD) Satellite Communications (ISSN 0147-7439), Nov. 1985, p. 67, 68, 70.

A review of the World Administrative Conference on the Use of Geostationary Orbit and Planning of Space Services is provided. Representatives from 112 nations including developing countries participated in the conference. The discussions between developed and developing countries over guaranteed access to the geostationary orbit, sovereignty over the geostationary orbit above the territorial rights, and the planning of services and number of bandwidths to be used is described. The conclusions reached are given; a compromise between the developed and developing nations was achieved. The U.S.'s reservations about certain limitations in the Final Acts of the conference are discussed. Some topics which were not resolved at the conference are presented. I.F.

A86-15663#
FUTURE WORLD METEOROLOGICAL SATELLITE SYSTEMS
E. L. HEACOCK (NOAA, Rockville, MD), IU. A. AFANASEV (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR), C. HONVAULT (ESA, Paris, France), T. YOSHIDA (Meteorological Satellite Center, Japan), and U. V. GOPALA RAO (Directorate of Satellite Meteorology, India) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 12 p.
(IAF PAPER 85-87)

As a result of the activity of the NOAA, ESA, the USSR State Research Center for Natural Resources Exploration, Japan's Meteorological Satellite Center, and India's Directorate of Satellite Meteorology, a system of world weather satellites provides weather and environmental data for more than 120 countries. Each agency makes decisions that control the type and quantity of data available to the world for the remainder of this century. The environmental and meteorological systems in operation (Meteor-2, Meteosat, POES, and GOES), the experimental satellites (Kosmos-1500, Kosmos-1602, and Japan's GMS-4), and future plans for the meteorological systems of the U.S., ESA, Japan, and the USSR are described. In particular, the developmental details of Japan's GMS include provision of hourly observations which will cover global area from 50 deg N to 10 deg N, and replacement of the analog HR-FAX mode of operation by the digital stretched VISSR mode. The planned advances in USSR's Kosmos satellites include an increased number of parameters to be measured, increased accuracy and higher spatial resolution of the images, and more efficient data handling. I.S.

A86-15903*#
TECHNOLOGY PROGRAMS AND RELATED POLICIES - IMPACTS ON COMMUNICATIONS SATELLITE BUSINESS VENTURES
J. S. GREENBERG (Princeton Synergetics, Inc., Princeton, NJ) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 13 p. NASA-sponsored research.
(IAF PAPER 85-433)

The DOMSAT II stochastic communication satellite business venture financial planning simulation model is described. The specification of business scenarios and the results of several analyses are presented. In particular, the impacts of NASA on-orbit propulsion and power technology programs are described. The effects of insurance rates and self-insurance and of the use of the Space Shuttle and Ariane transportation systems on a typical fixed satellite service business venture are discussed. C.D.

A86-15905#

INSURANCE FOR SPACE VENTURES

B. STOCKWELL (Corroon and Black Inspace, Inc., Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 11 p.

(IAF PAPER 85-435)

The coverage currently provided and necessary changes for the insurance of commercial space missions are studied. The 17 percent increase in launch insurance rates, the limited number of underwriters, and the strict policy terms that have resulted from numerous space mission failures are discussed. The coverages currently available are: (1) transit and storage, (2) launch delay, (3) third-party liability, (4 launch and commissioning, (5) in-orbit, and (6) political risk. The separation of launch risk into a vehicle and a spacecraft phase is analyzed. The need for additional policies to cover the new payloads being marketed, and increasing premiums have led to the development of a new means of providing insurance. Alternative means of supplying coverage which include the partition of risks in order to introduce more underwriters into the market, the formation of a cooperative by a pool of users who collectively self-insure the first loss in a series of launches, and the formation of a cooperative by the launch service vendor are being investigated. I.F.

A86-15941#

ANTHROPOLOGY AND THE HUMANIZATION OF SPACE

B. R. FINNEY (Hawaii, University, Honolulu) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 16 p. refs

(IAF PAPER 85-497)

The role of anthropology in the colonization of space is studied. Some problems that would be encountered in space living such as, isolation from earth, family, and friends, small living space, psychological strain, and interaction of heterogenous groups are described. The understanding of various cultures in order to have successful space living is discussed; the need for good cross-cultural relations in heterogenous space crews and the use of earth practices and institutions in space is analyzed. New cultures and societies will evolve to adapt to extraterrestrial environments once man settles space; the problems of reproduction and demographics are investigated. The application of anthropology to human expansion into space, taking into account possible contact with extraterrestrials, is discussed. I.F.

A86-15942#

GOVERNMENT IN ACTION - THE ROLE OF POLITICAL SCIENCE IN OUTER SPACE ACTIVITIES

E. GALLOWAY (International Academy of Astronautics; International Institute of Space Law, Washington, DC) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 8 p. refs

(IAF PAPER 85-498)

In this paper political science is examined as one of the social sciences in the context of the impact of science and technology on society. The ways in which political science concepts are involved in multidisciplinary space projects are explained by examples from U.S. experience, particularly when decisions were made in 1957-58 on organization of the government for conducting space activities. Analysis is made of the roles in space activities of the President, Vice President, Executive agencies, and the Congress (Senate and House of Representatives). Author

A86-15943#

ECONOMIC EQUITY AND INTERNATIONAL COOPERATION - THE EXAMPLE OF E.S.A

J. M. CONTANT (Aerospatiale, Direction Generale, Paris, France), G. DONDI (ESA, Contracts Dept., Paris, France), E. IGENBERG (Muenchen, Technische Universitaet, Munich, West Germany), and J. PH. BOISSIN (Paris IX, Universite, France) IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985. 10 p. refs

(IAF PAPER 85-499)

An interactive multicriteria evaluation model is used to assess the advantages accruing to European countries involved in space activities through the European Space Agency. The advantages are defined in both financial and nonfinancial terms, and the relative position of a group of countries is introduced. A disaggregative approach is used to estimate the relative importance of each criterion, and a series of evaluation functions are determined. Using these intermediate results, the advantages derived by ESA member states at the end of 1984 are assessed using an aggregative approach, and the consistency of the evaluation criteria is verified. C.D.

A86-17743

INTERNATIONAL COOPERATION AND COMPETITION IN CIVILIAN SPACE ACTIVITIES

R. A. WILLIAMSON (Office of Technology Assessment, Washington, DC) Space Policy (ISSN 0265-9646), vol. 1, Nov. 1985, p. 409-414. refs

This article considers how the U.S.A. can best maintain its commercial and governmental competitiveness in space, while facilitating private investment and international marketing, and at the same time keeping up significant cooperation with other nations. The current state of U.S. civilian space activities in each of these areas is summarized, and several alternative solutions are presented. The article concludes that strengthening U.S. competition with other space-capable nations, and improving U.S. ability to cooperate effectively, will require careful coordination of the activities of federal agencies with each other and with the private sector. Author

A86-18368

SPACE LAW CHALLENGED

D. D. SMITH (Schnader, Harrison, Segal and Lewis, Washington, DC) Space (ISSN 0267-954X), vol. 1, Sept. 1985, p. 23, 43.

The development of new agreements in order to promote international and regional cooperation in the development of space for scientific and commercial purposes is examined. The inabilities of existing space policies and laws to address the concerns arising from the use of the Space Shuttle are described. The need to establish terms by which participating and nonparticipating nations will have access to the Space Shuttle's facilities are discussed. An interpretation of liability laws in regard to Space Shuttle issues is presented. I.F.

A86-18381

HUMAN DEVELOPMENT AND THE CONQUEST OF SPACE

S. A. HEMPENIUS and C. VOUTE (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) Space Policy (ISSN 0265-9646), vol. 1, May 1985, p. 179-186. refs

Space age ethics are to be distinguished as a separate set of ethical concepts for several reasons: outer space constitutes a unifying element for mankind; the unique space environment has an international statute; and the impact of space science and the utilization of space technology will always have both positive and negative international consequences and repercussions. Its main objective is an immaterial output-related activity and much of its waste is equally immaterial. Space technology carries another hazard with it the danger of domination by extrovert cultures. Proper development of space technology requires international cooperation, scientific creativity and technological innovation combined with sociopolitical, economic and cultural aims and objectives and ethical values. Norms and objectives have to take into account religious concepts, humanistic viewpoints and sociocultural criteria. The ethics of the conquest of space have to consider the benefit of all mankind and that of each single individual, group and society as complementary and of equal importance. Author

A86-18384
US SPACE COMMERCIALIZATION - EFFECTS ON SPACE LAW AND DOMESTIC LAW
H. R. MARSHALL, JR. (U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs, Washington, DC) Space Policy (ISSN 0265-9646), vol. 1, May 1985, p. 204-210.

American attitudes and legislation concerning the commercialization of space are briefly reviewed. Emphasis is given to the privatization policy of the Reagan administration and its potential for causing conflicts between private space users and international space law. Efforts to privatize the Landsat program and expendable launch vehicle (ELV) development are discussed in detail. I.H.

A86-18389
THE USSR AND SATELLITE COMMUNICATIONS - COMPETITION AND COOPERATION
J. D. H. DOWNING (Hunter College, New York) Space Policy (ISSN 0265-9646), vol. 1, Aug. 1985, p. 250-262. refs

This article examines the USSR's satellite communications provision in the international arena. First outlined are the Intercosmos programme, collaboration between the USSR and France and India, and maritime satellite communications. Then discussed in detail are the INTERSPUTNIK system, and Soviet International coverage and competitiveness in television. In conclusion, the complex interaction and overlap between cooperation and competition in space is explained. Author

A86-18392
THE PARTICIPATION OF DEVELOPING COUNTRIES IN SPACE RESEARCH
J. G. ROEDERER (Alaska, University, Fairbanks) Space Policy (ISSN 0265-9646), vol. 1, Aug. 1985, p. 311-317.

The Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (Unispace 82) identified crucial problems and made recommendations on strategies for developing countries to bridge the gap with advanced nations in the area of space technology. This article addresses some issues which, although implicit in the Unispace Report, are not discussed in detail therein. The role of space science and related scientific research is particularly emphasized. Close attention is paid to the role of human factors, such as the motivation to conduct research, the motivation to engage in international cooperation, and the motivation to utilize and exploit space. Possible opportunities for space research for developing countries, as well as relevant issues concerning management of space, are briefly discussed. Author

A86-18394
INTELSAT AND THE CHALLENGE OF COMPETITIVE SYSTEMS
J. N. PELTON (INTELSAT, Washington, DC) Space Policy (ISSN 0265-9646), vol. 1, Aug. 1985, p. 322-329. refs

Intelsat represents an intergovernmental international organization, established under two international treaties. Intelsat, which has a membership of 109 countries, provides services to 165 different countries and territories around the world. It is pointed out that Intelsat does not have a monopoly on international telecommunications. Current forms of competitions are discussed, taking into account the problems posed by a totally unregulated and competitive market in international telecommunications. Attention is given to the issue of Intelsat's own accountability, the U.S. policy of deregulation, Intelsat's technological and service innovations record, the future potential of the Intelsat Business Service, the need to provide effective interconnection to fiber optic systems, the achievement of global interconnectivity, and an evaluation of Intelsat's performance. G.R.

A86-18848
RECENT DEVELOPMENTS IN AVIATION CASE LAW
W. D. CARTER, JR. (Fulbright and Jaworski, Houston, TX) Journal of Air Law and Commerce (ISSN 0021-8642), vol. 51, no. 1, 1985, p. 51-118. refs

A review of cases pertaining to recent aviation decisions is presented. Cases regarding federal subject matter, jurisdiction, personal jurisdiction, death in aircraft crashes in water, and federal removal are analyzed. Governmental liability and exception are studied. Cases concerning air carrier liability, including products damage and negligence, are examined. The applicability of the Warsaw Convention to notice of claims, limitation on liability, and damage recovery is investigated. General, and pilot qualification and airworthiness certificate insurance exclusions are discussed. Cases involving damage and the calculation of damage incurred in an aircraft accident are described. I.F.

A86-19261
MANAGEMENT OF OUTER SPACE
L. PEREK (Ceskoslovenska Akademie Ved, Astronomicky Ustav, Prague, Czechoslovakia) Earth-Oriented Applications of Space Technology (ISSN 0277-4488), vol. 5, no. 3, 1985, p. 247-252. refs

The control of outer space is necessary in order to protect space activities and the earth environment and to foster international cooperation. Existing United Nations regulations regarding jurisdiction, damage responsibility, announcement of launches, and enviromental pollution are examined. The roles of the International Telecommunication Union in monitoring space communications and nongovernmental organizations in controlling space studies ranging from astrodynamics to biology are described. Proposed methods of tracking satellites, reducing collision probability especially in geostationary orbit, and preventing pollution of the ground, and the high and low atmosphere are analyzed. I.F.

A86-19861#
NATIONAL AND INTERNATIONAL COOPERATION IN REMOTE SENSING AND APPLICATIONS
R. J. KEATING (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) AIAA, Aerospace Sciences Meeting, 24th, Reno, NV, Jan. 6-9, 1986. 8 p.
(AIAA PAPER 86-0412)

This paper provides an overview of the United States remote sensing satellite systems and how they complement those of our foreign partners. In addition, the paper describes the international cooperative efforts to achieve complementarity and compatibility of these satellite systems. Specific uses of the data and their applications are described. Author

A86-21123#
THE NEEDS OF DEVELOPING COUNTRIES IN THE APPLICATION OF SATELLITE TECHNOLOGY FOR DISASTER MANAGEMENT
C. VOUTE (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 247-261. refs

The possible use of space technology for disaster management is discussed in terms of disaster prevention, disaster preparedness and disaster relief operations, with emphasis on remote sensing applications. Specific needs of developing countries are identified. It is suggested that remote sensing imagery should not only be used for disaster prevention measures, disaster preparedness planning and damage assessment in case of emergencies, but also for audio-visual training programs and for on-site information of relief workers. Author

A86-21126#
USE OF SATELLITE DATA IN INTERNATIONAL DISASTER MANAGEMENT THE VIEW FROM THE U.S. DEPARTMENT OF STATE
L. A. ROSE (U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs, Washington, DC) and P. F. KRUMPE (Agency for International Development, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 18th, Paris, France, October 1-5, 1984, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1985, p. 301-306.

Requirements are elaborated that must be met in a joint program wherein the U.S. Department of State and the U.S. Agency for International Development are actively exploring ways of using satellite data in emergency preparedness and disaster warning worldwide. Considerations that must be taken into account include: the limits of satellite technology and data in providing effective disaster warning; the fact that cost and competing claims on national resources do not permit research and development specifically targeted at creation of disaster early warning capabilities for satellites; the need of disaster-prone nations to provide substantial resources of their own to ensure that satellite warnings reach the affected areas in time; the continuing impossibility of precise prediction of natural disasters; and the long lead-time to establish a truly global disaster warning system. D.H.

A86-22242
EUROPE - TOWARDS A NEW LONG-TERM PROGRAMME
R. GIBSON Space Policy (ISSN 0265-9646), vol. 1, Feb. 1985, p. 3-6.

The establishment of a new space program for Europe by the European Space Agency (ESA) is examined. The funding of mandatory and optional programs by the ESA is discussed. Budgetary allocations for programs in the areas of science, telecommunications, earth observations, microgravity research, support technology, launchers, and orbiting capacity are studied. The different views of ESA members on the development of launchers and in-orbit infrastructures are analyzed. The involvement of ESA in the U.S. Space Station program or development of a program independently is investigated. I.F.

A86-22244
INTERNATIONAL INVOLVEMENT IN THE US SPACE STATION PROGRAMME
J. M. LOGSDON (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 1, Feb. 1985, p. 12-25. refs

This article considers the issues surrounding the nature and extent of involvement in the U.S. space station initiative. The motives and objectives of U.S. cooperation with its allies are analyzed from the perspective of both the USA and its potential partners. Guidelines for the forthcoming negotiations between these parties are elaborated through a review of past experience in international space cooperation. Developing a framework for collaboration will require significant trade-offs and will have to accommodate a number of not always consistent interests. Author

A86-24122
UNDERWRITERS WORLDWIDE INCURRED $600 MILLION IN UNEXPECTED LOSSES, SIGNIFYING CHANGES AHEAD IN SPACE INSURANCE
H. J. COLEMAN Commercial Space (ISSN 8756-4831), vol. 1, Fall 1985, p. 61-63, 65.

The effect of satellite losses on insurability and space commercialization is examined. The possibility of government intervention is discussed; however, most groups including NASA do not support government involvement. New plans for insuring space projects are proposed; one method is for manufacturers to fund their own insurance. The changes in insurance policy terms, the excessive premiums of 17-20 percent, and the shortages in insurance capacity are studied. The limited amount of insurance availability will impact on the number of space projects being developed. The need for improved technical designs and test requirements in order for the insurance companies to risk providing coverage is investigated. The use of third-party legal liability insurance is analyzed. I.F.

A86-24127
FUTURE SPACE GOALS - NATIONAL COMMISSION DEFINES U.S. OPTIONS FOR THE 21ST CENTURY
A. LAWLER Commercial Space (ISSN 8756-4831), vol. 1, Fall 1985, p. 88, 89, 91.

The objectives of the National Commission on Space are discussed. The need for proper infrastructure in order to implement a national space policy is examined. Methods of integrating industry into national space programs and encouraging commercialization are analyzed. NASA current function in space development and its role following the commission's proposals are investigated. I.F.

A86-24598#
THE EVOLUTION OF THE AGENCY'S PATENT POLICY
R. OOSTERLINCK (ESA, Directorate of Administration, Paris, France) ESA Bulletin (ISSN 0376-4265), no. 44, Nov. 1985, p. 80-83.

The development of ESA's current 'license policy' for patents is discussed. Evolving out of the ESRO and ELDO policies which it took over, the ESA guidelines reflect the ESRO promotion of space applications for industry and the ELDO concern with the protection of information against nonpeaceful applications. Specifically, the contractor retains title to his patents but must grant a license to ESA and its member states to be used for their purposes in the field of space research and technology, and must pay ESA royalties for any other exploitation. In addition, the Agency may take title to an invention if the subcontractor abandons or declines to patent it; the subcontractor is not obliged to license his background patents to others, and he will be indemnified if he agrees to third party reproduction; and in-house inventions are Agency-owned with incentive rewards for the inventor. R.R.

A86-24675
INTERNATIONAL SPACE LAW AND DIRECT BROADCAST SATELLITES
H. M. WHITE, JR. (North Carolina, University, Chapel Hill) and R. LAURIA Space Communication and Broadcasting (ISSN 0167-9368), vol. 3, Dec. 1985, p. 321-335. refs

Legal principles for space communications are discussed in terms relating to direct broadcast satellites (DBSs). The resolutions and documents of the Legal and Scientific and Technical Subcommittees of the Committee on the Peaceful Use of Outer Space which are to deal with all space related issues, the International Telecommunication Union which is to establish guidelines and criteria to maximize space communications and DBSs, and the DBS Working Group which reports on the technical feasibility of communicating with DBSs, are examined. Various proposals regarding the development of technical procedures, international cooperative arrangements, and guiding principles for the application of DBSs are investigated. The issues of suppremacy of national sovereignty and requirement of prior consent versus the supremacy of personal sovereignty and the principle of free flow of information, which are major unresolved issues regarding the use of DBSs, are analyzed. I.F.

A86-26546
SPACE LAW IN THE UNITED NATIONS
M. BENKO, W. DE GRAAFF, and G. C. M. REIJNEN Dordrecht, Martinus Nijhoff Publishers, 1985, 275 p. refs

Problems relating to the peaceful uses of outer space currently being debated in the United Nations are analyzed from a technological and legal aspect. The remote sensing of the earth with satellites for meteorological, and earth resources, and military applications is discussed. The difficulties in establishing principles on remote sensing due to disagreements on the access to and the dissemination of the data are examined. Existing nuclear power sources and present deliberations in the U.N. are described. U.N.

discussions concerning the delimitation of outer space, outer space activities, and the utilization of the geostationary orbit are studied. Existing or planned military systems for outer space, treaties governing the militarization of outer space, and proposed measures on the prevention of an arms race in outer space are reviewed. I.F.

A86-27877#

THE NEW SPACE RACE - REMARKS

J. GREY (AIAA, New York) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 21-24.

An evaluation is made of the U.S. posture in the emerging international competition for preeminence in launch vehicle capability and profitability, telecommunications satellite performance capabilities, space industrialization, etc. Analogies are drawn between European and Japanese approaches to electronics and commercial aircraft development in the past and their current efforts toward commercial exploitation of satellite-launching systems. The need for U.S. regulatory organizations to reconsider existing antitrust legislation in order to facilitate competitive response to this challenge by U.S. industries is noted. Innovative contractual arrangements among research and development organizations are suggested. O.C.

A86-27881#

CAPITALISM AND DEMOCRACY ON THE HIGH FRONTIER

A. DULA (Dula, Shields and Egbert, Houston, TX) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 93-106.

Outer space is the latest spiritual and economic frontier to challenge free enterprise capitalism. Before business can develop the vast resources of space for the benefit of all humanity, a simple and flexible legal regime must evolve to authorize and supervise commercial space activities. This article outlines present space activities and speculates on what space industry could accomplish by the year 2020. The framework of existing law that influences business in space is examined, with special reference to the history of the first private spaceflight. A few policy suggestions, emphasizing minimum regulation, are offered to promote the growth of commercial space activities. Author

A86-27883#

SPACE LAW - THE DISILLUSIONED MAIDEN IN THE MILITARY GARDEN OF EDEN

G. S. ROBINSON (Smithsonian Institution, Washington, DC) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 118-126.

The Outer Space Treaty of 1967 'set forth essential legal principles applicable to outer space activities in an enlightened fashion that has no precedent in any previous age of exploration'. This paper explores the numerous interpretations of the Treaty which treat it as though it were a precisely drafted legal document with the underlying spirit and intent disfranchised from consideration in those interpretations, particularly as they relate to the military use of space. The paper also examines the military-private sector relationship in developing space capabilities, and probes the possibilities of the private sector riding the coattails of the military into space to: (1) exploit indigenous resources through the principles of private enterprise, and (2) inculcate the military movement into space with underlying values deeper in context and broader in scope than those normally attendant to military tactical planning. Author

A86-27888#

SPACE COMMERCIALIZATION - AN AMERICAN CASE STUDY IN DENATIONALIZATION

C. STADD (Starstruck, Inc., Washington, DC) IN: Space, our next frontier; Proceedings of the Conference, Dallas, TX, June 7, 8, 1984 . Dallas, TX, National Center for Policy Analysis, 1985, p. 255-258.

The U.S. Federal government does not contest the right of private organizations to send vehicles into outer space as part of profit-making enterprise, as long as measures are taken to safeguard national security and public safety, as well as any international liability problems that may ensue. It is presently suggested that existing laws, regulations, and agencies are sufficient to provide the necessary overview. With the creation of the Office of Commercial Space Transportation by Presidential order, and the recent congressional passage of statutes designating the Department of Transportation as lead agency, regulatory mechanisms will begin to fade as a primary impediment in the policy area to commercial efforts toward space industrialization. O.C.

A86-28582

ESA SPACE STATION PLANNING

J. COLLET (ESA, Directorate of Space Transportation Systems, Paris, France) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 97-103.
(AAS 85-113)

The evolution of the European Space Station program, Columbus, is briefly described. Considerations is given to the technical issues addressed during the planning phase of the initial Columbus Preparatory Program (CPP), including: the preliminary cost and schedule baselines for development and operation of Columbus hardware; design definition with respect to the pressurized module (PM) and supporting platforms of the Columbus Space Station; and the design of servicing vehicles and resource modules (RMs) to support PM operations in the free-flying mode. The role of cooperative agreements between ESA and NASA in the development of preliminary Columbus Space Station designs is also discussed. I.H.

A86-28583

JAPANESE POLICY ON PARTICIPATION IN THE SPACE STATION PROGRAM

T. MORI (Science and Technology Agency, International Space Affairs Div., Tokyo, Japan) IN: Europe/United States space activities . San Diego, CA, Univelt, Inc., 1985, p. 105-112.
(AAS 85-114)

Some of the ways that Japan can benefit from participation in the NASA Space Station program are discussed. Consideration is given to four goals of the Japanese space program which would be significantly advanced by participation in Space Station, including: promotion of advanced technology development on earth; enhancement of space operations and activities; promotion of international cooperation in large-scale space projects; and utilization of the space environment for commercial applications such as materials processing, earth observation, pharmaceuticals production, and communications. A list of some possible missions for a Japanese Space Station module is provided. I.H.

A86-28779

THE CIVILIAN SPACE PROGRAM - A WASHINGTON PERSPECTIVE

R. H. WARE (Cooperative Institute for Research in Environmental Sciences, Boulder, CO) and P. P. CHANDLER (Office of Technology Assessment, Washington, DC) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 49-64.
(AAS 84-153)

The rationale is discussed for obtaining additional space infrastructure (spacecraft - including Space Stations and launch and transportation systems) to move forward in America's second quarter century of space activities, and the broader policy questions arising from NASA's proposal for obtaining a particular constellation of infrastructure elements are examined. A table of possible hardware options is included; possible long-term goals are presented, and objectives are formulated to reach toward those goals. The types of infrastructure that these objectives demand, and the associated cost, schedule and financing, are examined. A suggestion is offered for future roles that other nations, the private sector, and NASA might play in space. D.H.

A86-28780
THE MARS BASE - INTERNATIONAL COOPERATION
N. C. GOLDMAN (Texas, University, Austin) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 65-71. refs
(AAS 84-154)

Views are given on the probability of cooperation or competition being the enabling force for establishing a human presence on Mars within the next half century. Science cannot be a political driver for such a large project. Several options are considered for organizing a U.S.-sponsored joint mission to Mars. The options are extrapolated from past and present experiences of NASA in cooperative space missions, especially in the Spacelab and the Space Station, as well as from the Western experience in cooperative international space organizations such as the International Telecommunications Satellite Consortium (Intelsat) and the European Space Agency (ESA). The Mars Mission may call forth hybrid or new organizational principles in keeping with the seminal and massive endeavor. D.H.

A86-28786* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACE STATION - THE FIRST STEP
H. C. MANDELL, JR. (NASA, Johnson Space Center, Houston, TX) IN: The case for Mars II . San Diego, CA, Univelt, Inc., 1985, p. 157-170.
(AAS 84-160)

The United States Space Station program, begun in Fiscal Year 1985 under significant cost constraints, should cause all those involved in the planning of manned interplanetary flight to revise their impressions of the cost and practicality of planetary missions. The presence of the Space Shuttle, as well as arrival of a capable Space Station, will provide a major impetus to planetary programs, both by removing most of the real barriers to extended manned space flights and by proving that significant manned space ventures may be performed very economically. Author

A86-29696
STATUS OF SPACE COMMERCIALIZATION IN THE USA
J. M. LOGSDON (George Washington University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 2, Feb. 1986, p. 9-15. refs

Positive and negative developments affecting space commercialization in the USA are discussed. A 75 percent reduction for one year in the potential revenue from space activities, a decrease in the amount of private investment, a financial loss by space commercialization investors, an increase in insurance premium costs, and the slow advancement of material processing in space are described as factors which have hindered space commercialization activities. Progress has been achieved in the formation of a research base and the infrastructure required for the realization of the economic potential of space activities. The future use of the Space Shuttle and its pricing policy, the development and operation of a Space Station, NASA's Commercial Space Policy, and the activities of the Office of Commercial Programs are examined. I.F.

A86-29698
US-SOVIET INTERGOVERNMENTAL AGREEMENT ON COOPERATIVE SPACE ACTIVITIES - SHOULD IT BE RE-ESTABLISHED?
P. P. CHANDLER (DFVLR, Cologne, West Germany) Space Policy (ISSN 0265-9646), vol. 2, Feb. 1986, p. 28-36. refs

Political and scientific policies which need to be considered to establish a US-Soviet agreement on cooperative space activities are analyzed. The need to limit the amount of technology exchanged in order to protect national security is discussed, while the use of scientific and technological cooperation to encourage liberalization within the Soviet society and reduce Soviet belligerence abroad is examined. The development of either short- or long-term cooperative programs is studied, and basic guidelines to be followed to insure space cooperation are described. I.F.

A86-30290
A CHRONICLE OF POLICY AND PROCEDURE - THE FORMULATION OF THE REAGAN ADMINISTRATION POLICY ON INTERNATIONAL SATELLITE TELECOMMUNICATIONS
R. R. COLINO (INTELSAT, Washington, DC) Journal of Space Law, vol. 13, no. 2, 1985, p. 103-156. refs

The developments which led to a new FCC policy on international satellite telecommunications systems are reviewed. The policies and functions of Intelsat established in 1964 to provide world-wide telecommunication services are described. Beginning in March 1983 the FCC began to receive applications from private corporations to construct and operate international satellite communication systems independent of Intelsat. The FCC, Departments of State and Commerce, Congress, and the Executive Branch analyzed the applications and their effect on Intelsat; foreign policy concerns, domestic issues, and economics are examined. The effects of the Presidential and FCC decision on November 28, 1984 which approved the applications, but required coordination with Intelsat are studied. The formation of new rules for operation of satellite communication system by the FCC is discussed. I.F.

A86-32562
SPACE INSURANCE - A RESOURCE FOR COMMERCIAL SPACE ACTIVITIES
D. E. CASSIDY (Marsh and McLennan Aviation and Aerospace Services, Washington, DC) IN: EASCON '85: National space strategy - A progress report; Proceedings of the Eighteenth Annual Electronics and Aerospace Systems Conference, Washington, DC, October 28-30, 1985 . New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p. 325-327.

Insurance market conditions are discussed as they affect the insurability of present and future space systems including boosters and transfer vehicles. Particular attention is focused on the need for space insurance by commercial space enterprises, and the importance of demonstrated repeatibility of successes in preserving insurance as a resource for space commercialization. Available insurance coverages are also discussed. Author

A86-33604
HISTORY OF BRITISH SPACE SCIENCE
H. MASSEY and M. O. ROBINS Cambridge and New York, Cambridge University Press, 1986, 535 p. refs

British involvement in space science experiments between 1957 and 1981 is recounted. Cooperation with NASA is described in some detail, and the part played by Britain in establishing European cooperation in space science is addressed, as is the more modest cooperative program with Commonwealth countries. The topics considered include: the Skylark rocket program, the Ariel program, the European Space Research Organization, the small Skua and Petrel rockets for scientific purposes, the Trend Committee and the Science Research Council, the transformation of ESRO into ESA, the Space Science Committee for Europe. C.D.

A86-34134
THE HEAVENS AND THE EARTH: A POLITICAL HISTORY OF THE SPACE AGE
W. A. MCDOUGALL (California, University, Berkeley) Research supported by the University of California. New York, Basic Books, Inc., 1985, 570 p. refs

The first comprehensive political history of the space race is presented. The subjects covered range from the utopian fantasies of the nineteenth century pioneers of rocketry to the Strategic Defense Initiative, and shows how international competition and the cold war created the impetus for state-directed technological change. The significance of this competition for the survival of Western values is emphasized. C.D.

A86-34228
AIRLINE INDEMNITY AGREEMENTS - WILL THE CONTRACTS SHIFT YOUR RISKS?
S. C. KENNEY (Fisher and Hurst, San Francisco, CA) Journal of Air Law and Commerce (ISSN 0021-8642), vol. 51, Spring 1986, p. 613-657. refs

Indemnity issues related to the aviation industry are investigated. The use of interairline agreements between airline carriers and airport users are analyzed. The importance of properly drafted airport user indemnity agreements is discussed and three types of agreements are studied. Examples of interairline and airport user agreements are presented. I.F.

A86-35562#
EUROPE AIMS FOR SPACE INDEPENDENCE
P. LANGEREUX Aerospace America (ISSN 0740-722X), vol. 24, April 1986, p. 50-54, 56 (3 ff.).

The formation of ESA in 1975 established a unified organization to direct European space efforts into the 21st century. The initial thrusts were the Ariane launcher used for communications satellites and joint programs with the U.S. The 1985-95 expenditures will be double those from 1975-85, with major programs being the Ariane 5 heavy-lift vehicle, the Hermes spaceplane and an in-orbit infrastructure which encompasses the Columbus space station segment and a DRS satellite. Controversy persists due to European plans for free-flying, pressurized, dockable Space Station modules while NASA is requiring that the Initial Operational Station be a set configuration. It is notable that the Ariane 5 is actually a new, not derivative, design, and will be powerful enough to lift space station segments, or the Hermes, into LEO. The HOTOL, a British spaceplane under study, is expected to take longer than the Hermes to develop. Cornerstone science missions will include an asteroid or cometary sample return mission, orbiting unmanned X, solar and UV observatories, and a Saturn orbiter. The Eureca is a means to perform materials science, biology, fluid physics and other basic experimentation on orbit to identify potential space industrial processes. M.S.K.

A86-36449
SOVIET SPACEFLIGHT COMES OF AGE
P. PESAVENTO New Scientist (ISSN 0028-6664), vol. 110, April 10, 1986, p. 44-47.

The evolution of Soviet spaceflight is traced, beginning with the launch of the Vostok 1 in 1961, and ending with the launch of the space station Mir in February, 1986. With the success of the Vostok 1 mission, the Soviets were in the lead with regard to space exploration; until 1967 when the Soyuz 1 mission failed. By 1971, the U.S.S.R. had sent five unmanned Soyuz-Luna aircraft around the moon, and from mid-1974 to 1981, 21 Salyut crews inhabited five space stations. Two pieces of Soviet hardware that are of particular interest are the Kosmolyot spaceplane and the Soviet version of the space shuttle; the spaceplane may carry crews within the next two years, while the shuttle will make its first flight by the early 1990's. In addition, there is evidence that the Soviets plan to send cosmonauts to the planets. K.K.

A86-42236
DEVELOPING THE FINAL FRONTIER: INTERNATIONAL COOPERATION IN THE PEACEFUL USES OF OUTER SPACE
A. FLORINI Research supported by the James S. McDonnell Foundation, Armand Hammer Foundation, and Carnegie Corp. New York, United Nations Association of the United States of America, Inc., 1985, 79 p.

This history and law of human activity in outer space is examined, current space programs are reviewed, and the major policy issues facing the U.S. and the world are outlined. The launching of Sputnik is discussed as well as the formation of NASA, the race to the moon, the Apollo-Soyuz Test Project, the Outer Space Treaty and the Moon Treaty. NASA's Space Shuttles are considered as well as U.S. scientific aspirations in space; the Salyut space stations; ESA's Ariane, Spacelab, and EURECA projects; and the space programs of Japan, China, India, and Canada. A treatment is provided of the Space Station from the point of view of international cooperation and the military. The militarization of outer space is discussed, with particular emphasis on antisatellite systems and 'SDI'. Multilateral initiatives are also outlined. K.K.

A86-43335
SPACE STATIONS: LEGAL ASPECTS OF SCIENTIFIC AND COMMERCIAL USE IN A FRAMEWORK OF TRANSATLANTIC COOPERATION; PROCEEDINGS OF THE INTERNATIONAL COLLOQUIUM, HAMBURG, WEST GERMANY, OCTOBER 3, 4, 1984
K.-H. BOECKSTIEGEL, ED. (Koeln, Universitaet, Cologne, West Germany) Colloquium organized by the Universitaet Koeln and DGLR; Supported by BMFT. Cologne, West Germany, Carl Heymanns Verlag (Schriften zum Luft- und Weltraumrecht. Volume 5), 1985, 262 p. In English and German. For individual items see A86-43336 to A86-43350.

American experiences and perspectives regarding an international cooperation on a permanently manned space station are considered along with European experience and perspectives, the relevance of general multilateral space conventions to space stations, possible models for specific space agreements, agreements between States and with International Organizations, and contracts of and with private enterprises concerning the development, the construction, and the assembly of space vehicles. Attention is given to contractual and related agreements required for a satellite launch, applicable law and dispute settlement, forms of coverage and current market situation in the case of insurance, state supervision and registration, and legal questions which need to be addressed in the case of the Space Station. Other questions explored are related to legal aspects of stations in space, space stations and the law concerning intellectual property, aspects of law and practice in the U.S., and the experience of the European Space Agency. G.R.

A86-43339
POSSIBLE MODELS FOR SPECIFIC SPACE AGREEMENTS
P. P. C. HAANAPPEL (McGill University, Montreal, Canada) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 59-68. refs

At the present time, space stations are in the developmental and experimental stages, while the operational stage will only be reached in the 1990s. Questions are, therefore, considered regarding the advisability of the development of rules and regulations for space stations ahead of impending technical and economic developments. It appears that the answer to these questions can be put in the broader framework of the relationships between law and technology and between law and economics. It is pointed out that the law does not precede technological developments. Rather it reacts to them ex post facto, once they have taken place. It is recommended that caution should be exercised in the legislative process so as not to hamper technological and economic developments regarding space stations. Attention is given to participants in space station activities, government regulation of space station activities by private enterprises, prolonged human presence in outer space, conflicts of law, and contractual and extra-contractual relations. G.R.

A86-43340
AGREEMENTS BETWEEN STATES AND WITH INTERNATIONAL ORGANIZATIONS
M. G. BOURELY IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 71-87. refs

The present paper is concerned with the form and the contents of agreements governing international cooperation in the construction, transport, and assembly in space of space stations within the framework of the American program. Attention is given to agreements to be drawn up in the future, taking into account the absence of precedents for such agreements. It is pointed out, however, that there are a number of international cooperative activities, both past and present, which have points in common with the space station project. In a review of such past arrangements, elements which have already formed part of an international cooperative program are considered. These elements are related to the construction of hardware, the transport of hardware, the use of hardware in orbit, man's participation in the use of space, and in-orbit rendezvous. The American offer is discussed along with international agreements between European partners, and transatlantic international agreements. G.R.

A86-43342
CONTRACTUAL AND RELATED AGREEMENTS REQUIRED FOR A SATELLITE LAUNCH
R. F. STOWE (Satellite Business Systems, McLean, VA) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 101-108.

This paper is mainly concerned with the experiences of a communications carrier which utilizes satellites for its principal transmission facilities. Developments related to the fourth satellite of this company provide, in particular, an informative case and interesting current inventory of contractual and legal requirements for construction and launch of a spacecraft by a private firm. Attention is given to the development of the fundamental agreement with the spacecraft's prime contractor, the need for launch support services for ejection of he satellite from the Shuttle, the need for orbital tracking services which can monitor and command the satellite as it moves around the earth, the arrangement for appropriate insurance coverage, and the most recent development in new financing techniques in the space area. G.R.

A86-43343
APPLICABLE LAW AND DISPUTE SETTLEMENT
K.-H. BOECKSTIEGEL (Koeln, Universitaet, Cologne, West Germany) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 109-116. refs

The development, construction, and operation of space stations will require the cooperation of many institutions, bodies, and persons. A formal settlement procedure will be required in cases in which agreement by negotiation cannot be reached, and questions regarding the applicable law arise. Treaties relating to space stations are discussed, taking into account the applicable law, and dispute settlement. Problems concerning contracts are also investigated, giving attention to questions regarding the substantive law applicable to a contract, the assurance of mandatory dispute settlement with regard to commercial contracts, the inclusion of arbitration clauses in the contract, and the choice of arbitration as the exclusive dispute settlement machinery even in cases in which a state or state institution is one of the contractual partners. G.R.

A86-43344
INSURANCE - FORMS OF COVERAGE AND CURRENT MARKET SITUATION
A. BAUER (Deutscher Luftpool, Munich, West Germany) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 117-126.

The present paper provides a look at insurance aspects of space risks, taking into account the approaches used to deal with these risks. Various types of risks arising in connection with space-related material are mainly concerned with four principal stages, including the construction phase, the prelaunch phase, the launch phase, and the in-orbit phase. An outline is presented of the basic forms of insurance coverage in the considered cases. Certain risks which remain are related to the loss of direct revenues, incentive payments, and indirect losses. Indirect losses, for instance, can be incurred by satellite systems users when, resulting from failures of any kind or even only late delivery by the manufacturer, the commissioning of a satellite system will be delayed. Attention is also given to Third Party Legal Liability insurance. G.R.

A86-43345
STATE SUPERVISION AND REGISTRATION
W. VON KRIES (DFVLR, Bonn, West Germany) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 129-136. refs

The basic provisions of the 1967 Outer Space Treaty dealing with state supervision, registration, and related legal issues are examined in the context of space station operations, taking into account also the 1976 Registration Convention. Three major developments considered are related to the unprecedented technical nature of future space stations, the expected intensive international participation in space station operations, and the anticipated high level private sector involvement in space station activities. The technological characterization of space stations is discussed, and questions regarding the legal characterization of space stations are examined. Attention is given to space stations as 'space objects', the registration of space stations, and space stations as launching facilities. Problems concerning the jurisdiction and control over space stations are also considered, taking into account the Space Shuttle/Spacelab precedent, the case of Columbus, and the integrated supervision and control of space station operations. G.R.

A86-43346* National Aeronautics and Space Administration, Washington, D.C.
THE SPACE STATION - PAST, PRESENT AND FUTURE WITH SOME THOUGHTS ON SOME LEGAL QUESTIONS THAT NEED TO BE ADDRESSED
S. N. HOSENBALL (NASA, Washington, DC) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 137-142.

The history of the concept of a space station is briefly considered, taking into account a story written by Hale (1869), quantitative work provided by Oberth and Tsiolkovsky, von Braun, and the U.S. decision regarding the establishment of a space station. Arguments in favor of constructing a space station are related to the utility of a laboratory in earth orbit, the importance of a repair and maintenance base for satellites, the provision of capabilities for the commercial utilization of space, and the employment of a space station as a staging base for missions to the moon, Mars, and, possibly, the asteroids. Plans for the implementation of the Space Station concept are discussed, taking into account also legal issues involved in such an implementation. Attention is given to questions regarding the applicability of the Liability convention, U.S. domestic law, the domestic law of other countries, and four treaties. G.R.

A86-43349
ASPECTS OF LAW AND PRACTICE IN THE UNITED STATES
B. LUXENBERG (DOC, Washington, DC) IN: Space stations: Legal aspects of scientific and commercial use in a framework of transatlantic cooperation; Proceedings of the International Colloquium, Hamburg, West Germany, October 3, 4, 1984 . Cologne, West Germany, Carl Heymanns Verlag, 1985, p. 175-185. refs

The establishment of a permanently orbiting space station will usher in a new era, in which a significant shift will occur toward private entrepreneurial activity in space. However, in order to provide an incentive to private entities to engage in such ventures, the protection of intellectual property resulting from space station activities must be assured. The international law of outer space is considered along with developments regarding intellectual property rights in the case of NASA, commercial activities in space, national policy on space commercialization, and issues for the future. It is pointed out that NASA has developed flexible legal arrangements for companies pursuing commercial space ventures in the shuttle era and that this policy will undoubtedly carry over into the space station. G.R.

A86-44540
THE BROKER'S ROLE IN SPACE INSURANCE
B. STOCKWELL (Corroon and Black Inspace, Inc., Washington, DC) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 163-171.

In the international space insurance marketplace the broker is a key player. By arranging the support of the world underwriting market for the financial risks facing commercial aerospace clients, the broker provides the assurances necessary for the commercialization of space. It is a task that has become increasingly difficult in the wake of the unprecedented total losses of 1984. A now uncooperative and uncertain insurance market has set new rules which are presenting new challenges to the broker. This paper will begin with a general description of the broker's role and then focus on a discussion of the emerging complexities of the broker's task in a difficult and changing industry. Author

A86-44541
INSURANCE AND COMMERCIAL SATELLITE SYSTEMS
M. C. NILSON (Advanced Business Communications, Inc., McLean, VA) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985 . Pinner, England, Online Publications, 1985, p. 181-187.

This paper explores the practical business reasons for insuring commercial satellites and their launches. The importance of insurance to operators of communications satellite systems is discussed. As examples of systems typical of those around the world, the United States domestic satellite systems are illustrated from a business viewpoint. Insurance coverage is found to be equal importance to governments or government designated organizations that operate satellite systems for revenue earning purposes. It is concluded that there will be a steady and increasing demand for all types of space insurance, including launch and commissioning, service interruption and launch delay categories of coverage. Author

A86-46375
SOMETHING HAS TO CHANGE
B. GOUDGE Space (ISSN 0267-954X), vol. 2, June-Aug. 1986, p. 46-50.

A matter of paramount importance to the continuing evolution of the space industry and in particular to the commercialization of space, is the survival of the space insurance market. From 1977 to 1985, insurers lost 900 million U.S. dollars while premiums for this period amounted to less than 535 million U.S. dollars. The evolution of the present state of affairs is traced and explanations and recommendations are provided. Excessive competition, poor judgement as to the appropriate premium and ignorance of the actual risks involved emerge as major factors. To date, the market responses to the present crisis have included severe rate increases and tightening up of policy terms while the insured's reaction has included the denial of any ability to pay premiums at much higher levels. To help remedy this situation it is suggested that insurers be actively involved in the strategic planning of projects. K.K.

A86-49454
THE SEARCH FOR COMMON GROUND
L. DAVID Space World (ISSN 0038-6332), vol. W-7-271, July 1986, p. 25-29.

Prospects are considered for international - specifically U.S.-Soviet - cooperation on missions to Mars. It has been pointed out that sharing the effort can make possible missions that would be prohibitively expensive for a single nation. Furthermore, the cooperative venture is envisioned as an opportunity to inspire better working relationship among countries, enhance understanding of other cultures and reduce workd tensions. Senator Matsunage (D-Hawaii) is a strong proponent of joint missions, having sponsored a Senate Joint Resolution calling for the President to direct NASA to explore the coordination of the unpiloted Soviet mission to the Martian moon Phobos in 1988 and the 1990 American Mars orbiter robot flight. Roald Sagdeev, director of the Soviet Academy of Sciences' Space Research Institute, has proposed a cooperative scenario involving the return to earth by a Soviet spacecraft of samples of Mars rocks collected by a U.S. roving robot vehicle; the U.S. National Commission on Space, recognizing certain difficulties, nonetheless calls this 'an extremely worthwhile project'. One danger is the 'risk of technology transfer'. Management, ownership, usage, data rights and operational responsibilities are issues that can be made more difficult by language and cultural differences. A new advocate for a joint project is the group called Search for Common Ground, which sees compelling reasons for the U.S. to cross interplanetary space with the Soviets. In a sidebar, a proposal is made for a joint biological research module in earth orbit to study returned Mars rock samples without risk of contaminating the earth with alien organisms. D.H.

N86-12163# State Dept., Washington, D. C. Bureau of Public Affairs.
US SPACE PROGRAMS: COOPERATION AND COMPETITION FROM EUROPE
H. R. MARSHALL, JR. and C. SABOE, ed. May 1985 6 p
(BPA-CP-695) Avail: NTIS HC A02/MF A01

International activities demonstrate the many applications of space science and technology for peaceful purposes and provide opportunities for contribution by scientists of other countries to the tasks of increasing human understanding and use of space. Cooperative activities range from flight of foreign spacecraft to groundbased study and analysis of data. Activities include contributions of experiments or payloads to be flown in space, joint projects to develop flight hardware, use of data provided by satellites, and joint publication of scientific results. These cooperative programs are generally carried out under government-to-government science and technology agreements coordinated by the State Department. In addition, NASA provides, on a reimbursable basis, commercial services such as deployment of telecommunication satellites. G.L.C.

N86-13230*# ECON, Inc., Alexandria, Va.
FEDERAL GOVERNMENT PROVISION OF THIRD-PARTY LIABILITY INSURANCE TO SPACE VEHICLE USERS Final Report
2 Jan. 1985 138 p refs
(Contract NASW-3339)
(NASA-CR-176346; NAS 1.26:176346; ECON-84-101) Avail: NTIS HC A07/MF A01 CSCL 05C

Support decisions concerning the provision by the Federal Government of third-party liability insurance for commercial space activities were studied. The practices associated with third-party liability insurance in the marine, aviation, and electric utility industries in addition to those industries associated with space missions were reviewed. Theoretical considerations of rate setting are discussed and a methodology to determine the period of time over which the insurers of each industry intend to set aside reserves to recover from a maximum liability loss should one occur is introduced. The data were analyzed to determine the setaside period in each industry, and to suggest reasonable standards from the insurer's point of view. Criteria for Federal provision of insurance are discussed, an interpretation of the Price-Anderson Act, determinants of the availability of commercial insurance, potential insurer liability, and measures of reasonableness for premium rates from the user's point of view are presented. Options available to the government regarding third part liability protection are presented. Author

N86-13234# Committee on Appropriations (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
In its Dept. of HUD, and Certain Independent Agencies Appropriations for Fiscal Year 1986, Pt. 1 p 1-407 1985 refs
Avail: Subcommittee of the Committee on Appropriations

In response to Public Law 98-371, dated July 18, 1984, the NASA Advanced Technology Advisory Committee (ATAC) has studied automation and robotics for use in the Space Station and prepared this report to the House and Senate Committees on Appropriations. The report is divided into two volumes: the Executive Overview, Volume 1, presents the major findings of the study and recommends to NASA principles for advancing automation and robotics technologies for the benefit of the Space Station and of the U.S. economy in general; the Technical Report, Volume 2, provides background information on automation and robotics technologies and their potential. As a result of its study, the Advanced Technology Advisory Committee believes that a key element of technology for the Space Station is extensive use of advanced general-purpose automation and robotics. This could include many systems and devices (such as computer vision, expert systems, and dexterous manipulators) that have been made possible by recent advances in artificial intelligence, robotics, computer science, and microelectronics. Author

N86-15166*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GOVERNMENT-TO-GOVERNMENT COOPERATION IN SPACE STATION DEVELOPMENT
S. H. NASSIFF *In its* R and D Productivity: New Challenges for the US Space Program p 88-108 1985
Avail: NTIS HC A25/MF A01 CSCL 05A

A memoranda of understanding was recently signed between the United States (NASA) and three international Space Station partners - Canada, European Space Agency (ESA), and Japan. The international partners are performing parallel Phase B preliminary design studies, concurrent with the U.S., on their proposed elements/systems for possible integration and operation with the U.S. Space Station System complex. During the 21-month Space Station Phase B study, a large amount of technical interface data will have to be transferred between the U.S. and the international partners. Scheduled bilateral technical coordination meetings will also be held. The coordination and large number of interfaces required to integrate the international requirements into the Space Station require a clean interface management organizational structure and operation procedures to accomplish the integration task. The international coordination management organizational structure, management tools, and communications network are discussed including the proposed international elements/systems being studied by the international partners. Author

N86-16152# Committee on Science and Technology (U. S. House).
THE ROLE OF TECHNICAL INFORMATION IN US COMPETITIVENESS WITH JAPAN
Washington GPO 1985 298 p refs Hearings before the Subcommittee on Science, Research and Technology, 99th Congr., 1st Sess., no. 27, 26-27 Jun. 1985
(GPO-51-564) Avail: Subcommittee on Science, Research and Technology

Hearings were held before the U.S. House of Representatives Subcommittee on science, research and technology. The role of technical information in US competetiveness with Japan was discussed. The strength of the US and Japan in selected high technology fields was compared. The shortage of Japanese language experts is attributed as one of the causes of a one way information flow from the US to Japan. The progress made on the availability of Japanese scientific information in the US, and the comparative strength of the US and Japan in selected high technology fields is investigated. E.A.K.

N86-17409# Department of Transportation, Washington, D. C. Office of Commercial Space Transportation.
REGULATORY ASPECTS OF COMMERCIAL, SPACE TRANSPORTATION
H. R. SCHMIDT *In* Johns Hopkins Univ. The 1985 JANNAF Propulsion Meeting, Volume 1 p 291-297 Apr. 1985 refs
Avail: Chemical Propulsion Information Agency, Johns Hopkins Rd., Laurel, Md. 20707 HC $78.98 CSCL 22A

Expendable launch vehicles (ELV's), developed and constantly improved over more than two decades, represent a major national investment and resource needed to ensure continued U.S. leadership in this technology. The policy background preceding P.L. 98-575, The Commercial Space Launch Act, giving the Secretary of Transportation exclusive authority to issue licenses for commercial space launches and launch operations, is reviewed. The launch license process developed to implement the licensing of commercial launch sites, a more complex issue in the preliminary planning stage, is briefly discussed. The central issues involved in setting liability insurance levels for damage caused to persons or property by this commercial space activity, as required by the Act, are summarized. Thus, the framework for a regulatory environment which facilitates growth of this new industry is well underway. Author

N86-19284# Committee on Science and Technology (U. S. House).
HIGH SPEED AERONAUTICS
Washington GPO 1985 195 p Hearing before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, 99th Congress, 1st Session, no. 21, 24 Jul. 1985
(GPO-51-341) Avail: Subcommittee on Transportation, Aviation and Materials

Testimonies on the research and development of hypersonic speed aviation is presented. The effect of high speed aircraft on space flight is noted. The need to press forward in this research in order to keep up with other countries is emphasized. Budgetary requirements are also considered. E.R.

N86-20174# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS FOR LANDSAT COMMERCIALIZATION
Washington GPO 1985 6 p Rept. to accompany H.S. 2800 presented by the Committee on Science and Technology to the 99th Congr., 1st Sess., Jun. 1985
(H-REPT-99-177; GPO-61-006) Avail: US Capitol, House Document Room

Appropriations for 1985 through 1989 for transfer to the private sector of the LANDSAT system by the Federal Government are described. B.G.

N86-20175# Comptroller General of the United States, Washington, D.C.
FEDERAL AGENCIES' POLICIES AND PRACTICES ARE IN ACCORDANCE WITH PATENT AND TRADEMARK AMENDMENTS OF 1980
1985 45 p
(B-207939; REPT-3) Avail: NTIS HC A03/MF A01

Implementation of Patent and Trademark Amendments of 1980 by 10 federal agencies was examined. Federal research and development procurement policies, regulations, and practices were reviewed for each agency. The 1984 funding agreements with contractors and grantees and the research and development titling and licensing activities of the agencies since the passage of the law were reviewed. The role of the Dept. of Commerce in implementing the Act was determined. How small businesses and nonprofit organizations viewed the changes in research and development activities was discussed. B.G.

N86-20177# Committee on Science and Technology (U. S. House).
TECHNOLOGY TRANSFER
Washington GPO 1985 259 p Hearings before the Subcommittee on Science, Research and Technology, 99th Congr., 1st Sess., no. 22, 21-22 May 1985
(GPO-49-539) Avail: Subcommittee on Science, Research and Technology

Budget restraints; assessment; of changes in technology transfer since 1980; redefining of Federal role in technology transfer; cooperative agreements; invention policy; transfer of technology from Federal laboratories; and flow of American Commercial products developed from government research were discussed. B.G.

N86-20436# Committee on Science and Technology (U. S. House).
SPACE SCIENCE: PAST, PRESENT AND FUTURE
Washington GPO 1985 210 p Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Technology, 99th Congress, 1st Session, no. 60, 8-10 Oct. 1985
(GPO-55-239) Avail: Subcommittee on Space Science and Applications CSCL 22A

The Congressional Subcommittee on Space Science and applications held hearings on Space Science: past, present and future. Topics discussed include: space sciences and exploration, space physics, Earth observations from space, Earth sciences, planetary and solar system formation, weather observations from space, biology studies from space, solar system space physics, and solar-terrestrial sciences. E.A.K.

N86-20464# Congressional Budget Office, Washington, D. C.
BUDGET EFFECTS OF THE CHALLENGER ACCIDENT
D. H. MOORE and P. H. JOHNSTON, ed. Mar. 1986 23 p
Avail: NTIS HC A02/MF A01

The preliminary estimates of the effects of the Challenger accident on the NASA budget for FY 1986 and 1987 are presented. E.A.K.

N86-21434# National Technical Information Service, Springfield, Va.
INFORMATION FOR THE DEVELOPING WORLD: NTIS'S (NATIONAL TECHNICAL INFORMATION SERVICES'S) ROLE IN INFORMATION TRANSFER TO DEVELOPING COUNTRIES
J. F. CAPONIO 1985 17 p Presented at the International Federation of Library Association Conference, Chicago, Ill., 1985
(PB85-243269) Avail: NTIS HC A02/MF A01 CSCL 05B

There is a great need for technical information in developing countries. Technical information is broadly defined to include all knowledge relating to how any specific economic activity is carried out. The techniques used by the National Technical Information Service (NTIS) of the U.S. Department of Commerce in helping both individuals and institutions (ranging from small shopkeepers to technical institutes) in developing countries to solve their technical information needs by providing access to NTIS's vast collection of reports and documents are described. The need for technical information in developing countries are outlined, then the techniques and mechanisms being used in the transfer of technical information described and finally, the findings of a recent study illustrating how data from NTIS documents is being applied to address a wide range of technical problems in developing countries are described. The competent local implementing institutions, are vital links the chain of international information dissemination. GRA

N86-21453# Committee on Science and Technology (U. S. House).
ASSURED ACCESS TO SPACE DURING THE 1990'S
Washington GPO 1986 187 p Joint Hearings on HASC-99-9 before the Subcommittee on Space Science and Applications of the Committee on Science and Technology and the Subcommittee on Research and Development of the Committee on Armed Services, 99th Congress, 1st Session, no. 51, 23-25 Jul. 1985
(GPO-53-617) Avail: Subcommittee on Space Science and Applications

The Subcommittees on Space Science and applications, and the subcommittee on research and development held joint hearings on assured access to space during the 1990's. Topics discussed include: space transportation systems, launch vehicle requirements of the Space Station Program during the 1990's, commercial payloads and satellite launches, strategic defense initiative, DOD launch plans through the 1990's, space launch vehicle capacity, complementary expendable launch vehicles (CELV), and adequacy of the orbiter fleet to meet the launch requirements through the 1990's. E.A.K.

N86-21458# Committee on Science and Technology (U. S. House).
TECHNOLOGY TRANSFER
Washington GPO 1985 258 p Hearings before the Subcommittee on Science, Research and Technology of the Committee on Science and Technology, 99th Congress, 1st Session, no. 22, 21-22 May 1985
(GPO-49-539) Avail: Subcommittee on Science, Research and Technology

The Congressional Subcommittee on science, research and technology held hearings on primarily technology transfer. The legislation was proposed on: utilization of federal technology basic research, commercializing intellectual property, technology utilization, stimulation of global competition, improvement of city services, stimulation of local economics, Federal commercial cooperation, and technology transfer from Government to private sector. E.A.K.

N86-21540# Department of the Air Force, Washington, D.C.
ROBOTIC REFUELING SYSTEM FOR TACTICAL AND STRATEGIC AIRCRAFT Patent Application
E. R. SCHULTZ, inventor (to Air Force) 12 Aug. 1985 17 p
(AD-D011980; US-PATENT-APPL-SN-764820) Avail: NTIS HC A02/MF A01 CSCL 01B

A ground based aircraft refueling system uses existing air-to-air refueling technology. A fixed facility design attaches a moveable air-to-air type refueling boom and probe to an overhead track mounted on the ceiling of a TAB VEE aircraft shelter. Movement of the boom and probe is controlled from a remote control room protected from hazardous chemical and biological environments. In a second embodiment a moveable facility design mounts on the top of a tank truck a first boom attached at a right angle to an air-to-air type refueling second boom and probe. The booms and probe are remotely controlled from the truck cab which is protected from hostile chemical and biological environments. A third embodiment adds to the moveable facility design a second tank and nozzle outlet for spraying decontaminate. Author (GRA)

N86-22114*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RECONFIGURABLE WORK STATION FOR A VIDEO DISPLAY UNIT AND KEYBOARD Patent Application
N. L. SHIELDS (Essex Corp.), M. F. FAGG (Essex Corp.), D. E. HENDERSON (Essex Corp.), and F. D. ROE, inventors (to NASA) 5 Dec. 1985 17 p
(NASA-CASE-MFS-26009-1SB; NAS 1.71:MFS-26009-1SB; US-PATENT-APPL-SN-805011) Avail: NTIS HC A02/MF A01 CSCL 05H

A reconfigurable workstation is illustrated having video, keyboard, and hand operated motion controller capabilities. The workstation includes main side panels between which a primary work panel is pivotally carried in a manner in which primary work panel may be adjusted and set in a negatively declined or positively inclined position for proper forearm support while operating hand controllers. A keyboard table supports a keyboard in such a manner that the keyboard is set in a positively inclined position with respect to the negatively declined work panel. Various adjustable devices are provided for adjusting the relative declinations and inclinations of the work panels, tables, and visual display panels. NASA

N86-22435# Committee on Science and Technology (U. S. House).
NASA'S LONG RANGE PLANS
Washington GPO 1986 224 p Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Technology, 99th Congress, 1st Session, no. 57, 17, 19, 1985
(GPO-55-035) Avail: Subcommittee on Space Science and Applications

The long range planning schedule for NASA programs is reviewed. Objectives are summarized for programs in space flight, space science and applications, space stations, space technology, and Space tracking and Data Systems. B.G.

N86-22444* National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES (SUPPLEMENT 28)
Jan. 1986 478 p
(NASA-SP-7039(28)SECT-2; NAS 1.21:7039(28)SECT-2) Avail: NTIS HC A21 CSCL 05B

A subject index is provided for over 4800 patents and patent applications for the period May 1969 through December 1985. Additional indexes list personal authors, corporate authors, contract numbers, NASA case numbers, U.S. patent class numbers, U.S. Patent numbers, and NASA accession numbers. Author

N86-22448# Committee on Science and Technology (U. S. House).
AUTHORIZING APPROPRIATIONS FOR LANDSAT COMMERCIALIZATION
Washington GPO 1985 6 p Report to accompany H.R. 2800 presented to the Committee of the Whole House on the State of the Union by the Committee on Science and Technology, 99th Congress, 1st Session, 20 Jun. 1985
(HR-REPT-99-177; GPO-51-006) Avail: US Capitol, House Document Room

Amendments to the Land Remote Sensing Commercialization Act of 1984 to provide full authorization for the transfer to the private sector of the Federal Government's civil land remote sensing satellite (LANDSAT) system were summarized. Appropriations of $295 million for fiscal years 1985 through 1989, of which not more than $125 million is available for fiscal years 1985 and 1986, were authorized. Author

N86-23484# National Science Foundation, Washington, D.C.
GUIDE TO PROGRAMS, FISCAL YEAR 1986: GUIDE DESCRIBING NATIONAL SCIENCE FOUNDATION PROGRAMS AND ACTIVITIES
Oct. 1985 90 p
(PB86-125184; NSF-85-40) Avail: NTIS HC A05/MF A01 CSCL 05A

The guide describes all of the Foundation's programs and activities. It is divided into chapters reflecting NSF's major divisions and details the areas of scientific and engineering research supported by each. Also included: a current NSF organization chart and the National Science Board's Criteria for the Selection of Research Projects. Author

N86-24673*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ICE DETECTOR Patent Application
L. M. WEINSTEIN, inventor (to NASA) 31 Mar. 1986 14 p
(NASA-CASE-LAR-13403-1; NAS 1.71:LAR-13403-1; US-PATENT-APPL-SN-846429) Avail: NTIS HC A02/MF A01 CSCL 01C

An ice detector for aircraft that can accurately determine the presence and thickness of ice and control devices to remove it is proposed. A small depression on the surface of an aircraft structure is filled with a plastic or epoxy material. Two capacitance gauges and a temperature gauge are embedded in this material near the surface. When moisture forms on the surface the capacitance of each of the gauges changes. This signal combined with the signal from a temperature gauge determines whether the moisture is water or ice. If ice is present its thickness may be measured based on the output of the second capacitance gauge. Once the presence of ice is determined, the thickness is easily determined. The output of the device may be used to provide an indication to the pilot or to automatically control heating elements to remove the ice. NASA

N86-24726# Presidential Commission on the Space Shuttle Challenger Accident, Washington, D.C.
REPORT OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT, VOLUME 1
W. P. ROGERS, N. A. ARMSTRONG, D. C. ACHESON, E. E. COVERT, R. P. FEYNMAN, R. B. HOTZ, D. J. KUTYNA, S. K. RIDE, R. W. RUMMEL, J. F. SUTTER et al. 6 Jun. 1986 260 p refs Original contains color illustrations For other volumes, see N86-28974, N86-28975, N86-28976, and N86-28977 5 Vol.
(AD-A171402) Avail: NTIS MF A01; also available GPO HC $18.00

The findings of the Commission regarding the circumstances surrounding the Challenger accident are reported and recommendations for corrective action are outlined. All available mission data, subsequent tests, and wreckage analyses were reviewed and specific failure scenarios were developed. The Commission concluded that the cause of the Mission 51-L accident was the failure of the pressure seal in the aft field joint of the right solid rocket motor. The failure was due to a faulty design unacceptably sensitive to a number of factors. These factors were the effects of temperature, physical dimensions, the character of materials, the effects of reuse, processing, and the reaction of the joint to dynamic loading. In addition to analyzing the material causes of the accident, the Commission examined the chain of decisions that culminated in approval of the launch. It concluded that the decision making process was flawed in several ways including (1) failure in communication resulting in a launch decision based on incomplete and misleading information, (2) a conflict between engineering data and management judgements, and (3) a NASA management structure that permitted flight safety problems to bypass key Shuttle managers. M.G.

N86-24729* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHUTTLE-LAUNCH TRIANGULAR SPACE STATION Patent
W. C. SCHNEIDER, inventor (to NASA), R. B. BERKA, inventor (to NASA), C. KAVANAUGH, inventor (to NASA), K. NAGY, inventor (to NASA), R. C. PARISH, inventor (to NASA), J. A. SCHLIESING, inventor (to NASA), P. D. SMITH, inventor (to NASA), F. J. STEBBINS, inventor (to NASA), and C. J. WESSELSKI, inventor (to NASA) 1 Apr. 1986 9 p Filed 9 Mar. 1984 Sponsored by NASA
(NASA-CASE-MSC-20676-1; US-PATENT-4,579,302; US-PATENT-APPL-SN-587764; US-PATENT-CLASS-244-159)
Avail: US Patent and Trademark Office CSCL 22B

A triangular space station deployable in orbit is described. The framework is comprized of three trusses, formed of a pair of generally planar faces consistine of foldable struts. The struts expand and lock into rigid structural engagement forming a repetition of equilater triangles and nonfolding diagonal struts interconnecting the two faces. The struts are joined together by node fittings. The framework can be packaged into a size and configuration transportable by a space shuttle. When deployed, the framework provides a large work/construction area and ample planar surface area for solar panels and thermal radiators. A plurity of modules are secured to the framework and then joined by tunnels to make an interconnected modular display. Thruster units for the space station orientation and altitude maintenance are provided.

Official Gazette of the U.S. Patent and Trademark Office

N86-25288# General Accounting Office, Washington, D. C. National Security and International Affairs Div.

NASA'S FIA (NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S FINANCIAL INTEGRITY ACT) PROGRAM: NASA'S PROGRESS IN IMPLEMENTING FINANCIAL INTEGRITY ACT REQUIREMENTS

Nov. 1985 54 p

(PB86-135100; GAO/NSIAD-86-3; B-216946) Avail: NTIS HC A04/MF A01 CSCL 05A

The National Aeronautics and Space Administration's (NASA's) continuing efforts to implement and comply with the Federal Manager's Financial Integrity Act (FIA) of 1982 (31 U.S.C. 3512 (b) and (c)) are reported. The review is part of a government wide assessment of 23 federal agencies. The GAO performed the reviews as part of their effort to enhance the federal government's ability to evaluate and improve internal controls and accounting systems. GRA

N86-26243* National Aeronautics and Space Administration, Washington, D.C.

SIGNIFICANT NASA INVENTIONS AVAILABLE FOR LICENSING IN FOREIGN COUNTRIES

1986 81 p

(NASA-SP-7038(08); NAS 1.21:7038(08)) Avail: NTIS SOD HC $5.00 as 033-000-00986-1 CSCL 05B

Abstracts of various NASA-owned inventions which are available for foreign licensing in the identified countries are listed in accordance with the NASA Patent Licensing Regulations. Instructions for requested applicatons are explained. B.G.

N86-26529# Department of the Air Force, Washington, D.C.

POWER SENSING DEVICE Patent Application

J. QUIROS, inventor (to Air Force) 19 Jul. 1985 12 p

(AD-D012171; US-PATENT-APPL-SN-756549) Avail: NTIS HC A02/MF A01 CSCL 09E

A power sensing device is disclosed for use with an electrical alternating current (AC) power source, a primary load, and a plurality of secondary loads. The power sensing device detects when the primary load is turned on, and automatically supplies power from the electrical AC power source to the plurality of secondary loads in response thereto. The power sensing device also senses when the primary load is turned off, and removes electrical power from the plurality of secondary loads in response thereto.

Author (GRA)

N86-27130# Congressional Research Service, Washington, D.C. Office of Senior Specialists.

PUBLIC LAWS OF THE 98TH CONGRESS RELATING TO INFORMATION POLICY

S. N. MILEVSKI 14 Mar. 1986 101 p

(CRS-TK-7885-F) Avail: NTIS HC A06/MF A01

Statutes of the 98th Congress treating information related concerns are enumerated. Limited to public laws of a substantive nature, the topical overview of areas of congressional concern is divided into nine sections: Federal Information Resources Management; International Communications and Information Policy; Telecommunication, Broadcasting, and Satellite Transmission; Intellectual Property; Library and Archives Policies; Information Disclosure, Confidentiality and the Right of Privacy; Computer Security and Crime; Information Technology for Education, Innovation, and Competitiveness; and Government Information Systems, Clearinghouses, and Dissemination. Brief considerations of parallel developments in the executive branch and private sector for 1983 to 1984 are included, along with significant laws from the 95th through 97th Congresses. The appendix provides a compilation of information policy public laws, 1977 through 1984.

Author

N86-27352*# National Aeronautics and Space Administration, Washington, D.C.

ACTIONS TO IMPLEMENT THE RECOMMENDATIONS OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT. REPORT TO THE PRESIDENT

14 Jul. 1986 52 p

Avail: NTIS HC A04/MF A01 CSCL 05A

The status of the implementation of the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident is reported. The implementation of recommendations in the following areas is detailed: (1) solid rocket motor design; (2) shuttle management structure, including the shuttle safety panel and astronauts in management; (3) critical item review and hazard analysis; (4) safety organization; (5) improved communication; (6) landing safety; (7) launch abort and crew escape; (8) flight rate; and (9) maintenance safeguards. Supporting memoranda and communications from NASA are appended. J.P.B.

N86-27513* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

METHOD AND APPARATUS FOR OPERATING ON COMPANDED PCM VOICE DATA Patent

F. BYRNE, inventor (to NASA) 13 May 1986 8 p Filed 28 Sep. 1984 Supersedes N85-29120 (23 - 18, p 3089) Sponsored by NASA. Kennedy Space Center

(NASA-CASE-KSC-11285-1; US-PATENT-4,588,986; US-PATENT-APPL-SN-655601; US-PATENT-CLASS-340-347DD; US-PATENT-CLASS-365-768; US-PATENT-CLASS-179-18BC)

Avail: US Patent and Trademark Office CSCL 17B

The method and apparatus constructed in accordance with this invention permits a plurality of parties to speak to each other on a conference line with a minimum of interference. The apparatus digitizes audio signals. Each of the parties has an audio transmitter and receiver provided for transmitting and receiving audio signals. The audio signals are converted to a PCM companded eight-bit parallel signal followed by a conversion to a serial signal for transmitting to a remote location and then reconverting each of the companded signals to a first-eight-bit parallel signal. The eight-bit parallel signal is fed to one input of a pre-programmed ROM. This eight-bit signal provides one-half of a sixteen-bit address of a lookup ROM. The other half of the sixteen-bit ROM address is supplied by another suscriber over an identical circuit.

Official Gazette of the U.S. Patent and Trademark Office

N86-28788* National Aeronautics and Space Administration, Washington, D.C.

NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS

Jul. 1986 52 p

(NASA-SP-7039(29)-SECT-1; NAS 1.21:7039(29)-SECT-1) Avail: NTIS HC A04 CSCL 05B

Abstracts are provided for 115 patents and patent applications entered into the NASA scientific and technical information system during the period January 1986 through June 1986. Each entry consists of a citation, an abstract, and in most cases, a key illustration selected from the patent application. Author

N86-28789* National Aeronautics and Space Administration, Washington, D.C.

NASA PATENT ABSTRACTS BIBLIOGRAPHY. A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES (SUPPLEMENT 29)

Jul. 1986 483 p

(NASA-SP-7039(29)-SECT-2; NAS 1.21:7039(29)-SECT-2) Avail: NTIS HC A21 CSCL 05B

Entries for over 4400 patents and patent applications citations for the period May 1969 through June 1986 are listed. Subject, invention, source, number, and accession number indexes are included. B.G.

N86-28800# National Defence Headquarters, Ottawa (Ontario). Directorate of Industry and Univ. Programs.
INTERNATIONAL INFORMATION EXCHANGE PROGRAMMES ARE NECESSARY
A. S. REEVES *In* AGARD The Value of Information as an Integral Part of Aerospace and Defence R and D Programmes 5 p Jan. 1986
Avail: NTIS HC A05/MF A01

The economic and cultural ties between Canada, the U.S. and European nations are enhanced by various means of information exchange between and among countries. The benefits of two different but interconnected processes of technology transfer are discussed: the alerting of allies to information available and the exchange of document literature. Since concern about national security and proprietary information may preclude defence research and development programs from publishing; as do other disciplines, in the open literature, special exchange agreements are necessary. The programs which have existed for some years among various NATO countries usually limit the subject areas of common interest to be discussed, and the organizations to be included. This process is illustrated using the Canadian situation. Some of the existing Canadian exchange agreements are examined, showing how they operate, the types of information which are included, the routes by which information is passed from one country to another. The ways in which information passes through the documentation centers to become a valuable service to the end users and thus enhance research and development productivity are detailed. Specific examples of the use of international information exchange programs to some major defence projects are shown. The release of information is beneficial to the releasing country as well as to the receiving country because of the increased visibility of the information and the resulting reciprocal transfer of related data. M.G.

N86-28806# General Accounting Office, Washington, D. C. Resources Community and Economic Development Div.
UNIVERSITY FUNDING. ASSESSING FEDERAL FUNDING MECHANISMS FOR UNIVERSITY RESEARCH
Feb. 1986 37 p
(AD-A165721; GAO/RCED-86-75) Avail: NTIS HC A03/MF A01 CSCL 05A

Over 60 percent of university research funding comes from federal agencies. this research is a key element in the United States' international competitiveness and technology advancement. Others sources for research funding include industry, foundations, and state governments. Approximately 71 percent of the federal research funds are provided through one funding mechanism or category of federal financial support for scientific research -- individual project grants. Some scientists and policymakers have questioned the consequences of such heavy reliance on individual project grants. For example, does this mechanism discourage the performance of innovative, high-risk, and interdisciplinary research? In response to the House Committee on Science and Technology's request that GAO assess the effects of; different funding mechanisms on the productivity and performance of research, GAO looked at: Whether particular funding mechanisms played a role in helping universities improve program quality. Whether two funding mechanisms -- individual project grants and center grants -- had different effects on the performance of research. GAO looked at five universities that, according to surveys of the scientific community carried out by two education and research organizations, had reputed improvement in program quality. GRA

N86-28974# Presidential Commission on the Space Shuttle Challenger Accident, Washington, D.C.
REPORT OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT, VOLUME 2
1986 485 p For other volumes, see N86-24726, N86-28975, N86-28976, and N86-28977
(AD-A171403) SOD HC $40.00 as 040-000-00503-0 in set with volume 3; NTIS MF A01

Volume 2 continues with the findings of the commission regarding the circumstances surrounding the Challenger accident. The report of an independent test team appointed to determine if the tests and analyses being performed by the Marshall Center and Morton Thiokol were adequate to provide the information needed by the panel is given. Some personal observations on the reliability of the shuttle is given by R. P. Feynman. The work schedules of NASA and contractor personnel involved in the launch processing at Kennedy and Marshall Centers are reviewed in terms of human factors analysis. In the flight readiness review treatment of O-ring problems case to case field joint and nozzle to case joint O-ring anomalies experiences in flight and documents are described. NASA's Prelaunch Activities Team, Mission Planning and Operations Team, Development and Production Team, and Accident Analysis Team reports are given. Finally, comments by Morton Thiokol on the NASA reports are presented. E.R.

N86-28975# Presidential Commission on the Space Shuttle Challenger Accident, Washington, D.C.
REPORT OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT, VOLUME 3
1986 534 p For other volumes, see N86-24726, N86-28974, N86-28976, and N86-28977
(AD-A171403) SOD HC $40.00 as 040-000-00503-0 in set with volume 2; NTIS MF A01

The report of the NASA Photo and TV Support Team is given. It describes the significant observed anomalies and related events of the STS 51-L accident and includes image enhancement results which were used to identify, locate, and determine time related characteristics of the events. The NASA Search, Recovery, and Reconstruction Task Force Team report is also given. It includes summaries of the surface search, sonar mapping, recovery, structural reconstruction and evaluations and conclusions drawn. E.R.

N86-28976# Presidential Commission on the Space Shuttle Challenger Accident, Washington, D.C.
REPORT OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT, VOLUME 4
1986 828 p For other volumes, see N86-24726, N86-28974, N86-28975, and N86-28977
(AD-A171404) SOD HC $47.00 as 040-000-00504-8 in set with volume 5; NTIS MF A01

This volume contains all the hearings of the Presidential Commission on the Space Shuttle Challenger accident from 6 February to 25 February 1986. Among others, the testimony of NASA's acting administrator William R. Graham is included. E.R.

N86-28977# Presidential Commission on the Space Shuttle Challenger Accident, Washington, D.C.
REPORT OF THE PRESIDENTIAL COMMISSION ON THE SPACE SHUTTLE CHALLENGER ACCIDENT, VOLUME 5
1986 884 p For other volumes, see N86-24726, N86-28974, N86-28975, and N86-28976
(AD-A171404) SOD HC $47.00 as 040-000-00504-8 in set with volume 4; NTIS MF A01

This volume contains all the hearings of the Presidential Commission on the Space Shuttle Challenger accident from 26 February to 2 May 1986. Among others is the testimony of L. Mulloy, Manager, Space Shuttle Solid Rocket Booster Program, Marshall Space Flight Center and G. Hardy, Deputy Director, Science and Engineering, Marshall Space Flight Center. E.R.

N86-30064# Joint Publications Research Service, Arlington, Va.
WORLDWIDE REPORT: TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT
28 Apr. 1986 64 p Transl. into ENGLISH from various worldwide articles
(JPRS-TTP-86-011) Avail: NTIS HC A04/MF A01

Telecommunication topics addressed include: fiber optics, satellite communications, bids for construction of the Anik E Satellite, trillium telephone marketing, digital equipment, remote sensing, television relay stations, digital phone systems, and microwave links.

N86-30582# Army War Coll., Carlisle Barracks, Pa.
TRANSFER OF HIGH-TECHNOLOGY TO THE SOVIET UNION. A PREDICAMENT FOR THE US
J. E. HOLLAND, JR. 21 Mar. 1986 29 p
(AD-A166469) Avail: NTIS HC A03/MF A01 CSCL 15D

Through reading Western open-source literature and by international purchases of U.S. computers and electronics, the Soviets have been able to modernize their military forces. This raises the question, Should U.S. technology be in the public domain and available for exploitation by the Soviet Union? The scope of Soviet information gathering operations raises concerns about the true Russian motivation for detente. Complicating the technology-transfer issue has been the prevailing attitude that parity promotes stability among world powers. As a result of this philosophy, the United States has found itself restrained from acquiring a significant technology advantage over the Soviet Union. The U.S. finds itself in the predicament of both needing a technology edge yet being unable to have a significant one. Thus, ensuring that the Soviets are not able to apply U.S. technology too quickly becomes an important aspect of the technology-transfer solution. Although technology controls are expensive and require the commitment of the American public, they are necessary. Should the Soviets gain technological parity, Then the U.S. would be compelled to match Soviet conventional forces to ensure that Russian expansionism is equally restrained. GRA

N86-30744*# Colorado Univ., Boulder. Center for Space Law and Policy.
A STUDY OF FACTORS RELATED TO COMMERCIAL SPACE PLATFORM SERVICES
S. N. HOSENBALL Aug. 1986 254 p
(Contract NAGW-884)
(NASA-CR-176881; NAS 1.26:176881) Avail: NTIS HC A12/MF A01 CSCL 22A

In the past four years, the issue of the commercial development of space has come to the forefront of the U. S. national space policy. Though the Administration, Congress and NASA have all shown strong support for encouraging the private sector to become more actively involved in the commercial utilization of space, the question remains whether they must do more to foster the creation and development of a viable U. S. commercial space industry. Marketing aspects, insurance and risk loss, tax related factors, space transportation, termination liability, institutional barriers, and procurement laws and regulations are discussed. B.G.

N86-31450# Committee on Appropriations (U. S. House).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
In its Department of Housing and Urban Development-Independent Agencies Appropriations Bill, 1987 p 42-49 1986
Avail: US Capitol, House Document Room

Budget allocations for the orbital space station, space flight control and data communications, space shuttles, construction of new facilities, research and project management, Advanced Communications Technology Satellite (ACTS) program, space commercialization, and the shuttle infrared telescope facility (SIRTF) are discussed. B.G.

N86-32343# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Div. Systemes Balistiques et Spatiaux.
LEGISLATION FOR SOFTWARE RIGHTS PROTECTION AT LAST [ENFIN UN STATUT POUR LA PROTECTION DES LOGICIELS]
O. BRUN and M. F. MURPHY 1986 5 p
(SNIAS-861-422-114; ETN-86-97601) Avail: NTIS HC A02/MF A01

The deficiencies of French jurisprudence and the content of a law to protect the rights for the exploitation of computer programs are discussed. The positive aspects of the law are shown. ESA

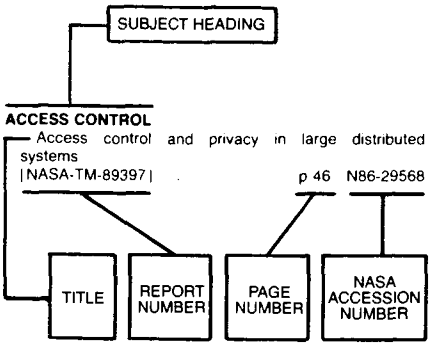
N86-33204# General Accounting Office, Washington, D. C. General Government Div.
FREEDOM OF INFORMATION ACT: NONCOMPLIANCE WITH AFFIRMATIVE DISCLOSURE PROVISIONS
Apr. 1986 36 p
(AD-A168589; GAO/GGD-86-68) Avail: NTIS HC A03/MF A01 CSCL 05A

To determine whether federal agencies were complying with the Freedom of Information Act's (FOIA) affirmative disclosure requirements, we interviewed officials of component organizations of the 13 cabinet-level departments and the Veterans Administration and evaluated their procedures. Our review was designed to assess compliance efforts at these organizations only, and the results can not be projected to the departments as a whole or to other organizations subject to FOIA requirements. At the 14 organizations we found that: in 13 instances, the U.S. Government organizations did not publish or keep current information on their central and field organizations; in six instances, organizations' published statements on where the public could obtain information were out of date; and one organization did not publish procedural information on its system of hearings and appeals. Officials in the 14 organizations attributed noncompliance with subsection (a)(1) to such reasons as delays in internal rules clearance processes, frequent agency reorganizations, and administrative error. Officials in some organizations also felt that publication of organization material in The United States Government Manual was sufficient compliance. In 20 instances, 60% of the organizations were not in full compliance with subsection (a)(2) requirements. Thus, these organizations did not provide members of the public the means to routinely identify and inspect all materials they might require in dealing with the organizations. GRA

SUBJECT INDEX

SUBJECT

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

B

C

D

E

F

H

I

J

K

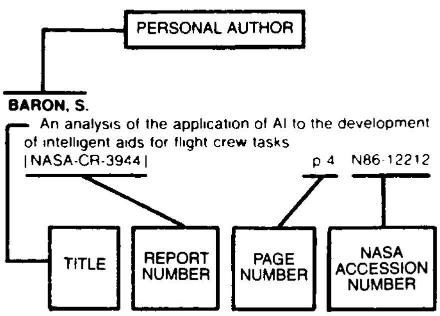
U

V

W

X

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

B

C

D

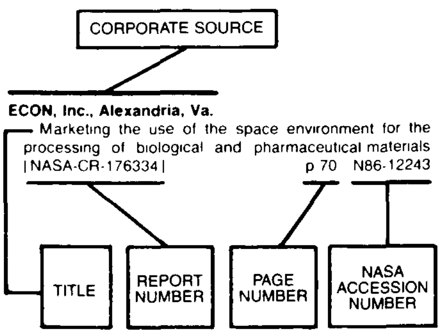
E

M

Y

Z

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

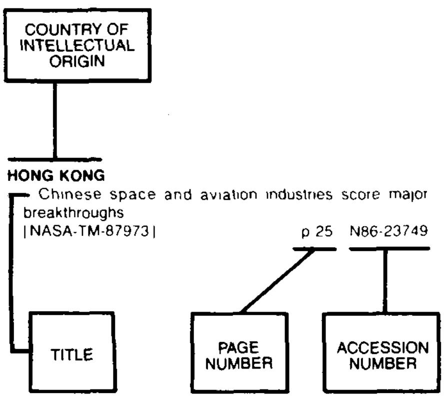
A

B

C

D

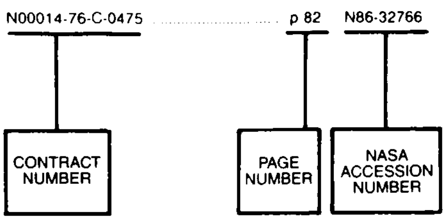
Typical Foreign Technology Index Listing



Listings in this index are arranged alphabetically by country of intellectual origin. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the citation in the abstract section.

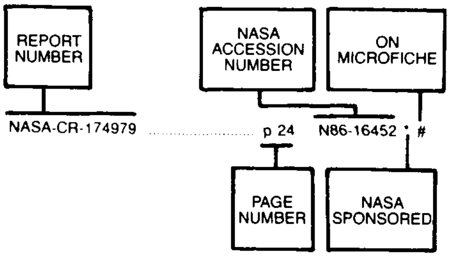
FOREIGN

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

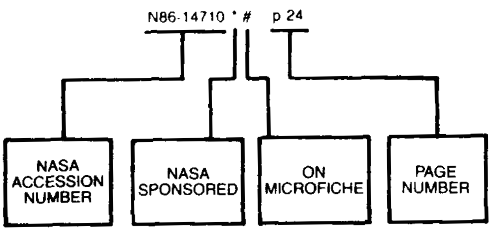
Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

REPORT

Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A86-10000 Series)

Publications announced in *IAA* are available from the AIAA Technical Information Service as follows: Paper copies of accessions are available at $10.00 per document (up to 50 pages), additional pages $0.25 each. Microfiche[1] of documents announced in *IAA* are available at the rate of $4.00 per microfiche on demand. Standing order microfiche are available at the rate of $1.45 per microfiche for *IAA* source documents and $1.75 per microfiche for AIAA meeting papers.

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

All inquiries and requests should be addressed to: Technical Information Service, American Institute of Aeronautics and Astronautics, 555 West 57th Street, New York, NY 10019. Please refer to the accession number when requesting publications.

STAR ENTRIES (N86-10000 Series)

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

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

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

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

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

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The current price and order number are given following the availability line. (NTIS will fill microfiche requests, as indicated above, for those documents identified by a # symbol.)

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

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: DOE Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of Department of Energy reports, usually in microfiche form, are listed in *Energy Research Abstracts*. Services available from the DOE and its depositories are described in a booklet, *DOE Technical Information Center - Its Functions and Services* (TID-4660), which may be obtained without charge from the DOE Technical Information Center.

Avail: ESDU. Pricing information on specific data, computer programs, and details on ESDU topic categories can be obtained from ESDU International Ltd. Requesters in North America should use the Virginia address while all other requesters should use the London address, both of which are on page vi.

Avail: Fachinformationszentrum, Karlsruhe. Sold by the Fachinformationszentrum Energie, Physik, Mathematik GMBH, Eggenstein Leopoldshafen, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the NASA Space Technology Laboratories, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) and microfilm. All requests should cite the author and the Order Number as they appear in the citation.

Avail: US Patent and Trademark Office. Sold by Commissioner of Patents and Trademarks, U.S. Patent and Trademark Office, at the standard price of $1.50 each, postage free. (See discussion of NASA patents and patent applications below.)

Avail: (US Sales Only). These foreign documents are available to users within the United States from the National Technical Information Service (NTIS). They are available to users outside the United States through the International Nuclear Information Service (INIS) representative in their country, or by applying directly to the issuing organization.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the availability of specific documents and the possible utilization of local copying services, such as color reproduction.

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

PUBLIC COLLECTIONS OF NASA DOCUMENTS

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

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

FEDERAL DEPOSITORY LIBRARY PROGRAM

In order to provide the general public with greater access to U.S. Government publications, Congress established the Federal Depository Library Program under the Government Printing Office (GPO), with 50 regional depositories responsible for permanent retention of material, inter-library loan, and reference services. At least one copy of nearly every NASA and NASA-sponsored publication, either in printed or microfiche format, is received and retained by the 50 regional depositories. A list of the regional GPO libraries, arranged alphabetically by state, appears on the inside back cover. These libraries are *not* sales outlets. A local library can contact a Regional Depository to help locate specific reports, or direct contact may be made by an individual.

ADDRESSES OF ORGANIZATIONS

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

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

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

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

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

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

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

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

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

NASA Scientific and Technical Information Facility
P.O. Box 8757
B.W.I. Airport, Maryland 21240

National Aeronautics and Space Administration
Scientific and Technical Information Branch (NTT-1)
Washington, D.C. 20546

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

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

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

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

University Microfilms, Ltd.
Tylers Green
London, England

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

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

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

U.S. Geological Survey Library
Box 25046
Denver Federal Center, MS914
Denver, Colorado 80225

NTIS PRICE SCHEDULES

(Effective January 1, 1987)

Schedule A
STANDARD PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	PAGE RANGE	NORTH AMERICAN PRICE	FOREIGN PRICE
A01	Microfiche	$ 6.50	$13.00
A02	001-025	9.95	19.90
A03	026-050	11.95	23.90
A04-A05	051-100	13.95	27.90
A06-A09	101-200	18.95	37.90
A10-A13	201-300	24.95	49.90
A14-A17	301-400	30.95	61.90
A18-A21	401-500	36.95	73.90
A22-A25	501-600	42.95	85.90
A99	601-up	*	*
NO1		45.00	80.00
NO2		48.00	80.00

Schedule E
EXCEPTION PRICE DOCUMENTS AND MICROFICHE

PRICE CODE	NORTH AMERICAN PRICE	FOREIGN PRICE
E01	$ 7.50	15.00
E02	10.00	20.00
E03	11.00	22.00
E04	13.50	27.00
E05	15.50	31.00
E06	18.00	36.00
E07	20.50	41.00
E08	23.00	46.00
E09	25.50	51.00
E10	28.00	56.00
E11	30.50	61.00
E12	33.00	66.00
E13	35.50	71.00
E14	38.50	77.00
E15	42.00	84.00
E16	46.00	92.00
E17	50.00	100.00
E18	54.00	108.00
E19	60.00	120.00
E20	70.00	140.00
E99	*	*

*Contact NTIS for price quote.

IMPORTANT NOTICE

NTIS Shipping and Handling Charges

U.S., Canada, Mexico — ADD $3.00 per TOTAL ORDER

All Other Countries — ADD $4.00 per TOTAL ORDER

Exceptions — Does NOT apply to:

ORDERS REQUESTING NTIS RUSH HANDLING
ORDERS FOR SUBSCRIPTION OR STANDING ORDER PRODUCTS *ONLY*

NOTE: Each additional delivery address on an order requires a separate shipping and handling charge.

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA SP-7500 (21)		

4. Title and Subtitle	5. Report Date
MANAGEMENT A Bibliography for NASA Managers	April 1987
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, DC 20546	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This bibliography lists 664 reports, articles and other documents introduced into the NASA scientific and technical information system in 1986. Items are selected and grouped according to their usefulness to the manager as manager. Citations are grouped into ten subject categories: human factors and personnel issues; management theory and techniques; industrial management and manufacturing; robotics and expert systems; computers and information management; research and development; economics, costs, and markets; logistics and operations management; reliability and quality control; and legality, legislation, and policy.

17. Key Words (Suggested by Authors(s))	18. Distribution Statement
Bibliographies Management Management Methods Management Planning	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price *
Unclassified	Unclassified	168	A08

*For sale by the National Technical Information Service, Springfield, Virginia 22161

NASA-Langley, 1987