NASA SP–7500 (25)
March 1991

MANAGEMENT

A BIBLIOGRAPHY FOR NASA MANAGERS

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NASA SP-7500 (25)
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A BIBLIOGRAPHY FOR NASA MANAGERS

National Aeronautics and Space Administration
Office of Management
Scientific and Technical Information Program
Washington, DC 1991

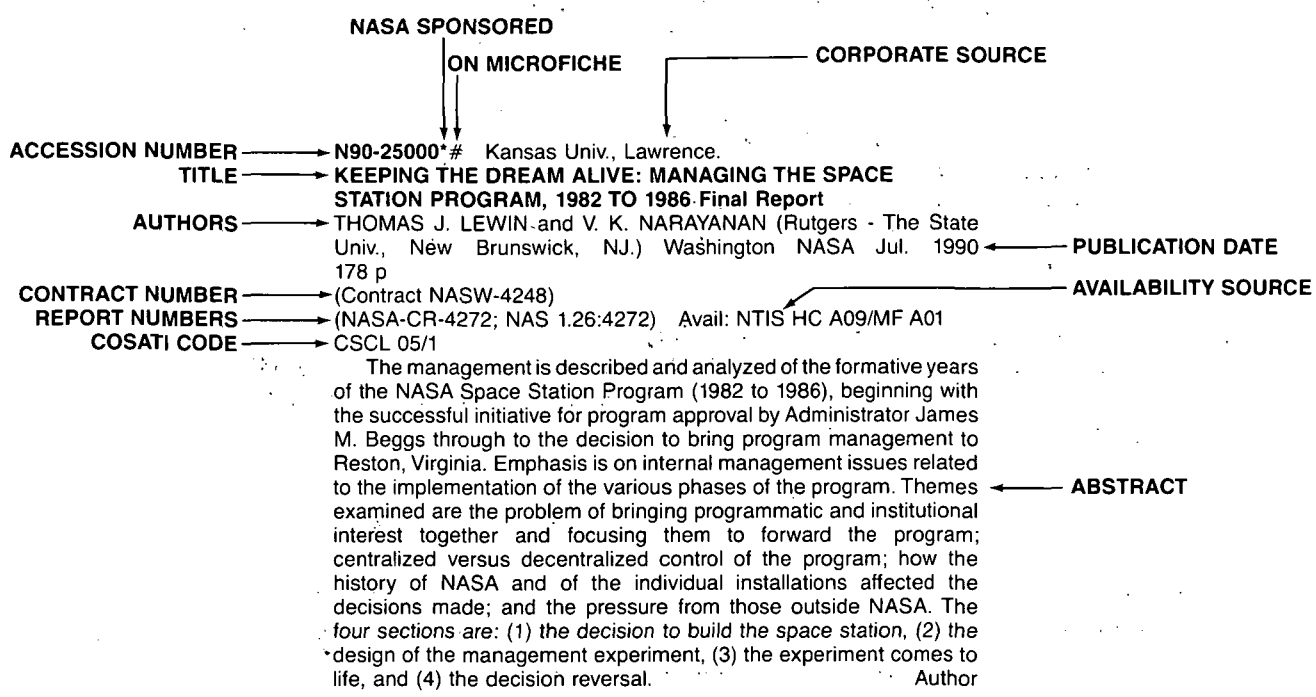
FOREWORD

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

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

TABLE OF CONTENTS

TYPICAL REPORT CITATION AND ABSTRACT



N90-25000*# Kansas Univ., Lawrence.

KEEPING THE DREAM ALIVE: MANAGING THE SPACE STATION PROGRAM, 1982 TO 1986 Final Report

THOMAS J. LEWIN and V. K. NARAYANAN (Rutgers - The State Univ., New Brunswick, NJ.) Washington NASA Jul. 1990 178 p

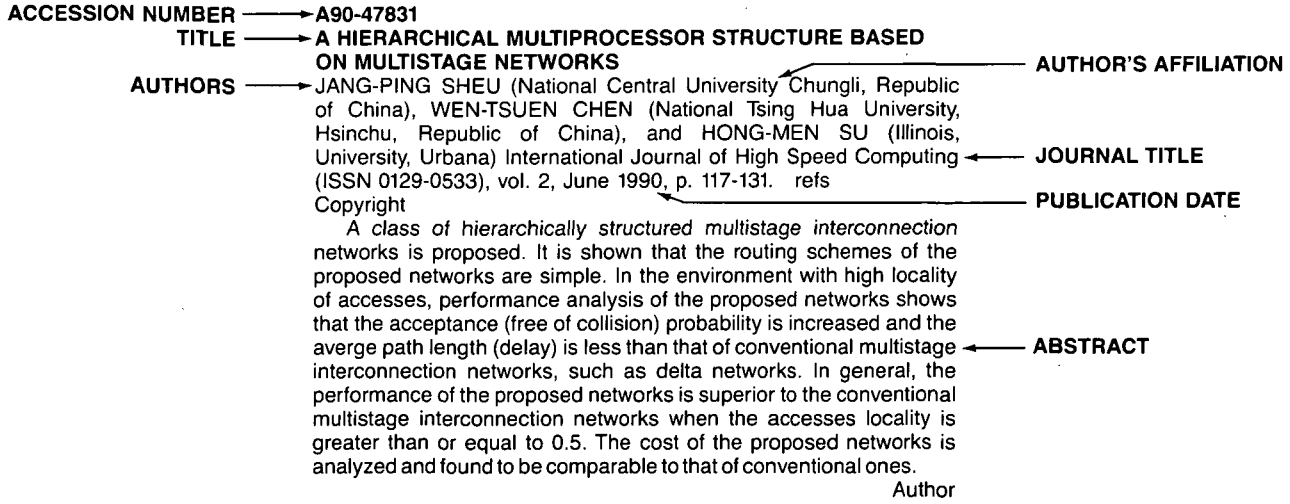
(Contract NASW-4248)

(NASA-CR-4272; NAS 1.26:4272) Avail: NTIS HC A09/MF A01

CSCL 05/1

The management is described and analyzed of the formative years of the NASA Space Station Program (1982 to 1986), beginning with the successful initiative for program approval by Administrator James M. Beggs through to the decision to bring program management to Reston, Virginia. Emphasis is on internal management issues related to the implementation of the various phases of the program. Themes examined are the problem of bringing programmatic and institutional interest together and focusing them to forward the program; centralized versus decentralized control of the program; how the history of NASA and of the individual installations affected the decisions made; and the pressure from those outside NASA. The four sections are: (1) the decision to build the space station, (2) the design of the management experiment, (3) the experiment comes to life, and (4) the decision reversal. Author

TYPICAL JOURNAL ARTICLE AND ABSTRACT



A90-47831

A HIERARCHICAL MULTIPROCESSOR STRUCTURE BASED ON MULTISTAGE NETWORKS

JANG-PING SHEU (National Central University Chungli, Republic of China), WEN-TSUEN CHEN (National Tsing Hua University, Hsinchu, Republic of China), and HONG-MEN SU (Illinois, University, Urbana) International Journal of High Speed Computing (ISSN 0129-0533), vol. 2, June 1990, p. 117-131. refs

Copyright

A class of hierarchically structured multistage interconnection networks is proposed. It is shown that the routing schemes of the proposed networks are simple. In the environment with high locality of accesses, performance analysis of the proposed networks shows that the acceptance (free of collision) probability is increased and the averge path length (delay) is less than that of conventional multistage interconnection networks, such as delta networks. In general, the performance of the proposed networks is superior to the conventional multistage interconnection networks when the accesses locality is greater than or equal to 0.5. The cost of the proposed networks is analyzed and found to be comparable to that of conventional ones.

Author

MANAGEMENT

A Bibliography for NASA Managers

MARCH 1991

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.

A90-13600#
IDEAS FOR MOTIVATING YOUNG PEOPLE TOWARDS CAREERS IN SPACE DURING THE INTERNATIONAL SPACE YEAR AND BEYOND
MANFRED VON EHRENFRIED (Technical and Administrative Services Corp., Washington, DC) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 7 p. refs
(IAF PAPER 89-546) Copyright

Possible ways of motivating young people to enter aerospace careers are discussed. Consideration is given to the future need for space managers, scientists, engineers, and astronauts. A set of three possible solutions to problem of interesting young people in aerospace careers are proposed. The solutions are the use of educational comic books, the development of a science and space award for scouting programs, and the possibility of trips to space for young people who achieve excellence in science and mathematics. R.B.

A90-13602#
NASA/USRA ADVANCED ENGINEERING EDUCATION - NASA/USRA UNIVERSITY ADVANCED DESIGN PROGRAM
CAROLYNNE P. HOPF (Universities Space Research Association, Columbia, MD) and GERALD M. GREGOREK (Ohio State University, Columbus) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 13 p.
(IAF PAPER 89-550) Copyright

Consideration is given to the resources available to the network of universities participating in the NASA/Universities Space Research Association (USRA) Universities Advanced Design Program for Space and Aeronautics. The history and objectives of the NASA/USRA program are outlined. The projects included in the program are listed and specific projects are described in detail. The impact of the program on NASA programs, students, faculty, and engineering design program curricula is discussed. R.B.

A90-13605*# National Aeronautics and Space Administration, Washington, DC.
SCIENTIFIC LITERACY FOR THE 21ST CENTURY (SL-21)
ROBERT W. BROWN (NASA, Educational Affairs Div., Washington, DC) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 9 p. refs
(IAF PAPER 89-557) Copyright

A proposal called, 'Scientific Literacy for the 21st Century (SL-21)', has been introduced, suggesting ways in which NASA may work to increase scientific literacy in the U.S. The future need for an adequate supply of scientists and engineers for the space program is discussed. The principles of the SL-21 proposal are outlined. The program would emphasize education in the fields of space technologies and earth and planetary sciences. The educational elements of the proposal for teachers, students, universities, and the general adult population are described. R.B.

A90-17810* American Univ., Washington, DC.
THE DECAY OF NASA'S TECHNICAL CULTURE
HOWARD E. MCCURDY (American University, Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Nov. 1989, p. 301-310. Research sponsored by NASA. refs
Copyright

Changes in the organization structure and technical research activities of NASA since 1970 are evaluated. The creation of NASA and the original organizational structure and operation of NASA are reviewed. The relationship between organization and advanced technology is discussed and suggestions are given for ways of maintaining NASA as a high reliability organization. R.B.

A90-26180#
A REVIEW OF AIRLINE SPONSORED AB INITIO PILOT TRAINING IN EUROPE
NEIL JOHNSTON IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 33-38.

The type of ab initio (zero time) training course in which graduates proceed directly from basic training to immediate copilot duties with a major air carrier is presented. This type of training is well established in Europe and recent trends indicate a growing interest in the concept throughout the world. After reviewing the training standards of pilot training it is concluded that full time ab initio training for airlines becomes a process of total immersion in all aspects of flying. The needs of the airline remain paramount throughout this process. Attention is given to the following components of ab initio training: (1) provision of comprehensive and highly integrated training; (2) training to a combined State and airline specification; (3) training to beyond basic State and ICAO requirements; (4) extensive use of simulation, especially at the final stages of advanced training; (5) early introduction to the needs of multicrew operations; (6) training directed at the development of desirable airline attributes and career-oriented professional skills; and (7) regular and rigorous evaluation of all parts of the training system. R.E.P.

A90-26185#
GLASS COCKPITS AND AB INITIO PILOTS
ASHOK PODUVAL IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 97-103.

Major changes facing the aviation industry today involve an acute shortage of experienced pilots and concurrently the advent of new generation advanced technology aircraft. This report looks at the combined effect of these two factors. It is argued that there is no magical solution to this unavoidable induction of less experienced pilots into the new 'glass' cockpits. It is suggested that the only long-term answer is to suitably alter training objectives so that even the ab initio pilot of today could be adequately equipped to tackle the problems posed by the advanced cockpits of tomorrow. A combination of several training methods and procedures are offered to improve pilot reliability: (1) increased simulator training specifically oriented towards crew management

and resource management; (2) flight safety programs and seminars for aircrew, incorporating audio-visual aids, encompassing actual situations/emergencies caused by human error in state-of-the-art aircraft; (3) mandatory cockpit resource management (CRM) workshops, highlighting the importance of CRM in the advanced technology aircraft; (4) increased line-oriented flying training; (5) scheduling of inexperienced or ab initio crew with highly experienced pilots; and (6) monitoring of flight data recorders with certain 'acceptable' stipulations. R.E.P.

A90-26186#
AIR FORCE AB INITIO PILOT TRAINING - USE OF SYSTEMS ENGINEERING CONCEPTS TO RELATE TRAINING REQUIREMENTS TO RESEARCH NEED
TENNY A. LINDHOLM, RICHARD B. DRAWBAUGH (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH), and ROBERT F. BACHERT (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 104-111.

Description and definition of the use of top-down Systems Engineering Methodology (SEM), tools, and techniques is presented to illustrate the USAF new 'Specialized' Undergraduate Pilot Training System (SUPTS). This is a complex ab initio pilot training system requiring integration of widely diverse training requirements and training devices. The heart of SUPTS will be the Training Management System (TMS), which will relate training requirements to training events and manage the use and configuration of the various training devices and curriculum. This paper shows, that by using Integrated Design Engineering Analysis Language (IDEAL), models are developed that relate training requirements to training system functional capability and define the complex functional and data/information interrelationships between subsystem components and the TMS. Arguments are given that an SEM approach is desirable, if not absolutely essential, to the initial specification of a large complex aircrew training system. R.E.P.

A90-26187#
DEVELOPING COCKPIT RESOURCE MANAGEMENT TRAINING CURRICULA FOR AB INITIO AIRLINE PILOT TRAINING
TOM SAMS (American Airlines, Inc., Fort Worth, TX) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 112-117. refs

The history of cockpit resource management (CRM) as it has emerged from the fields of aviation safety and human factors is reviewed. Nonstandardization of CRM objectives, lack of a CRM media pool, and other training priorities within the aviation industry have contributed to this difficulty. The economics of CRM training program development, curriculum changes, and training opportunity make the CRM issue difficult to resolve. Many questions remain regarding training methods and effectiveness. It is suggested that the potential gains in CRM proficiency through the undergraduate educational process, and existing collegiate aviation programs leading to professional pilot careers can provide the foundation of CRM attitudes for their students. It is believed that curriculum changes to facilitate these CRM objectives are well within the control of most academic institutions. R.E.P.

A90-26193#
FLIGHT INSTRUCTOR TRAINING AS THE FOUNDATION OF AB INITIO PILOT TRAINING
IRENE HENLEY (Newcastle, University, Australia) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 161-166. refs

The quality of flight instructor training in Canada and Australia is examined. Very little research has been devoted to assessing the quality of civil flight instructor training, and to finding ways of maximizing the instructor's effectiveness in flight training. Questionnaires were sent to a stratified sample of flight instructors and inspectors in order to evaluate the quality of flight instructor training, and the methods used in the evaluation of flight instructors, and the training needs of flight instructors and inspectors. Results corroborate previous findings that, in general, the whole teaching approach to flight training, including flight instructor training, is based on a flawed approach to teaching. This is accentuated by the fact that the teachers of flight instructors do not receive any training to prepare them to teach flight instructor trainees how to instruct. It is suggested that flight training needs to take advantage of the advances made in related fields, such as educational psychology and adult education. R.E.P.

A90-26204#
INTEGRATION OF A LOW COST PART TASK TRAINER (ADVANCED TRAINING DEVICE - ATD) INTO A FLIGHT CREW DEVELOPMENT PROGRAM
ROGER B. CROSTHWAITE (Massey University, Palmerston North, New Zealand) and JAMES N. SPARK (Civil Air Training Academy, Cessnock, Australia) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 227-232. refs

A training strategy is developed to reduce costs and improve learning efficiency for flight crews. Replicating an aircraft to a high level of fidelity is unnecessary in some stages of development. Evidence suggests that high fidelity may be redundant to skill acquisition in some training phases. Focusing on the needs of the learner is essential so that optimum operational competency can be developed. The rationale of this approach is that practice of part task components as a prelude to performance of complex tasks will improve whole task performances. Many tasks can be learned better, faster, and more economically in a controlled learning environment such as a groundbased trainer. It is concluded that there is little additional advantage in using an aircraft during some phases of training. R.E.P.

A90-26265#
AIRCREW TEAM DYNAMICS - A COMPREHENSIVE CREW MANAGEMENT PROGRAM FOR AMERICA WEST AIRLINES PILOTS AND FLIGHT ATTENDANTS
MICHAEL J. VANDERMARK (America West Airlines, Phoenix, AZ) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 2. Columbus, OH, Ohio State University, 1989, p. 640-645.

A90-26306*# Hampton Univ., VA.
MULTI-MEDIA AUTHORING - INSTRUCTION AND TRAINING OF AIR TRAFFIC CONTROLLERS BASED ON ASRS INCIDENT REPORTS
HERBERT B. ARMSTRONG (Hampton University, VA) and RENATE J. ROSKE-HOFSTRAND (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 2. Columbus, OH, Ohio State University, 1989, p. 896-901. refs

This paper discusses the use of computer-assisted instructions and flight simulations to enhance procedural and perceptual motor task training. Attention is called to the fact that incorporating the accident and incident data contained in reports filed with the Aviation Safety Reporting System (ASRS) would be a valuable training tool which the learner could apply for other situations. The need to segment the events is emphasized; this would make it possible to modify events in order to suit the needs of the training environment. Methods were developed for designing meaningful scenario development on runway incursions on the basis of analysis of ASRS reports. It is noted that, while the development of interactive training tools using the ASRS and other data bases holds much promise, the design and production of interactive video programs and laser disks are very expensive. It is suggested that this problem may be overcome by sharing the costs of production to develop a library of materials available to a broad range of users. I.S.

A90-27406* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MAINTAINING HUMAN PRODUCTIVITY DURING MARS TRANSIT
IRVING C. STATLER and CHARLES E. BILLINGS (NASA, Ames Research Center, Moffett Field, CA) SAE, Intersociety Conference on Environmental Systems, 19th, San Diego, CA, July 24-26, 1989. 11 p. refs
(SAE PAPER 891435) Copyright

This paper addresses the special nature of the human-machine relationship during a trip to Mars. In particular, the potential for monotony and boredom during a long-duration space voyage and the effect on motivation and productivity can be important considerations to the health and welfare of the crew. For the voyage to Mars, a design may be considered that will purposefully maintain some level of workload for the crew as a preventive measure for the deterioration of productivity that comes with boredom. This paper speculates on these considerations, on the appropriate level of workload for maximum productivity, and on what might be done during the mission to alleviate the problems caused by monotony and boredom. Author

A90-30774#
AFLC TOTAL QUALITY MANAGEMENT CORE EDUCATION AND TRAINING DEVELOPMENT
STEVE D. DOHERTY (USAF, Logistics Command, Wright-Patterson AFB, OH) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1480-1482.

The USAF Logistics Command (AFLC) has been implementing total-quality-management (TQM) philosophy since October 1987. A major concern, however, for every manager and supervisor is whether or not personnel are being adequately trained in TQM principles and disciplines. In looking after this concern, there is a tendency to assume that training is the proper solution for every problem. When not valid, this assumption results in wasted training effort. The tendency is to request more training than needed, thus causing overtraining and a waste of training resources. The author examines how AFLC can design an adequate, yet efficient quality training program and avoid the traps just indicated. He presents the AFLC education and training development model and schedule of the core curriculum development needed to ensure continuation of the AFLC quality revolution. I.E.

A90-31326
HUMAN FACTORS SOCIETY, ANNUAL MEETING, 33RD, DENVER, CO, OCT. 16-20, 1989, PROCEEDINGS. VOLUMES 1 & 2
Conference sponsored by the Human Factors Society. Santa Monica, CA, Human Factors Society, 1989, p. Vol. 1, 795 p.; vol. 2, 748 p. For individual items see A90-31327 to A90-31329, A90-31331 to A90-31387.
Copyright

Aerospace topics presented include spatial awareness and map displays, air traffic control, aviation controls and displays, simulation and decision aiding, and space-related activities. Other major topics addressed are communication, computer systems, environmental design, occupational biomechanics, international technology transfer, and system development. Also addressed are test and evaluation, perspectives on embedded training in military systems, training device design, and visual performance. R.E.P.

A90-31373* Colgate Univ., Hamilton, NY.
TRAINING FOR SPACECRAFT TECHNICAL ANALYSTS
THOMAS J. AYRES (Colgate University, Hamilton, NY) and LARRY BRYANT (JPL, Pasadena, CA) IN: Human Factors Society, Annual Meeting, 33rd, Denver, CO, Oct. 16-20, 1989, Proceedings. Volume 2. Santa Monica, CA, Human Factors Society, 1989, p. 1263-1267. refs
Copyright

Deep space missions such as Voyager rely upon a large team of expert analysts who monitor activity in the various engineering subsystems of the spacecraft and plan operations. Senior teammembers generally come from the spacecraft designers, and new analysts receive on-the-job training. Neither of these methods will suffice for the creation of a new team in the middle of a mission, which may be the situation during the Magellan mission. New approaches are recommended, including electronic documentation, explicit cognitive modeling, and coached practice with archived data. Author

A90-31708#
TQM SHOULD FOCUS ON THE HUMAN RESOURCE
LINDA RUFF (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 192-197.
(AIAA PAPER 89-3229) Copyright

Total quality management (TQM) focused on human resources, the benefits that can be realized if TQM is applied, and some of the current problems facing management without TQM are defined. Some methods that can be used to accomplish better relationships between supervisors/managers and employees with TQM are presented. It is suggested that the future success of an organization is in the success of its people, and that TQM of the human resource can make that success happen. R.E.P.

A90-31712#
TOTAL QUALITY MANAGEMENT PLANNING
LAWRENCE T. BAUER (Harris Corp., Government Support Systems Div., Syosset, NY) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 214-216.
(AIAA PAPER 89-3235) Copyright

The key ingredient to any successful TQM program is top management commitment and involvement. The early top management involvement reflects itself in a series of goals and visions for the organization. From these broad guidelines, awareness training of personnel can take place, followed by a selected level of skills training associated with the process of improvement and changing the culture of the organization. Management training must also be considered to include continuous improvement as another tool in the manager's kit of approaches to the business environment. To track the success of the program, it is appropriate that a series of measurements be determined reflecting the results of the teams pursuing process improvements. To maintain and coordinate the program, the issue of a responsible person or executive in charge is also appropriate. Following a series of early successes, most programs will tend to level out or even drop in their effectiveness. It is necessary to recognize that TQM requires certain planning for the next level of attainment and the long term infusion of TQM into the culture. Author

A90-31719#
THE LANGUAGE OF TQM
STUART I. FICKLER (Systems Research Laboratories, Inc., Dayton, OH) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 246-255. refs
(AIAA PAPER 89-3245) Copyright

The effects of cross-cultural and intracultural issues on neurolinguistic issues as related to total quality management (TQM) are studied. Basic Japanese and American cultural values are described. The successful adaptation of TQM by the Japanese and the transfer of this concept to an American environment are discussed. Particular attention is given to the direct translation of specific Japanese methods to an American environment. TQM in the environment of Japanese management and American labor is examined. The role of corporate managers in TQM is described. Specific communication strategies are presented. I.F.

A90-31723#
PERSPECTIVE: WORK MEASUREMENT IS WORK MANAGEMENT - A KEY FACTOR IN TQM PHILOSOPHY
WILLIAM L. JOHNSTONE (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 308, 309.
(AIAA PAPER 89-3641) Copyright

This paper will communicate that work measurement is a valuable tool to be used by production teams to identify issues impacting production and to facilitate effective corrective action or 'process improvement'. The paper will emphasize that asking the question 'Why didn't we meet standard?' is a positive first step to identifying a problem with the process, thus allowing the team to affect process correction and improvement. The blending of work measurement and TQM is found to be a win, win situation.
Author

A90-31726#
TOTAL QUALITY MANAGEMENT (TQM) KEY CONCEPTS AND IMPLEMENTATION METHODOLOGY FOR DEFENSE AND AEROSPACE INDUSTRIES
ROBERT F. MEYLAND (Martin Marietta Electronic Systems, Orlando, FL) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 322-326.
(AIAA PAPER 89-3649) Copyright

The TQM program designed to meet the DOD management initiative of continuously improving performance at every level is examined. The keys to a successful TQM program are: (1) top management support, (2) employee commitment, (3) continued improvement activities, (4) supplier involvement, and (5) customer involvement. The role of management and employees in TQM is discussed. An award program, the TQM cycle, and concurrent engineering are considered. I.F.

A90-31727#
TOTAL QUALITY MANAGEMENT AND DATA SECURITY
STEVEN L. MORRIS (Martin Marietta Data Systems, Englewood, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 327-329.
(AIAA PAPER 89-3650) Copyright

The relation between total quality management (TQM) and data security is examined. The objective of TQM and data security is to train and educate employees to their responsibilities toward data security. Data security goals and risks are discussed. I.F.

A90-31728#
USE TRAINING IN A TOTAL QUALITY MANAGEMENT (TQM) ENVIRONMENT TO INCREASE EFFICIENCY
LEROY R. PETERS (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 330-332.
(AIAA PAPER 89-3652) Copyright

Methods for improving the training of production worker without affecting production levels are described. Planned and unplanned time need to be used for the education and training of employees. This training time should be utilized to practice setups, and for cross training and additional job skills training. This training will lead to increased productivity and reduced product costs. I.F.

A90-31729#
REVISITING THE MEANING OF 'WORK' IN A TQM ENVIRONMENT
JEROME R. PIKULINSKI (General Dynamics Corp., Fort Worth, TX) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 333-338. refs
(AIAA PAPER 89-3653) Copyright

This paper reviews and discusses the applicability of selected personnel management theories to the Department of Defense objective of creating a 'Total Quality Management' environment within the operations of its defense contractors and their suppliers. The materials selected for review show that management has a basic behavioral requirement to create and maintain cooperation. Conversely, workers have a need to achieve motivational states characterized by satisfaction. Motivating workers to higher states of performance may interfere with workers' satisfactions. Various methods may be used to develop cooperation. Demographic factors, technological trends, and increasing desires and needs of workers to control their own work performance are increasing the complexity of managing worker performance. A return to basic management concepts is indicated. Author

A90-31731#
A TOTAL QUALITY MANAGEMENT (TQM) DIAGNOSTIC GUIDE
JANICE ROUILLER and RICHARD L. SOMERS (General Research Corp., McLean, VA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 353-360.
(AIAA PAPER 89-3655) Copyright

The Quality Planning and Evaluation Guide is developed. The Guide is designed to assist commercial and government activities in implementing or improving quality management procedures. The structure and content of the work force and staff modules of the Guide are described. The development and evaluation of the guide is discussed and a diagram of the total quality management model is provided. Case studies demonstrating the applicability of the guide are presented. I.F.

A90-31732#
ASSURING TQM FAILURE
ROBERT C. SCHALLER (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 361, 362.
(AIAA PAPER 89-3656) Copyright

Activities that can result in the failure of TQM are examined. Executive management, supervisory, and team member actions that can cause TQM failure are described. An equation for evaluating the probability of failure is provided. I.F.

A90-41613
R&D MANAGERS' PERFORMANCE EXPECTATIONS
DONALD R. DOMM (John Carroll University, Cleveland, OH), THOMAS E. DINERO (Kent State University, OH), and SUZANNE HAAS (Paragon Human Resource Systems, Canton, OH) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, May 1990, p. 139-143. refs
Copyright

Managers of professional employees from 18 companies were assessed to determine attributes associated with their most preferred and least preferred technical professional. It was found that managers of technical professionals have a clear cognitive set regarding behavior and characteristics associated with the most preferred and least preferred technical professional. A basic cognitive model for professional attributes emerges from the consistency of managerial perspective. This cognitive model encompasses technical expertise, ability to get along with coworkers and boss, a responsible attitude, ability to supervise their own work, self-motivation, and loyalty to the company as behavior associated with the most preferred technical professional. I.E.

A90-44047
EXPERIMENTATION AND UNCERTAINTY ANALYSIS FOR ENGINEERS
HUGH W. COLEMAN and W. GLENN STEELE, JR. (Mississippi State University, Mississippi State). New York, John Wiley and Sons, 1989, 216 p. refs
Copyright

The application of uncertainty analysis (UA) methods to experimental programs is discussed in an introduction for advanced undergraduate and graduate students of engineering and the physical sciences. Chapters are devoted to experimental errors and uncertainty; statistical considerations in measurement uncertainties; general UA methods for experiment planning; detailed UA methods for experiment design; problems due to variable but deterministic bias errors, digital/analog conversion, and instrument dynamic response; the debugging and execution of experiments; and data analysis and the reporting of results. The propagation of errors into an experimental result is examined in detail in an appendix. T.K.

A90-47907
THE EMPLOYER'S DUTY TO BARGAIN OVER LAY-OFFS IN THE AIRLINE INDUSTRY - HOW THE COURTS HAVE DISTORTED THE RAILWAY LABOR ACT
ATHANASSIOS PAPAIOANNOU Journal of Air Law and Commerce (ISSN 0021-8642), vol. 55, Summer 1990, p. 939-1008. refs
Copyright

The duty of air carriers, as governed by the Railway Labor Act (RLA), to bargain with unions over lay-offs is analyzed. RLA provisions regarding labor disputes are described. Case law concerning this labor dispute and which provide various interpretations of the RLA are presented. Some guidelines for future bargaining cases are discussed. I.F.

A90-49279
DESIGNING SPACE HABITATS FOR HUMAN PRODUCTIVITY
MARC M. COHEN (Michigan, University, Ann Arbor) SAE, Intersociety Conference on Environmental Systems, 20th, Williamsburg, VA, July 9-12, 1990. 15 p. refs
(SAE PAPER 901204) Copyright

This summary paper addresses each of the key words in its title: Designing, Space Habitats and Productivity; from the perspective of a research architect. This approach looks at definitions of productivity in their specific economic, industrial, social and technical context. The discussion covers crew autonomy, democracy and teamwork as productivity values for space habitats. Author

A90-50193
THE ADVANCED COMPOSITES SKILL BASE - AN ASSESSMENT OF ITS ADEQUACY FOR THE FUTURE
GAIL D. DISALVO (Ciba-Geigy Corp., Hawthorne, NY) IN: International SAMPE Symposium and Exhibition, 35th, Anaheim, CA, Apr. 2-5, 1990, Proceedings. Book 2. Covina, CA, Society for the Advancement of Material and Process Engineering, 1990, p. 1815-1824.
Copyright

The Suppliers of Advanced Composite Materials Association (SACMA) has conducted a survey to ascertain the prospective personnel and training requirements of this industry, which is projected to be capable of doubling in size in the next decade. SACMA has accordingly identified a mismatch between the industry's need for more processing and fabrication engineers and current educational programs that can address this need. Also required are materials scientists with a basic understanding of the dissimilar materials encountered in composites manufacture. O.C.

N90-10536# Air Univ., Maxwell AFB, AL. Airpower Research Inst.
THE EFFECT OF HIGHER EDUCATION VARIABLES ON CADET PERFORMANCE DURING 1987 LIGHT AIRCRAFT TRAINING
LARRY E. BAKER May 1989 254 p
(AD-A210199; AU-ARI-88-9) Avail: NTIS HC A12/MF A02 CSCL 05/6

Based on the data analysis, it was concluded that a significant relationship is evident between 3 of the higher education curriculum variables: prior flying time, athletics, and portions of the Air Force Officer Qualifying Test; and subject performance in the light aircraft training (LATR) program for Air Force Reserve Officer Training Corps cadets conducted at Embry-Riddle Aeronautical University during the summer of 1987. The curricular variables that proved significant are identified, why the relationship occurred is analyzed, and the possible ramifications of such a relationship are discussed. The 1987 LATR program provided a unique opportunity to explore the question of what specific variables may influence a qualified individual's ability to pilot military aircraft. The specificity of the research design prevents accurate statistical inference to other subject populations and flight training programs. However, the implications of the study are clear: the men and women selected for Air Force pilot training over the past 20 years have been very similar, the basic selection criteria have remained consistent. The rate of attrition from the undergraduate pilot training program has also remained somewhat consistent, with variations being detected as supply and demand change. The LATR research study was clear in indicating that many of the selection criteria did not relate to flying performance. With the similarity of populations, it is very possible that these variables also have no effect on undergraduate pilot training or operational flying. GRA

N90-10788# Carnegie-Mellon Univ., Pittsburgh, PA.
DIFFERENCES IN WRITERS INITIAL TASK REPRESENTATIONS
LINDA CAREY, LINDA FLOWER, JOHN R. HAYES, KAREN A. SCHRIVER, and CHRISTINA HAAS May 1989 29 p
(Contract N00014-85-K-0423)
(AD-A210433) Avail: NTIS HC A03/MF A01 CSCL 05/7

This exploratory study investigates how writers represent their task to themselves before beginning to write. Using data from verbal protocols, we examine the initial plans of twelve writers (five experts and seven student writers) who were working on an expository writing task. The protocols were coded for types of planning. We also obtained independent measures of the quality of the subjects' plans and of the quality of their texts. The analysis suggests that both the quantity and quality of a writer's initial planning may make a difference in the quality of the final text. We found a positive correlation between the amount of initial planning and text quality, and between the quality of planning and text quality. In particular, we found that writers who developed rhetorical plans (i.e., plans for audience and purpose) tended to produce higher-rated texts. From our analysis, we hypothesize that experienced writers build a rhetorical representation of their task. We defined a rhetorical representation as one which is rich in rhetorical goals and plans relating to the audience, purpose, form and language of the text, and in which the writer integrates his plans to form a coherent theory of the task. GRA

N90-11642# Office of Technology Assessment, Washington, DC.
HIGHER EDUCATION FOR SCIENCE AND TECHNOLOGY: A BACKGROUND PAPER
Mar. 1989 280 p
(PB89-191290; OTA-BP-SET-52) Avail: NTIS HC A13/MF A02; SOD HC $12.00 as 052-003-01148-4 CSCL 05/9

The background paper focuses on the end point of educational preparation for science and engineering careers-undergraduate and graduate study. It places the issue of future supply in the broad cultural context of changing demographics, labor market adjustments, and intervention policies. In a dynamic economy and an increasingly technological society, planning is essential. GRA

N90-11648# Carnegie-Mellon Univ., Pittsburgh, PA.
PLANNING IN WRITING: THE COGNITION OF A CONSTRUCTIVE PROCESS
LINDA FLOWER, JOHN R. HAYES, KAREN A. SCHRIVER, CHRISTINA HAAS, and LINDA CAREY May 1989 56 p
(Contract N00014-85-K-0423)
(AD-A210434) Avail: NTIS HC A04/MF A01 CSCL 05/7

Planning in writing is a strategic response to both the writing situation and the writer's own knowledge. This paper describes the process adult writers bring to ill-defined, expository tasks, such as writing essays, articles, reports and proposals. In planning, writers draw on (nest and integrate) three executive level strategies: knowledge-driven planning, script- or schema-driven planning, and constructive planning. Research in both instructional and academic writing suggests that writers may fail to turn to a constructive strategy even when ill-defined tasks demand it. This paper presents a theory of constructive planning based on a detailed analysis of expert and novice writers. It isolates five critical features of this constructive strategy, in which writers must create a unique network of working goals and deal with the special problems of integration, conflict resolution and instantiation this constructive process entails. The paper describes the strategies writers use to meet these demands and some expert/novice differences that affect the integration of the entire plan. This theoretical framework also suggests some goals for instruction and the support of planning. GRA

N90-13043# Army Natick Research and Development Command, MA.
AIR FORCE FLIGHT FEEDING. VOLUME 1: EVALUATION OF CURRENT SYSTEM AND ALTERNATIVE CONCEPTS Final Report, Oct. 1982 - Jan. 1985
ROBERT OBRIEN, BARBARA BELL, and CHRISTOPHER REES Jul. 1989 157 p
(Contract DAAK60-83-C-0055)
(AD-A212789; NATICK/TR-89/039-VOL-1) Avail: NTIS HC A08/MF A01 CSCL 06/8

This report covers the initial phase of the project, during which the current Air Force flight feeding system was evaluated via an extensive data collection and analysis effort. Project objectives included development of a new flight feeding system concept to meet the needs of current flight missions as well as those of the coming decade, improved flight meal customer acceptance, and increased operating efficiency of flight kitchens. Crew opinions were obtained through 2,811 mail survey and 146 on-site surveys. Feedback was received on availability and acceptability of menu items, adequacy of galley equipment on board the aircraft, and flight feeding issues in general. Project team members visited several Air Force bases to observe flight kitchens in operation, to collect technical data on selected aircraft, and to meet with key personnel (crew members, food service personnel, aircraft maintenance representatives) to determine current flight feeding deficiencies and to identify possible solutions. Structured telephone surveys of 40 Air Force flight kitchens were conducted to determine equipment inventories, work space, storage space, and personnel resources. GRA

N90-13932# Plessey Research Roke Manor Ltd., Romsey (England).
A GUIDE TO REASONING UNDER UNCERTAINTY
D. A. FINDLAY Nov. 1987 13 p
(REPT-72/87/R486U; ETN-90-94847) Copyright Avail: NTIS HC A03/MF A01

Some aspects of reasoning under uncertainty are discussed. The analysis is structured around the sort of question a prospective reasoner under uncertainty is likely to ask. The situations where the reasoning under uncertainty arises are outlined. The meaning of uncertainty is established. The way of representing uncertainty in a self-consistent manner is considered. The treatments of the approximate and plausible reasoning are given. ESA

N90-14400# Commerce Dept., Washington, DC. Office of Metric Programs.
METRIC HANDBOOK FOR FEDERAL OFFICIALS: RECOMMENDATIONS OF THE INTERAGENCY COMMITTEE ON METRIC POLICY
Aug. 1989 51 p
(PB89-226922) Avail: NTIS HC A04/MF A01 CSCL 13/2

Recommendations for introduction of metric units in proposed legislation, regulations, data requests and other Government use of measurement units are presented. These recommendations were developed for the Interagency Committee on Metric Policy by its working arm, the Metrication Operating Committee, and its Metric Practice and Preferred Units Subcommittee. Assistance in editing of the documents, coordination and publication in the Federal Register was provided by the U.S. Department of Commerce, Office of Metric Programs, which serves as the secretariat for the ICMP and its subordinate committees. Other Federal documents are provided for convenient reference as appendices. GRA

N90-14769# Office of Naval Research, Arlington, VA.
COGNITIVE AND NEURAL SCIENCES DIVISION 1989 PROGRAMS Summary Report, 1 Oct. 1988 - 30 Sep. 1989
WILLARD S. VAUGHAN Sep. 1989 244 p
(AD-A212634; OCNR-114289-22) Avail: NTIS HC A11/MF A02 CSCL 05/8

Cognitive and Neural Sciences programs develop fundamental knowledge about human capabilities and performance characteristics which guide Navy and Marine Corps efforts to improve personnel assessments for selection and classification, training, equipment and system designs for human operation and maintenance. One goal is to provide scientific underpinning for more accurate prediction and enhancement of human performance in training and operational environments. A second goal is to understand the neurobiological constraints and computational capabilities of neural information processing systems for future device implementation. The Division has core programs in cognitive, perceptual and neural sciences which seek to understand human behavior at successively deeper levels of analysis. GRA

N90-14777# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
HUMAN FACTORS EVALUATION OF ELECTROLUMINESCENT DISPLAY NUMBER 1
JACK L. AUFLICK Aug. 1989 18 p
(Contract DE-AC07-76ID-01570)
(DE90-002231; EGG-HFRU-8654) Avail: NTIS HC A03/MF A01

This report consists of an an electroluminescent display, done by scientists and researchers in the Human Factors Research Unit at EG&G, Idaho, Inc. The purpose of this evaluation was to examine the 'Sunlight Readability' of one electroluminescent (EL) display; a display which may be incorporated into a new generation of US Army diesel generators. The basic finding of this evaluation is that this particular EL display is not sunlight readable. DOE

N90-15584# Chief of Naval Education and Training Support, Pensacola, FL.
HUMAN BEHAVIOR
May 1989 163 p
(PB90-780008; NAVEDTRA-10058-C1) Avail: NTIS HC A08/MF A01 CSCL 05/9

A basic presentation is given of human behavior theory and utilization techniques as applied to basic assumptions about human behavior and motivation, the influence of perception, the effects of stress and conflict on human reactions, the formation and influence of attitudes, communication, problem solving, and teaching learning. Human behavior is designed to serve as a basic course on leadership concepts and principles for senior enlisted personnel, especially those in paygrades E-6, E-7, E-8, and E-9, who spend most of their time in supervisory duties. Author

N90-16472# National Science Foundation, Washington, DC. Div. of Science Resource Studies.
PROJECT SUMMARIES Report, FY 1988

Sep. 1988 86 p
(PB90-103987; NSF-88-336) Avail: NTIS HC A05/MF A01
CSCL 20/3

Summaries are included of over 68 projects that were in work during FY 1988 in the National Science Foundation's Division of Science Resources Studies. The projects concern the collection, interpretation, and analysis of data on characteristics, education, and employment of human resources (scientists, engineers, and technicians); on government, industry, and university funding of science and technology; on outputs and impacts of science and technology. Summaries of overviews of science and technology resources data and of data-system evaluations also are included. GRA

N90-16969# National Science Foundation, Washington, DC. Div. of Science Resources Studies, Surveys, and Analysis Section.
PROFILES-AERONAUTICAL/ASTRONAUTICAL ENGINEERING: HUMAN RESOURCES AND FUNDING Special Report, 1976 - 1986
MARY V. BURKE Nov. 1988 157 p
(PB90-103888; NSF-89-314) Avail: NTIS HC A08/MF A01
CSCL 13/2

Attention is focused on the field of aeronautical/astronautical engineering. This report provides current and historical information on personnel, education, and funding for the field through the use of graphs and detailed statistical tables. GRA

N90-17379# California Univ., San Diego, La Jolla. Inst. for Cognative Science.
STRUCTURAL UNDERSTANDING IN PROBLEM SOLVING Final Report
MARY RILEY 23 Oct. 1989 7 p
(Contract N00014-84-K-0579; NR PROJ. 667-538)
(AD-A214776) Avail: NTIS HC A02/MF A01 CSCL 05/8

A common instructional objective in domains of math and science is the capability to use formulas and arithmetic procedures to solve problems. Although students are explicitly taught the relevant formulas and principals, are shown worked-out examples, and are given practice, they frequently experience considerable difficulty when asked to solve similar problems. Previous research suggests that difficulties often result from mechanical application of rules and formulas with little understanding of important structural relations between elements in the problem domain. The objective of this research was to analyze in greater detail what is meant by structural understanding within the domain of basic electricity, the role this understanding plays in performance and learning, and the extent to which important structural relations can be taught more directly. The research involved: (1) theoretical analyses that represent detailed hypotheses about the knowledge underlying performance in this domain, and (2) empirical studies involving the collection of verbal protocols from subjects as they learn to solve basic electricity problems under different instructional treatments. GRA

N90-18611# Air Force Occupational Measurement Center, Randolph AFB, TX.
AIRBORNE RADAR SYSTEMS SPECIALIST, AFSC 118X2 Occupational Survey Report
Aug. 1989 48 p
(AD-A215450) Avail: NTIS HC A03/MF A01 CSCL 05/9

The results are presented of an occupational survey of the Airborne Radar Systems Specialty completed by the Occupational Analysis Division, USAF Occupational Measurement Center, in June 1989. This survey was requested by HQ TAC/DOY at Langley AFB VA, for evaluating the current AFSC 118X2 training program since this specialty was separated from AFSC A328X2 (now AFSC 445X4) and designated the 118X2 specialty (effective 31 October 1984). GRA

N90-19564# Laser Technology Center, Knoxville, TN. Center for Research and Development.
LASER TECHNOLOGY CENTER Final Report
JAMES E. PARKS 11 Jul. 1989 125 p
(Contract ARC-87-154/CO-9901)
(PB90-115387) Avail: NTIS HC A06/MF A01 CSCL 20/5

A survey of industries established a need for training laser technicians at Pellissippi State Technical Community College in Knoxville, Tennessee. The four courses that were set up by the Laser Technology Center, the implementation of a laser research laboratory, and progress on defining long term research and methods of industrial collaboration are all described. Author

N90-19744# Los Alamos National Lab., NM. Dept. of Earth and Environmental Sciences.
WORKING ON THE MOON: THE APOLLO EXPERIENCE
ERIC M. JONES 1989 11 p Presented at the Engineering, Construction and Operations for Space, Albuquerque, NM, Apr. 1990
(Contract W-7405-ENG-36)
(DE90-003662; LA-UR-89-3858; CONF-900442-3) Avail: NTIS HC A03/MF A01

The successful completion of any scientific or engineering project on the moon will depend, in part, on human ability to do useful work under lunar conditions. In making informed decisions about such things as the use of humans rather than robots for specific tasks, the scheduling of valuable human time, and the design and selection of equipment and tools, good use can be made of the existing experience base. During the six completed landing missions, Apollo lunar surface crews conducted 160 astronaut-hours of extra-vehicular activities (EVAs) and also spent a similar sum of waking hours working in the cramped confines of the Lunar Module. The first three missions were primarily proof-tests of flight hardware and procedures. The ability to land equipment and consumables was very modest but, despite stay times of no more than 32 hours, the crews of Apollos 11, 12, and 14 were able to test their mobility and their capability of doing useful work outside the spacecraft. For the last three missions, thanks to LM modifications which enabled landings with significant amounts of cargo, stay times more than doubled to three days. The crews were able to use Lunar Rovers to conduct extensive local exploration and to travel up to 10 kilometers away from their immediate landing sites. DOE

N90-22214# Idaho National Engineering Lab., Idaho Falls.
INSIGHTS INTO COMPLEX HUMAN PERFORMANCE
HEIDI ANN HAHN and HAROLD S. BLACKMAN 1990 7 p Presented at the American Nuclear Society Topical Meeting on Human Factors, Snowbird, 10-14 Jun. 1990
(Contract DE-AC07-76ID-01570)
(DE90-006957; EGG-M-89492; CONF-9006115-1) Avail: NTIS HC A02/MF A01

A research program was implemented to investigate the applicability of verbal protocol analysis to identify operator strategies for task performance and to assess how well strategies further define the performance of humans in complex systems. This research was conducted in two environments: control rooms of nuclear power plants and cockpits of civilian aircraft. Results are presented regarding the specific technique of applying verbal protocol methods as well as the importance of strategies in human performance in complex systems. DOE

N90-23460*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM MEDIA HANDBOOK
Apr. 1989 113 p
(NASA-TM-102901; NAS 1.15:102901) Avail: NTIS HC A06/MF A01 CSCL 22/2

This handbook explains in lay terms, the work that is going on at the NASA Centers and contractors' plants in designing and developing the Space Station Freedom. It discusses the roles, responsibilities, and tasks required to build the Space Station Freedom's elements, systems, and components. New, required ground facilities are described, organized by NASA Center in order to provide a local angle for the media. Included are information on the historical perspective, international aspects, the utilization

of the Space Station Freedom, a look at future possibilities, a description of the program, its management, program phases and milestones, and considerable information on the role of various NASA Centers, contractors and international partners. A list of abbreviations, a four-page glossary, and a list of NASA contacts are contained in the appendices. J.P.S.

N90-24369*# Norfolk State Univ., VA. School of Technology.
PREPARING TECHNICIANS FOR ENGINEERING MATERIALS TECHNOLOGY
JAMES A. JACOBS and CARLTON H. METZLOFF (Erie Community Coll., Buffalo, NY.) *In* NASA, Langley Research Center, National Educators' Workshop: Update 1989 Standard Experiments in Engineering Materials Science and Technology p 143-150 May 1990
Avail: NTIS HC A09/MF A02 CSCL 07/1

A long held principle is that for every engineer and scientist there is a need for ten technicians to maximize the efficiency of the technology team for meeting needs of industry and government. Developing an adequate supply of technicians to meet the requirements of the materials related industry will be a challenge and difficult to accomplish. A variety of agencies feel the need and wish to support development of engineering materials technology programs. In a joint effort among Battelle Laboratories, the Department of Energy (DOE) and Northwest College and University Association for Science (NORCUS), the development of an engineering materials technology program for vocational programs and community colleges for the Pacific Northwest Region was recently completed. This effort has implications for a national model. The model Associate of Applied Science degree in Engineering Materials Technology shown provides a general structure. It purposely has course titles which need delimiting while also including a core of courses necessary to develop cognitive, affective and psychomotor skills with the underlining principles of math, science and technology so students have job entry skills, and so that students can learn about and adapt to evolving technology. Author

N90-24720# Embry-Riddle Aeronautical Univ., Daytona Beach, FL.
PILOT DECISION-MAKING TRAINING Final Technical Report, Jun. 1985 - Dec. 1988
THOMAS J. CONNOLLY May 1990 88 p Sponsored by Air Force Human Resources Lab., Williams AFB, AZ
(AD-A221349; AFHRL-TP-88-67) Avail: NTIS HC A05/MF A01 CSCL 01/3

The effectiveness of a simulator-based approach to training pilot skills in risk assessment and decision making was evaluated in a sample for pilots enrolled in a university aviation science program. Experimental group subjects received 4 hours of classroom instruction designed to enhance pilot judgement skills, followed by 4 hours of simulated cross-country flights during which several critical in-flight events occurred. Subjects in the control group received classroom instruction in basic instrument flying, followed by simulator sessions emphasizing instrument flight. Measures of pilot judgement were obtained on all subjects before and after the training, and subjects in the experimental judgement-trained group performed significantly better on the post-training simulation than did control group subjects. The findings suggest that significant gains in pilot decision-making skill can be obtained through the use of the judgement training materials along with simulator practice. The implications of these findings for Air Force undergraduate pilot training are discussed. Included as an appendix to this document is a prototype manual for pilot decision making. This manual is designed for use by Air Force student pilots as part of their regular training program. A specific plan for implementation is proposed. At a later date, similar advanced training materials may be developed for both simulator and in-flight use. GRA

N90-25059*# Hampton Univ., VA. Dept. of Management.
A SYSTEMATIC APPROACH TO TRAINING: A TRAINING NEEDS ASSESSMENT
MARGARET H. MANNING *In* Old Dominion Univ., NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program 1989 p 114-116 Sep. 1989
Avail: NTIS HC A09/MF A02 CSCL 05/9

In an effort to determine the gap between the actual performance and the necessary performance of employees for the effective and efficient accomplishment of an organization's mission and goals, an organization-wide Training Needs Assessment must be conducted. The purpose of this work was to conduct a training needs analysis and prepare a NASA Langley Catalog of On-Site Training programs. The work included developing a Training Needs Assessment Survey, implementing the survey, analyzing and researching the training needs, identifying the courses to meet the needs, and preparing and designing an On-Site Training Catalog. This needs analysis attempted to identify performance weaknesses and deficits; seek out and provide opportunities for improved performance; anticipate and avoid future problems; enhance and create new strengths. The end product is a user-friendly catalog of on-site training available. The results include: top-down approach to needs assessment; improved communication with training coordinators; 98 percent return rate of the Training Needs Assessment survey; complete, newly designed, user-friendly catalog; 167 catalog descriptions advertised; 82 new courses advertised; training logo; and request for the training application form. Author

N90-25929# Naval Academy, Annapolis, MD.
UNITED STATES NAVAL ACADEMY SUMMARY OF RESEARCH, ACADEMIC DEPARTMENTS, 1989-1990
FRED M. FETROW, comp., ed. Dec. 1989 274 p
(AD-A221219) Avail: NTIS HC A12/MF A02 CSCL 05/2

The role of research at the Naval Academy is to maintain an atmosphere of scholarly excellence in which midshipmen seek knowledge. Discipline and curiosity are both essential to a naval officer, as to any educated man or woman, and the balance of these traits determines the character of our graduates. The information presented describes the research projects and productivity of our faculty and midshipmen for the 1988 to 1989 academic year. Each of sixteen academic departments in five divisions: engineering and weapons, english and history, mathematics and science, professional development, and U.S. and international studies are presented, showing the growth of research by our faculty. M.G.

N90-27255# Naval Health Research Center, San Diego, CA.
THE INTEGRATED AREA MEASURE OF VISUAL ENDOGENOUS ERPS: RELATION TO COGNITIVE WORKLOAD AND HEMISPHERE Final Report
LEX L. MERRILL and DAVID J. HORD Jun. 1989 23 p Sponsored by Naval Medical Research and Command, Bethesda, MD
(AD-A223191; NHRC-89-25) Avail: NTIS HC A03/MF A01 CSCL 06/4

The Integrated Area Measure (IAM) of event-related brain potentials components was assessed as a simple method of quantifying cognitive workload. Additionally, the hypothesis of Miskin and Appenzeller that the right hemisphere is more involved in visual processing than the left was evaluated. One hundred and two U.S. Navymen were used as subjects and each subject completed a baseline and an oddball visual task. EEG was recorded at two electrode sites (C3 and C4). The results indicate that the IAM may be useful as a measure of cognitive workload. The IAM showed that stimulus discrimination was not greater for the right hemisphere; therefore, the hypothesis of Miskin and Appenzeller was not supported. However, the IAM for the right hemisphere was significantly larger than the left hemisphere measure for discrimination memory. The present data may suggest that the right hemisphere generates the required activity for the updating of working memory. The IAM may ultimately prove to be a useful tool for monitoring the cognitive activity of personnel. GRA

N90-27260# Georgia Inst. of Tech., Atlanta. School of Psychology.
AUTOMATIC INFORMATION PROCESSING AND HIGH PERFORMANCE SKILLS: ACQUISITION, TRANSFER, AND RETENTION Interim Technical Report, Aug. 1988 - Oct. 1989
ARTHUR D. FISK, KEVIN A. HODGE, MARK D. LEE, and WENDY A. ROGERS Apr. 1990 145 p
(Contract F33615-88-C-0015)
(AD-A221744; AFHRL-TR-89-69) Avail: NTIS HC A07/MF A01 CSCL 05/2

Ten experiments involving basic laboratory research on automatic processing theory and skill acquisition are reviewed. The experiments were conducted to investigate the following issues: effects of modified practice, transfer of training, skill decay, and retention. The results of this work provide an understanding of skill acquisition, retention, and transfer with respect to high performance skills training. GRA

N90-27265# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Psychology.
RULE ACQUISITION EVENTS IN THE DISCOVERY OF PROBLEM SOLVING STRATEGIES Final Technical Report, 1 Jan. 1988 - 31 Dec. 1990
KURT A. VANLEHN Jul. 1989 60 p Submitted for publication
(Contract N00014-88-K-0086; N00014-86-K-0678)
(AD-A222428; PCG-17) Avail: NTIS HC A04/MF A01 CSCL 05/8

Although there are many machine learning programs that can acquire new problem solving strategies, we do not know exactly how their processes will manifest themselves in human behavior, if at all. In order to find out, a line-by-line protocol analysis was conducted of a subject discovering problem solving strategies. A model was developed that could explain 96 percent of the lines in the procol. On this analysis, the subject's learning was confined to 11 rule acquisition events, wherein she temporarily abandoned her normal problem solving and focused on improving her strategic knowledge. Further analysis showed that: (1) Not rule acquisition events are triggered by impasses. (2) Rules are acquired gradually, both because of competition between new and old rules, and because of the subject's apparently deliberate policy of gradual generalization. (3) This subject took a scientific approach to strategy discovery, even planning and conducting small experiments. GRA

N90-28437# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
FEDERAL SCIENTISTS AND ENGINEERS: 1988. (DETAILED STATISTICAL TABLES)
1990 47 p
(PB90-226895; NSF-89-322) Avail: NTIS HC A03/MF A01 CSCL 05/1

The report, utilizing data from the U.S. Office of Personnel Management, covers key aspects of the characteristics of Federal scientists and engineers as of October 1988. Also included is data on the large number of Federal personnel whose highest degree is in engineering or science who work in nonscience or nonengineering areas. GRA

N90-28447*# National Aeronautics and Space Administration, Washington, DC.
NASA'S EDUCATIONAL PROGRAMS
ROBERT W. BROWN *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 185-195 1990 Previously announced in IAA as A90-34048
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

The educational programs of NASA's Educational Affairs Division are examined. The problem of declining numbers of science and engineering students is reviewed. The various NASA educational programs are described, including programs at the elementary and secondary school levels, teacher education programs, and undergraduate, graduate, and university faculty programs. The coordination of aerospace education activities and future plans for increasing NASA educational programs are considered. Author

N90-29081# Lawrence Livermore National Lab., CA. Systems and Human Performance.
HUMAN FACTORS EVALUATION AND VALIDATION CRITERIA FOR QUALITY TRAINING PROGRAMS: DEVELOPMENT, PRESENTATION, AND ASSESSMENT
WILLIAM W. BANKS 15 May 1990 96 p
(Contract W-7405-ENG-48)
(DE90-014724; UCRL-ID-103792) Avail: NTIS HC A05/MF A01

This paper provides LLNL managers with a rigorous and quantitative human factors method for assessing the development and validity of any training program at the Lab. A secondary purpose is to provide a checklist for course developers and evaluators. The checklist is easy to use and comprehensive, and it helps ensure that critical components of a training program are adequately addressed. DOE

N90-29235# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
SCIENTISTS, ENGINEERS, AND TECHNICIANS IN NONMANUFACTURING INDUSTRIES: 1987. (DETAILED STATISTICAL TABLES)
1987 43 p
(PB90-226903; NSF-89-321) Avail: NTIS HC A03/MF A01 CSCL 05/1

Detailed statistics on scientists, engineers, and technicians (SET) in nonmanufacturing in 1987 are given. The data comes from the Occupational Employment Statistics Survey, a Federal/State program producing national, State, and local data on occupational employment by industry for nonfarm wage and salary workers. Author

N90-29770# Naval Health Research Center, San Diego, CA. Dept. of Sleep Research.
MINIMAL SLEEP TO MAINTAIN PERFORMANCE: SEARCH FOR SLEEP QUANTUM IN SUSTAINED OPERATIONS Interim Report
PAUL NAITOH 30 Nov. 1989 29 p Sponsored by Naval Research and Development Command, Bethesda, MD
(AD-A223815; NHRC-89-49) Avail: NTIS HC A03/MF A01 CSCL 06/4

In many civilian and military occupations, personnel are required to work on a job until it is completed, even if such requirements demand continuous work for a period longer than 24 hours and/or irregular work under irregular schedules, so that sleep becomes too disrupted and too short to allow the worker to recuperate from daily fatigue. The disruption of sleep results in the worker's reduced productivity and increased risks of error or injury at work sites. In this paper, applications of sleep management are proposed to minimize degradation in work performance and to improve job safety. The basic knowledge of sleep management is discussed in detail, supplementing a sleep management guideline previously published (Naitoh, Englund and Ryman, 1986). Some of the key questions of sleep management are to determine minimal sleep duration, to evaluate impact of time of day when sleep is taken on recuperative power of sleep, and to measure individual differences in sleep habits. GRA

N90-29915# International Atomic Energy Agency, Vienna (Austria).
HUMAN ERROR CLASSIFICATION AND DATA COLLECTION
Jan. 1990 172 p Presented at the Technical Committee on Human Error Classification and Data Collection, Vienna, Austria, 20-24 Feb. 1989
(DE90-631408; IAEA-TECDOC-538; CONF-8902182) Avail: NTIS (US Sales Only) HC A08/MF A01

Analysis of human error data requires human error classification. As the human factors/reliability subject has developed, so too has the topic of human error classification. The classifications

vary considerably depending on whether it has been developed from a theoretical psychological approach to understanding human behavior or error, or whether it has been based on an empirical practical approach. This latter approach is often adopted by nuclear power plants that need to make practical improvements as soon as possible. This document will review aspects of human error classification and data collection in order to show where potential improvements could be made. It will attempt to show why there are problems with human error classification and data collection schemes and that these problems will not be easy to resolve. The Annex of this document contains the papers presented at the meeting. A separate abstract was prepared for each of these 12 papers. DOE

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.

A90-10490#
THE AARDVARK AIS-R MANAGER'S AIDE - KNOWLEDGE BASED SUPPORT FOR AIR FORCE PROGRAM MANAGERS
DAVID MCCREADY and LAND FLEMING (Southwest Research Institute, San Antonio, TX) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 100-106.
(AIAA PAPER 89-2976) Copyright

The Aardvark AIS-R Manager's Aide is being built to help USAF acquisition program managers in program monitoring and control. Its goal is to provide an active guide for program managers, by supplementing and reinforcing knowledge and guidance on sound program management, typically provided by formal training, printed guidelines, and on-the-job experience, with computer based tools which can, (1) advise on vital actions or criteria that must be evaluated and/or documented at program progress points, (2) provide a way to see implications of actions taken at such points, and (3) explain the reasoning behind advice provided. The current system depicts the overall acquisition program life cycle, and generates and updates network diagrams for management of interrelated major tasks and events leading to final acceptance testing of the end items being acquired. Author

A90-10552#
HEURISTIC GUIDELINES FOR MANAGERS
DAVID L. BLANCHARD (Ford Aerospace Corp., Seabrook, MD) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 611-615.
(AIAA PAPER 89-3059) Copyright

This heuristic guide presents rules of thumb that can be applied to staffing issues, measuring progress, solving problems, planning, interfacing with the customer, and managing managers. These rules are provided to help novice managers as well as experienced managers alleviate staffing problems, perform sanity checks on more precise/detailed computations, get a feel for how things are progressing, make first estimations, deal with customers, and foster good managers. Author

A90-13412#
AN ECONOMICAL MODEL TO PROJECT THE VALUE OF A CENTRAL POWER PROVIDING SATELLITE IN LOW EARTH ORBIT
HARLAN S. FINER (KPMG Peat Marwick, Washington, DC) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 9 p.
(IAF PAPER 89-257) Copyright

This paper describes a near-term commercial power platform concept, and analyzes the financial aspects of privately funding such a venture with an Internal Rate of Return (IRR) cash flow model. The price elasticity of demand is an explicit part of the model. The study concludes that the advisability of pursuing this project concept depends upon signing up a customer prior to development, and the size and price sensitivity of the latent private market for space power services. Author

A90-13769
SPACE LAUNCHER DEVELOPMENT - A CRITICAL VIEW
H. O. RUPPE (Muenchen, Technische Universitaet, Munich, Federal Republic of Germany) Acta Astronautica (ISSN 0094-5765), vol. 19, Aug. 1989, p. 729, 730.
Copyright

Brief critical remarks on two recent proposals for advanced large (liftoff mass of several kilotons) rocket-powered launch vehicles (Bekey, 1988; Eldred and Talay, 1988) are presented. Estimates of payload per unit of structural mass are presented in tables for manned and unmanned, expendable and reusable versions of single-stage, two-stage H2-O2, and two-stage kerosene-O2/H2-O2 vehicles, and other factors affecting system life-cycle cost are discussed. Cost optimization of the overall space transportation system is found to be beyond the present state of the art, especially with respect to proposed air-breathing propulsion systems. It is argued that realistic short-term planning can only be based on modifications of current technology, while long-term projections based on preliminary evaluations of new technologies should be clearly identified as such. T.K.

A90-15998
NATIONAL CONFERENCE ON STRATEGIC MANAGEMENT OF RESEARCH AND DEVELOPMENT, ARLINGTON, VA, JUNE 14-16, 1988, EXECUTIVE SUMMARY AND SELECTED PRESENTATIONS
Conference sponsored by AIAA, Aerospace Industries Association, IEEE. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, 89 p. No individual items are abstracted in this volume.
Copyright

Issues related to the application of strategic management techniques to technological R&D in the U.S. are discussed from government, industry, and academic perspectives, and specific recommendations for action are presented. Particular attention is given to the need for clearly defined vision statements in each organization, the accurate assessment of organizational and market environments, the role of lower-level technological personnel in formulating and supporting strategies, the importance of innovative leadership in motivating personnel, and the technology transition (getting new ideas from the laboratory to the marketplace) as the measure of R&D success. T.K.

A90-16526* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE CASE FOR MARS III: STRATEGIES FOR EXPLORATION - TECHNICAL
CAROL R. STOKER, ED. (NASA, Ames Research Center, Moffett Field, CA) San Diego, CA, Univelt, Inc. (Science and Technology Series. Volume 75), 1989, 645 p. For individual items see A90-16527 to A90-16570.
Copyright

Papers on issues related to Mars exploration are presented, covering topics such as the social implications of manned missions to Mars, mission strategies, mission designs, the economics of a Mars mission, Space Station support for a Mars mission, a Diagnostic and Environmental Monitoring System, and a zero-g CELSS/recreation facility for an earth/Mars crew shuttle. Other topics include biomedical concerns and fitness in spaceflight, spaceflight environment habitability, the Mars Rover/Sample Return Mission, a rooitic Mars surface sampler, a Mars Orbiter, and

scientific goals of Mars exploration. Additional topics include Space Station evolution, mission options, modeling advanced space systems, computer support for Mars missions, launch system options, advanced propulsion techniques, the utilization of resources on Mars, the development of a Martian base, and options for mobility on Mars. R.B.

A90-16547*. National Aeronautics and Space Administration, Washington, DC.
MARS MISSION EFFECTS ON SPACE STATION EVOLUTION
BARBARA S. ASKINS and STEPHEN G. COOK (NASA, Washington, DC) IN: The case for Mars III: Strategies for exploration - Technical. San Diego, CA, Univelt, Inc., 1989, p. 285-292.
(AAS PAPER 87-248) Copyright

The permanently manned Space Station scheduled to be operational in low earth by the mid 1990's, will provide accommodations for science, applications, technology, and commercial users, and will develop enabling capabilities for future missions. A major aspect of the baseline Space Station design is that provisions for evolution to greater capabilities are included in the systems and subsystems designs. User requirements are the basis for conceptual evolution modes or infrastructure to support the paths. Four such modes are discussed in support of a Human to Mars mission, along with some of the near term actions protecting the future of supporting Mars missions on the Space Station. The evolution modes include crew and payload transfer, storage, checkout, assembly, maintenance, repair, and fueling. C.E.

A90-17842
THE BAYES PREDICTIVE APPROACH IN RELIABILITY THEORY
C. A. CLAROTTI (Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative, Rome, Italy) and F. SPIZZICHINO (Roma I, Universita, Rome, Italy) IEEE Transactions on Reliability (ISSN 0018-9529), vol. 38, Aug. 1989, p. 379-382.
Copyright

A strong motivation for reliability analyses is to support decision-making relative to the construction and operation of systems involving an economic/environmental risk. The Bayes approach to making decisions in face of uncertainty about mission survival is presented step by step. The authors show how the decision maker defines his own predictive probability distribution on the system time to failure and ranks the couples by means of a loss function. They also introduce the minimum-expected-loss principle as a leading criterion for decision making. Finally, they address the more general case in which the final decision can be delayed in favor of collecting more information and derive the optimal termination procedure for life testing. For selecting the best course of action in a Bayes reliability frame there is neither need nor room for estimation of probability distribution parameters. I.E.

A90-22437
THE STRENGTHS AND WEAKNESSES OF SYSTEMS ANALYSIS IN AEROSPACE
D. W. DANIEL (Ministry of Defence Procurement Executive, London, England) IN: Systems analysis in aerospace; Proceedings of the Symposium, London, England, May 11, 12, 1988. London, Royal Aeronautical Society, 1988, p. 113-124. refs
Copyright

Case histories of systems analysis applications are discussed with a view to ascertaining whether the discipline has reached a developmental impasse or may be ready to branch off in novel directions. A classification is introduced which distinguishes between studies conducted on behalf of decisionmakers who possess the same objective, and those who may be pursuing disparate objectives. Attention is given to the problems of defense procurement in a problem-context classification that further differentiates among mechanical, 'simple' objectives and 'systemic', complex ones. O.C.

A90-28575
BOUNDARY ELEMENT FUNDAMENTALS - BASIC CONCEPTS AND RECENT DEVELOPMENTS IN THE POISSON EQUATION
G. STEVEN GIPSON (Oklahoma State University, Stillwater) Southampton, England and Billerica, MA, Computational Mechanics Publications (Topics in Engineering. Volume 2), 1987, 302 p. refs
Copyright

Mathematical and applications aspects of the boundary-element method (BEM) are discussed in an introduction for graduate engineering students. Chapters are devoted to integral equations and Green's functions, approximation techniques, BEMs for Poisson-type problems, sample Laplace problems, a Monte Carlo approach to Poisson problems, sample Poisson analyses, and computer implementation of the BEM. Diagrams, graphs, and listings of the (FORTRAN) computer programs are provided. T.K.

A90-29410*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTIBODY MODEL REDUCTION BY COMPONENT MODE SYNTHESIS AND COMPONENT COST ANALYSIS
J. T. SPANOS (JPL, Pasadena, CA) and D. L. MINGORI (California, University, Los Angeles) IN: AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 31st, Long Beach, CA, Apr. 2-4, 1990, Technical Papers. Part 4. Washington, DC, American Institute of Aeronautics and Astronautics, 1990, p. 1914-1921. refs
(AIAA PAPER 90-1037) Copyright

The classical assumed-modes method is widely used in modeling the dynamics of flexible multibody systems. According to the method, the elastic deformation of each component in the system is expanded in a series of spatial and temporal functions known as modes and modal coordinates, respectively. This paper focuses on the selection of component modes used in the assumed-modes expansion. A two-stage component modal reduction method is proposed combining Component Mode Synthesis (CMS) with Component Cost Analysis (CCA). First, each component model is truncated such that the contribution of the high frequency subsystem to the static response is preserved. Second, a new CMS procedure is employed to assemble the system model and CCA is used to further truncate component modes in accordance with their contribution to a quadratic cost function of the system output. The proposed method is demonstrated with a simple example of a flexible two-body system. Author

A90-29685#
NEED FOR CONTROL OF NUMERICAL ACCURACY
PATRICK J. ROACHE (Ecodynamics Research Associates, Inc., Albuquerque, NM) Journal of Spacecraft and Rockets (ISSN 0022-4650), vol. 27, Mar.-Apr. 1990, p. 98-102. Research supported by USAF, U.S. Navy, Sandia National Laboratories, and NSF. Previously cited in issue 18, p. 2863, Accession no. A89-43192. refs
Copyright

A90-29714
A NONPARAMETRIC BAYES EMPIRICAL BAYES PROCEDURE FOR ESTIMATING THE PERCENT NONCONFORMING IN ACCEPTED LOTS
H. F. MARTZ (Los Alamos National Laboratory, NM) and W. J. ZIMMER (New Mexico, University, Albuquerque) Journal of Quality Technology (ISSN 0022-4065), vol. 22, April 1990, p. 95-104. refs
Copyright

A90-29715
THE LOGNORMAL DISTRIBUTION FOR MODELING QUALITY DATA WHEN THE MEAN IS NEAR ZERO
SUSAN L. ALBIN (Rutgers University, Piscataway, NJ) Journal of Quality Technology (ISSN 0022-4065), vol. 22, April 1990, p. 105-110. refs
Copyright

The standard approach for dealing with lognormal data is to transform it to normal data by taking the natural log of each observation. This presents a problem for acceptance sampling applications: the procedures and consumers need to express their quality requirements in units that have meaning to the product of interest. Here, we bridge the gap between the units of the product of interest and the units of the log-transformed data with formulas to determine required sample size and to construct Operating Characteristic curves for sampling plans. The work was motivated by a project that was set up to design acceptance sampling plans for the minute amounts of aluminum impurity in recycled plastic material. The lognormal distribution provided a useful model for this data having a mean near zero. Author

A90-30771
PROVIDING FOCUS FOR CONTINUOUS IMPROVEMENT ACTIVITY
JEFFREY L. TURNER (Boeing Military Airplanes, Wichita, KS) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1468-1470.
Copyright

The author describes the philosophy and actions necessary for the implementation of a total-quality environment. Total quality is a state of performance of all work processes that collectively provide the product or service. The framework for implementation of total-quality commitment (TQC) is characterized by an integration of problem-solving teams, the management of work processes, and quality-planning activity. Such an implementation design assures participation by all levels of the organization, attention to critical business activity, and measurable, long-term results. The management system changes required to implement TQC are defined. I.E.

A90-30776
QUALITY FUNCTION DEPLOYMENT - A COMPREHENSIVE TOOL FOR PLANNING AND DEVELOPMENT
MICHAEL A. SCHUBERT (General Motors Corp., Dayton, OH) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1498-1503. refs
Copyright

The central theme of the quality function deployment (QFD) methodology is identification of the 'voice of the customer' and using this voice as a basis for planning and development. This methodology has been applied successfully to products, services, and software. The QFD methodology and how this methodology furnishes a planning framework are examined. A brief history of QFD introduction and growth both in Japan and in the US is included. In addition, how QFD fits with or relates to systems engineering, design reviews, value analysis, and product process planning and analysis is discussed. I.E.

A90-30777#
STATISTICAL PROCESS CONTROL: REQUIREMENTS FOR SUCCESS - M.4 DESIGN QUALITY - PRODUCIBILITY AND PROCESS OPTIMIZATION
THOMAS J. FIESSINGER (USAF, Aeronautical Systems Div., Wright-Patterson AFB, OH) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1509-1515.

The author describes the implementation of statistical process control (SPC) from a manager's perspective. He lays the groundwork for SPC both in terms of design and manufacturing, sets the stage for startup, and discusses what critical elements must be present for success. SPC's essential role in design and its relationship with manufacturing are thoroughly detailed. Traditional problem areas of SPC are covered including what process or product parameters need to be controlled, what charting techniques should be used, and how requirements should be levied on suppliers. A few case studies are presented on the successes and failures of several companies' efforts to start an SPC program. Finally, the real and long-term benefits of SPC, including increased communications among all departments, better insights into cost-reduction opportunities, variability-reduction opportunities, continuous quality improvement, and a more effective design-manufacturing interface, are addressed to show why this methodology has great potential for success in today's extremely competitive global environment. I.E.

A90-30783
STATISTICAL PROCESS CONTROL IN SOFTWARE QUALITY ASSURANCE
W. STEVEN DEMMY (Wright State University, Dayton, OH) and ARTHUR B. PETRINI (Entek, Inc., Fairborn, OH) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1585-1590.
Copyright

The author shows how SPC (statistical process control) techniques can be used to improve the quality and productivity of large-scale software development. They describe the major elements of a SPC system and consider the use of SPC in manufacturing. General criteria for selecting SPC candidates are presented. The steps required to apply SPC to software development activities are described, and activities that appear to be particularly good SPC candidates are identified. Major advantages of the SPC approach to software development are summarized. I.E.

A90-30810
SPC FOR SHORT PRODUCTION RUNS
CHAD C. CULLEN and DAVIS R. BOTHE (International Quality Institute, Inc., Northville, MI) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1960-1963.
Copyright

A control chart designed especially to provide statistical process control (SPC) for short production runs has been developed. This chart allows the operator to plot different part numbers on the same chart, thus considerably reducing the required amount of paperwork and time spent in looking for the right chart. In addition, since all the information concerning the process is now on the same chart, any time-related changes in the process can be more easily detected. With some of the more advanced short-run techniques, even part numbers with different characteristics can be plotted on the same chart. Multiple process streams, subgroups with different sample sizes, and flexible machining centers (with multiple characteristics per part) can all be charted together. I.E.

A90-31676
AIAA/ADPA/NSIA NATIONAL TOTAL QUALITY MANAGEMENT SYMPOSIUM, 1ST, DENVER, CO, NOV. 1-3, 1989, TECHNICAL PAPERS
Washington, DC, American Institute of Aeronautics and Astronautics, 1989, 430 p. For individual items see A90-31677 to A90-31742.
Copyright

Topics presented include reliability and maintainability beyond the year 2000, building in total quality management, variability reduction in rocket engine performance, total quality management and defense, using process improvement to introduce TQM, tinning machine experimental design, design automation for concurrent engineering, managing the TQM cultural change, engineering drawing quality, and total quality management in design. Attention is also given to improving quality and productivity in the workplace, measuring the cost of quality of business processes, total quality management planning, the critical path method and the process of a project, the language of TQM, the space-based interceptor program, and TQM improvement of combat support training. R.E.P.

A90-31679#
BUILDING IN TOTAL QUALITY MANAGEMENT
G. A. REYNOLDS (Douglas Aircraft Co., Long Beach, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 15-18.
(AIAA PAPER 89-3184) Copyright

Justification for the application of total quality management (TQM) and the application techniques are discussed. Responsibility, authority, and accountability (RAA) is noted as a fundamental tenet of TQM and serves as the 'litmus test' for determining what areas are good candidates for restructuring and if the new structure is appropriate. Previously, improvement efforts were not considered important enough to survive occasional cutbacks or were superseded by other more popular improvement programs. Beneficial change was not sustained, and positive results were marginal or even reversed. It is concluded that organizational structure must embody TQM as the prerequisite for sustaining continuous improvement. R.E.P.

A90-31680#
EXCELLENCE THROUGH CONTINUAL IMPROVEMENT (ETCI)
WILFORD R. POE and JACKSON M. FREEMAN (Honeywell, Inc., Space Systems Group, Clearwater, FL) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 19-27.
(AIAA PAPER 89-3186) Copyright

Total quality management (TQM) is becoming accepted by many U.S. companies as the fundamental business strategy for increasing their competitive position and for improving their financial performance. DOD has embraced it as a means to get higher-quality, more available products and services at prices more consistent with a shrinking defense budget. Application of TQM in an engineering-dominated aerospace business is described. Customer satisfaction is obtained through the quality of its nonhardware items such as data item submittals, design reviews, and engineering analyses. As a result it more closely resembles a service business than a product business. This concept is long-term, realizing that becoming an excellent operation is a managed progression at all levels of the organization. R.E.P.

A90-31686#
TEAMWORK FOR EXCELLENCE
SHABBIR SHAD and JANE HAGA (LTV Aircraft Products Group, Dallas, TX) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 62-72. refs
(AIAA PAPER 89-3195) Copyright

Implementation of a long-range plan is outlined that includes the assumptions, principles, goals, and strategy to integrate a total quality philosophy into strategic planning for continuous improvement. Focus is then placed on a measurement and reporting system that indicates whether the continuous improvement efforts are successful. Finally, a summary of the lessons learned in introducing total quality management in an aerospace and defense company is given. R.E.P.

A90-31687#
TOTAL QUALITY MANAGEMENT AND DEFENSE
GAIL R. DIMITROFF (General Dynamics Corp., Space Systems Div., San Diego, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 73-78. refs
(AIAA PAPER 89-3196) Copyright

This paper presents the current status of the TQM movement within the DOD and the defense industry and demonstrates implementation strategies as well as impediments to those approaches. The emphasis is on strategies that span government and industry. The core of TQM is viewed as a customer-driven strategy for continual improvement, which can also accommodate and integrate innovation. While problems in the past have been addressed in terms of conflict resolution, the new philosophy requires the creation of an environment consonant with cross-functional/cross-institutional problem solving (a major cultural change). Author

A90-31698#
TOTAL QUALITY MANAGEMENT AND THE TRANSITIONING COMPANY - THE PERFECT FIT
MICHAEL J. PISCATELLA (Textron Lycoming, Stratford, CT) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 136-141.
(AIAA PAPER 89-3211) Copyright

The path that Textron Lycoming is taking to achieve a culture of continuous improvement is discussed. A historical perspective illustrates the growing production requirements that resulted in the evolution of the total quality management (TQM) concept. The management team led a strategy to make step-function improvements in process technology and the effectiveness of the workforce in conjunction with assistance provided by the government. This joint effort embodied the basic principles of TQM through the use of quantitative measures and participation of the involved users to continually improve the specific product or service. These changes in technology and human resource skills have allowed significant improvements over the past several years. R.E.P.

A90-31699#
MANAGING THE TQM CULTURAL CHANGE
JERALD B. GARTMAN and JOHN S. W. FARGHER, JR. (U.S. Navy, Cherry Point, NC) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 142-147.
(AIAA PAPER 89-3212)

The Naval Aviation Depot in North Carolina has been recognized by the federal government as a quality improvement prototype. This quality improvement program has provided: (1) the implementation of the strategic planning process, (2) performance measurement using a 'home grown' manufacturing resource planning system, (3) substantial advances in management accounting and cost control, (4) quality of work and work life, and (5) productivity gain sharing, as well as other productivity enhancement programs. The cornerstone has been the adoption of a philosophy incorporating total quality management and statistical process control. R.E.P.

A90-31700#
MAINTAINABILITY - A CRITICAL LINK IN TQM
SANDRA L. KAMMERT (Martin Marietta Corp., New Orleans, LA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 148-151. refs
(AIAA PAPER 89-3213) Copyright

Maintainability is the area of lifetime product support having the greatest potential for substantial cost savings in terms of manpower, supply support, and technical documentation. The quality of maintainability must be emphasized as is the quality of the design. Total quality management, as an initiative for performance and product improvement, incorporates the principles and tools of concurrent engineering. Examples where the quality of product maintainability was deficient in the hands of the user, the ultimate judge on how well the job is done, are addressed. R.E.P.

A90-31706#
THE NEW STANDARDS FOR MATERIAL MANAGEMENT AND ACCOUNTING SYSTEMS ARE A TQM INITIATIVE
ALEXANDER LENGYEL and MICHAEL M. IVERSON (Andersen

Consulting, Los Angeles, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 181-184.
(AIAA PAPER 89-3224) Copyright

This paper examines the reasons why material management and accounting systems (MMAS; formerly the 'ten key elements') should be a total quality management initiative. MMAS represents a set of standards that will help position companies for TQM and launch them on the path of continuous improvement. It is concluded that the 'ten key elements' are a TQM initiative because they control and improve the process of doing business in aerospace and defense manufacturing. R.E.P.

A90-31709#
MEASURING THE COST OF QUALITY OF BUSINESS PROCESSES
HERBERT M. APPLETON (Martin Marietta Corp., Orlando, FL) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 198-203. refs
(AIAA PAPER 89-3231) Copyright

This paper presents arguments for analysis and measurement of processes that control organizations. All activities in a business process have either a direct or indirect effect on service and quality within the organization which ultimately is passed on to the customer in the form of higher costs or against the organization's profit line. Today, most of the costs of quality, nonconformance, and poor service are generated by indirect labor as opposed to direct-touch labor. Applying enhancements of classical industrial engineering work measurement tools in a team of interfunctional, experienced 'knowledgeworkers' provides monitoring tools to measure the cost of quality and breakthroughs to simplify and improve the process. Author

A90-31711#
TOTAL QUALITY MANAGEMENT - CULTURES FOR IMPROVED PRODUCTIVITY
DOMINICK R. BARRY (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 209-213. refs
(AIAA PAPER 89-3234) Copyright

Environmental issues associated with the total quality management (TQM) concept are considered. TQM emphasizes the need for gradual, continual organizational resistance. The role of management in providing goals and support is examined. The formation of a reward system which supports TQM is discussed. I.F.

A90-31714#
THE CRITICAL PATH METHOD AND THE PROCESS OF A PROJECT
D. H. BUSCH (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 221-224.
(AIAA PAPER 89-3240) Copyright

The critical path method (CPM), which is a project planning tool, is described. The CPM consists of: the forward pass, the backward pass, and float calculation. Float is the difference between the time available to accomplish a sequence of work and the estimated time required to accomplish the same work. The time reserve equation is utilized to calculate float. The effects of the project's performance on the time reserve are examined. Methods for altering the time available and the cumulative path length are discussed. An example demonstrating the applicability of the CPM is presented. I.F.

A90-31718#
INPUTS TO TRADE STUDIES AND TOTAL QUALITY MANAGEMENT
TODD E. FICKEN (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 242-245.
(AIAA PAPER 89-3244) Copyright

The need for a trade study which considers multiple parameters at the same time and maintains credibility is examined. A schematic of the current structure of a multiparameter trade study is presented, and the credibility problems that result from the process are discussed. A trade study which produces more accurate and precise results is proposed; it involves utilizing the Shewhart Plan-Do-Check-Act (PDCA) cycle. The main components of the PDCA are described. I.F.

A90-31721#
TOTAL QUALITY MANAGEMENT WITHIN MULTILEVEL MULTIGOAL HIERARCHICAL SYSTEMS - A CONCEPTUAL INTRODUCTION
FABIO R. GOLDSCHMIED and NICHOLAS V. PETROU IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 266-280. refs
(AIAA PAPER 89-3252) Copyright

A multilevel, multigoal hierarchical system for the structural organization of total quality management is proposed. The hierarchical system consists of three levels: (1) level of description or abstraction (stratum), (2) level of decision complexity (layer), and (3) level of organization structure (echelon). The interaction of these three levels is discussed. The decision-making hierarchy includes a selection layer, a learning or adaptation layer, and a self-organizing layer; the decision units hierarchy is: a single level, single-goal system, a single-level, multigoal system, and a multilevel, multigoal system. It is noted that hierarchical structures provide better resource utilization; adapt faster to environmental changes; and a unit failure does not completely effect the entire system. Four case histories of quality management and diagrams of the proposed system are provided. I.F.

A90-31722#
MAKING TQM WORK THROUGH THE VARIABILITY REDUCTION PROCESS
BRUCE A. JOHNSON (USAF, Washington, DC) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 303-307. refs
(AIAA PAPER 89-3259)

The Variability Reduction Process (VRP) is a means of improving product performance and reliability while reducing time and cost. The best way to reduce the effects of variation is to eliminate the causes of variation or by developing designs which are insensitive to variation. Employing statistical process control (SPC) and having capable manufacturing process is good but not sufficient. Often, the causes of variability are difficult to remove or control. It is important to develop robust production processes that are insensitive to the manufacturing environment, and robust designs that are insensitive to the operational environment. For the concepts of VRP to succeed, management must create a supportive atmosphere for continuous improvement. Author

A90-31724#
BUYING INTO TOTAL QUALITY MANAGEMENT
GREGORY R. JONES (General Dynamics Corp., Space Systems Div., San Diego, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 310-315. refs
(AIAA PAPER 89-3642) Copyright

The importance of participation in total quality management (TQM) is discussed. Team work and interpersonal skill are essential for the implementation of TQM principles. The role of management in TQM is examined. Particular consideration is given to the need for management to drive out fear and educate and train employees. I.F.

A90-31725#
STATISTICAL METHODS FOR PRODUCTION IMPROVEMENT
KATHRYN G. LANIER (Martin Marietta Electronic Systems, Orlando, FL) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 316-319.
(AIAA PAPER 89-3645) Copyright

Statistical Methods for Production Improvement (SMPI), the bridge between the Total Quality Management (TQM) philosophy and continuous improvement in production areas, was begun at Martin Marietta Electronic Systems in September 1988. The program's aim was to find new ways to improve yield, reduce rework, and identify areas of potential improvement in a final assembly and test-oriented facility. SMPI provides an approach to evaluating technical and cost alternatives in a preemptive and disciplined manner, using long-standing statistical techniques and Kepner-Tregoe problem-solving guidelines. This approach has proved highly successful at Martin Marietta Electronic Systems and has resulted in increased yield, significant cost savings, and reduction in product build time. This paper discusses the methodology for applying statistical tools in the production environment and focuses on phases of project identification, prioritizing, selection, analysis, and implementation. Author

A90-31734#
TOTAL QUALITY MANAGEMENT (TQM)
VERNON B. SELBY IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 373-378.
(AIAA PAPER 89-3661) Copyright

The concept of TQM is described. The goal of TQM is to satisfy all customers and to identify and implement continuous improvement in processes or products. The ideas and approaches of leading experts in the field of quality management are discussed. Consideration is given to the establishment of high performance work groups and training in order to achieve the objectives of TQM. I.F.

A90-31735#
ORGANIZATION STRUCTURES AND MANAGEMENT TECHNIQUES THAT PROMOTE TOTAL QUALITY MANAGEMENT
OWEN SMITH and TIMOTHY PETERS (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 379-383. refs
(AIAA PAPER 89-3662) Copyright

Management techniques and organizational structures applicable for implementing total quality management (TQM) are described. These techniques are useful for increasing the productivity and output quality of an organization. Consideration is given to employee responsibility, goal setting, good communications, the training of personnel, and meeting customer's needs. I.F.

A90-31736#
A PROCESS APPROACH TO TQM IMPLEMENTATION
MICHAEL N. SHAPIRO (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 384-387.
(AIAA PAPER 89-3666) Copyright

A four-phased approach to corporate culture change management is proposed. The objectives of the four phases, educate senior management, train change agents, train the trainer, and additional training, are described. The implementation of this approach is discussed. A diagram of job function training requirements is provided. I.F.

A90-31738#
IMPLEMENTING TQM IN THE AIR FORCE'S SPACE BASED INTERCEPTOR PROGRAM OFFICE
RON KURTUS (USAF, Space Systems Div., Los Angeles, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 396-398.
(AIAA PAPER 89-3669) Copyright

The Space Based Interceptor (SBI) program is the pilot program for TQM. The goal of the program is to provide quality, cost effective products to customers. The use of work groups, training sessions, a newsletter, and rain storming sessions to implement TQM is described. The importance of a good relationship between the USAF and the contractors in order to implement TQM is discussed. The SBI program is in the demonstration/validation phase; problems associated with using TQM in this phase are considered. It is noted that the use of TQM in the SBI program has resulted in a potential $10-20 million savings in the SBI Flight Experiment and a reduction of $30 million in SBI software development. I.F.

A90-31739#
SDIO'S IMPLEMENTATION OF TQM
THOMAS W. LIGHT (SDIO, Washington, DC) and JAMES J. LINDENFELSER (Analytic Sciences Corp., Arlington, VA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 399-410.
(AIAA PAPER 89-3695) Copyright

The use of TQM in the SDI program is discussed. The SDI Organization (SDIO) approach for implementing TQM involves an internal and an external step. The internal step is concerned with improving the acquisition process, management of the SDS and technology development activities, and internal technical and administrative processes. The external step involves the SDI management network, including executing agents and their contractors. The procedures involved in internal and external implementation of TQM in the SDIO are described. Concurrent engineering, producibility, logistics, acquisition strategies, and cost reduction are examined in terms of TQM. A flow diagram of the overall SDIO TQM implementation approach is presented. I.F.

A90-31742#
WHY DON'T MORE COMPANIES IMPLEMENT TQM SUCCESSFULLY?
HARRY E. WILKINSON (University Affiliates, Inc., Rockville, MD) and JAMES E. SPATES (Action Counsel, Inc., Bethesda, MD) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 419-424. refs
(AIAA PAPER 89-3700) Copyright

Organizational cultural transformation is necessary for the effective implementation of TQM. Functional teams consisting of research, engineering, production, marketing, and sales, are essential for an effective TQM program. Short, intermediate, and long term goals can be achieved with TQM if a complete organizational cultural transformation occurs. The steps necessary for a successful organizational cultural transformation and the elements that reduce or eliminate resistance to the cultural transformation are described. The roles of employees, management, and facilitator in establishing an effective TQM program are examined. Factors which hinder the cultural transformation and ways to avoid these problems are discussed. I.F.

A90-36006#
DIRECT R&D COST MODEL OF LAUNCH VEHICLE
YUNXIANG FENG (MAS, People's Republic of China), SONGDI QIAN (MAS, Nanjing Management Institute, People's Republic of China), and WENHAN ZHANG (China Academy of Launch Vehicle Technology, People's Republic of China) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 7 p.

A cost model for the research and development of a launch vehicle is proposed, based on the Chinese Long March program. Emphasis is given to the development of a general cost estimating relationship for a launch vehicle program. The maximum payload capability is chosen as the performance parameter for the model. The determination of maximum payload capability and the relationship between payload capability and cost are examined. A linear regression analysis is performed to obtain the cost model for a launch vehicle. R.B.

A90-36007#
STUDY OF MODELS OF ESTIMATION AND PRELIMINARY ALLOCATION OF SATELLITE DEVELOPMENT COST
YUHUA HUANG, PING ZENG (Chinese Academy of Space Technology, Beijing, People's Republic of China), and GIYAO REN (Ministry of Aerospace Industry of China, Beijing, People's Republic of China) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 16 p.

The cost estimation methods used for satellite R&D programs are examined, focusing on the estimation of development cost using a weighting model of the cost per unit mass of the satellite. A preallocation approach to developing a satellite development budget is proposed, including the establishment of six levels for predicting the proportion relation of satellite R&D is discussed. The agreement between the model estimations and Chinese satellite programs is discussed. R.B.

A90-36008#
A GENERALIZED LOGISTIC CURVE AND ITS APPLICATIONS IN SPACE PROJECT R&D EXPENDITURE FORECASTING AND EVALUATING
OUYANG YIRU (Beijing Institute of Information and Control, People's Republic of China) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 11 p.

A theory about the mechanism of expenditure taking place in an R&D program is proposed, and a generalized logistic curve (GLC) (a model describing such a process) is constructed based on this theory. The GLC is a flexible curve and reveals some significant connections between the shape of the R&D expenditure growth (or distribution) curve and some technical-economic factors of the R&D program. GLC has been proved an effective tool for expenditure forecasting and evaluation in space projects and other advanced R&D programs. Author

A90-36009*# NASA Space Station Program Office, Reston, VA.
SENSITIVITY STUDY OF SPACE STATION FREEDOM OPERATIONS COST AND SELECTED USER RESOURCES
ANNE ACCOLA, H. J. FINCANNON, GREGORY J. WILLIAMS (NASA, Space Station Freedom Program Office, Reston, VA), and R. TIMOTHY MEIER (Grumman Corp., Space Station Program Support Div., Reston, VA) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 10 p.

The results of sensitivity studies performed to estimate probable ranges for four key Space Station parameters using the Space Station Freedom's Model for Estimating Space Station Operations Cost (MESSOC) are discussed. The variables examined are grouped into five main categories: logistics, crew, design, space transportation system, and training. The modification of these variables implies programmatic decisions in areas such as orbital replacement unit (ORU) design, investment in repair capabilities, and crew operations policies. The model utilizes a wide range of algorithms and an extensive trial logistics data base to represent Space Station operations. The trial logistics data base consists largely of a collection of the ORUs that comprise the mature station, and their characteristics based on current engineering understanding of the Space Station. A nondimensional approach is used to examine the relative importance of variables on parameters. N.B.

A90-36011#
LAUNCH SYSTEM LIFE CYCLE COSTING THROUGH PROCESS ANALYSIS
R. B. NICOL (Martin Marietta Corp., Denver, CO) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 7 p.

The use of computer modeling to simulate the entire design, testing, production, and operation of a space transportation system is addressed. Such modeling facilitates life cycle costing by demonstrating new approaches to the space transportation business and identifying the resulting cost benefits. Comparisons are made between this approach and the limitations of past ones. C.D.

A90-36012*# General Dynamics Corp., Huntsville, AL.
A COMPARISON OF TRANSPORTATION NODE COSTS AND THEIR PRIMARY DRIVERS
DOUGLAS A. COMSTOCK (General Dynamics Corp., Space Systems Div., Huntsville, AL), KYLE M. SHEPARD, and JACK M. YOUNGS (General Dynamics Corp., Space Systems Div., San Diego, CA) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 16 p. refs
(Contract NAS8-37588)

This paper describes the process for defining and evaluating the costs of alternative transportation node concepts for Space Station Freedom. A cost estimating methodology including costs of development, production, delivery, assembly, steady state operations, and mission-specific operations is described in detail. The primary drivers of transportation node costs are identified and discussed. C.D.

A90-36013#
SYSTEM MODELING - REQUIREMENT FOR A NEW GENERATION OF COST MODELING
M. G. WOLFE (Aerospace Corp., El Segundo, CA), M. B. OLIVER, and C. J. MCCLAIN (General Dynamics Corp., Space Systems Div., San Diego, CA) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 11 p.

The Advanced Launch System Model (ALSYM), a dynamic computer simulation of the envisioned Advanced Launch System (ALS), is used to analyze potential issues early in the conceptual development phase of ALS and to provide a framework for concurrent engineering on ALS. The ALS development environment is reviewed and the ALSYM is described, including its Global Evaluation Model, Executive Database System, Performance and Reliability Model, Infrastructure Model, and Integrated Cost Model. ALSYM enabling technology is addressed and the ALSYM integrated cost model for analyzing the interaction among multiple vehicles or changing mission models is discussed, using examples. C.D.

A90-36014#
A PROPOSED SOFTWARE COST ESTIMATING METHODOLOGY
DANIEL E. RAMIREZ IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 19 p.

A methodology is presented with the aim of optimum employment of the existing complement of software cost estimating models. The methodology uses multiple models in parallel in order to have available as much useful data as possible to derive a reasonable estimate. It provides flexibility and evolution to these processes in order to ensure the best and most appropriate data

is gathered, and builds in a process by which later projects may benefit from the information used in the present. C.D.

A90-36015#
COST ESTIMATION OF THE M-V LAUNCH VEHICLE
R. AKIBA, M. HINADA, and H. MATSUO (Institute of Space and Astronautical Science, Sagamihara, Japan) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 14 p.

The process of cost estimation for the Japanese M-V three staged solid propellant rocket is discussed. Methods of cost estimation are presented and are used to estimate vehicle cost with an accuracy of about 10 percent. Although the prediction of R&D cost is more ambiguous than the vehicle cost prediction, R&D cost does not account for a large portion of M-V cost, since the M-V launch vehicle is part of the already-developed Mu launcher family. The M-V vehicle development scenario and cost figures are presented. R.B.

A90-36017#
COST ANALYSIS OF SPACE SHUTTLE OPERATIONS
BRENDAN O'CONNOR, PAT FLANAGAN, and CURT BILBY (KDT Industries, Austin, TX) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 7 p.

An activity-based cost estimation method is proposed for life-cycle cost estimation of large-scale space systems operations. The application of the method to the operation of the Space Shuttle is described to demonstrate the proposed method. Also, a computerized cost estimation tool concept, CALC2, is introduced, which can accommodate both traditional product-based cost estimation methods and activity-based estimation methods. R.B.

A90-36019#
A TOTAL SYSTEM APPROACH TOWARDS THE DESIGN OF FUTURE COST-EFFECTIVE LAUNCH SYSTEMS
R. C. PARKINSON (British Aerospace /Space Systems/, Ltd., Stevenage, England) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 10 p.

The cost analysis program for the Hotol vehicle is presented as an example of a total system design and cost estimation approach. Problems associated with a cost-oriented design are discussed, including the level of cost assessment, funding assumptions, the use of previous cost estimates, the cost of producing new hardware, operational costs, and predicting system utilization. The process of modeling development costs, operational costs, and reliability and resilience is outlined. The results of the Hotol cost assessment are presented and compared with analyses for other space vehicles. R.B.

A90-36021*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE DESIGN-TO-COST MANIFOLD
EDWIN B. DEAN (NASA, Langley Research Center, Hampton, VA) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 14 p. refs

A mathematical technique which both quantifies the design-to-cost process and the mass/complexity issue is presented. A simplified approximation of the PRICE H production-production cost is used to generate a dual set of differential equations which define the directions of maximum and minimum cost change over (mass, complexity) space. The equations are solved in closed form to obtain the one-dimensional design-to-cost and design-for-cost spaces. Preliminary results indicate that cost is relatively insensitive to changes in mass and that the reduction of complexity, both in the manufacturing process and in the spacecraft itself, is dominant in reducing cost. Two major objections to the design-to-cost method are discussed. N.B.

A90-36023#
THE ROLE OF COST MODELS IN MAJOR SPACE PROGRAMMES
R. P. ROGERS, H. C. LEESON (Logica Space and Defence Systems, Ltd., London, England), and A. P. FOURNIER-SICRE (ESA, Noordwjik, Netherlands) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 12 p.

The use of modeling techniques applied to operations costs in the European Columbus program is discussed. Some of the key attributes of the cost modeling technique when applied to complex space programs are identified, and the main characteristics required in such models are examined. Two concrete examples of the use of purpose-built cost models, including COLUCOU (Columbus costs of operation and utilization), in the early stages of a project, for two different purposes (trade-offs of different technical options and the examination of the consequences of different cost sharing alternatives for a given option) are presented. It is concluded that such models can play an important role at the early phases of a large project, particularly in performing simple parametric evaluations and identifying the true cost drivers. N.B.

A90-41611
AN INTERACTIVE APPROACH FOR SELECTING IR&D PROJECTS
DAVID L. HALL and ALEXANDER NAUDA (HRB Systems, Inc., State College, PA) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, May 1990, p. 126-133. refs
Copyright

A strategy for systematically allocating resources to competing independent research and development (IR&D) projects is developed for a company building systems for the U.S. DOD. The approach is less mathematically complex than many techniques reported in the literature, utilizing the judgement of key business and technical elements in the organization. A taxonomy characterizing various approaches and a brief review of R&D selection methods reported in recent literature are presented, and an interactive selection process is described which, rather than substituting complex calculations for good technical and material judgement, facilitates better utilization of the expertise of organizational elements within the context of corporate strategic planning. Procedures are included for idea submittal and evaluation. The experience gained during the application of the process to a corporation with multiple business units is discussed. I.E.

A90-41612
A MANAGERIAL APPROACH TO RESEARCH AND DEVELOPMENT COST-EFFECTIVENESS EVALUATION
YUTAKA KUWAHARA and YASUTSUGU TAKEDA (Hitachi, Ltd., Central Research Laboratory, Tokyo, Japan) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, May 1990, p. 134-138. refs
Copyright

An overall R&D cost-effectiveness evaluation system that is currently in operation is described and discussed. Evaluation is done on several cross sections of R&D management. For use with several usage objectives of cost effectiveness, some variations of the figure of merit (FOM) are shown. The FOM indicates R&D danger symptoms, especially on promising future trunk-line products. It is concluded that cost-effectiveness evaluation can be used strategically by taking into consideration the phase of research, the product's life cycle, and future growth factors. Some prospects and analyses for future R&D are reviewed and discussed. I.E.

A90-42205#
LESSONS LEARNED WHEN IMPLEMENTING TOTAL QUALITY MANAGEMENT
BRIAN J. CHITESTER (United Technologies Corp., Pratt and Whitney Group, West Palm Beach, FL) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18,

1990. 5 p.
(AIAA PAPER 90-2693) Copyright

Despite being called by some the 'alphabet soup program of the year'. TQM is accelerating throughout the aerospace industry. However, organizational inertia can ground even the most soundly designed processes. Critical TQM implementation barriers and lessons learned have been accumulated and expounded on in this paper. Dealing with organizational culture is one of the most difficult issues. In high-technology environments, where people have been task-oriented and product-focused, engineers and scientists often struggle to embrace a process orientation that focuses on participative involvement and prevention. Successful implementation requires a fundamental change in the way companies are structured to do business. Active executive involvement and leadership are paramount to achieving this cultural leap. Without this senior level commitment and accountability TQM will not flourish. Author

A90-46247
THE USE OF CANONICAL CORRELATION ANALYSIS IN COMPONENT MODEL REDUCTION
R. E. SKELTON and D. DA (Purdue University, West Lafayette, IN) IN: Machinery dynamics - Applications and vibration control problems; Proceedings of the Twelfth Biennial ASME Conference on Mechanical Vibration and Noise, Montreal, Canada, Sept. 17-21, 1989. New York, American Society of Mechanical Engineers, 1989, p. 325-331. refs
Copyright

This paper presents a method to reduce the model of each component in a large scale system, while taking into account the interactions with the rest of the system. The paper compares two methods: canonical correlation analysis and component cost analysis. First, the interaction between component k and the rest of the system is described by canonical correlation analysis. Next, a component cost analysis is performed in the canonical correlation coordinates. Better performance properties are obtained by the component cost analysis method when it yields stability. Better stability properties are obtained by the canonical correlation method when it yields acceptable performance. Author

A90-47607#
MODEL REDUCTION WITH WEIGHTED MODAL COST ANALYSIS
A. HU (Dynacs Engineering Co., Inc., Palm Harbor, FL) and R. E. SKELTON (Purdue University, West Lafayette, IN) IN: AIAA Guidance, Navigation and Control Conference, Portland, OR, Aug. 20-22, 1990, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1990, p. 295-303.
(AIAA PAPER 90-3347) Copyright

Analytical expressions are developed for the controllability Grammian matrix and for the model costs when the disturbances to the flexible structures are modeled as colored noise processes which have only finite bandwidth. This new algorithm is called weighted modal cost analysis, and is the generalization of the theory of modal cost analysis for which the disturbances are assumed as white noise processes which have infinite bandwidth. Comparing to the conventional numerical procedure, the closed form expression derived for controllability Grammian and modal costs are more efficient and more accurate and are thus quite useful in model reduction processes, especially for high order systems since no interations are required to solve the Liapunov equation. Author

A90-47609#
PARAMETER SELECTION FOR MODEL REDUCTION USING MODIFIED COMPONENT COST ANALYSIS
JEFFREY D. BOOHER, JAYANT RAMAKRISHNAN (Dynacs Engineering Co., Inc., Clearwater, FL), and DAVID S. CHANG (Honeywell, Inc., Avionics Div., Clearwater, FL) IN: AIAA Guidance, Navigation and Control Conference, Portland, OR, Aug. 20-22, 1990, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1990, p. 316-327. refs
(AIAA PAPER 90-3349) Copyright

Large scale mechanical systems are composed of interconnected dynamic components. This paper seeks to simplify the model of each dynamic component so that the overall system is of manageable size. Models of components are reduced so as to approximate the response of all components and the nonworking constraint forces acting on all components. The modified component cost method seeks to decompose the norm of the response vector (in this case the response and the vector of nonworking constraint forces) into contributions of each coordinate of each component. The reduction methodology requires the selection of some parameters which emphasize quantities such as the steady state response to a step input. This paper deals with the parameters selection process and presents the best set of parameters for the specific problem and objective considered. Using these parameter values, the coordinates can be ranked according to their contribution and deleted accordingly. Author

A90-48875#
AIR FORCE USE OF CIVIL AIRWORTHINESS CRITERIA FOR TESTING AND ACCEPTANCE OF MILITARY DERIVATIVE TRANSPORT AIRCRAFT
ROBERT I. MARX, DOUGLAS M. CHAPMAN, MARK J. LANGLEY, and RANDALL S. FOUTS (USAF, Transport Test Div., Wright-Patterson AFB, OH) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 38 p. refs
(AIAA PAPER 90-3289) Copyright

A review of commercial aircraft programs and the use of FAA certification criteria in the acquisition of off-the-shelf transport aircraft by the USAF to fulfill its airlift requirements is presented. In addition, major differences between military and commercial test programs and acquisition are cited to illustrate the principal benefits to the Air Force of this method. Significantly reduced acquisition time, and reduced ground and flight testing and development costs are shown as benefits of this process. The unique aspects of certification of military derivatives, recent initiatives to codify the processes, and the impacts on changes required in the manner in which the USAF currently contracts for aircraft are discussed. R.E.P.

A90-49490
1990-1995, A PERIOD OF INTERNATIONAL DECISION MAKING FOR THE NAVIGATION COMMUNITY - IS OUR PLANNING AS GOOD AS IT SHOULD BE?
R. JOHANNESSEN (STC Technology, Ltd., Harlow, England) IN: Institute of Navigation, National Technical Meeting, San Diego, CA, Jan. 23-25, 1990, Proceedings. Washington, DC, Institute of Navigation, 1990, p. 15-18. refs
Copyright

A review of navigation systems, planning and decisions required for hyperbolic terrestrial navigation in Europe, GPS, GLONASS and GPS interoperability, GPS and INMARSAT, and Loran-C and geostationary satellites is presented. The major decisions these developments require to be made in the months to follow are summarized. In addition, means are suggested in which the international community can improve its navigation planning. R.E.P.

N90-11506# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
PREFERENCE PROPAGATION IN TEMPORAL/CAPACITY CONSTRAINT GRAPHS
NORMAN SADEH and MARK S. FOX Jan. 1989 58 p
Sponsored by McDonnell Aircraft Co.
(Contract F30602-88-C-0001)
(AD-A210668; CMU-RI-TR-89-2) Avail: NTIS HC A04/MF A01
CSCL 12/4

Scheduling can be formalized as a constraint satisfaction problem. Within this framework activities in a plan are interconnected via temporal relation constraints a la Allen, thereby defining a temporal constraint graph (TCG). Additionally there are capacity constraints restricting the use of each resource to only one activity at a time. Together these constraints form a

temporal/capacity constraint graph (T/CCG). Preferences such as meeting due dates, reducing order flowtime, or selecting accurate machines are modeled as utility functions over the domain of possible start times and durations of activities and over the sets of possible resources activities can use. These preferences interact via the TCG and via the resource capacity constraints. Hence, in general, they cannot be simultaneously optimized. The objective of preference propagation techniques is to transform such local a priori preferences so as to account for their interactions. This paper describes a probabilistic framework in which start time, duration and resource preferences are propagated across T/CCGs in order to focus attention in an incremental scheduler. GRA

N90-12235# Stanford Univ., CA. Inst. for Mathematical Studies in the Social Sciences.
A DYNAMIC PROOF OF THE FROBENIUS-PERRON THEOREM FOR METZLER MATRICES
KENNETH J. ARROW Apr. 1989 11 p
(Contract N00014-86-K-0216)
(AD-A211839; TR-542) Avail: NTIS HC A03/MF A01 CSCL 12/1

Matrices with non-negative off-diagonal elements have many applications in mathematical economics and other fields of investigation. Economists have called them Metzler matrices. An important property, especially for the study of stability of dynamic systems, is that the largest real part of the characteristic roots is itself a characteristic root and has a semi-positive characteristic vector. There is a less well-known property of linear dynamic systems governed by Metzler matrices: if the forcing term is a non-negative vector and if the system starts in the positive orthant, it will remain there forever. The result does not appear to be derivable from the standard Frobenius-Perron theorem. Its proof is not very hard, however. The question is then raised, whether the Frobenius-Perron result is derivable simply from this theorem. This note shows that the answer is affirmative. The result may very possibly be useful for expository purposes. GRA

N90-13158# Universiteit Twente, Enschede (Netherlands). Faculty of Applied Mathematics.
REMARKS ON THE CONTROL OF DISCRETE TIME NONLINEAR SYSTEMS
HENK NIJMEIJER Feb. 1989 20 p Submitted for publication
(MEMO-770; ISSN-0169-2690; ETN-89-95661) Avail: NTIS HC A03/MF A01

The (dynamic) input-output decoupling problem and the problem of right-invertibility for discrete-time nonlinear systems are studied. It is shown that under generic conditions these problems are solvable around an equilibrium point if and only if the same problems are solvable for the linearization of the nonlinear system. The results typically apply to well known questions in economics and an example stemming from economic modeling is given. ESA

N90-13693# National Telecommunications and Information Administration, Washington, DC.
LONG-RANGE PLAN FOR MANAGEMENT AND USE OF THE RADIO SPECTRUM BY AGENCIES AND ESTABLISHMENTS OF THE FEDERAL GOVERNMENT Special Report
Jun. 1989 154 p
(PB89-232367; NTIA-SP-89-22) Avail: NTIS HC A08/MF A01 CSCL 17/2

Federal Government electromagnetic spectrum planning issues are addressed in a long range plan. This plan will be used in U.S. preparations for international spectrum negotiations and conferences. In addition, a plan for improved spectrum management procedures is provided which includes information related to spectrum-use plans of the Federal Government. The material is divided into four major topics: (1) a description of the national spectrum resource; (2) a plan for national spectrum management; (3) a plan for international radiocommunications activities; and (4) a plan for spectrum use. GRA

N90-14127# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT IMPLEMENTATION STRATEGY: DIRECTORATE OF QUALITY ASSURANCE
May 1989 56 p
(AD-A212863) Avail: NTIS HC A04/MF A01 CSCL 05/1

The Directorate of Quality Assurance strategy for implementing TQM is described. It includes information concerning TQM concepts, methodology for implementation, goals and execution. The primary goal of the DLA-Q implementation strategy is to focus on doing the job right the first time, on time, everytime, and continually improving the way the job is done. GRA

N90-14128# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT PLAN: TECHNICAL AND LOGISTICS SERVICES
May 1989 29 p
(AD-A212864) Avail: NTIS HC A03/MF A01 CSCL 05/1

The TQM plan for DLA Technical and Logistics Services is described. As a quality provider of technical and logistics services, the Directorate will implement TQM initiatives at Headquarters DLA and at functional counterparts in the Field. The plan requires continuous assessment of customer needs and a systematic evaluation of the processes performed that contribute to customer satisfaction. GRA

N90-14129# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT IMPLEMENTING PLAN: OFFICE OF SMALL AND DISADVANTAGED BUSINESS UTILIZATION
Jul. 1989 8 p
(AD-A212865) Avail: NTIS HC A02/MF A01 CSCL 05/1

The Office of Small and Disadvantaged Business Utilization plans for implementing TQM is described. A brief discussion is presented of TQM concepts, methodology for implementation and goals. In addition to focusing on internal improvements, DLA-U will provide TQM information to potential small and disadvantaged businesses as part of their implementation efforts. GRA

N90-14130# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT PLAN: OFFICE OF CONGRESSIONAL AFFAIRS
Jul. 1989 5 p
(AD-A212866) Avail: NTIS HC A01/MF A01 CSCL 05/1

The DLA Office of Congressional Affairs Total Quality Management implementing plan is described. The plan emphasizes five areas: Customer relations, processes, measurement, awards, and training. The plan also includes specific improvement goals and milestones. GRA

N90-14132# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT PLAN: OFFICE OF PUBLIC AFFAIRS
Jul. 1989 15 p
(AD-A212868) Avail: NTIS HC A03/MF A01 CSCL 05/1

The Office of Public Affairs TQM implementing plan is described. A description is provided of three concepts considered vital to TQM as it applies to DLA's Public Affairs program: The customers are the first concern, precise measureable goals and teamwork. Public Affairs TQM goals and a methodology for accomplishment are included. GRA

N90-14986*# Houston Univ., Clear Lake, TX. Research Inst. for Computing and Information Systems.
DEVELOPING INTEGRATED PARAMETRIC PLANNING MODELS FOR BUDGETING AND MANAGING COMPLEX PROJECTS
VANCE A. ETNYRE and KEN U. BLACK 18 Apr. 1988 13 p
(Contract NCC9-16)
(NASA-CR-186006; NAS 1.26:186006; RICIS-IM-7) Avail: NTIS HC A03/MF A01 CSCL 05/1

The applicability of integrated parametric models for the budgeting and management of complex projects is investigated. Methods for building a very flexible, interactive prototype for a

project planning system, and software resources available for this purpose, are discussed and evaluated. The prototype is required to be sensitive to changing objectives, changing target dates, changing costs relationships, and changing budget constraints. To achieve the integration of costs and project and task durations, parametric cost functions are defined by a process of trapezoidal segmentation, where the total cost for the project is the sum of the various project cost segments, and each project cost segment is the integral of a linearly segmented cost loading function over a specific interval. The cost can thus be expressed algebraically. The prototype was designed using Lotus-123 as the primary software tool. This prototype implements a methodology for interactive project scheduling that provides a model of a system that meets most of the goals for the first phase of the study and some of the goals for the second phase. J.P.S.

N90-15116# Westinghouse Hanford Co., Richland, WA.
PHYSICAL AND ELECTRICAL STANDARDS LABORATORY GENERAL OPERATING PROCEDURES
J. E. BONGERS Mar. 1989 68 p
(Contract DE-AC06-87RL-10930)
(DE90-003515; WHC-SP-0446) Avail: NTIS HC A04/MF A01

Various procedures used in the operation of the Westinghouse Hanford Standards Laboratory are presented. These procedures consist of the following titles: Organization, Operating Directives and Traceability, Preparation and Control of Operating Procedures, Selection and Qualification of Standards Laboratory Personnel, Environmental Guides and Considerations for the Standards Laboratory, Calibration Recall Program, Calibration Reports and Labels, Calibration Stamps, Quality Assurance Records, Nonconforming Equipment in the Standards Laboratory, Receiving/Shipping Instructions, Shipment of Measuring and Test Equipment at Hanford, Offsite Shipment of Standards, and Offsite Shipment of Measuring and Test Equipment. DOE

N90-15586# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
WHERE TO FROM HERE. FUTURE APPLICATIONS OF MENTAL MODELS OF COMPLEX PERFORMANCE
HEIDI ANN HAHN, WILLIAM R. NELSON, and HAROLD S. BLACKMAN 1988 2 p Presented at the Human Factors Society Annual Meeting, Anaheim, CA, 24-28 Oct. 1988
(Contract DE-AC07-76ID-01570)
(DE90-002091; EGG-M-88288; CONF-881058-7) Avail: NTIS HC A01/MF A01

The purpose of this paper is to raise issues for discussion regarding the applications of mental models in the study of complex performance. Applications for training, expert systems and decision aids, job selection, workstation design, and other complex environments are considered. DOE

N90-15682# Florida State Univ., Tallahassee.
TWO BASIC PARTIAL ORDERINGS FOR DISTRIBUTIONS DERIVED FROM SCHUR FUNCTIONS AND MAJORIZATION
KUMAR JOAG-DEV (Illinois Univ., Chicago.) and JAYARAM SETHURAMAN Sep. 1989 13 p
(Contract DAAL03-86-K-0094)
(AD-A213703; FSU-TR-M-814; ARO-23699.25-MA) Avail: NTIS HC A03/MF A01 CSCL 12/1

Researchers in applied fields have long recognized the usefulness of inequalities when exact results are not available. The use of inequalities allows one to state that one estimate is better than another, that one maintenance policy is better than another or that a certain selection procedure is better than another or that a certain selection procedure is better than another etc., even though, the best estimator may not be known, nor the best maintenance policy or the best selection procedure. Such results are generally obtained from inequalities between two probability measures or random variables. Inequalities between random variables are in turn obtained from deterministic inequalities or deterministic partial orderings. Herein, the essentials of stochastic majorization and DT ordering are described and some applications demonstrated. A new proof of a slight generalization of earlier result on DT functions is given. GRA

N90-15844# Defense Systems Management School, Fort Belvoir, VA.
PROGRAM MANAGER'S HANDBOOK
Mar. 1989 422 p
(AD-A214338) Avail: NTIS HC A18/MF A03 CSCL 05/1

A reference tool for program managers and related functional or staff managers is designed. The document is in the form of a three-ring notebook containing a series of fact sheets on the fundamentals of nearly all major facets of the program management business with references for sources of more detailed information on each subject. Recipients are provided with updated and new facts sheets as they become available. GRA

N90-16583# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
INTERNATIONAL CONFERENCE MANAGEMENT
GEORGE ZINNEMANN Oct. 1989 21 p Revised
Avail: NTIS HC A03/MF A01

Guidelines and helpful hints to individuals involved in managing and participating in international conferences are provided. The guidelines are intended for individuals involved in international conference management, namely, the conference project officer, the host organization and its coordinator, the meeting chairman, and the individual speaker. The aim is to help conference planners to elude the traps, embarrassments, and obstacles which appear to be built into any meeting ever held. B.G.

N90-16777*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PLANNING AND SCHEDULING LEXICON
JENNIFER W. CRUZ and WILLIAM C. EGGEMEYER 15 Sep. 1989 45 p
(Contract NAS7-918)
(NASA-CR-186061; NAS 1.26:186061; JPL-PUBL-89-25) Avail: NTIS HC A03/MF A01 CSCL 22/1

A lexicon related to mission planning and scheduling for spacecraft is presented. Planning and scheduling work is known as sequencing. Sequencing is a multistage process of merging requests from both the science and engineering arenas to accomplish the objectives defined in the requests. The multistage process begins with the creation of science and engineering goals, continues through their integration into the sequence, and eventually concludes with command execution onboard the spacecraft. The objective of this publication is to introduce some formalism into the field of spacecraft sequencing-system technology. This formalism will make it possible for researchers and potential customers to communicate about system requirements and capabilities in a common language. Author

N90-16829*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
US SPACE SHUTTLE EVOLUTION
CHARLES TEIXEIRA *In* ESA, Progress in Space Transportation p 373-382 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03 CSCL 22/2

The long term systematic series of upgrades and enhancements needed to insure that the Space Shuttle remains a viable, cost-effective transportation system are discussed. A candidate Space Shuttle evolution strategy is presented. It emphasizes enhanced reliability, crew safety, reduced operations costs and enhanced capabilities required to meet projected long-range requirements. The strategy includes definition of long-term goals and requirements, potential hardware and operation enhancements, and addresses the issues of fleet size and utilization. ESA

N90-18180# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
A HUNDRED IMPOSSIBILITY PROOFS FOR DISTRIBUTED COMPUTING
NANCY A. LYNCH Aug. 1989 31 p

(Contract N00014-85-K-0168; N00014-83-K-0125; NSF CCR-86-11442)
(AD-A216391; MIT/LCS/TM-394) Avail: NTIS HC A03/MF A01 CSCL 12/5

This talk is about impossibility results in the area of distributed computing. In this category, I include not just results that say that a particular task cannot be accomplished, but also lower bound results, which say that a task cannot be accomplished within a certain bound on cost. I started out with a simple plan for preparing this talk: I would spend a couple of weeks reading all the impossibility proofs in our fields, and would categorize them according to the ideas used. Then I would make wise and general observations, and try to predict where the future of this area is headed. That turned out to be a bit too ambitious; there are many more such results than I thought. Although it is often hard to say what constitutes different results, I managed to count over 100 such impossibility proofs and my search wasn't even very systematic or exhaustive. It's not quite as hopeless to understand this area as it might seem from the number of papers. Although there are 100 different results, there aren't 100 different ideas. I thought I could contribute something by identifying some of the commonality among the different results. GRA

N90-18330*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
BACKGROUND OF THE WORKSHOP
In its Solar-Terrestrial Science Strategy Workshop p 1-4 Sep. 1989
Avail: NTIS HC A04/MF A01; 4 functional color pages CSCL 03/2

The long-term effects of the Challenger accident on solar-terrestrial science resulted in the need to examine the near-term missions under development for the next five years. The workshop was organized to seek ideas and opinions about the future of solar-terrestrial flight programs. Included are considerations of all types of space platforms, i.e., balloons, rockets, free flying satellites, and the variety of platforms supported by NASA astronauts. Specific issues include: the establishment of the level of understanding to be accomplished with the completion of the current worldwide program of research in solar-terrestrial sciences; the identification of major questions to be answered by the future solar-terrestrial sciences research program as it might be if initiated within the next ten years; the identification of space capabilities to be available to the future program and provision of input about the Space Physics Division's priorities for using these to accomplish its future scientific program; and mapping a program strategy to accomplish a future program of research in the solar-terrestrial sciences within the research community's perception of capabilities and constraints. B.G.

N90-18895# University of Southern California, Marina del Rey. Information Sciences Inst.
APPROACHES TO THE PLANNING OF COHERENT TEXT
EDUARD H. HOVY Nov. 1989 24 p Presented at the 4th International Workshop on Text Generation, Catalina Island, CA, Jul. 1988
(Contract F49620-87-C-0005; N00014-82-K-0149)
(AD-A216463; ISI/RS-89-245) Avail: NTIS HC A03/MF A01 CSCL 05/7

The planning of multisentential text by computer is discussed. In order to construct coherent paragraphs, relations were used from Rhetorical Structure Theory (RST) operationalized as plans. The current method of planning a paragraph using operationalized RST relation/plans is first described in some detail. Then two points are made that illustrate why RST relation/plans are the ideal tool for planning paragraphs. First, these relation/plans can be shown to combine the best features of paragraph-sized schemas and clause-sized planning rules under a top-down planning regime in a way which affords much flexibility to the user. Second, RST relation/plans can support both standard top-down planning and open-ended conversation-like behavior; a small difference in treatment gives rise to either paradigm. GRA

N90-18898# Institute for Defense Analyses, Alexandria, VA.
THE EXECUTIVE WORKSHOP ON COST/PERFORMANCE MEASUREMENT. VOLUME 1: EXECUTIVE SUMMARY Final Report, Apr. - Oct. 1989
RICHARD T. CHESLOW and J. RICHARD NELSON Oct. 1989 20 p Workshop held in Alexandria, VA, 31 May - 1 Jun. 1989
(Contract MDA903-89-C-0003)
(AD-A216745; AD-E501181; IDA-P-2321-VOL-1; IDA/HQ-89-34914-VOL-1) Avail: NTIS HC A03/MF A01 CSCL 05/1

On 31 May through 1 June 1989, an executive workshop was held in Alexandria, Virginia, to address problems perceived when applying current cost/performance measurement and management systems to new advanced-technology design and manufacturing methods. The goal was to provide the Department of Defense (DOD) with recommendations for change. This paper is the proceedings of the workshop. Volume 1 contains a summary of findings and recommendations of the attendees. The primary recommendation was that the Under Secretary of Defense (Acquisition) initiate pilot programs to investigate possible changes in cost/performance measurement systems. Continued dialog and cooperation between DOD and industry is also recommended. Volume 2 contains the remarks of the speakers, the panel members, and the discussion team representatives. GRA

N90-18899# Massachusetts Inst. of Tech., Cambridge. Microsystems Technology Labs.
OPTIMUM AND HEURISTIC ALGORITHMS FOR FINITE STATE MACHINE DECOMPOSITION AND PARTITIONING Memorandum Report
PRAVNAV ASHAR, SRINIVAS DEVADAS, and A. RICHARD NEWTON (California Univ., Berkeley.) Sep. 1989 6 p Presented at the International Conference of Computer Aided Design, Nov. 1989 Sponsored in part by Digital Equipment Corp.; Bell Telephone Labs., Inc.; Semiconductor Research Corp.
(Contract N00014-87-K-0825; N00014-87-C-0182)
(AD-A216778; VLSI-M-89-558) Avail: NTIS HC A02/MF A01 CSCL 12/9

Techniques have been proposed in the past for various types of finite state machine (FSM) decomposition that use the number of states or edges in the decomposed circuits as the cost function to be optimized. These measures are not reflective of the true logic complexity of the decomposed circuits. These methods have been mainly heuristic in nature and offer limited guarantees as to the quality of the decomposition. In this paper we present optimum and heuristic algorithms for the general decomposition of FSMs such that the sum total of the number of product terms in the one-hot coded and logic minimized submachines is minimum or minimal. This cost function is much more reflective of the area of an optimally state-assigned and minimized submachine than the number of states/edges in the submachine. The problem of optimum two-way FSM decomposition is formulated as one of symbolic-output partitioning and show that this is an easier problem than optimum state assignment. A procedure of constrained prime-implicant generation and covering represents an optimum FSM decomposition algorithm, under the specified cost function. Exact procedures are not viable for large problem instances. A novel iterative optimization strategy of symbolic-implicant expansion and reduction, modified from two-level Boolean minimizers, represents a heuristic algorithm based on our exact procedure. GRA

N90-18939# San Diego State Univ., CA. Center for Research in Mathematics and Science Education.
SCHEMA-BASED THEORIES OF PROBLEM SOLVING Annual Report, 1 Nov. 1988 - 31 Oct. 1989
STEPHEN K. REED 1 Nov. 1989 29 p
(Contract AF-AFOSR-0107-89; AF PROJ. 2313)
(AD-A216717; AFOSR-89-1673TR) Avail: NTIS HC A03/MF A01 CSCL 05/9

The objective of this research is to construct a schema-based model of problem solving to represent construction of equations for solving algebra word problems. The research summarized is

concerned with the selection, use, and description of instructional examples. Experiment 1 shows that mathematical experience was beneficial for improving the selection of good analogies when the analogies are isomorphic to the test problems, but was not beneficial when the analogies are more inclusive than the test problems. In Experiment 2 students were able to effectively combine information from two analogous problems but did significantly worse when combining information from one example and a set of procedures. The last three experiments required that students categorize motion problems according to whether the two distances in a problem should be equated, added, or subtracted. Categorization significantly improved as the number of training examples representing a category increased from one to four (Experiment 3). Categorization was also significantly better when students received both specific and general descriptions of the examples than when they received only a single description (Experiment 4). However, as shown in Experiment 5, students were unable to form their own general descriptions by comparing similar examples. GRA

N90-20769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
INSTITUTE FOR COMPUTATIONAL MECHANICS IN PROPULSION (ICOMP) FOURTH ANNUAL REVIEW, 1989
Mar. 1990 59 p
(Contract NASA ORDER C-99066-G)
(NASA-TM-102519; ICOMP-90-01; E-5323; NAS 1.15:102519)
Avail: NTIS HC A04/MF A01 CSCL 12/1

The Institute for Computational Mechanics in Propulsion (ICOMP) is operated jointly by Case Western Reserve University and the NASA Lewis Research Center. The purpose of ICOMP is to develop techniques to improve problem solving capabilities in all aspects of computational mechanics related to propulsion. The activities at ICOMP during 1989 are described. Author

N90-20901*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
MIDDLE MANAGEMENT OF RESEARCH
ROBERT W. GRAHAM Jan. 1990 14 p Submitted for publication
(NASA-TM-102417; E-5183; NAS 1.15:102417) Avail: NTIS HC A03/MF A01 CSCL 05/1

The role of the middle manager in a research organization is discussed. The middle manager serves as a liaison between upper management and researchers to assure that individual research projects manifest the goals of the organization. The author draws on his long experience in this role to describe management practices that have proven successful. A general discussion is presented of the makeup of a research environment, derived from a study of a division involved in aerospace research and development (R and D). The study emphasized the importance of planning and management style in producing an attractive environment. Management practices are described, which include goal setting, planning, staffing, reviewing and evaluating, and rewarding. The importance of selecting and defining an appropriate research area is discussed. It is emphasized that in relating to the staff the middle manager must cultivate the human side of supervision, develop the art of delegating responsibility, judiciously select facilities, and provide recognition and meaningful rewards to develop a productive research staff. The development of the staff is probably the most important and challenging role of the manager. Author

N90-21400# Defense Contract Administration Services Region, Saint Louis, MO.
QUALITY AT A GLANCE
DONALD S. PARSONS, JR., comp. Jan. 1990 33 p
(AD-A217297) Avail: NTIS HC A03/MF A01 CSCL 05/1

This document contains summaries of fifteen of the well known books which underlie the Total Quality Management philosophy. Members of the DCASR St. Louis staff offer comments and opinions on how the authors have presented the quality concept in today's business environment. GRA

N90-21680*# National Aeronautics and Space Administration, Washington, DC.
SMALL BUSINESS INNOVATION RESEARCH. ABSTRACTS OF 1988 PHASE 1 AWARDS
Mar. 1990 90 p
(NASA-TM-102991; NAS 1.15:102991; SBIR-88-2) Avail: NTIS HC A05/MF A01 CSCL 05/1

Non-proprietary proposal abstracts of Phase 1 Small Business Innovation Research (SBIR) projects supported by NASA are presented. Projects in the fields of aeronautical propulsion, aerodynamics, acoustics, aircraft systems, materials and structures, teleoperators and robots, computer sciences, information systems, data processing, spacecraft propulsion, bioastronautics, satellite communication, and space processing are covered. R.J.F.

N90-21681*# National Aeronautics and Space Administration, Washington, DC.
SMALL BUSINESS INNOVATION RESEARCH. ABSTRACTS OF COMPLETED 1987 PHASE 1 PROJECTS
Dec. 1989 95 p
(NASA-TM-101797; NAS 1.15:101797; SBIR-87-2) Avail: NTIS HC A05/MF A01 CSCL 05/1

Non-proprietary summaries of Phase 1 Small Business Innovation Research (SBIR) projects supported by NASA in the 1987 program year are given. Work in the areas of aeronautical propulsion, aerodynamics, acoustics, aircraft systems, materials and structures, teleoperators and robotics, computer sciences, information systems, spacecraft systems, spacecraft power supplies, spacecraft propulsion, bioastronautics, satellite communication, and space processing are covered. R.J.F.

N90-21688# Oak Ridge Y-12 Plant, TN. Dept. of Fabrication Systems.
ADVANCED MANUFACTURING TECHNOLOGY: A DEPARTMENT OF ENERGY TECHNOLOGY TRANSFER INITIATIVE
R. S. STEELE, JR. and W. E. BARKMAN 1 Feb. 1990 8 p Presented at the 2nd International Conference on Computer Integrated Manufacturing, Troy, NY, 21-23 May 1990
(Contract DE-AC05-84OR-21400)
(DE90-008601; Y/DX-916; CONF-9005134-1) Avail: NTIS HC A02/MF A01

This paper describes a new initiative called the Advanced Manufacturing Technology (AMT) Program that is managed for the U.S. Department of Energy (DOE) by Martin Marietta Energy Systems in Oak Ridge, Tennessee. The AMT Program seeks to assist the U.S. manufacturing community regain some of the market share that it has lost to competiting companies in both Europe and the Far East. One key element to this program is the establishment of teaching and development facilities called manufacturing technology centers (MTCs) which will showcase unclassified DOE manufacturing technologies. This paper describes some of the precision flexible manufacturing system (PFMS) technology that is available through the Oak Ridge Y-12 Plant. This technology will be highlighted in the first of the MTCs that is being established. DOE

N90-23942# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Operations Research, Statistics, and System Theory.
SEQUENCING AND SCHEDULING: ALGORITHMS AND COMPLEXITY
EUGENE L. LAWLER, JAN KAREL LENSTRA, ALEXANDER H. G. RINNOOYKAN, and DAVID B. SHMOYS (Massachusetts Inst. of Tech., Cambridge.) Jun. 1989 73 p Submitted for publication Sponsored in part by Presidential Youth Investigator Award; IBM; Sun Microsystems; and UPS
(Contract AF-AFOSR-0078-86; NSF CCR-87-04184)
(CWI-BS-R8909; ETN-90-96746) Copyright Avail: NTIS HC A04/MF A01

A survey on the area of deterministic machine scheduling is given. Sequencing and scheduling as a research area is motivated by questions arising in production planning, in computing control,

and generally in all situations in which scarce resources have to be allocated to activities over time. The work includes a review on complexity results and optimization and approximation algorithms for problems involving a single machine, parallel machines, open shops and jobs shops. Two extensions of this area are also considered: resource-constrained project scheduling and stochastic machine scheduling. ESA

N90-24173*# National Aeronautics and Space Administration, Washington, DC.
SMALL BUSINESS INNOVATION RESEARCH PROGRAM SOLICITATION: CLOSING DATE JULY 16, 1990
1990 122 p
(NASA-TM-101798; NAS 1.15:101798) Avail: NTIS HC A06/MF A01 CSCL 05/1

This is the eighth annual solicitation by NASA addressed to small business firms, inviting them to submit proposals for research, or research and development, activities in some of the science and engineering areas of interest to NASA. The solicitation describes the Small Business Innovative Research (SBIR) program, identifies eligibility requirements, outlines the required proposal format and content, states proposal preparation and submission requirements, describes the proposal evaluation and award selection process, and provides other information to assist those interested in participating in NASA's SBIR program. It also identifies the technical topics and subtopics for which SBIR proposals are solicited. These cover a broad range of current NASA interests, but do not necessarily include all areas in which NASA plans or currently conducts research. High-risk high pay-off innovations are desired. Author

N90-24992*# Virginia Commonwealth Univ., Richmond. Dept. of Mathematical Sciences.
EVALUATING STATISTICAL PROCESS CONTROL (SPC) TECHNIQUES AND COMPUTING THE UNCERTAINTY OF FORCE CALIBRATIONS Final Report
SHARON E. NAVARD *In* Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 15 p Dec. 1989
Avail: NTIS HC A08/MF A01 CSCL 14/4

In recent years there has been a push within NASA to use statistical techniques to improve the quality of production. Two areas where statistics are used are in establishing product and process quality control of flight hardware and in evaluating the uncertainty of calibration of instruments. The Flight Systems Quality Engineering branch is responsible for developing and assuring the quality of all flight hardware; the statistical process control methods employed are reviewed and evaluated. The Measurement Standards and Calibration Laboratory performs the calibration of all instruments used on-site at JSC as well as those used by all off-site contractors. These calibrations must be performed in such a way as to be traceable to national standards maintained by the National Institute of Standards and Technology, and they must meet a four-to-one ratio of the instrument specifications to calibrating standard uncertainty. In some instances this ratio is not met, and in these cases it is desirable to compute the exact uncertainty of the calibration and determine ways of reducing it. A particular example where this problem is encountered is with a machine which does automatic calibrations of force. The process of force calibration using the United Force Machine is described in detail. The sources of error are identified and quantified when possible. Suggestions for improvement are made. Author

N90-25000*# Kansas Univ., Lawrence.
KEEPING THE DREAM ALIVE: MANAGING THE SPACE STATION PROGRAM, 1982 TO 1986 Final Report
THOMAS J. LEWIN and V. K. NARAYANAN (Rutgers - The State Univ., New Brunswick, NJ.) Washington NASA Jul. 1990 178 p
(Contract NASW-4248)
(NASA-CR-4272; NAS 1.26:4272) Avail: NTIS HC A09/MF A01 CSCL 05/1

The management is described and analyzed of the formative years of the NASA Space Station Program (1982 to 1986), beginning with the successful initiative for program approval by Administrator James M. Beggs through to the decision to bring program management to Reston, Virginia. Emphasis is on internal management issues related to the implementation of the various phases of the program. Themes examined are the problem of bringing programmatic and institutional interests together and focusing them to forward the program; centralized versus decentralized control of the program; how the history of NASA and of the individual installations affected the decisions made; and the pressure from those outside NASA. The four sections are: (1) the decision to build the space station, (2) the design of the management experiment, (3) the experiment comes to life, and (4) the decision reversal. Author

N90-25176# European Space Agency, Paris (France).
MATERIALS AND PROCESSES FOR SPACECRAFT: THE ESTEC APPROACH
J. DAUPHIN (European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands) Feb. 1990 16 p Revised
(ESA-STM-244; ESA-STM-237; ISSN-0379-4075; ETN-90-96983)
Copyright Avail: NTIS HC A03/MF A01; EPD, ESTEC, Noordwijk, Netherlands, HC 20 Dutch guilders

The approach to materials and processes problems used by ESTEC is described. The approach combines pragmatism with standardization. The need to further formalize the work of the division in tackling larger and more complex future projects is discussed. The need to maintain flexibility and the ability to make ad hoc interventions is stressed. The training of new staff, engineers and technicians in the specialized domain of space materials and processes is identified as the biggest challenge facing ESTEC in preparing itself to meet future challenges. ESA

N90-25694# Nijmegen Univ. (Netherlands). Dept. of Information Systems.
THE CONCEPTUAL TASK MODEL: A SPECIFICATION TECHNIQUE BETWEEN REQUIREMENTS ENGINEERING AND PROGRAM DEVELOPMENT
S. BRINKKEMPER and A. H. M. TERHOFSTEDE (Software Engineering Research Centre, Utrecht, Netherlands) Sep. 1989 20 p
(TR-89-15; ETN-90-96886) Avail: NTIS HC A03/MF A01

A specification technique called the Conceptual Task Model (CTM) is introduced. It is designed to bridge the gap between the informal requirements of engineering activities and the more formal program development stages. The CTM is related explicitly to the results of the global requirements specification, i.e., process models and data models that can be input to code generation. The CTM technique is based on and defined in terms of Predicatetransition nets. CTM integrates the specifications of the data manipulation function with control structures and local and global data models. The precise relation between the process model and some other theoretical issues is discussed. ESA

N90-27434# Florida State Univ., Tallahassee. Dept. of Statistics.
A HYPOTHESIS TEST OF CUMULATIVE SUMS OF MULTINOMIAL PARAMETERS
J. H. CLAIR and D. A. MEETER Feb. 1990 39 p
(Contract AF-AFOSR-0040-88; AF PROJ. 2304)
(AD-A221466; TR-90-247; AFOSR-90-0426TR) Avail: NTIS HC A03/MF A01 CSCL 12/3

The Air Force is considering the contract renewal application of a civilian contractor hired to maintain in working order a series of radar stations. The measure of performance of interest is T, the time that a particular station is not on line while being down for repair. The contract stipulates that repair service will be such that on the average 50 percent of all repairs will be completed before L sub 1 hours and 90 percent of all repairs shall be completed before L sub 2 hours. It also states that the repair contract will be renewed on the basis of a decision rule that errs by failing to renew when the case is that the contract should be renewed with a probability of alpha. The renewal of the contract

depends on the making a decision based on N repair times, T sub 1, T sub 2, ..., T sub N, of the contractor as to whether or not L sub 1 is at least the 50 to the th power percentile and L sub 2 is at least the 90 to the th power percentile of F(.), the distribution function F(.) of these repair times. The usual test based on the binomial distributions of the number of repairs before L sub 1 and the number of repairs before L sub 2 suffers from two problems: its true size is at times far from the nominal size; and because of the discrete of the random variables, cannot be performed at the stipulated size. The use is proposed of the likelihood ratio test based on the nultinomial joint distribution of the number of repairs before L sub 1 and the number of repairs before L sub 2. GRA

N90-28438# Royal Signals and Radar Establishment, Malvern (England).
PURCHASE OF COMPUTER EQUIPMENT: JUSTIFICATION AND COST APPRAISAL
R. F. BATEMAN Dec. 1989 10 p
(RSRE-89023; BR113097; ETN-90-97062) Copyright Avail: NTIS HC A02/MF A01

The Information Technology Strategy Committee (ITSC) has decided that a cost appraisal should be performed for all major computer equipment purchases made by Royal Signals and Radar Establishment (RSRE). The support requirements are considered and the costs for the new computer system are evaluated. ESA

N90-28581# Federal Aviation Administration, Washington, DC.
DEVELOPMENT OF ACCEPTANCE PLANS FOR AIRPORT PAVEMENT MATERIALS. VOLUME 1: DEVELOPMENT Final Report, 1 Oct. 1986 - 31 May 1990
JOHN E. FOSTER and KAMRAN MAJIDZADEH (Resource International, Inc., Columbus, OH.) May 1990 197 p
(Contract DTFA01-86-Y-01046)
(DOT/FAA/RD-90/15) Avail: NTIS HC A09/MF A02

Statistically based acceptance/rejection plans and payment adjustment schedules were developed for five specifications: (1) excavation and embankment; (2) crushed aggregate base course; (3) cement treated base course; (4) econocrete subbase course; and (5) portland cement concrete pavement. The statistical analysis of data, development of payment adjustment plans (PAP), and development of PAP computer diskette system are presented. Test data used for this effort were collected from field sources. The developed PAP formulas, schedules, and computer diskette system were verified using new pavement construction projects. Author

N90-29907*# Centre National de la Recherche Scientifique, Toulouse (France).
THE INDEXED TIME TABLE APPROACH FOR PLANNING AND ACTING
MALIK GHALLAB and AMINE MOUNIR ALAOUI *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 5 p 321-332 31 Jan. 1989 Sponsored in part by EEC and by French National Research Program
Avail: NTIS HC A19/MF A03 CSCL 05/8

A representation is discussed of symbolic temporal relations, called IxTeT, that is both powerful enough at the reasoning level for tasks such as plan generation, refinement and modification, and efficient enough for dealing with real time constraints in action monitoring and reactive planning. Such representation for dealing with time is needed in a teleoperated space robot. After a brief survey of known approaches, the proposed representation shows its computational efficiency for managing a large data base of temporal relations. Reactive planning with IxTeT is described and exemplified through the problem of mission planning and modification for a simple surveying satellite. Author

N90-29938# Mitre Corp., Bedford, MA.
EFFECTS OF PARAMETER UNCERTAINTIES ON SOFTWARE DEVELOPMENT EFFORT ESTIMATES Final Report
FREDERICK D. POWELL May 1990 58 p
(Contract F19628-86-C-0001)
(AD-A223304; MTR-10226; ESD-TR-90-307) Avail: NTIS HC A04/MF A01 CSCL 12/5

The Constructive Cost Model (COCOMO) for software cost estimation uses inputs of size in lines of code and 15 Development Effort Multipliers (DEMs) that calibrate the estimate to the environment. This study examines the effects of uncertainties, expressed as probability densities of size and DEMs, on COCOMO effort estimates for software developments consisting of more than one Computer Software Configuration Item (CSCI). A Taylor series is used to find the mean and standard deviation of effort in terms of the means and standard deviations of the sizes and the DEMs of the CSCIs. The Central Limit Theorem then enables the evaluation of probability density and cumulative distribution functions for effort. Conditions under which this method is valid are demonstrated. GRA

N90-30122# Army War Coll., Carlisle Barracks, PA.
TOTAL QUALITY MANAGEMENT: A RECIPE FOR SUCCESS Study Project
MICHAEL G. PAZAK 2 Apr. 1990 53 p
(AD-A223287) Avail: NTIS HC A04/MF A01 CSCL 05/1

Total Quality Management (TQM) is a high level Department of Defense (DOD) initiative that is being touted as the primary management tool to force the fundamental cultural change in the way the DOD conducts business in the systems age. What is TQM. Where did it come from. What are it's guiding principles. How has it been used. What successes can be attributed to TQM. How can it best be implemented. These questions along with many others are addressed and answered in this work. In addition, an appendix of popular quality improvement models for organizations, their processes, and their individuals is provided. It was concluded that the DOD must embrace the TQM philosophy and proliferate it's principles in order to maximize the return on defense budget dollars. This will require an enormous investment in education, training and time and an equally positive commitment by the DOD leadership to create a DOD wide organizational climate that will stimulate and perpetuate individual productivity enhancing contributions. GRA

03

INDUSTRIAL MANAGEMENT AND MANUFACTURING

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

A90-13307*# NASA Space Station Program Office, Reston, VA.
SPACE STATION FREEDOM OPERATIONS PLANNING
ANNE L. ACCOLA and BRYANT KEITH (NASA, Space Station Freedom Program Office, Reston, VA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 7 p.
(IAF PAPER 89-097)

The Space Station Freedom program is developing an operations planning structure which assigns responsibility for planning activities to three tiers of management. The strategic level develops the policy, goals and requirements for the program over a five-year horizon. Planning at the tactical level emphasizes program integration and planning for a two-year horizon. The tactical planning process, architecture, and products have been documented and discussed with the international partners. Tactical planning includes the assignment of user and system hardware as well as significant operational events to a time increment (the period of time from the arrival of one Shuttle to the manned base to the arrival of the next). Execution-level planning emphasizes implementation, and each organization produces detailed plans, by increment, that are specific to its function. Author

A90-15746
ADVANTAGE AIRBUS?
GUY NORRIS Flight International (ISSN 0015-3710), vol. 136, Oct. 21, 1989, p. 28, 30, 31.
Copyright

The overriding development objectives of the A330 and A340 airliners have been the reduction of drag and weight to minimize fuel consumption and operating costs. Taken together with other advanced technologies incorporated in these designs, these improvements represent a total savings for a fleet of 10 aircraft of $230 million over 15 years. Emphasis has been given to increasing the content of (1) Al-Li alloys, (2) polymeric matrix composites, and (3) metal-matrix composites, while decreasing the proportion of conventional Al alloys, Ti alloys, and specialty steels. Aerodynamic drag reductions are obtained through laminar flow wing surface area maximization; a drag reduction of 10 percent is expected. O.C.

A90-16874#
THE U.S. AEROSPACE INDUSTRY AND AMERICA'S COMPETITIVENESS - AN AIAA POSITION PAPER
Washington, DC, American Institute of Aeronautics and Astronautics, 1989, 10 p.
Copyright

The impact of the aerospace industry on the overall U.S. economy is examined, and recommendations for government and industry action are presented. The consistent export surplus generated by the industry's high-value-added products is recalled, and it is pointed out that the industry is highly sensitive to changes in government R&D and procurement policies. Continued support of large projects, increased government and industry investment in education at all levels, and stimulation of technology exports are urged, along with industry efforts to encourage the application of aerospace technology in other fields. Graphs tracing the evolution of industry exports and NASA and DOD funding during the period 1961-1987 are provided. T.K.

A90-17307#
AIRCRAFT DESIGN: A CONCEPTUAL APPROACH
DANIEL P. RAYMER (Lockheed Aeronautical Systems Co., Burbank, CA) Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1989, 740 p. refs
Copyright

Practical techniques for the conceptual design of aircraft are presented in a comprehensive introduction for college students. Chapters are devoted to sizing from a conceptual sketch; airfoil and geometry selection; thrust/weight ratio and wing loading; initial sizing; configuration layout and loft; crew station, passengers, and payload; propulsion and fuel-system integration; and landing gear and subsystems. Consideration is given to aerodynamics, propulsion, structures and loads, weights, stability and control, performance and flight mechanics, cost analysis, sizing and trade studies, and VTOL aircraft design. Extensive diagrams, drawings, graphs, photographs, and tables of numerical data are provided. T.K.

A90-17876
TAGUCHI METHODS: APPLICATIONS IN WORLD INDUSTRY
A. BENDELL, ED., J. DISNEY, ED. (Trent Polytechnic, Nottingham, England), and W. A. PRIDMORE, ED. Berlin and New York, Springer-Verlag, 1989, 409 p. No individual items are abstracted in this volume.
Copyright

The off-line quality-control techniques developed by G. Taguchi and their industrial application are discussed in a collection of previously published papers by leading experts. A general overview of the Taguchi approach to quality engineering and parameter design is given, and individual sections are devoted to applications in electronics, information technology, process industries, the automotive industry, and plastics. Extensive diagrams, drawings, graphs, photographs, and tables of numerical data are included. T.K.

A90-23199
THE SSX - A TRUE SPACESHIP
MAXWELL W. HUNTER Journal of Practical Applications in Space (ISSN 1046-8757), vol. 1, Fall 1989, p. 41-62. refs
Copyright

The design of the Spaceship Experimental, SSX, is discussed and a framework for testing the SSX design is proposed. It is suggested that the SSX design is a high-performance space rocket with the ability to save itself, the crew, and the payload in the event of almost all conceivable flight difficulties. Consideration is given to issues related to propulsion, structural technology, continuous intact abort, maintenance requirements, and operating costs. R.B.

A90-28322
CONCURRENT ENGINEERING - AN OVERVIEW FOR AUTOTESTCON
JAMES P. PENNELL, ROBERT I. WINNER, HAROLD E. BERTRAND, and MARKO M. G. SLUSARCZUK (Institute for Defense Analyses, Alexandria, VA) IN: AUTOTESTCON '89 - IEEE International Automatic Testing Conference, Philadelphia, PA, Sept. 25-28, 1989, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 88-99. refs
(Contract MDA903-84-C-0031)
Copyright

A 1988 investigation of concurrent engineering and its role in weapons system acquisition is presented with some attention to testability implications. Included is the definition of concurrent engineering developed during the study. Some benefits reported include 60 percent reduction in product development time, elimination of two thirds of the inspectors in one factory, and several-million-dollars annual savings in chemical and soldering processes. The methods and technologies of concurrent engineering are outlined and the process management ideas, the computer support, and the problem-solving techniques are considered. A conceptual framework is offered to describe the continuing research needed in this area. I.E.

A90-29717
CONSTRUCTION AND SELECTION OF TIGHTENED-NORMAL-TIGHTENED (TNT) PLANS
V. SOUNDARARAJAN and R. VIJAYARAGHAVAN (Bharatiar University, Coimbatore, India) Journal of Quality Technology (ISSN 0022-4065), vol. 22, April 1990, p. 146-153. Research supported by the UGCI. refs
Copyright

Tables are presented for the design of Tightened-Normal-Tightened (TNT) plans on different criteria. When products are forthcoming in a stream of lots and a zero acceptance number is to be maintained, the TNT scheme, developed by Calvin (1977), becomes appropriate. The scheme utilizes two zero acceptance number sampling plans of different sample sizes together with switching rules to build up the shoulder of the operating characteristic (OC) curve after the manner of the switching rules of MIL-STD-105D (1963). This is done by a change in sample size rather than acceptance numbers as in MIL-STD-105D. Designs of TNT plans from the given tables based on different entry parameters are discussed. Methods of plotting the OC curve and computing the Average Outgoing Quality Level are indicated. S.A.V.

A90-31678#
ENGINEERING EXCELLENCE AND HOW IT RELATES TO PRODUCT EXCELLENCE
H. C. WROTON and D. A. RUSCIO (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 8-14.
(AIAA PAPER 89-3183) Copyright

The transition from engineering excellence to product excellence and the status, initiatives, and implementation of a product excellence program are discussed. Prior to achieving

excellence in products, it is mandatory to achieve excellence in engineering. Excellence in engineering means providing documents to the fabrication community that have: (1) requirements that are constant and consistent with contract specifications, (2) parts that can be procured to schedule and have correct numbers, (3) tolerances that are established with consideration to the build process, and (4) drawing presentations and definition that can be integrated and converted to the finished product. Thus engineering products must be error-free and engineering excellence must be accomplished before automation occurs. R.E.P.

A90-31681#
TOTAL QUALITY MANAGEMENT - THE PROMISE IS REAL
R. G. ROBINSON (Harris Corp., Melbourne, FL) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 28-31.
(AIAA PAPER 89-3187) Copyright

The total quality management program at Harris Corporation as a structured, orderly, and systematic approach to continuous improvement is described. As an integral part of the plan, specific goals for improvement of quality, timeliness, and cost performance get a high level of visibility and attention throughout the organization. Management teams at each level work on problems that only they can solve. Once it is clearly understood where to go through strategic planning, the next step is to define the best way to get there. It is indicated that all of the processes of the business must be well defined and optimized for total organizational effectiveness and efficiency. R.E.P.

A90-31682#
PDES - THE KEY TO QUALITY PRODUCTS
HOWARD M. BLOOM (NIST, Boulder, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 32-40.
(AIAA PAPER 89-3189)

Activities at the National Institute of Standards and Technology that are being applied to the Product Data Exchange Specification (PDES) and the role of the institute in working with the standards community to facilitate the development of needed product-related standards are outlined. Product-data-driven engineering (PDDE) that can be used to improve the competitiveness of U.S.industry and the various technologies and standards associated with PDDE are defined. Finally, consideration is given to the research needed to make PDES into a standard that will be useful for implementing the information systems to support the sophisticated PDDE concurrent engineering environment. R.E.P.

A90-31684#
CONCURRENT ENGINEERING APPLIED TO AN SDIO TECHNOLOGY PROGRAM
RICHARD H. RAWCLIFFE and RICK L. RANDALL (Aerojet ElectroSystems, Azusa, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 46-53.
(AIAA PAPER 89-3191) Copyright

The paper examines a key concurrent engineering construct involving the use of multifunction teams that employ quality function deployment to enhance the definition of a solid set of product and process requirements based on the wishes of the customer. Aerojet has been tailoring concurrent engineering constructs over the past year and has chosen SPIRIT 111 as a pilot for testing these new constructs because of the potential benefits in reducing cost and improving schedule while providing a state-of-the-art high quality product. The multifunction teams address the issues that exist, including thermal, mechanical, electrical, environmental, performance, modularity, and interchangeability. Lessons learned that may help those considering concurrent engineering and quality function deployment for prototypes or production are summarized. R.E.P.

A90-31689#
USING PROCESS IMPROVEMENT TO INTRODUCE TQM
PETER N. WEBER and ELLEN R. DOMB (Aerojet ElectroSystems, Azusa, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 83-88.
(AIAA PAPER 89-3202) Copyright

Product improvement has proven to be an excellent way of introducing total quality management (TQM) because of the commonality of principles, in that both require customer-defined quality, employee involvement, and continuous improvement. The establishment of a TQM organization structure that separates the 'process improvement' from 'process ownership' has insured that a high degree of objectivity is maintained in the process improvement. Involvement by all levels of management in prioritizing process improvement efforts and approving team recommendations has guaranteed the necessary support for process improvement teams (and by extension TQM) to be successful. R.E.P.

A90-31690#
TOTAL QUALITY MANAGEMENT - AN ACTION PROJECT APPROACH
PETER DANNA and MICHAEL HERRINGTON (Olin Corp., Stamford, CT) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 89-97.
(AIAA PAPER 89-3203) Copyright

Achieving total quality management is a mind set that often requires a culture change. When it is achieved, the overwhelming priority of the organization is to always meet the agreed upon expectations of both internal and external customers. By-products of this achievement are elimination of waste, increased productivity, reduced costs, and reduced cycle time. Total quality management and the quality planning process as practiced by Olin Corporation are described, along with two examples of this process at work. R.E.P.

A90-31704#
ENGINEERING DRAWING QUALITY
L. K. ROGOWSKI (Ball Corp., Electro-Optics and Cryogenics Div., Boulder, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 171-174.
(AIAA PAPER 89-3220) Copyright

The quality of engineering as it is reflected in engineering drawings and the measurement of that quality are problems that face all engineering organizations. The design of a questionnaire that allows the machinist, assembler, or other hands-on user to give a numerical score to a drawing each time it is used is presented. The engineering organization will use the data to determine what areas need improvement and what to concentrate on. R.E.P.

A90-31737#
SABIR TQM IMPLEMENTATION PLANS AND PROGRESS
TERRY BEDBURY (Martin Marietta Corp., Bethesda, MD) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 390-395.
(AIAA PAPER 89-3668) Copyright

In March of 1989 the Martin Marietta Space Based Interceptor (SABIR) program began the formal implementation of Total Quality Management (TQM). This paper discusses the process of implementing TQM on a program that is in the Demonstration/Validation phase. An implementation flow is presented and progress and lessons learned during each step accomplished are discussed. Author

A90-31902
AEROSPACE MATERIALS - TRENDS AND POTENTIAL
W. BUNK (DLR, Institut fuer Werkstoff-Forschung, Cologne, Federal Republic of Germany), P. ESSLINGER (MTU Motoren- und Turbinen-Union Muenchen GmbH, Munich, Federal Republic of Germany), and H. KELLERER (MBB GmbH, Munich, Federal Republic of Germany) IN: Materials and processing - Move into the 90's; Proceedings of the Tenth International European Chapter Conference of SAMPE, Birmingham, England, July 11-13, 1989. Amsterdam, Elsevier Science Publishers, 1989, p. 327-341. refs
Copyright

The current status of materials used for airframes and engines is reviewed with reference to the goals and limitations and the philosophies and strategies employed in the pursuit of these goals. In particular, attention is given to the competition between metals and polymer materials; cost considerations in relation to the requirements of safety and performance; recent developments in aluminum-lithium alloys, rapid solidification technology, and metal matrix composites; and materials for jet engines. V.L.

A90-32275
THE FUTURE OF THE U.S. AIRCRAFT INDUSTRY
ARTEMIS MARCH (Harvard University, Cambridge, MA) Technology Review (ISSN 0040-1692), Jan. 1990, p. 27-34, 36.
Copyright

The major factors that face aviation manufacturers in the U.S. are discussed. Among these factors are: competition from an effective European consortium that is building and marketing products worldwide, enormous financial risks with launch costs for a new aircraft running between two and four billion dollars, development, testing, and certification of airframes and engines that have 20 or more years of service life, launch decisions that are taken with a 25 year perspective and under conditions of great uncertainty, and the entire ramifications of deregulation. To counteract these mounting problems the aircraft industry and goverment agencies acting with the Aerospace Industries Association are attempting to build a cohesive strategy without asking for any additional government funds. AIA has forged an industry consensus around eight key technologies including sensors, propulsion systems, and artificial intelligence and advanced composites. R.E.P.

A90-34955
OUT OF THE CRISIS
W. EDWARDS DEMING Cambridge, MA, MIT, Center for Advanced Engineering Study, 1989, 518 p. refs
Copyright

Current problems in the management of U.S. service and manufacturing industries are addressed, with a focus on failures leading to the erosion of the U.S. competitive position in world markets, and a set of 14 fundamental changes in traditional scientific management techniques is proposed. Chapters are devoted to diseases and obstacles; quality and the consumer; quality and productivity in service organizations; new principles in training and leadership; and operational definitions, conformance, and performance. Also considered are standards and regulations, common and specific causes of improvement, the minimum average total cost of testing incoming materials and final products, organization for improvement of quality and productivity, and management transformation in Japan. T.K.

A90-36947
A HIGH COMPLEXITY TAPE AUTOMATED BONDING APPLICATION FOR SPACE HARDWARE
W. C. WHITWORTH (Grumman Corp., Space Systems Div., Irvine, CA) and P. RIMA (International Micro Industries, Inc., Cherry Hill, NJ) IN: Materials, devices, techniques, and applications for Z-plane focal plane array technology; Proceedings of the Meeting, Orlando, FL, Mar. 29, 30, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 167-171.
Copyright

Tape Automated Bonding (TAB) processes have been used to simplify a highly complex Z-technology module intended for use in a surveillance satellite. The module design is based on multiple layers of thin-film substrates as interconnections between active devices mounted on three surfaces as packaging protection for custom LSIC devices. The discussion covers the advantages of TAB processes, reliability, cost effectiveness, automation considerations, and the current status of the program. V.L.

A90-38254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
COMPARISON OF CONCEPTUAL DESIGNS FOR 25 KWE ADVANCED STIRLING CONVERSION SYSTEMS FOR DISH ELECTRIC APPLICATIONS
RICHARD K. SHALTENS and JEFFREY G. SCHREIBER (NASA, Lewis Research Center, Cleveland, OH) IN: IECEC-89; Proceedings of the Twenty-fourth Intersociety Energy Conversion Engineering Conference, Washington, DC, Aug. 6-11, 1989. Volume 5. New York, Institute of Electrical and Electronics Engineers, 1989, p. 2305-2315. Previously announced in STAR as N89-26781. refs

The Advanced Stirling Conversion System (ASCS) Project is managed by NASA Lewis Research Center through a cooperative interagency agreement with DOE. Conceptual designs for the ASCS's were completed under parallel contracts in 1987 by Mechanical Technology Inc. (MTI) of Latham, NY, and Stirling Technology Company (STC) of Richland, WA. Each design features a free-piston Stirling engine, a liquid metal heat pipe receiver, and a means to provide about 25 kW of electric power to a utility grid while meeting DOE's long term performance and cost goals. An independent assessment showed that both designs are manufacturable and have the potential to easily meet DOE's long term cost goals. Author

A90-42652
ANNUAL GENERAL MEETING OF THE CANADIAN AERONAUTICS AND SPACE INSTITUTE, 36TH, OTTAWA, CANADA, MAY 15, 16, 1989, PROCEEDINGS
Ottawa, Canadian Aeronautics and Space Institute, 1989, 536 p. For individual items see A90-42653 to A90-42659, A90-42661, A90-42662, A90-42664 to A90-42675.

The present conference discusses ultrahigh bypass engine technology, the use of lunar dust as a propellant, the Canadian airspace system plan, the RJ-601 regional airliner, the velocity field of a reverse-flow combustor, flash-lamp planar imaging for high speed flow, advanced stress analysis techniques for gas turbine castings, erosion-resistant compressor airfoil coatings, mechanical processes in turbine blade thermal fatigue, blisked rotor fracture mechanics, and the Dash-8 series 400 regional airliner. Also discussed are future tactical cockpit systems, the integration of EW systems, two-dimensional experiments and simulations of turbine blade film-cooling, the BD-10J supersonic aircraft, a probabilistic approach to fleet management, marine environment airframe materials' fatigue testing, and ultralight aircraft design. O.C.

A90-48828#
INTEGRATED PRODUCT DEVELOPMENT (IPD) AT GENERAL DYNAMICS FORTH WORTH
EDWARD M. PETRUSHKA and C. DALE LITTLE (General Dynamics Corp., Fort Worth, TX) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 15 p.
(AIAA PAPER 90-3192) Copyright

The evolution of integrated product development (IPD) is reviewed in terms of its fundamental elements of guidance principles, enabling electronic tools, and cultural acceptance. Past experiences from 1971 are covered, including such products as F-111, YF-16 prototype, and F-16 full-scale programs. The current environment with the USAF Advanced Tactical Fighter, USN A-12, and National Aerospace Plane programs is described, along with the existing IPD principles, further electronic-tool development, continuing cultural changes, benefits derived, and lessons learned in the areas of management responsibilities, organizational aspects,

and development and application of enabling tools. Future changes in the basic elements of IPD and their impacts are considered. V.T.

A90-48829#
IMPLEMENTATION OF INTEGRATED PRODUCT DEVELOPMENT
H. R. KESSLER (Hughes Aircraft Co., Radar Systems Group, El Segundo, CA) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 7 p. (AIAA PAPER 90-3194) Copyright

Simultaneous engineering or integrated product development (IPD) efforts in the area of the physical design and manufacturing planning are outlined, with focus placed on CAD techniques enhancing IPD. An advanced airborne expendable-decoy project and an F/A-18-radar upgrade program are described as two pilot programs. Emphasis is placed on the process-definition process, flowcharting the process as the means of providing the technical guidelines how to do IPD, teamwork as the way of conquering the social impediments to IPD, social and cultural changes, and implementation methods. Next steps and challenges involving the creation of teams and teaming as an implementation strategy as well as a necessary set of tools are assessed, and suggestions for getting started are given. V.T.

A90-48833#
THE CANADAIR CL-84 EXPERIMENTAL AIRCRAFT - LESSONS LEARNED
FREDERICK C. PHILLIPS AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 14 p. refs
(AIAA PAPER 90-3205) Copyright

After seven years of V/STOL studies by Canadair, design of the CL-84 tilt-wing prototype began in 1963. Three articles were developed and flown between 1965 and 1974 for 476 hours total, including important operations at USNATC and at sea. Prime emphasis on flying qualities and the changes triggered by pilot comments were primarily responsible for positive reactions by almost all 40 pilots who flew the CL-84. During the program many technical and organizational/managerial lessons were learned, of significance particularly to Canadair, which had previously designed and built in-house only a jet-trainer airplane. Lack of success in a military market dominated by jet and helicopter advocates caused Canadair to abandon tilt-wing activities in favor of more conventional pursuits. While the tilt-wing scores well technically for certain missions, the current overall situation, at least in North America, does not augur well for its future, especially if V-22 tilt-rotor production ensues. Author

A90-51142
RATIONAL DECISION MAKING - STRUCTURING OF DESIGN MEETINGS
HUGO J. W. VLIEGEN (Philips Corp., Small Domestic Appliance Div., Eindhoven, Netherlands) and HERMAN H. VAN MAL (Eindhoven, Technische Universiteit, Netherlands) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, Aug. 1990, p. 185-190. refs
Copyright

The design process is discussed from the viewpoint of decision-making. In sorting design problems the following stages of strategy, tactics, and execution (called the decision-making cycle), are assumed to always occur. Particular design meetings to obtain improved structuring of the design process are included in this decision-making cycle. The design meetings include decision analysis (DA), potential problem analysis (PPA), failure-mode and effect analysis (FMEA), and design for production (DFP). Progress controls in the decision-making cycle are included to ensure faster feedback about the progress of a project involving checks of the management aspects quality, throughput time, and costs. The necessity of this approach is illustrated by means of data gathered from an industrial automation department. I.E.

N90-11020# National Space Development Agency, Tokyo (Japan).
DEVELOPMENT OF THE LARGE SPACECRAFT STRUCTURE
K. NAKAMURA, H. MITSUMA, A. TSUJIHATA, T. KATOH, T. TSUKASHIMA, and F. KUWAO (Toshiba Corp., Kawasaki, Japan) *In* ESA, Spacecraft Structures and Mechanical Testing p 247-252 Jan. 1989
Copyright Avail: NTIS HC A99/MF E06

The development work involved in designing the ETS-6 (engineering test satellite-6) satellite is described. The ETS-6 satellite is a two ton class geostationary spacecraft to be launched in the summer of 1992. Structural tests were carried out on a full-scale model. The results of these tests of structural design, analysis and construction technique are included. The feasibility of a large scale lightweight structure which meets the requirements of ETS-6 is confirmed. ESA

N90-12505*# Douglas Aircraft Co., Inc., Long Beach, CA.
LFC: A MATURING CONCEPT
JOHN MORRIS *In* NASA, Langley Research Center, Research in Natural Laminar Flow and Laminar-Flow Control, Part 1 p 45-51 Dec. 1987
(DOUGLAS-PAPER-7878) Avail: NTIS HC A14/MF A02 CSCL 01/1

The existence of both turbulent and laminar flow was known for a long time, but it was not until the middle of the last century that the first systematic tests with fluids were conducted to establish the physical relationships and governing laws. The importance of turbulent and laminar airflows in aeronautics was recognized as early as the 1930's, but actual laminar flow control (LFC) investigations were not undertaken until the 1940's. This overview briefly touches on some of the historical development of LFC leading up to current activities. It then examines the technical problems being addressed and potential long-term LFC applications. Past and current Douglas activities are examined and the required future testing involving hybrid laminar flow control (HLFC) is discussed. Author

N90-13277*# National Aeronautics and Space Administration, Washington, DC.
ISSUES IN NASA PROGRAM AND PROJECT MANAGEMENT
FRANCIS T. HOBAN, ed. 1989 57 p
(NASA-SP-6101(02); NAS 1.21:6101(02)) Avail: NTIS HC A04/MF A01; SOD HC $15.00 as 033-000-010-64-8 CSCL 05/1

This new collection of papers on aerospace management issues contains a history of NASA program and project management, some lessons learned in the areas of management and budget from the Space Shuttle Program, an analysis of tools needed to keep large multilayer programs organized and on track, and an update of resources for NASA managers. A wide variety of opinions and techniques are presented. Author

N90-15299# Allied-Signal Aerospace Co., Kansas City, MO.
A STRATEGY FOR CONCURRENT PRODUCT AND PROCESS DESIGN OF AEROSPACE COMPONENTS
DAVID H. BREWER, A. SHERIFEL-GIZAWY, and JENG-YIH HWANG (Missouri Univ., Columbia.) Jul. 1989 22 p Presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, San Francisco, CA, 10-15 Dec. 1989
(Contract DE-AC04-76DP-00613)
(DE90-002926; KCP-613-4145; CONF-891208-24) Avail: NTIS HC A03/MF A01

A strategy is presented for concurrent product and process design of aerospace components that require high strength and light weight. A modular modeling technique that combines physical and computer models was developed to implement the concurrent product and process design approach. The strategy provides for timely evaluation of the product and process design changes on manufacturing performance as measured by cost effectiveness and productivity indices. Implementation of the strategy is illustrated by a case study from the aerospace industry. Three different product designs for manufacture were tested with eight different processing conditions. The selected processes included

conventional hot forging coupled with heavy machining, net-shape forming, and near-net-shape forming plus finish machining. The results indicated that the product and preform geometries, interface friction condition, and speed of deformation used design parameters that could be optimized to reduce costs and improve productivity. The study illustrates clearly the advantage of the strategy realized through reduction of lead time and development costs for product, process, and tooling. DOE

N90-21470# Solar Kinetics, Inc., Dallas, TX.
DESIGN AND DEMONSTRATION OF AN IMPROVED STRETCHED-MEMBRANE HELIOSTAT
Dec. 1989 101 p
(Contract DE-AC04-76DP-00789; SNL-33-1227)
(DE90-007904; SAND-89-7028) Avail: NTIS HC A06/MF A01

Improvements to a stretched-membrane heliostat have been designed and implemented under contract with Sandia National Laboratories. Specific improvements were made to the mirror module to improve performance and reduce costs. The performance of the heliostat in windy conditions was improved by adding a restraint to the rear membrane. An open-section ring was used to increase structural efficiency. The rear structure was redesigned to take advantage of common manufacturing techniques and lower cost materials. The control system was improved, and a means of achieving passive defocus was achieved. Finally, membrane preload was applied with nonconsumable tooling. An 8 percent reduction in mirror-module cost was realized. The improved design was successfully demonstrated with a 50 sq m prototype. This prototype had improved optical stability in fluctuating winds. Its slope error in calm winds was measured to be 1.3 mrad. DOE

N90-23338*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DESIGN TRENDS FOR ARMY/AIR FORCE AIRPLANES IN THE UNITED STATES
M. LEROY SPEARMAN Washington Jun. 1990 23 p
(NASA-TM-4179; L-16636; NAS 1.15:4179) Avail: NTIS HC A03/MF A01 CSCL 01/2

Some design trends in Army/Air Force airplane systems in the U.S. are traced from the pre-World War 2 era to the present time. Various types of aircraft systems are reviewed with a view toward noting design features that were used. Some observations concerning the design trends indicate that some may be driven by advanced technology and some by a need for new mission requirements. In addition, it is noted that some design trends are evolutionary and result in an extension of service life or utility of existing systems. In other cases the design trends may be more revolutionary with the intent of creating a system with a new capability. Some examples are included of designs that did not proceed to production for reasons that sometimes were technical and sometimes were not. Author

N90-23394*# Kansas Univ., Lawrence.
PRELIMINARY DESIGN OF A SUPERSONIC SHORT TAKEOFF AND VERTICAL LANDING (STOVL) FIGHTER AIRCRAFT
BRIAN COX, PAUL BORCHERS, CHARLIE GOMER, DEAN HENDERSON, TAVIS JACOBS, TODD LAWSON, ERIC PETERSON, TWEED ROSS, III, and LARRY BELLMARD 1990 422 p
(Contract NASW-4435)
(NASA-CR-186670; NAS 1.26:186670) Avail: NTIS HC A18/MF A03 CSCL 01/3

The preliminary design study of a supersonic Short Takeoff and Vertical Landing (STOVL) fighter is presented. A brief historical survey of powered lift vehicles was presented, followed by a technology assessment of the latest supersonic STOVL engine cycles under consideration by industry and government in the U.S. and UK. A survey of operational fighter/attack aircraft and the modern battlefield scenario were completed to develop, respectively, the performance requirements and mission profiles for the study. Three configurations were initially investigated with the following engine cycles: a hybrid fan vectored thrust cycle, a lift+lift/cruise cycle, and a mixed flow vectored thrust cycle. The lift+lift/cruise aircraft configuration was selected for detailed design work which consisted of: (1) a material selection and structural layout, including engine removal considerations, (2) an aircraft systems layout, (3) a weapons integration model showing the internal weapons bay mechanism, (4) inlet and nozzle integration, (5) an aircraft suckdown prediction, (6) an aircraft stability and control analysis, including a takeoff, hover, and transition control analysis, (7) a performance and mission capability study, and (8) a life cycle cost analysis. A supersonic fighter aircraft with STOVL capability with the lift+lift/cruise engine cycle seems a viable option for the next generation fighter. Author

N90-26049*# Illinois Univ., Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
NASA/USRA UNIVERSITY ADVANCED DESIGN PROGRAM AT THE UNIVERSITY OF ILLINOIS FOR THE 1989-1990 ACADEMIC YEAR Final Report
ANDREW KOEPKE and KENNETH SIVIER 29 Jun. 1990 32 p
(Contract NGT-21-002-800)
(NASA-CR-186829; NAS 1.26:186829) Avail: NTIS HC A03/MF A01 CSCL 22/2

The University's design project, the Unmanned Probe to Pluto, is reviewed. Forty-two students divided into seven groups, participated in the program. A presentation, prepared by three students and a graduate teaching assistant for the program's summer conference, summarized the project results. Author

N90-26050*# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
WINGED CARGO RETURN VEHICLE. VOLUME 1: CONCEPTUAL DESIGN NASA/USRA Advanced Design Project
2 Jun. 1990 270 p
(Contract NGT-21-002-800)
(NASA-CR-186823; NAS 1.26:186823) Avail: NTIS HC A12/MF A02 CSCL 22/2

The Advanced Design Project (ADP) allows an opportunity for students to work in conjunction with NASA and other aerospace companies on NASA Advanced Design Projects. The following volumes represent the design report: Volume 1 Conceptual Design; Volume 2 Wind Tunnel Tests; Volume 3 Structural Analysis; and Volume 4 Water Tunnel Tests. The project chosen by the University of Minnesota in conjunction with NASA Marshall Space Flight Center for this year is a Cargo Return Vehicle (CRV) to support the Space Station Freedom. The vehicle is the third generation of vehicles to be built by NASA, the first two being the Apollo program, and the Space Shuttle program. The CRV is to work in conjunction with a personnel launch system (PLS) to further subdivide and specialize the vehicles that NASA will operate in the year 2000. The cargo return vehicle will carry payload to and from the Space Station Freedom (SSF). Author

N90-26173# European Space Agency, Paris (France).
MATERIALS AND STRUCTURES FOR 2000 AND BEYOND: AN ATTEMPTED FORECAST BY THE DLR MATERIALS AND STRUCTURES DEPARTMENT
CARL-JOCHEN WINTER, MARTIN MAILAENDER, HEINRICH BERGMANN, HANS FOERSCHING, WOLFGANG BUNK, GERHARD GRUENINGER, and BERNDT FEUERBACHER May 1990 85 p Transl. into ENGLISH of Werkstoffe und Bauweisen fuer 2000 und Danach: Ein Versuch des DLR-Forschungsbereichs Werkstoffe und Bauweisen (Stuttgart, Fed. Republic of Germany, DFVLR), Feb. 1989 p 1-82 Original language document was announced as N89-25358
(ESA-TT-1154-REV; DFVLR-MITT-89-02-REV; ETN-90-97357)
Avail: NTIS HC A05/MF A01; original German version available from DFVLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne 90, Fed. Republic of Germany, 20.50 DM

The following forecasts were attempted on 21 to 22 Oct. 1988: to estimate what challenges the next 15 years might bring, and what would be the consequences for the direction and methodology of work, and for the organization of the institutes and of the

research department. Building on the basis of the current position and of the discussions, the views of the five institutes, namely those for aeroelasticity, advanced design and manufacturing technology, space simulation, structural mechanics and materials research, on the future, are presented. A summary drawn up, and derived action guidelines, are given. ESA

N90-26333*# Florida State Univ., Tallahassee. Dept. of Mechanical Engineering.
DESIGN OF A LUNAR TRANSPORTATION SYSTEM, VOLUME 2 Annual Report
Jun. 1990 191 p
(Contract NGT-21-002-800)
(NASA-CR-186833-VOL-2; NAS 1.26:186833-VOL-2) Avail: NTIS HC A09/MF A01 CSCL 13/9

The Spring 1990 Introduction to Design class was asked to conceptually design second generation lunar vehicles and equipment as a semester design project. A brief summary of four of the final projects, is presented. The designs were to facilitate the transportation of personnel and materials. The eight topics to choose from included flying vehicles, ground based vehicles, robotic arms, and life support systems. A lunar flying vehicle that uses clean propellants for propulsion is examined. A design that will not contribute to the considerable amount of caustic pollution already present in the sparse lunar atmosphere is addressed by way of ballistic flight techniques. A second generation redesign of the current Extra Vehicular Activity (EVA) suit to increase operating time, safety, and efficiency is also addressed. A separate life support system is also designed to be permanently attached to the lunar rover. The two systems would interact through the use of an umbilical cord connection. A ground based vehicle which will travel for greater distances than a 37.5 kilometer radius from a base on the lunar surface was designed. The vehicle is pressurized due to the fact that existing lunar rovers are limited by the EVA suits currently in use. A robotic arm for use at lunar bases or on roving vehicles on the lunar surface was designed. The arm was originally designed as a specimen gathering device, but it can be used for a wide range of tasks through the use of various attachments. Author

N90-26695# Rolls-Royce Ltd., Derby (England).
MAKING IT HAPPEN: PROJECT MANAGEMENT
GEOFF COLLIS 21 Jun. 1989 9 p Presented at the Lucas Seminar, Shirley, England, 21 Jun. 1989
(PNR90618; ETN-90-97134) Copyright Avail: NTIS HC A02/MF A01

Objectives and organization of program management specific to the Rolls-Royce company are outlined. The concept as a master program is described. Central program management interfaces, culture and style are depicted. The program culture is based on the functions managing and achieving their commitments on time. A small central team works with the customer and across all internal functions on a by exception basis to ensure that master program and engine delivery contracts are achieved on time. ESA

N90-28093# University Coll., London (England). Dept. of Mechanical Engineering.
IMPACT OF NDE-NDI METHODS ON AIRCRAFT DESIGN, MANUFACTURE, AND MAINTENANCE, FROM THE FUNDAMENTAL POINT OF VIEW
LEONARD J. BOND *In* AGARD, Impact of Emerging NDE-NDI Methods on Aircraft Design, Manufacture, and Maintenance 5 p May 1990
Copyright Avail: NTIS HC A11/MF A02; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Comments are presented on the impact of emerging NDE-NDI (nondestructive evaluation-nondestructive inspection) methods on aircraft design, manufacture, and maintenance. In particular, fundamental aspects of recent developments are considered, together with current trends and future prospects. The meeting presentations and discussion are reviewed in terms of the philosophy, physics, and technology involved. NDE-NDI is shown to require consideration as an integral part of the design, manufacturing, and operational condition monitoring process, for all parts of an aircraft. Various areas of NDE are highlighted and these include the importance of high performance quantitative NDE, the impact of new materials (e.g., composites), changes in manufacturing processes (e.g., diffusion bonding), and the importance of mathematical modeling for inspection optimization and also for the identification of NDE inspection techniques. Automation of the implementation of NDT and both the recording and the display of the resulting data is seen to be necessary in many cases to achieve the required sensitivity and level of reliability of inspection. Global inspection techniques are being sought which highlight suspect zones that can then be investigated using other techniques, to provide detailed local examinations. 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.

A90-10359
TASK PLANNING ISSUES FOR AN IN-ORBIT SERVICE MANIPULATOR
RICHARD E. SMITH (FMC Advanced Systems Center, Minneapolis, MN) IN: Space Station automation IV; Proceedings of the Meeting, Cambridge, MA, Nov. 7-9, 1988. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 71-78. Research supported by ESA. refs
Copyright

Goals and concerns surrounding the development of intelligent robotics software for the Service Manipulator System (SMS) being developed for the European Space Agency are discussed. The principal goal of the SMS task software is to automate the mundane details of operating the manipulator as much as possible. The astronaut or other operator would only need to identify a task and the SMS would automatically plan and execute the appropriate motions and grasping operations needed to carry it out. The technical problems underlying these activities have been studied closely by robotics researchers; the effectiveness of available techniques often depends on the complexity of the in-orbit service environment. Reliability and testability requirements as well as uncertainties introduced in component geometries by the stress of launch and deployment are also important. These problems are currently being explored through software experiments and the development of an intelligent robotic testbed. C.E.

A90-10368* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AUTONOMY THROUGH INTERACTION - THE JPL TELEROBOT INTERACTIVE PLANNING SYSTEM
STEPHEN F. PETERS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Space Station automation IV; Proceedings of the Meeting, Cambridge, MA, Nov. 7-9, 1988. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 173-178. refs
Copyright

The telerobot interactive planning system (TIPS) has been developed to provide automated task planning and reasoning for satellite servicing in NASA's Jet Propulsion Laboratory telerobot testbed. The strategy taken in this development is that an interface between a partially autonomous system and external sources of knowledge is a feature which enables application of technology not yet fully autonomous. Interactive features, both between the operator and TIPS and among the reasoning engines within TIPS, result in a system which has greater robustness than the reasoning engines alone could provide. C.E.

A90-10483#
RISC LIFTING OFF IN AVIONICS
JAMES M. H. WONG (Sanders Associates, Inc., Nashua, NH) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 45-51. refs
(AIAA PAPER 89-2967) Copyright

The philosophy behind the use of the reduced instruction set computer (RISC) in avionics is addressed, and the merits of RISC versus the complex instruction set computer (CISC) are examined. The different RISC architectures are examined, using as illustrations the designs taken from various vendors. Cost aspects and technology trends are briefly considered. C.D.

A90-12860
DEVELOPMENT AND APPLICATION OF A COMPUTER-BASED SYSTEM FOR CONCEPTUAL AIRCRAFT DESIGN
CORNELIS BIL (Delft, Technische Universiteit, Netherlands) Delft, Delft University Press, 1988, 263 p. refs
Copyright

The design concept and implementation of an aircraft CAD system are described. The history and advantages of computer engineering in the aircraft-design field are reviewed; the steps of the aircraft-design process are outlined; and particular attention is given to a three-component software package developed at Delft University of Technology. This package comprises ADAS (aircraft design and analysis system), ADAP (an executive program to control processing of user-supplied analysis programs), and MEDUSA (a general-purpose drafting and modeling system to draw and represent design configurations). Details of the design analysis, design evaluation, weight and aerodynamic analysis, and performance prediction are discussed, and an application of the package to a short-haul passenger aircraft is shown. T.K.

A90-14335
VIRTUAL PROTOTYPE - THE KEY TO QUALITY AND PRODUCTIVITY
JOHN BINDER (Prime Computer, Inc., Milford, MA) SAE, General Aviation Aircraft Meeting and Exposition, Wichita, KS, Apr. 11-13, 1989. 11 p. refs
(SAE PAPER 891024) Copyright

The virtual prototype is introduced as a concept to model current CAD/CAM/CAE or CIM directions. This concept is analyzed within the components of the virtual prototype - design engineering, engineering analysis and manufacturing engineering. The utilization of the virtual prototype model provides insight in improving productivity and product quality. Author

A90-14337
GENERATIVE DESIGN DRIVES MANUFACTURING
FRANK A. LOGAN SAE, General Aviation Aircraft Meeting and Exposition, Wichita, KS, Apr. 11-13, 1989. 16 p. refs
(SAE PAPER 891026) Copyright

This paper reviews the collaboration that is being forced on Engineering and Manufacturing as they move from the manual translation of Engineering drawings toward automatic decoding of Product Data Definitions (PDDs), a pre-requisite to integrated manufacture. Based on case studies and implementation experience gained over the last decade, it defines the step-by-step evolution of a generative design capability that will drive manufacturing logic. It reviews the changing relationship of Engineering to Manufacturing and Industrial Engineering and the challenge this presents to manufacturing management in its struggle to remain competitive in both domestic and international markets. Author

A90-18844*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
OVERVIEW OF SDCM - THE SPACECRAFT DESIGN AND COST MODEL
MELVIN J. FEREBEE, JEFFERY T. FARMER, GREGORY C. ANDERSEN (NASA, Langley Research Center, Hampton, VA), JEFFERY D. FLAMM (Georgia Institute of Technology, Atlanta), and DEBORAH M. BADI (Polytechnic University, New York) IN: AIAA/DARPA Meeting on Lightweight Satellite Systems, Monterey, CA, Aug. 4-6, 1987, Collection of Papers. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1988, p. 137-153. refs

The Spacecraft Design and Cost Model (SDCM) is a computer-aided design and analysis tool for synthesizing spacecraft configurations, integrating their subsystems, and generating information concerning on-orbit servicing and costs. SDCM uses a bottom-up method in which the cost and performance parameters for subsystem components are first calculated; the model then sums the contributions from individual components in order to obtain an estimate of sizes and costs for each candidate configuration within a selected spacecraft system. An optimum spacraft configuration can then be selected. O.C.

A90-26202*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AN EVALUATIVE MODEL OF SYSTEM PERFORMANCE IN MANNED TELEOPERATIONAL SYSTEMS
RICHARD F. HAINES (NASA, Ames Research Center; Research Institute for Advanced Computer Science, Moffett Field, CA) IN: International Symposium on Aviation Psychology, 5th, Columbus, OH, Apr. 17-20, 1989, Proceedings. Volume 1. Columbus, OH, Ohio State University, 1989, p. 215-220. refs

Manned teleoperational systems are used in aerospace operations in which humans must interact with machines remotely. Manual guidance of remotely piloted vehicles, controling a wind tunnel, carrying out a scientific procedure remotely are examples of teleoperations. A four input parameter throughput (Tp) model is presented which can be used to evaluate complex, manned, teleoperations-based systems and make critical comparisons among candidate control systems. The first two parameters of this model deal with nominal (A) and off-nominal (B) predicted events while the last two focus on measured events of two types, human performance (C) and system performance (D). Digital simulations showed that the expression A(1-B)/C+D) produced the greatest homogeneity of variance and distribution symmetry. Results from a recently completed manned life science telescience experiment will be used to further validate the model. Complex, interacting teleoperational systems may be systematically evaluated using this expression much like a computer benchmark is used. Author

A90-27492* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
PAYLOAD ACCOMMODATION AND DEVELOPMENT PLANNING TOOLS - A DESKTOP RESOURCE LEVELING MODEL (DRLM)
JOHN D. HILCHEY (NASA, Marshall Space Flight Center, Huntsville, AL), BOBBY LEDBETTER, and RICHARD C. WILLIAMS (Planning Research Corp., McLean, VA) SAE, Intersociety Conference on Environmental Systems, 19th, San Diego, CA, July 24-26, 1989. 26 p. refs
(SAE PAPER 891528) Copyright

The Desktop Resource Leveling Model (DRLM) has been developed as a tool to rapidly structure and manipulate accommodation, schedule, and funding profiles for any kind of experiments, payloads, facilities, and flight systems or other project hardware. The model creates detailed databases describing 'end item' parameters, such as mass, volume, power requirements or costs and schedules for payload, subsystem, or flight system elements. It automatically spreads costs by calendar quarters and sums costs or accommodation parameters by total project, payload, facility, payload launch, or program phase. Final results can be saved or printed out, automatically documenting all assumptions, inputs, and defaults. V.L.

A90-30768#
THE IMIS F-16 INTERACTIVE DIAGNOSTIC DEMONSTRATION
WILLIAM R. LINK (USAF, Human Resources Laboratory, Wright-Patterson AFB, OH) IN: NAECON 89; Proceedings of the

IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1359-1362.

The design and operation of an integrated maintenance information system (IMIS) are discussed. The IMIS allows a hand-held computer to be plugged into an aircraft, perform built-in-tests, read and analyze the fault data on the data-transfer unit, provide diagnostic advice, and present automated technical procedures. An interactive diagnostic demonstration on an F-16 is scheduled for Homestead AFB, Florida, in early 1989. I.E.

A90-31705#
IMPLEMENTING TQM AND JIT IN A MANUFACTURING ENVIRONMENT
DANIEL MCARTHUR (Coopers and Lybrand, Houston, TX) and DAVID CARR (Coopers and Lybrand, Washington, DC) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 175-180.
(AIAA PAPER 89-3221) Copyright

Total Quality Management (TQM) can and should be used in conjunction with other improvement programs. At a large manufacturing facility TQM was used as the quality component of a Just-in-Time (JIT) cycle time management system. TQM was also introduced to nonproduction staff and to vendors, resulting in efficiencies and subsequent reduction in the cost of quality. Use of a single quality method throughout an organization avoids confusion and increases the power of all other productivity and efficiency improvement programs. Author

A90-34439
COMPUTING PERFORMANCE AS A FUNCTION OF THE SPEED, QUANTITY, AND COST OF THE PROCESSORS
M. L. BARTON and G. R. WITHERS IN: Supercomputing '89; Proceedings of the Second Conference, Reno, NV, Nov. 13-17, 1989. Washington, DC/New York, IEEE Computer Society/ACM Press, 1989, p. 759-764. refs
Copyright

Much controversy exists over how best to balance processor speed against the number of processors used. The value of single processors, measured in floating-point performance per dollar, is relatively easy to assess, but the corresponding value of parallel systems is obscured by the fact that applications are not generally perfectly parallel, with some loss in efficiency occurring due to sequential bottlenecks and communication overhead. The authors present measured performance results from an actual application and then show the theoretical basis. They conclude that the utility of parallel speedup measurements is strictly to assess the degree of parallelism in a particular application or computer code. The authors emphasize the fact that the role of parallel processing in the world of floating-point computing is to reduce costs. Two CPUs are to be preferred to only only when they are, in combination, more cost effective. I.E.

N90-10598# Cornell Univ., Ithaca, NY.
USING COMPUTER DESIGN AND SIMULATION TO IMPROVE MANUFACTURING PRODUCTIVITY Quarterly Status Report
JOHN E. HOPCROFT Jun. 1989 3 p
(Contract N00014-88-K-0591; ARPA ORDER 6419)
(AD-A210338) Avail: NTIS HC A01/MF A01 CSCL 13/8

The most significant development is the commitment to develop a uniform platform for specifying geometric objects and operations. The necessity for such a framework became obvious as the number of people in the project grew, and the reseach needed justification, and to avoid duplication of code. The platform, written in CLOS (Common Lisp Object System), will facilitate the use of various parallel architectures, and will allow programming at higher levels of abstraction, interchangeability of packages written at different institutions, and better documentation. The platform will include a geometric modeler, an algebra package, a utilities package (to include basic data structures and finite sets), a graphics package, and a finite element mesh generation package. Initial efforts will be focused on the geometric modeler and the algebra package. The finite element mesh generation package is an application that is built on top of these two packages. The utilities package will contain the basic data structures and other tools necessary for programming, and will be developed as needed. GRA

N90-11462# Cornell Univ., Ithaca, NY.
USING COMPUTER DESIGN AND SIMULATION TO IMPROVE MANUFACTURING PRODUCTIVITY, REPORT PERIOD 1, 2 AND 3 Quarterly Status Report No. 1
JOHN E. HOPCROFT Mar. 1989 5 p
(Contract N00014-88-K-0591; ARPA ORDER 6419)
(AD-A210255) Avail: NTIS HC A01/MF A01 CSCL 12/5

In the area of simulation, a system's ability to produce models of contact and collision was developed. These models are essential to research on gripping and manipulation of physical objects by electronic prototypes. Other areas being explored include anthropoid walking (a model of a human torso and legs); parallel, distributed control of complex systems (containing many degrees of freedom); solid modeler robustness; triangulations for the finite element method; and the problem of swept volumes (the volume swept by a polyhedral object as it moves). K.C.D.

N90-11903# Allied-Signal Aerospace Co., Kansas City, MO.
COUPLING RULE-BASED AND OBJECT-ORIENTED PROGRAMMING FOR THE CLASSIFICATION OF MACHINED FEATURES
K. E. HUMMEL Aug. 1989 24 p Presented at the Computers in Engineering Conference, Anaheim, CA, 2 Aug. 1989
(Contract DE-AC04-76DP-00613)
(DE89-017705; KCP-613-4130; CONF-8908153-1) Avail: NTIS HC A03/MF A01

An expert system, XCUT, currently is being developed which will generate process plans for the production of machined parts given descriptions of manufacturing features. Generally speaking, these features form recurring geometric and technological patterns for which an expert process engineer has acquired years of manufacturing experience. Because they capture much of the terminology and methodology of the process engineer, manufacturing features have become a topic of considerable interest in the development of process planning systems. In the XCUT system manufacturing features generally correspond to volumes of material which are to be removed from an initial stock. A language has been developed for XCUT which generates an object-oriented description of a feature as well as methods for extracting relevant information from the feature volume representation. These methods may invoke either procedural code or production rules to deduce the appropriate information. In addition, the language generates a production rule whose conditions use these methods to identify an instance of the appropriate feature body. These rules are then used by the XCUT planning system to automatically classify and define feature instances from the initial solid geometric descriptions. This paper describes the XCUT feature language and illustrates its use for the automatic classification of features. DOE

N90-12029# Sheffield Univ. (England). Dept. of Control Engineering.
AN OPTIMUM TRAJECTORY PLANNER FOR ROBOT MANIPULATORS IN JOINT-SPACE AND UNDER PHYSICAL CONSTRAINTS
A. M. S. ZALZALA and A. S. MORRIS Nov. 1988 51 p
(RR-349; ETN-89-95136) Avail: NTIS HC A04/MF A01

A trajectory algorithm is developed, where the minimum-time history of the movement of the robot end-effector is defined. Planning is made in the joint-mode by combining a new approach to polynomial splines along with an exhaustive search technique to identify the best minimum-time trajectory. The uniqueness of this algorithm emerges from the unique combination of cubic and quadratic polynomials, and the ability to perform the search on local parts of each joint trajectory. A scaling process is applied to these local segments to ensure maximum performance. All physical and dynamical limitations inherent in the manipulator design, in

addition to any geometric constraints imposed on the path are taken into consideration. Simulation programs and results are reported for a Puma 600 robot manipulator. ESA

N90-12195# Allied-Signal Aerospace Co., Kansas City, MO.
REASONING ABOUT CHANGE AND EXCEPTIONS IN AUTOMATED PROCESS PLANNING
S. L. BROOKS and K. E. HUMMEL Aug. 1989 7 p Presented at the AAAI Spring Symposium for AI in Manufacturing, Stanford, CA, 28 Mar. 1989
(Contract DE-AC04-76DP-00613)
(DE89-017706; KCP-613-4099; CONF-8903164-1) Avail: NTIS HC A02/MF A01

Automated process planning is generally defined as the automatic planning of the manufacturing procedures for producing a part from a computer aided design (CAD) based product definition. The knowledge in this domain is largely heuristic and has been a good application of expert systems for developing an automated planner. We are currently developing an automated process planning system, XCUT, using the HERB rule-based expert system shell which employs hierarchical abstraction and object-oriented programming. Two areas where we have found the AI techniques implemented in HERB lacking for our domain are reasoning about change and exceptions. To reason about change is the frame problem, where after applying an action the planner must determine what facts are still true. Reasoning about exceptions is determining when general heuristics can be used or not. In AI terms reasoning about exceptions is default reasoning or in terms of ATMS is hypothetical reasoning. The focus of this paper will explore both the need and the ways we plan to augment the XCUT system for reasoning about change and exceptions. DOE

N90-13037# Advanced Decision Systems, Mountain View, CA.
TELEROBOTIC CONTROL FOR TEAMS OF SEMI-AUTONOMOUS AGENTS, PHASE 1 Final Report, 19 Jul. 1988 - 27 Feb. 1989
MARCEL SCHOPPERS and DANIEL SHAPIRO 20 Apr. 1989 37 p
(Contract DAAE07-88-C-R076)
(AD-A211648; ADS-TR-3213-01) Avail: NTIS HC A03/MF A01 CSCL 23/2

A Robotic Command Center is to be developed to allow a commander and two drivers (three people) to control four remote vehicles. The drivers will be attempting to control two vehicles each, a difficult task. Giving vehicles a measure of autonomy is one way to simplify that task. On the other hand, deployed vehicles must not be hampered by software with limited competence or reliability. The only solution available soon is a vehicle control interface that allows for the entire range of possibilities between autonomous behavior and continuous teleoperation. Ideas are fused from telerobotics and from the Reaction Planning subfield of Artificial Intelligence, to develop a technology that permits vehicles to react autonomously to expected circumstances, while also permitting the human operator to instruct vehicles about what to do and how to do it. This study will program some examples of behaviors for the vehicles to perform semi-autonomously, and those behaviors by running them in the Team Works I environment. An interface was designed and built that allows the vehicle driver to communicate with the intelligent software controlling any and all of the vehicles. A single person is capable of controlling four simulated vehicles at the same time. The competence of the vehicle is to be expanded to give the operator new ways of instructing the vehicles, and to push those capabilities toward deployment in the real world. GRA

N90-13434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
AUTOMATION OF ORBIT DETERMINATION FUNCTIONS FOR NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)-SUPPORTED SATELLITE MISSIONS
H. MARDIROSSIAN, K. HEUERMAN, A. BERI, M. V. SAMII (Computer Sciences Corp., Silver Spring, MD.), and C. E. DOLL *In its* Flight Mechanics/Estimation Theory Symposium, 1989 p 349-366 Oct. 1989
(Contract NAS5-31500)
Avail: NTIS HC A20/MF A03 CSCL 22/1

The Flight Dynamics Facility (FDF) at Goddard Space Flight Center (GSFC) provides spacecraft trajectory determination for a wide variety of National Aeronautics and Space Administration (NASA)-supported satellite missions, using the Tracking Data Relay Satellite System (TDRSS) and Ground Spaceflight and Tracking Data Network (GSTDN). To take advantage of computerized decision making processes that can be used in spacecraft navigation, the Orbit Determination Automation System (ODAS) was designed, developed, and implemented as a prototype system to automate orbit determination (OD) and orbit quality assurance (QA) functions performed by orbit operations. Based on a machine-resident generic schedule and predetermined mission-dependent QA criteria, ODAS autonomously activates an interface with the existing trajectory determination system using a batch least-squares differential correction algorithm to perform the basic OD functions. The computational parameters determined during the OD are processed to make computerized decisions regarding QA, and a controlled recovery process isactivated when the criteria are not satisfied. The complete cycle is autonomous and continuous. ODAS was extensively tested for performance under conditions resembling actual operational conditions and found to be effective and reliable for extended autonomous OD. Details of the system structure and function are discussed, and test results are presented. Author

N90-13682# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
THE ECONOMIC IMPACT OF AUTOMATION TECHNOLOGY
AYDAN KUTAY Jul. 1989 29 p
(AD-A213363; CMU-RI-TR-89-13) Avail: NTIS HC A03/MF A01 CSCL 05/3

There is a growing consensus among academicians, business leaders and government officials that the American competitive problem rests centrally on the slowing rate of investment to integrate new automation technology into manufacturing operations. Although the source of major innovations in automation technology is from United States universities and research centers, American firms have been too slow in adopting these technologies. One of the major factors underlying this problem is the lack of an economic analysis technique specifically aimed at estimating the benefits of automation technology. This paper offers an economic analysis technique based upon the premise of increased probability of capturing the market segments through economies of scope. The paper first demonstrates the inadequacy of current economic analysis techniques to assess the benefits of automation technology, then proposes a new methodology which can be integrated to an expert system to assess the economic impact of various types of automation technology. GRA

N90-13980# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE CELLULAR APPROACH: A NEW METHOD TO SPEED UP SIMULATED ANNEALING FOR MACRO PLACEMENT
PETER C. SCHUUR Oct. 1988 24 p
(MEMO-COSOR-88-29; ETN-90-95942) Avail: NTIS HC A03/MF A01

Considerable reduction in the computation time associated with the standard annealing algorithm for the macro placement problem is demonstrated. The most time consuming part of this algorithm is the evaluation of the difference in cost between the present and a candidate configuration. A cellular approach that greatly simplifies this calculation is introduced. If the number of rectangles is large compared to the average number of rectangle cells, then an annealing program based on the cellular approach is shown to perform significantly better. ESA

N90-15456# Army Construction Engineering Research Lab., Champaign, IL.
AUTOMATION AND ROBOTICS IN CONSTRUCTION: JAPANESE RESEARCH AND DEVELOPMENT Final Report

THOMAS M. GATTON and FRANK W. KEARNEY Oct. 1989 38 p
(Contract DA PROJ. 4A1-62731-AT-41)
(AD-A214170; CERL-TR-M-90/03) Avail: NTIS HC A03/MF A01 CSCL 12/9

The U.S. Army Corps of Engineers' construction program needs to reduce costs and improve quality. Productivity is decreasing in the U.S. construction industry, which is the opposite of the manufacturing segment, where productivity is improving. One reason for this is the use of advanced computer and machine technologies. The introduction of advanced construction technologies is particularly evident in Japan. This report presents information gathered during a study of Japanese construction industry. Much of the information was gained through interviews with company representatives. Particular focus was placed on identifying the methodology and organization that the Japanese use in their research and development for automated construction systems, including development of robotics. The information gathered shows that the Japanese are considerably ahead of other countries in their applied research towards construction automation. The organization and methodology that each Japanese company used toward this effort seem very similar. The differences between Japanese companies and their U.S. counterparts as they affect the introduction of new construction technologies are discussed. GRA

N90-15458# Environmental Research Inst. of Michigan, Ann Arbor.
PLANNING SYSTEMS FOR AUTONOMOUS LEGGED VEHICLES Final Technical Report, Jul. 1986 - Aug. 1987
May 1989 67 p Sponsored in part by Wisconsin Univ., Madison
(Contract DAAE07-86-C-R013; ARPA ORDER 5575)
(AD-A214242; ERIM-196000-7-F) Avail: NTIS HC A04/MF A01 CSCL 13/6

This report describes efforts to integrate the areas of mobility research and autonomous navigation in support of the Adaptive Suspension Vehicle program. Experimental research on the locomotion of Nubian goats is summarized. A decision model of terrain navigation based upon the experimental results is reported. The Computer Simulation of Animal based upon the experimental results is reported. The Computer Simulation of Animal Navigation, which implements the decision model, is presented. The need for increased flexibility in planning systems is discussed, and a sliding vehicle simulation which incorporates some of the desired features (the Blackboard Planning System) is described. A paper discussing the fundamental notions of search and exploration in autonomous navigation is included. GRA

N90-15467# Westinghouse Savannah River Co., Aiken, SC. Scientific Computations Div.
AN EXPERT SYSTEM FOR QUALITY ASSURANCE (A.K.A.) QA EXPRESS
MARY BETH MCGRATH 1989 15 p Presented at the Annual Westinghouse Computer Symposium, Pittsburgh, PA, 6-7 Nov. 1989
(Contract DE-AC09-89SR-18035)
(DE90-003887; WSRC-RP-89-524; CONF-891192-22) Avail: NTIS HC A03/MF A01

An Expert System to assist and advise engineers and programmers with quality assurance computational software applications was developed using Level 5 software. The expert system was created using production rule language (logic programming) which launches external Hypercard applications and prompts the user for simple answers in order to print out the appropriate QA forms for a specific quality assurance application. The Level 5 and Hypercard interfaces make for a friendly and reliable system which allows for simply maintenance and accessible modifications. DOE

N90-16395# Decision Science Consortium, Inc., Reston, VA.
USER INTERACTION WITH SELF-LEARNING SYSTEMS Final Report, Dec. 1988 - Jul. 1989
MARTIN A. TOLCOTT, PAUL E. LEHNER, and THERESA M. MULLIN Aug. 1989 81 p
(Contract F33615-88-C-0540)
(AD-A214280; AAMRL-TR-89-029) Avail: NTIS HC A05/MF A01 CSCL 12/9

This research investigated how users interact with an expert system in which underlying values change as a function of the situation or of the planning time horizon. The problem context was the prioritization of tactical air strike targets, and Air Force targeteers were the experimental subjects. Their task was to explain why the system made the recommendations it did. The expert system was simulated in storyboard form. It was found that users who were given a good conceptual model of the expert system, in the form of a brief summary of its step-by-step processes, performed better than those whose model of the system was relatively poor. Users whose displays were relatively user-oriented (geographic, top-down, and simplified) did not consistently differ in performance from users whose displays were relatively aid-oriented (data-intensive matrices). However, the aid-oriented displays seem to encourage users to make more frequent reference to three tables (available to all subjects) containing important information about the expert assessments on which the aid's algorithms operated. Users would typically generate their own solutions, using criteria and heuristics that often differed from those used by the aid, and question the expert system solution. GRA

N90-16699*# Lehigh Univ., Bethlehem, PA. Dept. of Industrial Engineering.
OFF-LINE ROBOT PROGRAMMING AND GRAPHICAL VERIFICATION OF PATH PLANNING
GREGORY L. TONKAY *In* University of Central Florida, NASA/ASEE Summer Faculty Fellowship Program p 303-323 Oct. 1989
Avail: NTIS HC A18/MF A03 CSCL 09/2

The objective of this project was to develop or specify an integrated environment for off-line programming, graphical path verification, and debugging for robotic systems. Two alternatives were compared. The first was the integration of the ASEA Off-line Programming package with ROBSIM, a robotic simulation program. The second alternative was the purchase of the commercial product IGRIP. The needs of the RADL (Robotics Applications Development Laboratory) were explored and the alternatives were evaluated based on these needs. As a result, IGRIP was proposed as the best solution to the problem. Author

N90-17440# Tennessee Univ., Knoxville. Dept. of Electrical and Computer Engineering.
A VISION SYSTEM FOR ROBOTIC INSPECTION AND MANIPULATION
MOHAN M. TRIVEDI, CHUXIN CHEN, and SURESH MARAPANE Mar. 1989 12 p Presented at the SPIE/SPSE Symposium on Electronic Imaging: Advanced Devices and Systems, Los Angeles, CA, 15-20 Jan. 1989
(Contract DE-FG02-86NE-37968)
(DE90-005412; DOE/NE-37968/11; CONF-890143-3) Avail: NTIS HC A03/MF A01

Advanced robotic systems should be able to perform a variety of tasks in complex, unstructured environments with increased level of autonomy. Robots provide the physical link between intelligence and action. Structurally, a robot can be considered as having three modules. These include: (1) mechanical assemblies, such as robot arm, end effectors, and mobility platforms, (2) sensors, for sensing the work environment of a robot, and (3) the Perception, Planning and Control unit, which is utilized for interpreting the sensory inputs and for planning and controlling the actions of the robot. Most of the robotic systems currently employed in the industry require a highly structured environment for the robot to operate. This requirement can be relaxed if the robot is endowed with an array of external sensors to sense its environment. The sensor-driven operation is critical for making robots more versatile and flexible to use. Advanced robotic systems which are capable of utilizing sensor modalities such as vision, range, force, and touch can be employed in a variety of application

domains. Of these, vision is recognized to be a very important sensory modality. It offers rich sensory data for accurate and detailed interpretation of the composition of a robot's work environment. Object recognition, determination of their locations in the 3-dimensional workspace, inspection of their status are all important tasks where vision derived information can be effectively utilized. DOE

N90-17514# Logistics Management Inst., Bethesda, MD.
AUTOMATED INFORMATION SYSTEMS PLAN Final Report
DENNIS J. OCONNOR Oct. 1989 42 p
(Contract MDA903-85-C-0139)
(AD-A214982; LMI-DP701R1) Avail: NTIS HC A03/MF A01 CSCL 15/5

This plan contains a systematic approach for allocating automated data processing resources to support the functional and management activities of the OASD(P and L) staff. The plan is presented in six sections, one corresponding to each major P and L objective: Connectivity and data exchange with external systems and organizations; User support and enhanced operations; Cooperative OSD efforts; Hardware/software selection and procurement; Development and conversion of applications; and System security and integrity. GRA

N90-18174# BBN Systems and Technologies Corp., Cambridge, MA.
AN INTELLIGENT TOOL FOR THE DESIGN OF PRESENTATIONS: A SYSTEM IDENTIFICATION STUDY Final Report, Mar. - Oct. 1988
BRUCE PAPAZIAN, R. B. ROBERTS, DONALD J. REDICK, DANIEL M. TANI, and RICHARD W. PEW Oct. 1989 186 p
(Contract F30602-87-D-0093)
(AD-A215770; BBN-6932; RADC-TR-89-197) Avail: NTIS HC A09/MF A01 CSCL 12/5

This report summarizes a study to identify the appropriate role of knowledge based technology in the design of user-computer interfaces and to assess the suitability of the published human factors design guidelines as a source of interface design knowledge. In addition to specific recommendations in these areas, the report incorporates a literature review of the following topics: the development of knowledge-based systems, rules-of-thumb concerning the types of problems to which knowledge-based systems have been successfully applied, the general nature of design problem solving, interface design methods, the use of human factors guidelines in interface design, and the state-of-the-art in interface design support tools. GRA

N90-20398# Sandia National Labs., Albuquerque, NM.
SWING-FREE MOVEMENT OF SIMPLY SUSPENDED OBJECTS EMPLOYING PARAMETER ESTIMATION
JILL C. WERNER, RUSH D. ROBINETT, and BEN J. PETTERSON 1989 7 p Presented at the IEEE Robotics and Automation Conference, Cincinnati, OH, 13-18 May 1990
(Contract DE-AC04-76DP-00789)
(DE90-002238; SAND-89-2511C; CONF-900559-3) Avail: NTIS HC A02/MF A01

An adaptive, swing-free trajetory planner for a gantry robot has been analytically developed and experimentally implemented on a commercial robot. A batch, nonlinear least square estimator (differential correction) is used to predict the initial conditions, mass, and frequency of the simply suspended object from a set of force sensor measurements. These parameters, in turn, are supplied to the swing-free trajectory planner to perform the maneuver. These algorithms have been implemented on a CIMCORP XR6100 gantry robot, and swing-free trajectories have been performed by the robot using the adaptive trajectory planner. DOE

N90-20709# Argonne National Lab., IL. Mathematics and Computer Science Div.
JOINT JAPANESE-AMERICAN WORKSHOP ON FUTURE TRENDS IN LOGIC PROGRAMMING
G. W. PIEPER, ed. Dec. 1989 284 p Workshop held in Argonne, IL, 11-13 Oct. 1989
(Contract W-31-109-ENG-38)
(DE90-008343; ANL-89/43; CONF-8910372) Avail: NTIS HC A13/MF A02

The objective of the workshop was to review developments and discuss the goals of logic programming. Four main areas were considered: multiprocessing, constraint logic programming, logical foundation of programming, and knowledge representation and database. Abstracts are presented for the sixteen presentations; Section 10 includes more detailed papers on each topic. Also summarized are the group discussions that were held informally during the three-day workshop, and the question-and-answer sessions that addressed pertinent issues, such as how logic programming addresses the needs of the software community. An important part of the workshop was the demonstration of the Japanese computer, the Multi-PSI. A summary of that demonstration is included; in Section 11 is a detailed Guide to the Japanese demonstrations. DOE

N90-20938*# Princeton Univ., NJ. Dept. of Mechanical and Aerospace Engineering.
AN EXPERT SYSTEM FOR WIND SHEAR AVOIDANCE
ROBERT F. STENGEL and D. ALEXANDER STRATTON *In* NASA, Langley Research Center, Joint University Program for Air Transportation Research, 1988-1989 p 183-188 Mar. 1990
(Contract NAG1-834)
Avail: NTIS HC A10/MF A02 CSCL 01/3

A study of intelligent guidance and control concepts for protecting against the adverse effects of wind shear during aircraft takeoffs and landings is being conducted, with current emphasis on developing an expert system for wind shear avoidance. Principal objectives are to develop methods for assessing the likelihood of wind shear encounter (based on real-time information in the cockpit), for deciding what flight path to pursue (e.g., takeoff abort, landing go-around, or normal climbout or glide slope), and for using the aircraft's full potential for combating wind shear. This study requires the definition of both deterministic and statistical techniques for fusing internal and external information , for making go/no-go decisions, and for generating commands to the manually controlled flight. The program has begun with the development of the WindShear Safety Advisor, an expert system for pilot aiding that is based on the FAA Windshear Training Aid; a two-volume manual that presents an overview , pilot guide, training program, and substantiating data provides guidelines for this initial development. The WindShear Safety Advisor expert system currently contains over 200 rules and is coded in the LISP programming language. Author

N90-22294*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE 1990 GODDARD CONFERENCE ON SPACE APPLICATIONS OF ARTIFICIAL INTELLIGENCE
JAMES L. RASH, ed. May 1990 342 p Conference held in Greenbelt, MD, 1-2 May 1990
(NASA-CP-3068; REPT-90B00078; NAS 1.55:3068) Avail: NTIS HC A15/MF A02 CSCL 09/2

The papers presented at the 1990 Goddard Conference on Space Applications of Artificial Intelligence are given. The purpose of this annual conference is to provide a forum in which current research and development directed at space applications of artificial intelligence can be presented and discussed. The proceedings fall into the following areas: Planning and Scheduling, Fault Monitoring/Diagnosis, Image Processing and Machine Vision, Robotics/Intelligent Control, Development methodologies, Information Management, and Knowledge Acquisition.

N90-22301*# Rockwell International Corp., Houston, TX. Space Operations.
CONSTRAINT-BASED EVALUATION OF SEQUENTIAL PROCEDURES
MATTHEW R. BARRY *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 95-103 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

Constraining the operation of an agent requires knowledge of the restrictions to physical and temporal capabilities of that agent, as well as an inherent understanding of the desires being processed by that agent. Usually a set of constraints are available that must be adhered to in order to foster safe operations. In the worst case, violation of a constraint may be cause to terminate operation. If the agent is carrying out a plan, then a method for predicting the agent's desires, and therefore possible constraint violations, is required. The conceptualization of constraint-based reasoning used herein assumes that a system knows how to select a constraint for application as well as how to apply that constraint once it is selected. The application of constraint-based reasoning for evaluating certain kinds of plans known as sequential procedures is discussed. By decomposing these plans, it is possible to apply context dependent constraints in production system fashion without incorporating knowledge of the original planning process. Author

N90-22316*# Martin Marietta Corp., Denver, CO. Information and Communications Systems.
KNOWLEDGE STRUCTURE REPRESENTATION AND AUTOMATED UPDATES IN INTELLIGENT INFORMATION MANAGEMENT SYSTEMS
STEPHEN COREY and RICHARD S. CARNAHAN, JR. *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 271-285 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

A continuing effort to apply rapid prototyping and Artificial Intelligence techniques to problems associated with projected Space Station-era information management systems is examined. In particular, timely updating of the various databases and knowledge structures within the proposed intelligent information management system (IIMS) is critical to support decision making processes. Because of the significantly large amounts of data entering the IIMS on a daily basis, information updates will need to be automatically performed with some systems requiring that data be incorporated and made available to users within a few hours. Meeting these demands depends first, on the design and implementation of information structures that are easily modified and expanded, and second, on the incorporation of intelligent automated update techniques that will allow meaningful information relationships to be established. Potential techniques are studied for developing such an automated update capability and IIMS update requirements are examined in light of results obtained from the IIMS prototyping effort. Author

N90-22319*# Quebec Univ., Montreal.
A KNOWLEDGE-BASED SYSTEM WITH LEARNING FOR COMPUTER COMMUNICATION NETWORK DESIGN
SAMUEL PIERRE, HAI HOC HOANG (Montreal Univ., Quebec), and EVELYNE TROPPER-HAUSEN *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 323-337 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

Computer communication network design is well-known as complex and hard. For that reason, the most effective methods used to solve it are heuristic. Weaknesses of these techniques are listed and a new approach based on artificial intelligence for solving this problem is presented. This approach is particularly recommended for large packet switched communication networks, in the sense that it permits a high degree of reliability and offers a very flexible environment dealing with many relevant design parameters such as link cost, link capacity, and message delay. Author

N90-22981# Nippon Electric Co. Ltd., Tokyo (Japan).
STRATEGY OF SUPERCOMPUTER DEVELOPMENT
MASATO SAITO *In* NLR, Supercomputer and Technology p 85-90 1988
Avail: NTIS HC A05/MF A01; 1 functional color page

The development of technology, based on a computers and communications philosophy is presented. Computers and communications research and development during the last nine years are outlined. The worldwide growing demand for supercomputers is explained. Several aspects of user demands have to be taken into account: speed, simulation results output, software development environment, network support, and computer operation environment. The basic philosophy for supercomputer development is to respond actively to the user requirements. ESA

N90-23125*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AUTOMATED ELECTRIC POWER MANAGEMENT AND CONTROL FOR SPACE STATION FREEDOM
JAMES L. DOLCE, PAMELA A. MELLOR, and JAMES A. KISH 1990 8 p Proposed for presentation at the 25th Intersociety Energy Conversion Engineering Conference, Reno, NV, 12-17 Aug. 1990; cosponsored by AIChE, SAE, ACS, AIAA, ASME, and IEEE (NASA-TM-103151; E-5505; NAS 1.15:103151) Avail: NTIS HC A02/MF A01 CSCL 09/2

A comprehensive automation design is being developed for Space Station Freedom's electric power system. It strives to increase station productivity by applying expert systems and conventional algorithms to automate power system operation. An integrated approach to the power system command and control problem is defined and used to direct technology development in: diagnosis, security monitoring and analysis, battery management, and cooperative problem-solving for resource allocation. The prototype automated power system is developed using simulations and test-beds. Author

N90-23981# Yale Univ., New Haven, CT. Dept. of Computer Science.
THE WAKEUP PROBLEM
MICHAEL J. FISCHER, SHLOMO MORAN, STEVEN RUDICH (Carnegie-Mellon Univ., Pittsburgh, PA.), and GADI TAUBENFELD Mar. 1990 14 p Presented at the 22nd Annual Symposium on Theory of Computing, Baltimore, MD, May 1990 Sponsored in part by Hebrew Technical Inst.; Technion - Israel Inst. of Tech., Haifa; and Israel Academy of Sciences and Humanities, Jerusalem
(Contract N00014-89-J-1980; NSF CCR-84-05478)
(AD-A220534; YALEU/DCS/TR-771) Avail: NTIS HC A03/MF A01 CSCL 12/5

We study a new problem, the wakeup problem that seems to be very fundamental in distributed computating. We present efficient solutions to the problem, and show how these solution can be used to solve the consensus problem, the leader election problem, and other related problems. The main question we try to answer is, how much memory is needed to solve the wakeup problem. We assume a model that captures important properties of real systems that have been largely ignored by previous work on cooperative problems. GRA

N90-24753# Institute for Defense Analyses, Alexandria, VA.
***THE ARMY/AIR FORCE RAMCAD (RELIABILITY AND MAINTAINABILITY COMPUTER-AIDED DESIGN) PROGRAM* Progress Report, period ending Sep. 1989**
G. WATTS HILL and FREDERICK R. RIDDELL Jan. 1990 69 p
(Contract MDA903-89-C-0003)
(AD-A220923; AD-E501211; IDA-D-736; IDA/HQ-90-35154)
Avail: NTIS HC A04/MF A01 CSCL 13/8

The document encompasses RAMCAD studies at IDA between FY82 and FY89. The goal of RAMCAD is to design reliability and maintainability into a product rather than accept these characteristics as by-products of a design driven largely by performance criteria. The report focuses on the three (TRW Federal Systems, Boeing Computer Services, and General Dynamics' Convair Division), recipients of Army/Air Force RAMCAD Program software development contracts with emphasis on the work done by General Dynamics Convair Division. Recommendations for further research are discussed under Potential Avenues for Improvement. This document was written at the request of the

U.S. Army Armament Research, Development, and Engineering Center (ARDEC) who are the co-sponsors of the General Dynamics RAMCAD Software Development Contract and have the responsibility for the technical direction of the contract. GRA

N90-24991*# Pittsburgh Univ., PA. Dept. of Information Science.
A COMPARISON OF TWO NEURAL NETWORK SCHEMES FOR NAVIGATION Final Report
PAUL W. MUNRO *In* Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 2 10 p Dec. 1989
Avail: NTIS HC A08/MF A01 CSCL 09/2

Neural networks have been applied to tasks in several areas of artificial intelligence, including vision, speech, and language. Relatively little work has been done in the area of problem solving. Two approaches to path-finding are presented, both using neural network techniques. Both techniques require a training period. Training under the back propagation (BPL) method was accomplished by presenting representations of (current position, goal position) pairs as input and appropriate actions as output. The Hebbian/interactive activation (HIA) method uses the Hebbian rule to associate points that are nearby. A path to a goal is found by activating a representation of the goal in the network and processing until the current position is activated above some threshold level. BPL, using back-propagation learning, failed to learn, except in a very trivial fashion, that is equivalent to table lookup techniques. HIA, performed much better, and required storage of fewer weights. In drawing a comparison, it is important to note that back propagation techniques depend critically upon the forms of representation used, and can be sensitive to parameters in the simulations; hence the BPL technique may yet yield strong results. Author

N90-25516*# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
MODELING STRENGTH DATA FOR CREW CHIEF
JOE W. MCDANIEL *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 143-148 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 09/2

The Air Force has developed CREW CHIEF, a computer-aided design (CAD) tool for simulating and evaluating aircraft maintenance to determine if the required activities are feasible. CREW CHIEF gives the designer the ability to simulate maintenance activities with respect to reach, accessibility, strength, hand tool operation, and materials handling. While developing the CREW CHIEF, extensive research was performed to describe workers strength capabilities for using hand tools and manual handling of objects. More than 100,000 strength measures were collected and modeled for CREW CHIEF. These measures involved both male and female subjects in the 12 maintenance postures included in CREW CHIEF. The data collection and modeling effort are described. Author

N90-25521*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
AUTONOMOUS POWER EXPERT FAULT DIAGNOSTIC SYSTEM FOR SPACE STATION FREEDOM ELECTRICAL POWER SYSTEM TESTBED
LONG V. TRUONG, JERRY L. WALTERS, MARY ELLEN ROTH, TODD M. QUINN, and WALTER M. KRAWCZONEK (Sverdrup Technology, Inc., Cleveland, OH.) *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 181-186 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 21/8

The goal of the Autonomous Power System (APS) program is to develop and apply intelligent problem solving and control to the Space Station Freedom Electrical Power System (SSF/EPS) testbed being developed and demonstrated at NASA Lewis Research Center. The objectives of the program are to establish artificial intelligence technology paths, to craft knowledge-based tools with advanced human-operator interfaces for power systems, and to interface and integrate knowledge-based systems with conventional controllers. The Autonomous Power EXpert (APEX) portion of the APS program will integrate a knowledge-based fault diagnostic system and a power resource planner-scheduler. Then APEX will interface on-line with the SSF/EPS testbed and its Power Management Controller (PMC). The key tasks include establishing knowledge bases for system diagnostics, fault detection and isolation analysis, on-line information accessing through PMC, enhanced data management, and multiple-level, object-oriented operator displays. The first prototype of the diagnostic expert system for fault detection and isolation has been developed. The knowledge bases and the rule-based model that were developed for the Power Distribution Control Unit subsystem of the SSF/EPS testbed are described. A corresponding troubleshooting technique is also described. Author

N90-25537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE FLIGHT TELEROBOTIC SERVICER (FTS) NASA'S FIRST OPERATIONAL ROBOTIC SYSTEM
J. ANDARY, K. HALTERMAN, D. HEWITT, and P. SABELHAUS *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 311-318 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 05/8

NASA has completed the preliminary definition phase of the Flight Telerobotic Servicer (FTS) and is now preparing to begin the detailed design and fabrication phase. The FTS will be designed and built by Martin Marietta Astronautics Group in Denver, CO, for the Goddard Space Flight Center, in support of the Space Station Freedom Program. The design concepts for the FTS are discussed, as well as operational scenarios for the assembly, maintenance, servicing and inspection tasks which are being considered for the FTS. The upcoming Development Test Flight (DTF-1) is the first of two shuttle test flights to test FTS operations in the environment of space and to demonstrate the FTS capabilities in performing tasks for Space Station Freedom. Operational planning for DTF-1 is discussed as well as development plans for the operational support of the FTS on the space station. Author

N90-25562*# Ford Aerospace and Communications Corp., Sunnyvale, CA.
OMS FDIR: INITIAL PROTOTYPING
ERIC W. TAYLOR and MATTHEW A. HANSON *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 545-549 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 05/1

The Space Station Freedom Program (SSFP) Operations Management System (OMS) will automate major management functions which coordinate the operations of onboard systems, elements and payloads. The objectives of OMS are to improve safety, reliability and productivity while reducing maintenance and operations cost. This will be accomplished by using advanced automation techniques to automate much of the activity currently performed by the flight crew and ground personnel. OMS requirements have been organized into five task groups: (1) Planning, Execution and Replanning; (2) Data Gathering, Preprocessing and Storage; (3) Testing and Training; (4) Resource Management; and (5) Caution and Warning and Fault Management for onboard subsystems. The scope of this prototyping effort falls within the Fault Management requirements group. The prototyping will be performed in two phases. Phase 1 is the development of an onboard communications network fault detection, isolation, and reconfiguration (FDIR) system. Phase 2 will incorporate global FDIR for onboard systems. Research into the applicability of expert systems, object-oriented programming, fuzzy sets, neural networks and other advanced techniques will be conducted. The goals and technical approach for this new SSFP research project are discussed here. Author

N90-25567*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
FUNCTIONAL DESCRIPTION OF A COMMAND AND CONTROL LANGUAGE TUTOR
DAVID R. ELKE, THOMAS L. SEAMSTER (Carlow Associates, Inc., Fairfax, VA.), and WALTER TRUSZKOWSKI *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 585-592 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 09/2

The status of an ongoing project to explore the application of Intelligent Tutoring System (ITS) technology to NASA command and control languages is described. The primary objective of the current phase of the project is to develop a user interface for an ITS to assist NASA control center personnel in learning Systems Test and Operations Language (STOL). Although this ITS will be developed for Gamma Ray Observatory operators, it will be designed with sufficient flexibility so that its modules may serve as an ITS for other control languages such as the User Interface Language (UIL). The focus of this phase is to develop at least one other form of STOL representation to complement the operational STOL interface. Such an alternative representation would be adaptively employed during the tutoring session to facilitate the learning process. This is a key feature of this ITS which distinguishes it from a simulator that is only capable of representing the operational environment. Author

N90-25606# University of Southern California, Marina del Rey. Information Sciences Inst.
A RESEARCH PROGRAM IN COMPUTER TECHNOLOGY Annual Technical Report, Jul. 1985 - Jun. 1986
Aug. 1989 150 p
(Contract MDA903-81-C-0335)
(AD-A221184; ISI/SR-87-178) Avail: NTIS HC A07/MF A01 CSCL 12/5

This report summarizes the research performed by USC/Information Sciences Institute from July 1, 1985, to June 30, 1986, for the Defense Advanced Research Projects Agency. The research is focused on the development of computer science and technology, which is expected to have a high DoD/military impact. Common LISP Framework; Explainable Expert Systems; Formalized System Development; Command and Control Communications; Advanced Very Large Scale Integration (VLSI); KITSERV - VLSI Kit Design Service; Empirically Valid Knowledge Representation; Text Generation for Strategic Computing; Commercial Mail; Computer Research Support; DARPA Headquarters Support Center; Exportable Workstation Systems; New Computing Environment; Strategic Computing - Development Systems; and Strategic C3 System Experiment Support are among the topics covered. GRA

N90-26012# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Guidance and Control Panel.
TECHNICAL EVALUATION REPORT ON THE GUIDANCE AND CONTROL PANEL 49TH SYMPOSIUM ON FAULT TOLERANT DESIGN CONCEPTS FOR HIGHLY INTEGRATED FLIGHT CRITICAL GUIDANCE AND CONTROL SYSTEMS
BERNARD CHAILLOT (Direction des Recherches, Etudes et Techniques, Paris, France) May 1990 21 p Symposium held in Toulouse, France, 10-13 Oct. 1989
(AGARD-AR-281; ISBN-92-835-0559-X) Copyright Avail: NTIS HC A03/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Twenty-three papers were presented at the Guidance and Control Panel 49th Symposium including the keynote address, covering the following headings; trends in integrated flight critical systems; advanced fault tolerant design concepts; system architectures, mechanization, and integration issues; high integrity software design methodologies and algorithms; and system validation, simulation, and flight test experience. Author

N90-26488*# Old Dominion Univ., Norfolk, VA. Dept. of Electrical and Computer Engineering.
INVESTIGATION OF AUTOMATED TASK LEARNING, DECOMPOSITION AND SCHEDULING Final Report, period ending 28 Feb. 1990
DAVID L. LIVINGSTON, GURSEL SERPEN, and CHANDRASHEKAR L. MASTI Jul. 1990 88 p
(Contract NAG1-962)
(NASA-CR-186791; NAS 1.26:186791) Avail: NTIS HC A05/MF A01 CSCL 05/9

The details and results of research conducted in the application of neural networks to task planning and decomposition are presented. Task planning and decomposition are operations that humans perform in a reasonably efficient manner. Without the use of good heuristics and usually much human interaction, automatic planners and decomposers generally do not perform well due to the intractable nature of the problems under consideration. The human-like performance of neural networks has shown promise for generating acceptable solutions to intractable problems such as planning and decomposition. This was the primary reasoning behind attempting the study. The basis for the work is the use of state machines to model tasks. State machine models provide a useful means for examining the structure of tasks since many formal techniques have been developed for their analysis and synthesis. It is the approach to integrate the strong algebraic foundations of state machines with the heretofore trial-and-error approach to neural network synthesis. Author

N90-26564*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Facility, Edwards, CA.
AN AUTOMATED CALIBRATION LABORATORY FOR FLIGHT RESEARCH INSTRUMENTATION: REQUIREMENTS AND A PROPOSED DESIGN APPROACH
NORA ONEILL-ROOD and RICHARD D. GLOVER May 1990 16 p Presented at the 36th ISA International Instrumentation Symposium, Denver, CO, 7-10 May 1990
(NASA-TM-101719; H-1594; NAS 1.15:101719) Avail: NTIS HC A03/MF A01 CSCL 09/2

NASA's Dryden Flight Research Facility (Ames-Dryden), operates a diverse fleet of research aircraft which are heavily instrumented to provide both real time data for in-flight monitoring and recorded data for postflight analysis. Ames-Dryden's existing automated calibration (AUTOCAL) laboratory is a computerized facility which tests aircraft sensors to certify accuracy for anticipated harsh flight environments. Recently, a major AUTOCAL lab upgrade was initiated; the goal of this modernization is to enhance productivity and improve configuration management for both software and test data. The new system will have multiple testing stations employing distributed processing linked by a local area network to a centralized database. The baseline requirements for the new AUTOCAL lab and the design approach being taken for its mechanization are described. Author

N90-26696# Rolls-Royce Ltd., Derby (England). Systems and Computing Research.
THE VALUE OF REAL EXPERIENCE
STEWART B. L. WILSON 10 Oct. 1989 19 p Presented at the Computers in Manufacturing Conference 1989, 10 Oct. 1989
(PNR90619; ETN-90-97136) Copyright Avail: NTIS HC A03/MF A01

An interpretation of Computer Integrated Management (CIM) is presented. Techniques of computer engineering and control systems engineering, embodying principles of topdown understanding and planning of the business processes and their shared data needs, and bottom up implementation of simplified procedures within the integration plan, were adopted. The need to understand the real overall business needs of the enterprise, and the understanding and integration of shared data as the vital technical element are proposed approaches to CIM. ESA

N90-27119# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
DEVELOPMENT OF AN INTEGRATED MOBILE ROBOT SYSTEM AT CARNEGIE-MELLON UNIVERSITY Final Report, 1 Jul. 1988 - 31 Dec. 1989
STEVE SHAFER and WILLIAM WHITTAKER May 1990 109 p
(Contract DACA76-86-C-0019; DARPA ORDER 5682)
(AD-A222494; CMU-RI-TR-90-12; ETL-0565) Avail: NTIS HC A06/MF A01 CSCL 12/9

This report describes progress in development of an integrated mobile robot system at the Robotics Institute at Carnegie Mellon University from July 1988 to December 1989. This research was sponsored by the Defense Advanced Research Projects Agency and monitored by the U.S. Army Engineer Topographic Laboratories under contract DACA76-86-C-0019. In this program, we pursued a broad agenda of research in the development of mobile robot vehicles, focused on the NAVLAB computer-controlled van. In the period covered by this report, July 1988 to December 1989, we addressed major software issues for mobile robot vehicles: Evolution of the CODGER Blackboard and the Driving Pipeline Architecture; and Kinematic Path Planning for Wheeled Vehicles. This software is central to the New Generation System (NGS) for robot vision and navigation, which combines many independent technologies to produce an integrated mobile robot system. GRA

N90-27270# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
KNOWLEDGE AND DISTRIBUTED COMPUTATION Ph.D. Thesis
MARK TUTTLE May 1990 242 p
(Contract N00014-83-K-0125)
(AD-A223100; MIT/LCS/TR-477) Avail: NTIS HC A11/MF A02 CSCL 12/7

Understanding systems of agents that interact in some way is fundamental to many areas of science, including philosophy, linguistics, economics, game theory, logic artificial intelligence, robotics, and distributed computing. As we try to understand these systems, we often find ourselves reasoning (at least informally) about the knowledge these agents have about other agents. Recent work has shown that these informal notions of knowledge can be made precise in the context of computer science. In this thesis, we provide convincing evidence that reasoning in terms of knowledge can lead to general, unifying results about distributed computation, and we extend the standard definitions of knowledge and apply them in new contexts such as cryptography. GRA

N90-27276*# Boeing Co., Huntsville, AL.
AGENT INDEPENDENT TASK PLANNING
WILLIAM S. DAVIS *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 1-10 May 1990
Avail: NTIS HC A25/MF A04 CSCL 05/8

Agent-Independent Planning is a technique that allows the construction of activity plans without regard to the agent that will perform them. Once generated, a plan is then validated and translated into instructions for a particular agent, whether a robot, crewmember, or software-based control system. Because Space Station Freedom (SSF) is planned for orbital operations for approximately thirty years, it will almost certainly experience numerous enhancements and upgrades, including upgrades in robotic manipulators. Agent-Independent Planning provides the capability to construct plans for SSF operations, independent of specific robotic systems, by combining techniques of object oriented modeling, nonlinear planning and temporal logic. Since a plan is validated using the physical and functional models of a particular agent, new robotic systems can be developed and integrated with existing operations in a robust manner. This technique also provides the capability to generate plans for crewmembers with varying skill levels, and later apply these same plans to more sophisticated robotic manipulators made available by evolutions in technology. Author

N90-27291*# Alabama Univ., Huntsville.
ESTABLISHING A COMMUNICATIONS-INTENSIVE NETWORK TO RESOLVE ARTIFICIAL INTELLIGENCE ISSUES WITHIN NASA'S SPACE STATION FREEDOM RESEARCH CENTERS COMMUNITY
E. DAVIS HOWARD, III *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 139-145 May 1990
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09/2

MITRE Corporation's, A Review of Space Station Freedom Program Capabilities for the Development and Application of Advanced Automation, cites as a critical issue the following situation, extant at the NASA facilities visited in the course of preparing the review: The major issues noted with regard to design and research facilities deal with cooperative problem solving, technology transfer, and communication between these facilities. While the authors were visiting lab and test beds to collect information, personnel at many of these facilities were interested in any information they could collect on activities at other facilities. A formal means of gathering this information could not be identified by these personnel. While communication between some facilities was taking place or was planned, for technology transfer or coordination of schedules (e.g., for SADP demonstrations), poor communication between these facilities could lead to a lack of technical standards, duplication of effort, poorly defined interfaces, scheduling problems, and increased cost. Formal mechanisms by which effective communication and cooperative problem solving can take place, and information can be disseminated, must be defined. A solution is proposed for the communications aspects of the issues addressed above; and offered at the same time a solution which can prove effective in dealing with some of the problems being encountered with expertise being lost via retirement or defection to the private sector. The proffered recommendations are recognizably cost-effective and tap the rising sector of expert knowledge being produced by the American academic community. Author

N90-27300*# McDonnell-Douglas Space Systems Co., Houston, TX.
SPACE STATION ADVANCED AUTOMATION
DONALD WOODS *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 221-230 May 1990
(Contract NAS9-18200)
Avail: NTIS HC A25/MF A04 CSCL 22/2

In the development of a safe, productive and maintainable space station, Automation and Robotics (A and R) has been identified as an enabling technology which will allow efficient operation at a reasonable cost. The Space Station Freedom's (SSF) systems are very complex, and interdependent. The usage of Advanced Automation (AA) will help restructure, and integrate system status so that station and ground personnel can operate more efficiently. To use AA technology for the augmentation of system management functions requires a development model which consists of well defined phases of: evaluation, development, integration, and maintenance. The evaluation phase will consider system management functions against traditional solutions, implementation techniques and requirements; the end result of this phase should be a well developed concept along with a feasibility analysis. In the development phase the AA system will be developed in accordance with a traditional Life Cycle Model (LCM) modified for Knowledge Based System (KBS) applications. A way by which both knowledge bases and reasoning techniques can be reused to control costs is explained. During the integration phase the KBS software must be integrated with conventional software, and verified and validated. The Verification and Validation (V and V) techniques applicable to these KBS are based on the ideas of consistency, minimal competency, and graph theory. The maintenance phase will be aided by having well designed and documented KBS software. Author

N90-27301*# Symbolics, Inc., Cambridge, MA.
A DEVELOPMENT FRAMEWORK FOR ARTIFICIAL INTELLIGENCE BASED DISTRIBUTED OPERATIONS SUPPORT SYSTEMS
RICHARD M. ADLER and BRUCE H. COTTMAN *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 231-240 May 1990
(Contract NAS10-11606; DAAB10-87-C-0053)
Avail: NTIS HC A25/MF A04 CSCL 09/2

Advanced automation is required to reduce costly human operations support requirements for complex space-based and ground control systems. Existing knowledge based technologies have been used successfully to automate individual operations tasks. Considerably less progress has been made in integrating and coordinating multiple operations applications for unified intelligent support systems. To fill this gap, SOCIAL, a tool set for developing Distributed Artificial Intelligence (DAI) systems is being constructed. SOCIAL consists of three primary language based components defining: models of interprocess communication across heterogeneous platforms; models for interprocess coordination, concurrency control, and fault management; and for accessing heterogeneous information resources. DAI applications subsystems, either new or existing, will access these distributed services non-intrusively, via high-level message-based protocols. SOCIAL will reduce the complexity of distributed communications, control, and integration, enabling developers to concentrate on the design and functionality of the target DAI system itself.
Author

N90-27328*# Missouri Univ., Rolla. Graduate Engineering Center.
USING DECISION-TREE CLASSIFIER SYSTEMS TO EXTRACT KNOWLEDGE FROM DATABASES
D. C. ST.CLAIR, C. L. SABHARWAL, KEITH HACKE, and W. E. BOND (McDonnell-Douglas Research Labs., Saint Louis, MO.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 507-516 May 1990 Sponsored in part by McDonnell-Douglas Independent Research and Development Program
Avail: NTIS HC A25/MF A04 CSCL 09/2

One difficulty in applying artificial intelligence techniques to the solution of real world problems is that the development and maintenance of many AI systems, such as those used in diagnostics, require large amounts of human resources. At the same time, databases frequently exist which contain information about the process(es) of interest. Recently, efforts to reduce development and maintenance costs of AI systems have focused on using machine learning techniques to extract knowledge from existing databases. Research is described in the area of knowledge extraction using a class of machine learning techniques called *decision-tree classifier systems. Results of this research suggest* ways of performing knowledge extraction which may be applied in numerous situations. In addition, a measurement called the concept strength metric (CSM) is described which can be used to determine how well the resulting decision tree can differentiate between the concepts it has learned. The CSM can be used to determine whether or not additional knowledge needs to be extracted from the database. An experiment involving real world data is presented to illustrate the concepts described.
Author

N90-27344# Argonne National Lab., IL. Computing and Telecommunications Div.
A PLAN FOR SCIENTIFIC VISUALIZATION AT ANL
TORRI A. BENNINGTON, ed. and JOHN ROWLAN Mar. 1990 27 p
(Contract W-31-109-ENG-38)
(DE90-013565; ANL/TM-476) Avail: NTIS HC A03/MF A01

This report discusses the uses of scientific visualization through computer simulation and graphics. Also covered are hardware and software tools available to users.
DOE

N90-28055# National Academy of Sciences - National Research Council, Washington, DC. Air Force Studies Board.
ADVANCED ROBOTICS FOR AIR FORCE OPERATIONS
1989 158 p
(Contract F49620-87-C-0122)
(PB90-157009) Avail: NTIS HC A08/MF A01 CSCL 13/9

While robots are gaining widespread use in industry, application of robotic technology has not progressed as quickly within the military. However, projected manpower shortages, shorter weapon response times, and the severe environmental conditions anticipated in combat make the use of robots more attractive. To help the Air Force assess the potential for operational use of robots, the committee will examine and recommend how to best direct research, development, and acquisition resources to make the most effective use of this technology. The component technologies, infrastructure, data base systems, and management structure required to support the next generation of maintenance, repair, supply, and distribution systems in the field and at the depots as they pertain to robotics are reviewed. The committee will evaluate current and potential uses of advanced robotic systems to support Air Force systems; recommend the most effective applications of advanced robotics; identify high payoff areas for research and development, particularly at the component level; and assess the potential effects robots will have on acquisition, logistics, and manpower considerations, such as education and training.
Author

N90-28062*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
REACTION-COMPENSATION TECHNOLOGY FOR MICROGRAVITY LABORATORY ROBOTS
DOUGLAS A. ROHN, CHARLES LAWRENCE, and JEFFREY H. MILLER (Sverdrup Technology, Inc., Brook Park, OH.) 1990 5 p Proposed for presentation at the i-SAIRAS 1990 International Symposium on Artificial Intelligence, Robotics and Automation in Space, Kobe, Japan, 18-20 Nov. 1990
(NASA-TM-103271; E-5713; NAS 1.15:103271) Avail: NTIS HC A01/MF A01 CSCL 13/9

Robots operating in the microgravity environment of an orbiting laboratory should be capable of manipulating payloads such that the motion of the robot does not disturb adjacent experiments. The current results of a NASA Lewis Research Center technology program to develop smooth, reaction-compensated manipulation based on both mechanism technology and trajectory planning strategies are present. Experimental validation of methods to reduce robot base reactions through the use of redundant degrees of freedom is discussed. Merits of smooth operation roller-driven robot joints for microgravity manipulators are also reviewed.
Author

N90-28656*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ROBOTIC AND AUTOMATIC WELDING DEVELOPMENT AT THE MARSHALL SPACE FLIGHT CENTER
C. S. JONES, M. E. JACKSON, and L. A. FLANIGAN (Rockwell International Corp., Canoga Park, CA.) *In its* Advanced Earth-to-Orbit Propulsion Technology 1988, Volume 1 p 742-750 Sep. 1988
Avail: NTIS HC A99/MF E06 CSCL 13/8

Welding automation is the key to two major development programs to improve quality and reduce the cost of manufacturing space hardware currently undertaken by the Materials and Processes Laboratory of the NASA Marshall Space Flight Center. Variable polarity plasma arc welding has demonstrated its effectiveness on class 1 aluminum welding in external tank production. More than three miles of welds were completed without an internal defect. Much of this success can be credited to automation developments which stabilize the process. Robotic manipulation technology is under development for automation of welds on the Space Shuttle's main engines utilizing pathfinder systems in development of tooling and sensors for the production applications. The overall approach to welding automation development undertaken is outlined. Advanced sensors and control

systems methodologies are described that combine to make aerospace quality welds with a minimum of dependence on operator skill. Author

N90-29036*# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
PLAN RECOGNITION FOR SPACE TELEROBOTICS
BRADLEY A. GOODMAN and DIANE J. LITMAN (Bell Telephone Labs., Inc., Murray Hill, NJ.) *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 1 p 395-404 31 Jan. 1989
(Contract NSF IRI-87-01874)
Avail: NTIS HC A21/MF A03 CSCL 05/8

Current research on space telerobots has largely focused on two problem areas: executing remotely controlled actions (the tele part of telerobotics) or planning to execute them (the robot part). This work has largely ignored one of the key aspects of telerobots: the interaction between the machine and its operator. For this interaction to be felicitous, the machine must successfully understand what the operator is trying to accomplish with particular remote-controlled actions. Only with the understanding of the operator's purpose for performing these actions can the robot intelligently assist the operator, perhaps by warning of possible errors or taking over part of the task. There is a need for such an understanding in the telerobotics domain and an intelligent interface being developed in the chemical process design domain addresses the same issues. Author

N90-29041*# George Mason Univ., Fairfax, VA. School of Information Technology and Engineering.
GRASP PLANNING UNDER UNCERTAINTY
A. M. ERKMEN and H. E. STEPHANOU *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 1 p 447-456 31 Jan. 1989
Avail: NTIS HC A21/MF A03 CSCL 09/2

The planning of dexterous grasps for multifingered robot hands operating in uncertain environments is covered. A sensor-based approach to the planning of a reach path prior to grasping is first described. An on-line, joint space finger path planning algorithm for the enclose phase of grasping was then developed. The algorithm minimizes the impact momentum of the hand. It uses a Preshape Jacobian matrix to map task-level hand preshape requirements into kinematic constraints. A master slave scheme avoids inter-finger collisions and reduces the dimensionality of the planning problem. Author

N90-29076*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
A SURVEY OF PLANNING AND SCHEDULING RESEARCH AT THE NASA AMES RESEARCH CENTER
MONTE ZWEBEN *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 2 p 353-358 31 Jan. 1989 Previously announced as N89-19820
Avail: NTIS HC A17/MF A03 CSCL 05/1

NASA Ames Research Center has a diverse program in planning and scheduling. Some research projects as well as some applications are highlighted. Topics addressed include machine learning techniques, action representations and constraint-based scheduling systems. The applications discussed are planetary rovers, Hubble Space Telescope scheduling, and Pioneer Venus orbit scheduling. Author

N90-29077*# Teleos Research, Palo Alto, CA.
INTEGRATING PLANNING AND REACTIVE CONTROL
STANLEY J. ROSENSCHEIN and LESLIE PACK KAELBLING *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 2 p 359-366 31 Jan. 1989
Sponsored in part by System Development Foundation
(Contract NCC2-494; SU PROJ. 6359)
Avail: NTIS HC A17/MF A03 CSCL 05/1

Artificial intelligence research on planning is concerned with designing control systems that choose actions by manipulating explicit descriptions of the world state, the goal to be achieved, and the effects of elementary operations available to the system. Because planning shifts much of the burden of reasoning to the machine, it holds great appeal as a high-level programming method. Experience shows, however, that it cannot be used indiscriminately because even moderately rich languages for describing goals, states, and the elementary operators lead to computational inefficiencies that render the approach unsuitable for realistic applications. This inadequacy has spawned a recent wave of research on reactive control or situated activity in which control systems are modeled as reacting directly to the current situation rather than as reasoning about the future effects of alternative action sequences. While this research has confronted the issue of run-time tractability head on, in many cases it has done so by sacrificing the advantages of declarative planning techniques. Ways in which the two approaches can be unified are discussed. The authors begin by modeling reactive control systems as state machines that map a stream of sensory inputs to a stream of control outputs. These machines can be decomposed into two continuously active subsystems: the planner and the execution module. The planner computes a plan, which can be seen as a set of bits that control the behavior of the execution module. An important element of this work is the formulation of a precise semantic interpretation for the inputs and outputs of the planning system. They show that the distinction between planned and reactive behavior is largely in the eye of the beholder: systems that seem to compute explicit plans can be redescribed in situation-action terms and vice versa. They also discuss practical programming techniques that allow the advantages of declarative programming and guaranteed reactive response to be achieved simultaneously. Author

N90-29079*# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Computer Science.
INTEGRATING PLANNING, EXECUTION, AND LEARNING
DANIEL R. KUOKKA *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 2 p 377-386 31 Jan. 1989 Sponsored in part by Hughes Aircraft Co.
(Contract NCC2-463; N00014-79-C-0661; N00014-82-C-50767; F33615-84-K-1520)
Avail: NTIS HC A17/MF A03 CSCL 05/1

To achieve the goal of building an autonomous agent, the usually disjoint capabilities of planning, execution, and learning must be used together. An architecture, called MAX, within which cognitive capabilities can be purposefully and intelligently integrated is described. The architecture supports the codification of capabilities as explicit knowledge that can be reasoned about. In addition, specific problem solving, learning, and integration knowledge is developed. Author

N90-29097# Los Alamos National Lab., NM. Safeguards Systems Group.
GRAPH STRUCTURE MODEL
JARED S. DREICER 1990 7 p Presented at the Institute of Nuclear Materials Management Conference, Los Angeles, CA, 15-18 Jul. 1990
(Contract W-7405-ENG-36)
(DE90-014930; LA-UR-90-2342; CONF-9007106-43) Avail: NTIS HC A02/MF A01

The Graph Structure (GRPHSTRUC) model is a generic software-system tool that was developed to allow a system analyst to conduct studies and design analysis concerning control flow in graph structures. The GRPHSTRUC model is a knowledge-based expert system using icons and object-oriented methodologies. This software tool was implemented using the expert system shell called Knowledge Engineering Environment (KEE), Common Lisp methods, and KEE Pictures for graphical display. The GRPHSTRUC model provides a user interface that is designed to allow the user to rapidly and efficiently represent graph components, interconnections, and interrelationships. GRPHSTRUC was generically designed and developed to use classical graph theory and to allow the display of vertices and links of a graph structure. In particular, the model was developed to assist a computer security

analyst in assessing the security of and to conduct security studies and design analysis concerning computer networks. The model is applicable to other disciplines that can be portrayed by graph structures, in particular safeguards. DOE

N90-29853*# Naval Postgraduate School, Monterey, CA. Dept. of Computer Science.
VEHICLE PATH-PLANNING IN THREE DIMENSIONS USING OPTICS ANALOGS FOR OPTIMIZING VISIBILITY AND ENERGY COST
NEIL C. ROWE and DAVID H. LEWIS *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 4 p 217-226 31 Jan. 1989
Avail: NTIS HC A19/MF A03 CSCL 05/8

Path planning is an important issue for space robotics. Finding safe and energy-efficient paths in the presence of obstacles and other constraints can be complex although important. High-level (large-scale) path planning for robotic vehicles was investigated in three-dimensional space with obstacles, accounting for: (1) energy costs proportional to path length; (2) turn costs where paths change trajectory abruptly; and (3) safety costs for the danger associated with traversing a particular path due to visibility or invisibility from a fixed set of observers. Paths optimal with respect to these cost factors are found. Autonomous or semi-autonomous vehicles were considered operating either in a space environment around satellites and space platforms, or aircraft, spacecraft, or smart missiles operating just above lunar and planetary surfaces. One class of applications concerns minimizing detection, as for example determining the best way to make complex modifications to a satellite without being observed by hostile sensors; another example is verifying there are no paths (holes) through a space defense system. Another class of applications concerns maximizing detection, as finding a good trajectory between mountain ranges of a planet while staying reasonably close to the surface, or finding paths for a flight between two locations that maximize the average number of triangulation points available at any time along the path. Author

N90-29868*# Honeywell, Inc., Minneapolis, MN.
DETERMINING ROBOT ACTIONS FOR TASKS REQUIRING SENSOR INTERACTION
JOHN BUDENSKE and MARIA GINI (Minnesota Univ., Minneapolis.) *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 4 p 373-382 31 Jan. 1989
(Contract NSF DMC-85-18735)
Avail: NTIS HC A19/MF A03 CSCL 05/8

The performance of non-trivial tasks by a mobile robot has been a long term objective of robotic research. One of the major stumbling blocks to this goal is the conversion of the high-level planning goals and commands into the actuator and sensor processing controls. In order for a mobile robot to accomplish a non-trivial task, the task must be described in terms of primitive actions of the robot's actuators. Most non-trivial tasks require the robot to interact with its environment; thus necessitating coordination of sensor processing and actuator control to accomplish the task. The main contention is that the transformation from the high level description of the task to the primitive actions should be performed primarily at execution time, when knowledge about the environment can be obtained through sensors. It is proposed to produce the detailed plan of primitive actions by using a collection of low-level planning components that contain domain specific knowledge and knowledge about the available sensors, actuators, and sensor/actuator processing. This collection will perform signal and control processing as well as serve as a control interface between an actual mobile robot and a high-level planning system. Previous research has shown the usefulness of high-level planning systems to plan the coordination of activities such to achieve a goal, but none have been fully applied to actual mobile robots due to the complexity of interacting with sensors and actuators. This control interface is currently being implemented on a LABMATE mobile robot connected to a SUN workstation and will be developed such to enable the LABMATE to perform non-trivial, sensor-intensive tasks as specified by a planning system. Author

N90-29905*# Institut National de Recherche d'Informatique et d'Automatique, Rennes (France).
TEMPORAL LOGICS MEET TELEROBOTICS
ERIC RUTTEN and LIONEL MARCE *In* JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 5 p 301-310 31 Jan. 1989
Avail: NTIS HC A19/MF A03 CSCL 05/8

The specificity of telerobotics being the presence of a human operator, decision assistance tools are necessary for the operator, especially in hostile environments. In order to reduce execution hazards due to a degraded ability for quick and efficient recovery of unexpected dangerous situations, it is of importance to have the opportunity, amongst others, to simulate the possible consequences of a plan before its actual execution, in order to detect these problematic situations. Hence the idea of providing the operator with a simulator enabling him to verify the temporal and logical coherence of his plans. Therefore, the power of logical formalisms is used for representation and deduction purposes. Starting from the class of situations that are represented, a STRIPS (the STanford Research Institute Problem Solver)-like formalism and its underlying logic are adapted to the simulation of plans of actions in time. The choice of a temporal logic enables to build a world representation, on which the effects of plans, grouping actions into control structures, will be transcribed by the simulation, resulting in a verdict and information about the plan's coherence. Author

N90-29927# Yale Univ., New Haven, CT. Dept. of Computer Science.
STRATEGIES FOR TUTORING MULTIPLE BUGS Final Report, 15 Aug. 1985 - 15 Nov. 1988
DAVID CARL LITTMAN 18 May 1990 274 p
(Contract N00014-82-K-0714)
(AD-A223921) Avail: NTIS HC A12/MF A02 CSCL 05/8

A problem was investigated in the field of intelligent Tutoring Systems that has not been effectively addressed before. That problem is how to help students who need help with more than one error, or bug. For example, novice students who write computer programs rarely make a single bug. Rather, they come to their tutors with five, six, seven, or more bugs and they need help with all the bugs. Empirical observations of experienced human tutors show that they do not just jump in and start tutoring the first bug in the program. Instead, tutors formulate a tutorial plan for helping the student. Creating the tutorial plan requires the tutor to answer five tutorial planning decisions about each bug. The problem of multiple bugs was studied. Starting from empirical observations of experienced human tutors, a model was developed of the knowledge required to answer the five tutorial planning questions. The model is implemented as a computer program, TP, that can develop tutorial plans for multiple bugs that are as good as the tutorial plans generated by experienced human tutors. GRA

N90-29954# APTEK, Inc., Colorado Springs, CO.
AN INTERACTIVE OPTIMIZATION BASED, COMPUTER GRAPHICS SOFTWARE PACKAGE. PHASE 2: USERS MANUAL Final Technical Report, Oct. 1987 - Oct. 1989
MARK D. LANDON and JERRY L. UDY 25 Oct. 1989 150 p
(Contract F08635-88-C-0063)
(AD-A223854; MSD-TR-90-10) Avail: NTIS HC A07/MF A01
CSCL 12/5

This report documents the work that was completed to develop the software tools and geometric data base that will help Air Force Design Engineers take aircraft and missiles from concept to test specimen. Navgraph is a geometric modeling program that allows the user to define complex, convex and non-convex geometric solid objects for use in the various modules developed. A summary of the capabilities are given here: NAVGRAPH can be used to create geometric models of aircraft, weapons, submunitions, pylons, racks, etc. to whatever detail is necessary

for the problem being studied. NAVGRAPH can be used to recall any geometric model(s) from the existing data base (via DBMERGE) to define the desired complex model to whatever detail is necessary. The existing data base consists of the models developed under this contract, mainly, an F-15 aircraft, fuel tank, racks, rails, bombs, missiles, and submunitions. CALIPER can be used to study physical fit compatibility. For example, CALIPER can calculate the separation distance between a missile fin and an aircraft wing or detect and calculate the interference distance and direction of internal components with respect to the interior of a missile body. The information derived here can be used to translate the interfering object and remove the interference.
GRA

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.

A90-10299#
ELECTRONIC DISSEMINATION OF INFORMATION BY ESA CONTRACTS DEPARTMENT
G. DONDI (ESA, Contracts Dept., Paris, France) ESA Bulletin (ISSN 0376-4265), no. 59, Aug. 1989, p. 75-78.
Copyright
The operation of the ESA Contracts Department, which records and updates information on ESA procurement activities, is described. The department's data dissemination systems are outlined, including the Electronic Mail Invitation to Tender System, the Documents Dissemination System, and the Space Industry Database. Consideration is given to the role of these systems in providing industries with information on ESA procurement programs, in keeping ESA Member State delegations informed on contractual and industrial policies, and in preparing statistical contract information.
R.B.

A90-10518#
AN ECONOMICS FOUNDATION FOR SOFTWARE REUSE
JOHN E. GAFFNEY, JR. (Software Productivity Consortium, Herndon, VA) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 351-360. refs
(AIAA PAPER 89-3016) Copyright
An economics model of software reuse is presented. It provides information on productivity, the cost of engineering reusable components, the cost of software component reuse, the proportion of software reused in an application, and the number of reuses. An analysis of code reuse suggests that the development of better technology for improved reusable component creation as well as for more efficient integration and testing is required for the potential economic impact of widespread software reuse to be realized.
K.K.

A90-10519*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BOUNDS ON EFFECTIVENESS OF SOFTWARE REUSE
ROBERT C. TAUSWORTHE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 361-367. refs
(AIAA PAPER 89-3017) Copyright
In an earlier work, the author developed a communication channel analogy model of the software development process, which established a quantifiable, parametric upper bound on human productivity in terms of information put into the process and yield of product output by the process. This paper extends this work to focus on factors of that bound associated with software reuse. Specifically, it is shown, that under policies of heavy reuse, human productivity associated with the language advantage grows at best logarithmically in the size of the reuse base.
Author

A90-10540#
A PARADIGM FOR THE 1990S VALIDATED IN THE 1980S
BRUCE I. BLUM (Johns Hopkins University, Laurel, MD) IN: AIAA Computers in Aerospace Conference, 7th, Monterey, CA, Oct. 3-5, 1989, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 502-511. refs
(Contract N00039-89-C-5301; AF-AFOSR-89-0080)
(AIAA PAPER 89-3041) Copyright
This paper presents a paradigm for improving the software process and thereby improving both productivity and the ability to adapt existing systems to changing requirements. The paper begins with an analysis of the software process and then identifies a software development environment that should improve the process. An implementation of the paradigm is described, and it is shown that - over a period of nine years' use - the environment has justified its expectations. The paper concludes with some observations on the transfer of the lessons learned to other types of product.
Author

A90-13680#
SATCAV - A SPACE SYSTEM LIFE CYCLE COST AND AVAILABILITY MODEL
JOEL S. GREENBERG (Princeton Synergetics, Inc., NJ) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 15 p.
(IAF PAPER 89-694) Copyright
The launch and orbital operations of a generic space mission involving multiple satellite that carry multiple sensors can be simulated by the SATCAV dynamic stochastic life cycle cost and availability model. Either expendable or recoverable launch vehicles and upper stages may be treated, and account is taken of the consequences of a set of defined failures in terms of cost-incurring events and time delays. SATCAV encompasses alternative maintenance scenarios that include both ground and orbitally dormant or active spares; also, both launch-on-failure and launch-in-anticipation-of-wearout-failure alternatives are available.
O.C.

A90-16632
A MODEL FOR PLANNING SATELLITE COMMUNICATIONS SYSTEMS
JEROME L. WERNIMONT, WILLIAM L. COOK (COMSAT Laboratories, Clarksburg, MD), and GEOFFREY J. H. BROWN COMSAT Technical Review (ISSN 0095-9669), vol. 19, Spring 1989, p. 63-98.
Copyright
The Communications System Planning Model (CSPM) is an interactive computer program that facilitates the planning of a satellite communications system. The need for CSPM stems from the large amount of data involved in the planning process, and from the desire to examine many system alternatives. The objective of this effort was to design and implement a package that a system planner would want to use. The CSPM contains a number of analysis algorithms for evaluating the effective capacity and cost of satellite communications systems. In implementing the model, attention was focused on these algorithms, as well as on the user interface. This paper describes the software and its user interface, the data requirements and analysis algorithms of the model, and some of its specific applications.
Author

A90-19797#
OPERATIONAL CONCERNS WHEN DEALING WITH NOAA COMPUTER SOFTWARE
OSCAR R. STONE (NOAA, National Environmental Satellite, Data, and Information Service, Suitland, MD) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 6 p.
(AIAA PAPER 90-0326)

The paper covers operational concerns that NOAA deals with in regard to their meteorological satellite computer systems. Topics discussed include the importance of software configuration control, the failover of operational computer systems, the backing up of operational systems, the pluses and minuses of networking computers and the turnover of contractor developed operational software to government maintenance programmers. Author

A90-22436
FUTURE INFORMATION SYSTEMS - A CUSTOMER'S VIEW
GEORGE A. TINGLEY (Swissair-Schweizerischer Luftverkehr AG, Zurich, Switzerland) IN: Systems analysis in aerospace; Proceedings of the Symposium, London, England, May 11, 12, 1988. London, Royal Aeronautical Society, 1988, p. 60-82. refs
Copyright

Consideration is given to two major trends in information systems development, namely prototyping and integrated-development environments based on data dictionaries, in the context of the experience of a major European airline. Significant successes were scored with prototyping in the cases of aircraft fueling procedures and crew-assignment practices. Attention is given to the use of data dictionaries for 'business systems planning' top-down analysis of information systems, as well as to the views of Geoffrion (1987) on standardization and integration, Carlzon (1987) on service organizations, and Drucker (1988) on the effect of information systems on middle management. O.C.

A90-23205
A SERIES ON OPTIMIZING SATELLITE SYSTEMS. II - INCENTIVES FOR TRAFFIC DIVERSION FROM MATURE TO NEW SATELLITE SYSTEMS
MARCELLUS S. SNOW (Hawaii, University, Honolulu) Space Communications (ISSN 0167-9368), vol. 7, Dec. 1989, p. 37-44. refs
Copyright

Mathematical models are used to characterize the breakeven point beyond which it is counterproductive for users or owners of a mature satellite system to continue diverting traffic to a new system. Three scenarios to describe this phenomenon are examined. The scenarios include a new system with lower minimum average costs than the mature system, an owner-user's financial incentives in a large cooperatively financed system, and the case in which the mature system sets the price at average cost while the new system sets prices at marginal cost. R.B.

A90-25680#
AN ADVANCED MESH NETWORK VSAT SYSTEM
REINHARD STAMMINGER (Future Systems International Corp., Gaithersburg, MD) IN: AIAA International Communication Satellite Systems Conference and Exhibit, 13th, Los Angeles, CA, Mar. 11-15, 1990, Technical Papers. Part 2. Washington, DC, American Institute of Aeronautics and Astronautics, 1990, p. 684-688.
(AIAA PAPER 90-0859) Copyright

An advanced mesh network Very Small Aperture Terminal (VSAT) system for voice, data, and two-way video communications on a circuit switched basis is described. The system architecture, satellite and ground network characteristics, and system economics are examined. The possible applications of the advanced mesh network VSAT system are discussed. R.B.

A90-28378
SOFTWARE PROJECT MANAGEMENT UNDER INCOMPLETE AND AMBIGUOUS SPECIFICATIONS
ROBERT B. ROWEN (IBM Corp., Austin, TX) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, Feb. 1990, p. 10-21. refs
Copyright

It is noted that large system development and government contracts still adhere to a classical life-cycle approach to software development. A major problem in the classical approach is the completeness and clarity of the user requirements. Some authors have suggested that alternative paradigms are more timely. One such paradigm is the use of prototype software models. The author believes that prototyping is an appropriate approach that can be used as a significant feature of the more formal life-cycle process, with little overall reduction in project control. He explores three aspects of such a development process. First, the underlying assumptions and the evolution of the current life-cycle management control method are discussed. The differing perspectives of the software designer and the user are discussed. A conceptual framework that graphically portrays this difference is proposed. Second, requirements are assumed to be ambiguous and incomplete. The contents of a requirements document are discussed with the perspective that requirements will always be incomplete until late in the development cycle. Third, prototyping activities have a primary objective of reducing ambiguity. Different prototyping strategies are appropriate for different phases of the development cycle. An altered life cycle (which includes prototyping as a format part of the process) is used to trace the evolution of the requirements document from an ambiguous objective to a system reference document. I.E.

A90-31710#
TOTAL QUALITY MANAGEMENT OVERVIEW (TQMO) WITH MULTIPLE PERSPECTIVE ANALYSIS (MPA)
R. MICHAEL BACKES (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 204-208.
(AIAA PAPER 89-3232) Copyright

The total quality management overview (TQMO) analysis tool is described. TQMO is a comprehensive real-time qualitative and quantitative nonconformance analysis yielding basic statistical performance assessments. The task set in defining the TQMO was to put into perspective (by association of like groups and in simplified fashion) the supporting data for the '7 w' elements (who, what, where, when, why, with, and wherefore). In this way, the TQMO architecture evolved into a multiple-perspective analysis. R.E.P.

A90-31716#
TOTAL QUALITY MANAGEMENT APPLIED TO PROJECT PLANNING AND CONTROL
CHERYL L. DIETZ (Martin Marietta Data Systems, Englewood, CO) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 229-233.
(AIAA PAPER 89-3242) Copyright

The project planning and control system study aimed at reducing project management costs and improving project performance is examined. The total quality management concept is applied to the project management/status reporting framework. A global project management process with an open structure to different levels of requirements and standards is proposed. It includes independent project management techniques and evaluation of planning technologies. Software requirements based on standard project planning and control devices are developed. Schematics of the project management/management reporting process and the developed network configuration are provided. I.F.

A90-31717#
IMPROVEMENT OF RECEIVING OPERATIONS EFFICIENCY THROUGH TOTAL QUALITY MANAGEMENT
JOHN E. DIETZ (Martin Marietta Corp., Astronautics Group, Denver, CO) IN: AIAA/ADPA/NSIA National Total Quality Management

Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 234-241.
(AIAA PAPER 89-3243) Copyright

Total quality management (TQM) is applied to the procurement and receiving system to determine if it is compatible with the planned on-line procurement system. The basic features of the on-line system, SUPPORT (System Utilization for Procurement, Planning, Ordering and Requirements Tracking), are described. Statistical samples of the procurement operation are obtained using fundamental management tools. Analysis of the data reveal that the existing procurement and receiving process is not compatible with the on-line system and will not maximize efficiency. A schematic of the receiving process is presented. I.F.

A90-34457
THE ELECTROMAGNETIC CODE CONSORTIUM
JOSEPH C. FAISON (USAF, Wright Research and Development Center, Wright-Patterson AFB, OH) IEEE Antennas and Propagation Magazine (ISSN 1045-9243), vol. 32, Feb. 1990, p. 19-23.
Copyright

A decision was made in 1987 to consolidate radar cross section (RCS) code development sponsored by the U.S. armed services and NASA. An RCS code consortium was formed, consisting of a government steering group and members from the industrial/academic community. Since the formation of the consortium, significant progress has been made to advance code development work sponsored by the U.S. government. This paper is intended to make the RCS community aware of the Electromagnetic Code Consortium, so that potential contributors to code development can become involved with its work. It covers the approach taken by the consortium, the acquisition of a government-owned geometry code, validation, language and documentation, the support contractor, a survey of industry codes, and benchmarking. I.E.

A90-37456
EXTENDING THE MEMORY HIERARCHY INTO MULTIPROCESSOR INTERCONNECTION NETWORKS - A PERFORMANCE ANALYSIS
HAIM E. MIZRAHI, JEAN-LOUP BAER, EDWARD D. LAZOWSKA, and JOHN ZAHORJAN (Washington, University, Seattle) IN: 1989 International Conference on Parallel Processing, University Park, PA, Aug. 8-12, 1989, Proceedings. Volume 1. University Park, PA, Pennsylvania State University Press, 1989, p. I-41 to I-50. Research supported by the U.S. Navy, U.S. West Advanced Technologies, Washington Technology Center, and Digital Equipment Corp. refs
(Contract NSF DCR-83-52098; NSF CCR-86-19663; NSF CCR-87-02915; NSF CCR-87-03049)
Copyright

The use of the interconnection network itself as a component of the memory hierarchy to reduce memory latency in medium- to large-scale systems is explored. Instead of copies of an item of shared data being present is several caches, a single copy of the item migrates in the network according to the reference patterns of the individual processors. Switches in the network contain directories to indicate where the items are stored and local memories to store some of these data items. The performances of this architecture and of several associated migration policies are compared to those of more classical architectures under various loads. This evaluation is performed by simulation. The main results are that this architecture can improve performance markedly and that the introduction of directories in the switches is the most important reason for this improvement. I.E.

A90-37469
A HYPERCUBE SHARED VIRTUAL MEMORY SYSTEM
KAI LI and RICHARD SCHAEFER (Princeton University, NJ) IN: 1989 International Conference on Parallel Processing, University Park, PA, Aug. 8-12, 1989, Proceedings. Volume 1. University Park, PA, Pennsylvania State University Press, 1989, p. I-125 to I-132. Research supported by the Intel Corp. refs
(Contract NSF CCR-88-14265)
Copyright

The design and implementation of a shared virtual memory (SVM) system for Intel iPSC/2 hypercube multicomputers are described. The SVM system provides clients on all the nodes with a large, coherent, shared address space supporting both the shared-memory and message-passing models of parallel programming. The authors have implemented a prototype SVM on the Intel iPSC/2 hypercube. The preliminary performance results indicate that SVM is an effective strategy for implementing the next generation of operating systems for hypercube multicomputers. I.E.

A90-37478
EMBEDDING OF LINEAR ARRAY AND BINARY TREE IN CUBICAL RING CONNECTED CYCLES NETWORKS
CHUNGTI LIANG, YIGANG CHEN, and WEI-TEK TSAI (Minnesota, University, Minneapolis) IN: 1989 International Conference on Parallel Processing, University Park, PA, Aug. 8-12, 1989, Proceedings. Volume 1. University Park, PA, Pennsylvania State University Press, 1989, p. I-192 to I-195. refs
Copyright

The cubical ring connected cycles (CRCC) network, a modified version of cube connected cycles (CCC) network, preserves all the desirable aspects of CCC, such as fixed node connectivity, modularity, ease of layout, and capability of pipelining and parallelism, and can emulate the topology of a CCC even in the case of multiple failures of processors and links. To enhance the capability of dynamic reconfiguration, the authors study the embedding of linear arrays and complete binary trees in CRCC. The expansion and dilation cost of their embedding method is analyzed. A distributed algorithm for binary tree embedding is presented. I.E.

A90-41187
A BLACKBOARD SYSTEM FOR PLANNING SPACE MISSIONS
GLEN PEARSON (TRW Sunnyvale Laboratory, CA) IN: IEA/AIE-89; Proceedings of the Second International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, Tullahoma, TN, June 6-9, 1989. Volume 1. Tullahoma, TN, University of Tennessee, 1989, p. 409-416. refs
Copyright

A 'blackboard' architecture is presently used to combine AI planning techniques with conventional models of computing to create an innovative planning and scheduling system for spacecraft mission managers. The Integrated Mission Planning System (IMPS) environment, which operates on this basis, is proposed for the conduct of satellite coverage analysis, link-connectivity analysis, mission planning and performance analysis of existing systems, and constellation tradeoff analysis for candidate designs. IMPS consists of a set of analysis modules subdivided into two vertical processing streams that access an underlying Consolidated Input Data Base. Attention is given to mission planning applications that determine radio frequency interference among communicating space objects and the scheduling of resources for spacecraft battery conditioning. O.C.

A90-43754
OPERATIONAL MANAGEMENT OF THE INTELSAT SYSTEM
F. J. BURKITT and R. PARTHASARATHY (INTELSAT, Washington, DC) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 43, Aug. 1990, p. 365-370.
Copyright

The Intelsat system comprises fourteen operational satellites providing capacity for a wide range of international and domestic telecommunications services and the requisite connectivity for over 2000 paths between earth stations spread all over the globe. The services carried on the system range from international telephone trunks to customized digital links for private business networks. In the case of international services, Intelsat performs detailed planning, coordinates the establishment of the links and constantly monitors the quality of performance. In the case of services carried

on certain types of bulk capacity leases such as domestic systems, Intelsat coordinates initial planning so that the users' links do not interfere with, or are interfered by, other links in the system and then leaves it to the user entity to decide how best to use the satellite resources set apart for the lease. The basic objective of operational management is the maintenance of satellites in orbit within very tightly held tolerances of inclination and pointing error, and the maintenance of the quality of service on all links in the system. This paper presents a bird's eye-view of this fascinating picture of international cooperation and effective organization in the Intelsat family of user entities. Author

A90-44786
INFORMATION - DOCUMENTATION; EUROPEAN FORUM, STRASBOURG, FRANCE, JAN. 17-19, 1990, PROCEEDINGS [INFORMATION - DOCUMENTATION; FORUM EUROPEEN, STRASBOURG, FRANCE, JAN. 17-19, 1990, COMPTES RENDUS]
Forum sponsored by AAAF, Royal Aeronautical Society, and DGLR. Paris, Association Aeronautique et Astronautique de France, 1990, 289 p. In French and English. For individual items see A90-44787 to A90-44792.
Copyright
This collection covers such topics as aerospace information in the Federal Republic of Germany, the role of external information in an enterprise, access to non-European information (Japan, the U.S., and the USSR), and electronic information transmission at the European Space Agency. Consideration is also given to an application example of the electronic management of documentation, the training of information experts, and the application of value analysis to information and documentation. B.J.

A90-45505
IMPROVING COMPUTER TECHNIQUES FOR REAL-TIME DIGITAL FLIGHT SIMULATION
MICHAEL K. SINNETT, ROBERT B. OETTING, and BRUCE P. SELBERG (Missouri-Rolla, University, Rolla) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Sept. 25-28, 1989. 6 p. Research supported by McDonnell Aircraft Co. refs (SAE PAPER 892354) Copyright
Real-time digital flilght simulation is becoming increasingly more important in the aerospace industry. As the use of flight simulation for engineering development, research, and pilot training grows, so does the demand for engineers experienced in simulation technology. It is the role of the university to provide such trained individuals, but the cost of simulator systems can be prohibitive. The purpose of this paper is to present to the research and educational community some considerations for reducing the cost requirements for simulator hardware, and for reducing the complexity and the computational load of the soft-ware model. Author

A90-47494
ROBUST STABILITY AND PERFORMANCE OF SYSTEMS WITH STRUCTURED AND BOUNDED UNCERTAINTIES - AN EXTENSION OF THE GUARANTEED COST CONTROL APPROACH
O. I. KOSMIDOU (Thrace, University, Xanthi, Greece) International Journal of Control (ISSN 0020-7179), vol. 52, Sept. 1990, p. 627-640. refs
Copyright
A method is presented for designing a full state feedback linear control law that will ensure the robust stability and performance of a given linear uncertain system. The systems under consideration are described by state equations that depend on uncertain parameters. These uncertain parameters may be time varying. Their values are constrained to lie within known compact bounding sets. The method is based on the guaranteed cost control concept of Chang and Peng (1972). The controller gains result from the solution of a Riccati equation in which the weighting matrices depend on the uncertainty bounds. Sufficient conditions for the existence of a solution arise from the standard LQG control theory. Author

A90-47831
A HIERARCHICAL MULTIPROCESSOR STRUCTURE BASED ON MULTISTAGE NETWORKS
JANG-PING SHEU (National Central University Chungli, Republic of China), WEN-TSUEN CHEN (National Tsing Hua University, Hsinchu, Republic of China), and HONG-MEN SU (Illinois, University, Urbana) International Journal of High Speed Computing (ISSN 0129-0533), vol. 2, June 1990, p. 117-131. refs
Copyright
A class of hierarchically structured multistage interconnection networks is proposed. It is shown that the routing schemes of the proposed networks are simple. In the environment with high locality of accesses, performance analysis of the proposed networks shows that the acceptance (free of collision) probability is increased and the average path length (delay) is less than that of conventional multistage interconnection networks, such as delta networks. In general, the performance of the proposed networks is superior to the conventional multistage interconnection networks when the accesses locality is greater than or equal to 0.5. The cost of the proposed networks is analyzed and found to be comparable to that of conventional ones. Author

A90-51675
COMPACT PRIVATE HUBS FOR CORPORATE VSAT NETWORKS
TOM M. SHIMABUKURO and RAVI SUBBARAYAN (GTE Spacenet Corp., McLean, VA) Telematics and Informatics (ISSN 0736-5853), vol. 7, no. 2, 1990, p. 123-133.
Copyright
Satellite communications has played a significant role in making information networks a strategic corporate asset. Very small aperture terminal (VSAT) networks, in particular, have special appeal for the corporate network user community because of unique advantages in cost, operations, and user control. The recent rapid proliferation of these networks in a multitude of market segments, as diverse as retail and financial services, is evidence of their wide acceptance for business communications. Author

A90-52872*# National Aeronautics and Space Administration, Washington, DC.
A SYSTEMS ENGINEERING MANAGEMENT APPROACH TO RESOURCE MANAGEMENT APPLICATIONS
RHODA SHALLER HORNSTEIN (NASA, Office of Space Operations, Washington, DC) IN: IEEE International Conference on Systems Engineering, Dayton, OH, Aug. 24-26, 1989, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 205-208. refs
The author presents a program management response to the following question: How can the traditional practice of systems engineering management, including requirements specification, be adapted, enhanced, or modified to build future planning and scheduling systems for effective operations? The systems engineering management process, as traditionally practiced, is examined. Extensible resource management systems are discussed. It is concluded that extensible systems are a partial solution to problems presented by requirements that are incomplete, partially immeasurable, and often dynamic. There are positive indications that resource management systems have been characterized and modeled sufficiently to allow their implementation as extensible systems. I.E.

N90-10326# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.
SINCGARS (SINGLE-CHANNEL GROUND/AIRBORNE RADIO SYSTEM) OPERATOR PERFORMANCE DECAY Interim Report, Oct. 1983 - Feb. 1987
RICHARD L. PALMER and LOUIS W. BUCKALEW Nov. 1988 20 p
(AD-A210716; ARI-RR-1501) Avail: NTIS HC A03/MF A01 CSCL 17/4

The Single-Channel Ground/Airborne Radio System (SINCGARS) is scheduled to replace the Army's VRC-12 and PRC-77 radios. However, SINCGARS is more complex to operate and requires more training. This study examined the decay of operational skills and knowledge in two groups of recently trained operators who went without exposure to SINCGARS for several weeks. Performance levels were measured with the SINCGARS Learning-Retention Test (SLRT), a simulated hands-on performance test emphasizing skills and operational knowledge retention. The results provided tentative indications that operators may lose about 10 percent of their prior performance levels within the first few weeks. This figure is expected to vary considerably, depending on the type of soldier, the length of the nonexposure period, and other conditions. It was also found that performance level was correlated with soldiers' Armed Services Vocational Aptitude Battery (ASVAB) General Technical (GT) scores. Correlations between GT and SLRT scores obtained at two different times were .43 and .50, respectively. However, no relation was observed between performance decay and GT. Further evaluation of operator performance decay needs to be done to determine the effect of longer periods of nonexposure (e.g., 60 and 90 days). GRA

N90-10336# Allied-Signal Aerospace Co., Kansas City, MO. Technical Communications Div.
STATISTICAL MODELING OF ELECTRICAL COMPONENTS Final Report
R. L. JOLLY Jul. 1988 17 p
(Contract DE-AC04-76DP-00613)
(BDX-613-3939) Avail: NTIS HC A03/MF A01

A method of forecasting production yields based on SPICE (Computer Program) circuit simulation and Monte Carlo techniques was evaluated. This method involved calculating functionally accurate component models using statistical techniques and using these component models in a SPICE electrical circuit simulation program. The results of the simulation program allow production yields to be calculated using standard statistical techniques. Author

N90-10587# Transportation Systems Center, Cambridge, MA.
WAVEFORM GENERATOR SIGNAL PROCESSING SOFTWARE Final Report, Jan. 1985 - Feb. 1988
Sep. 1988 171 p Prepared in cooperation with MGA Research Corp., Akron, NY
(Contract DOT-HS-8-01936; DTNH22-82-C-07041; DTRS-57-84-C-00003; DTRS-57-86-P-81655)
(PB89-192660; DTS-74; DOT-TSC-NHTSA-88-2; DOT-HS-807-312) Avail: NTIS HC A08/MF A01 CSCL 09/2

The report describes the software that was developed to process test waveforms that were recorded by crash test data acquisition systems. The test waveforms are generated by an electronic waveform generator which provides precise, repeatable signals designed to test the performance characteristics (amplitude and timing accuracy, and frequency response) of a data acquisition system. The waveform characteristics, processing algorithms, and instructions for use of the software are described in the report. Complete source listings are provided. Author

N90-10592# National Weather Service, Silver Spring, MD. Techniques Development Lab.
STRUCTURE FLOW DIAGRAM GENERATOR
SUSAN M. ADAMS Mar. 1989 18 p
(PB89-195978; NOAA-NWS-TDL-CP-89-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

The Structure Flow Diagram Generator provides the user with a convenient, easy-to-use, and less time-consuming way of diagramming the overall structure of a program. It allows for several options including segment and overlay numbers, and the inclusion of repetitive calls within a subroutine. The software can also be useful in preparing external documentation and publications which require an overall program structure diagram as part of the supporting documents. Author

N90-10597# Naval Ocean Systems Center, San Diego, CA.
COST METRIC ALGORITHMS FOR INTERNETWORK APPLICATIONS Final Report
D. OLSEN and R. DILLARD Apr. 1989 47 p
(AD-A210324; NOSC/TR-1284) Avail: NTIS HC A03/MF A01 CSCL 12/7

The particular function of the Multi-Network Controller (MC) to be implemented for the 1990 Unified Networking Technology Advanced Technology Demonstration addressed in this Independent Exploratory Development (IED) project is the final selection of a subnet in response to a Transmit Service Request. The architectural description of the MC defines databases and performance measures used by this IED effort. In FY88, initial conclusions about the applicability of neural networks, fuzzy set methods, cost/value functions, and expert systems were investigated and documented. A Real Time Expert System (RTES), using subroutines that implement the decision techniques described, was selected as the best method for experimentation. A transportable, embeddable RTES shell (CLIPS) was chosen, and implementation of subnet selection algorithms began. An independent research effort for FY89 is also a spin-off of the FY88 IED effort, and is described. GRA

N90-10607# Institute for Defense Analyses, Alexandria, VA.
AEROSPACE SYSTEM UNIFIED LIFE CYCLE ENGINEERING PRODUCIBILITY MEASUREMENT ISSUES Final Report, Jan. 1988 - Sep. 1989
DALE E. CALKINS, RICHARD S. GAEVERT, FREDERICK J. MICHEL, and KAREN J. RICHTER May 1989 177 p
(Contract MDA903-89-C-0003)
(AD-A210937; AD-E501132; IDA-P-2151; IDA/HQ-88-33817)
Avail: NTIS HC A09/MF A01 CSCL 05/1

The goal of the Unified Life Cycle Engineering (ULCE) program is to develop enhanced design environments that will allow supportability and producibility to be considered early in the product design cycle along with the usual factors of cost, performance, and schedule. An investigation into methods for the incorporation of producibility issues in early design is reported. Producibility is a product characteristic inherent in its design denoting ease and economy of manufacture. Many aspects of producibility are judgmental in character. However, to design products that are properly balanced with regard to all of the ULCE design factors, these qualitative aspects of a design must be handled and methods of trading off such factors against quantitative factors such as performance and cost measures must be developed. Methods of measuring and evaluating factors related to producibility are discussed and a plan is presented for the development of a design environment of an aerospace design synthesis model with a producibility module. Included is a description of relevant design and manufacturing methodologies (e.g., Design for Manufacture and Assembly, Taguchi Methods, Quality Function Deployment, Statistical Process Control) and a discussion of the kinds of tools (hardware, software, and attitude) that can and have been established to ensure strong producibility characteristics in a product. In addition, an extensive bibliography is provided in an appendix. GRA

N90-10786# California Univ., Berkeley. School of Education.
MOTIVATING THE NOTION OF GENERIC DESIGN WITHIN INFORMATION PROCESSING THEORY: THE DESIGN PROBLEM SPACE Technical Report, Dec. 1987 - Dec. 1988
VINOD GOEL and PETER PIROLLI 9 Dec. 1988 46 p
(Contract N00014-88-K-0233; RR04206)
(AD-A210266; DPS-1) Avail: NTIS HC A03/MF A01 CSCL 23/2

A preliminary attempt is made to differentiate design problem solving from non-design problem solving by identifying major invariants in the design problem space. There are four major steps in the strategy: (1) characterize design as a radial category and flesh out the task environment of the central or prototypical cases; (2) take the design task environment seriously; (3) explicate the impact of this task environment on the design problem space; and (4) argue that, given the structure of the information processing

system as a constant, the features noted in the problem spaces of design tasks will not all occur in problem spaces where the task environment is vastly different. This analysis leads to the claim that these features are invariants in the problem spaces of design situations, and collectively constitute a design problem space. Descriptive protocol studies are used to explore the problem spaces of three prototypical design tasks from the disciplines of architecture, mechanical engineering, and instructional design. GRA

N90-10787# Defense Logistics Agency, Alexandria, VA. Operations Research and Economic Analysis Office.
COMPUTER AVAILABILITY IMPACT ON THE ARCHIVING OF SCIENTIFIC AND TECHNICAL REPORTS Final Report
CHARLES W. ELLIOTT Jul. 1989 47 p
(AD-A210283) Avail: NTIS HC A03/MF A01 CSCL 05/2

This is an examination of the impact the DTIC-Z DROLS Mainframe computer availability has on the ability to efficiently input scientific and technical reports. There is an interesting approach to problem identification and resolution using cause and effect diagrams, the Pareto principle, quality circles and task teams. GRA

N90-10790# Defence Research Establishment Suffield, Ralston (Alberta).
WEEDING POLICY AND PROCEDURES: INFORMATION SERVICES
JOHN G. CURRIE and ANNE M. DICKASON May 1989 20 p
(AD-A210568; DRES-SP-128) Avail: NTIS HC A03/MF A01 CSCL 05/2

The policy concerning the weeding of material from the DRES libraries is presented. Specific procedures to be followed for the weeding of monographs, periodicals, Sci-Tech reports and government documents are stated. A bibliography is included. GRA

N90-10791# Vector Research, Inc., Ann Arbor, MI.
DEVELOPMENT OF INFORMATION QUALITY ENGINEERING (IQE) METHODOLOGY FOR INFORMATION RESOURCE MANAGEMENT Final Report
JAMES R. BAMBERY 22 Jul. 1989 12 p
(Contract DAAH01-88-C-0105; DARPA ORDER 6208)
(AD-A210615; VRI-DARPA-1-FR89-1(R)) Avail: NTIS HC A03/MF A01 CSCL 05/2

The applicability and efficacy was demonstrated of the IQE methodology to develop a Quality Assurance/Quality Control system approach to enhance quality and productivity of the information support activity of DARPA. The IQE methodology was used to develop a model for the DARPA information system and a system architecture. Work was then suspended on the project because of an internal realignment within DARPA which resulted in revised IRM policies. Study effort was then directed at finding an alternative area where the IQE technique could be applied. The use of IQE in developing war game/protocols for the exchange of information between concurrently running war games appear to have merit. GRA

N90-11066# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands). Testing Div.
NEW DATA HANDLING SYSTEM (MDH) FOR MECHANICAL TESTS AT ESTEC
C. FRANSEN *In its* Spacecraft Structures and Mechanical Testing p 613-617 Jan. 1989
Copyright Avail: NTIS HC A99/MF E06

The updated Mechanical Data Handling (MDH) system used for mechanical tests carried out at ESTEC (European Space Research and Technology Center) is described. The need for such a system in the analysis of larger and more complex space structures is outlined. During structural testing, fast processing of response data is required for a cost effective utilization of available test facilities. The planned capabilities, performance and methodologies applied in developing the updated MDH system are described. ESA

N90-11448# National Inst. of Standards and Technology, Gaithersburg, MD. National Computer Systems Lab.
ELECTRONIC PUBLISHING: GUIDE TO SELECTION
LYNNE S. ROSENTHAL Jun. 1989 39 p
(PB89-214753; NIST/SP-500/164) Avail: NTIS HC A03/MF A01; SOD HC $2.50 as 003-003-02938-6 CSCL 09/2

The purpose of the report is to assist managers and users in making informed decisions on which systems are best for them. The report presents the technical and managerial choices and implications associated with selecting and using electronic publishing systems. A matrix of publishing capabilities and features is presented in the appendix to illustrate one method of comparing and selecting a publishing system. GRA

N90-11937 Physics and Electronics Lab. TNO, The Hague (Netherlands).
FEASIBILITY OF GRAPHICS VOICE TELEPHONES FOR THE POST 2000 ERA
A. J. RUIZENAAR Sep. 1988 19 p Original contains color illustrations
(Contract A86/KL/045)
(FEL-1988-26; TD88-4381; ETN-89-95074) Copyright Avail: TNO Physics and Electronics Laboratory, P.O. Box 96864, 2509 JG The Hague, Netherlands

The philosophy behind the work and the choice of the implemented technique, concerning developed models of an integrated graphics voice telephone, are discussed. Military user requirements versus technical possibilities, are considered. Based on the feasibility study and the results, the following conclusions are drawn: an integrated graphics voice telephone offers the user extra capabilities besides voice for exchanging messages, sketches or images; voice and data can be handled simultaneously and in the same way over a common radio channel; it is feasible to limit the size of such a multifunctional telephone to a hand-held portable terminal; the use of redundant speech pauses for exchanging data traffic is an attractive method; efficient and state of the art voice and error correcting coding techniques have to be developed in order to increase the technical qualities of the Gravophone; due to the obtained experience and the comments by military planners given during demonstrations, a better overview on user facilities and system requirements is obtained. ESA

N90-12206# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
ADOPTION OF SOFTWARE ENGINEERING INNOVATIONS IN ORGANIZATIONS Final Report
JUDY BAYER and NANCY MELONE Apr. 1989 150 p
Sponsored by DOD, Washington, DC
(AD-A211573; CMU/SEI-89-TR-17; ESD-TR-89-25) Avail: NTIS HC A07/MF A01 CSCL 12/5

Designing effective strategies to facilitate the adoption of new software engineering technologies is a complex endeavor. The experiences are considered of organizations in the defense industry that have considered and in many cases adopted any one of five software engineering technologies: structured programming, program design languages, software cost models, complexity metrics, and Ada. In all, 296 respondents participated. These respondents represented approx. 120 business units within approximately 75 defense contractor organizations. Data were collected using a structured survey instrument administered over the telephone. The motivations behind technology acquisition and adoption decisions, the use of various technology transfer mechanisms during the stages of the adoption process, and the relationship between technology transfer mechanisms and the timing, pass through, and smoothness of adoption process stages are all examined. Adoption is assumed to be a multistage process that may proceed in a linear or nonlinear fashion. Also explored is the relationship between managerial level of the advocate (i.e., top management, middle management, technical management, and

broad-based support) and the speed and smoothness of technology acquisition and adoption. GRA

N90-13085# Mitre Corp., Bedford, MA.
SOFTWARE ENGINEERING EXERCISE (SEE) GUIDELINES Final Report
HERMAN P. SCHULTZ Jul. 1989 27 p
(Contract F19628-89-C-0001)
(AD-A212510; M89-32; ESD-TR-89-199) Avail: NTIS HC A03/MF A01 CSCL 12/5

This Software Engineering Exercise (SEE) was found to be an *effective discriminator in reducing the risks normally associated* with a software acquisition. It is designed to be used during the source selection process as part of the technical evaluation of offerors and encompasses the development and administration of a well defined exercise (test problem) that is implemented by an offeror in a restricted time period (usually less than a month). The exercise problem typically addresses one or more software risk areas and is designed to be evaluated quickly to minimize its impact on the source selection schedule. Guidance is provided to acquisition offices in the planning and tasking required to implement a SEE and the flexibility that may be occasioned by tailoring the SEE to each program's needs. GRA

N90-13144# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
ON A RATE OF CONVERGENCE OF THE MULTIKNAPSACK VALUE FUNCTION
SARA A. VANDERGEER and LEEN STOUGIE (Amsterdam Univ., Netherlands) Jul. 1988 8 p
(CWI-MS-R8812; ETN-89-95634) *Copyright* Avail: NTIS HC A02/MF A01

The almost sure asymptotic characterization for the optimal solution of the Knapsack capacities, when the profit and requirement coefficients of items to be selected from are random variables, which was derived in Meanti et al., 1988, is studied. A rate of convergence for this process is established using results from the theory of empirical processes. ESA

N90-13528# European Space Agency, Paris (France).
THE INTERFACE WITH THE DATA REDUCTION CONSORTIA
J. VANDERHA *In its* The Hipparcos Mission. Prelaunch Status. Volume 1: The Hipparcos Satellite p 305-315 Jun. 1989
Copyright Avail: NTIS HC A16/MF A03; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The scientific data flow and associated monitoring during Hipparcos normal operations is presented. It comprises preparatory, monitoring, and processing tasks. The activities related to the execution of payload functions, including the input catalog, the nominal scanning law, and the program star file, are described. The monitoring of the data reduction and the telemetry data processing are examined. ESA

N90-14135*# National Aeronautics and Space Administration, Washington, DC.
INFORMATION SYSTEM LIFE-CYCLE AND DOCUMENTATION STANDARDS, VOLUME 1
E. DAVID CALLENDER and JODY STEINBACHER 28 Feb. 1989 111 p
(NASA-TM-101856; NAS 1.15:101856) Avail: NTIS HC A06/MF A01 CSCL 05/2

The Software Management and Assurance Program (SMAP) Information System Life-Cycle and Documentation Standards Document describes the Version 4 standard information system life-cycle in terms of processes, products, and reviews. The description of the products includes detailed documentation standards. The standards in this document set can be applied to the life-cycle, i.e., to each phase in the system's development, and to the documentation of all NASA information systems. This provides consistency across the agency as well as visibility into the completeness of the information recorded. An information system is software-intensive, but consists of any combination of software, hardware, and operational procedures required to process, store, or transmit data. This document defines a standard life-cycle model and content for associated documentation. J.P.S.

N90-14136*# National Aeronautics and Space Administration, Washington, DC.
MANAGEMENT PLAN DOCUMENTATION STANDARD AND DATA ITEM DESCRIPTIONS (DID). VOLUME OF THE INFORMATION SYSTEM LIFE-CYCLE AND DOCUMENTATION STANDARDS, VOLUME 2
E. DAVID CALLENDER and JODY STEINBACHER 28 Feb. 1989 185 p
(NASA-TM-101857; NAS 1.15:101857) Avail: NTIS HC A09/MF A01 CSCL 05/2

This is the second of five volumes of the Information System Life-Cycle and Documentation Standards. This volume provides a well-organized, easily used standard for management plans used in acquiring, assuring, and developing information systems and software, hardware, and operational procedures components, and related processes. J.P.S.

N90-14137*# National Aeronautics and Space Administration, Washington, DC.
PRODUCT SPECIFICATION DOCUMENTATION STANDARD AND DATA ITEM DESCRIPTIONS (DID). VOLUME OF THE INFORMATION SYSTEM LIFE-CYCLE AND DOCUMENTATION STANDARDS, VOLUME 3
E. DAVID CALLENDER and JODY STEINBACHER 28 Feb. 1989 183 p
(NASA-TM-101858; NAS 1.15:101858) Avail: NTIS HC A09/MF A01 CSCL 05/2

This is the third of five volumes on Information System Life-Cycle and Documentation Standards which present a well organized, easily used standard for providing technical information needed for developing information systems, components, and related processes. This volume states the Software Management and Assurance Program documentation standard for a product specification document and for data item descriptions. The framework can be applied to any NASA information system, software, hardware, operational procedures components, and related processes. J.P.S.

N90-14140# Massachusetts Inst. of Tech., Cambridge. Microsystems Research Center.
RETRIEVING AND INTEGRATING IC FABRICATION DATA FROM DISSIMILAR DATABASES
MICHAEL P. RUF Jun. 1989 25 p
(Contract N00014-87-K-0825)
(AD-A211890; VLSI-MEMO-89-552) Avail: NTIS HC A03/MF A01 CSCL 09/1

Factory personnel need to access data from many aspects of the fabrication environment. Many IC fabrication facilities store manufacturing data in distributed, heterogeneous database networks. Retrieval and integration of data can be a cumbersome task due to this configuration. The ideal solution to these problems is to standardize a data model, storing the manufacturing data in a single database. However, since such a standardization is not likely to occur in the near future, a more immediate solution is needed. Discussed here is a system addressing these problems: DRIFS - A Data Retrieval Interface for Integrated Circuit Fabrication Systems. A uniform query interface and data model is defined for heterogeneous, distributed fabrication databases. A DRIFS prototype is described and evaluated. GRA

N90-14435# Massachusetts Technological Lab., Inc., Bethesda, MD.
COMMUNICATION OVERVIEW PROGRAM (COP)
D. J. FANG, I. BENOLIEL, and H. SOICHER (Army *Communications-Electronics Command, Fort Monmouth, NJ.) In* AGARD, Operational Decision Aids for Exploiting or Mitigating Electromagnetic Propagation Effects 8 p Sep. 1989
Copyright Avail: NTIS HC A20/MF A03

In establishing a communications system for fulfilling a given

mission requirement, multiple levels of decision-making processes are encountered. The decision making process at the lowest level, such as subsystem design and component specification can be accomplished by known routines and procedures, or even by computer packages known as CAD. The middle level of decision-making involves professional articulation as the processes generally involve trade-off's and optimization. As such, engineering prejudice, preference and experience play a significant role. The highest level of decision making, because of its nature, generally is more policy oriented rather than technically oriented. In this level, a broad view including the background, the finance, priority and other administrative concerns are included for decision. The unfortunate part of this is that the decision makers often do not have the necessary insight in making a proper technical decision which has a profound and unequivocal impact on the implementation at lower levels. The Communication Overview Program (COP) is being developed for applications at the highest level of decision-making. The program is not a design tool but is intended to provide the necessary scenarios and technical insights to assure a correct decision can be made for the establishment of a communications system to carry out a given mission.

Author

N90-14770# Lawrence Livermore National Lab., CA.
MIPS AND BIPS ARE MEGAFLOPS: LIMITS OF UNIDIMENSIONAL ASSESSMENTS
WILLIAM W. BANKS and MICHAEL PIHLMAN Jul. 1989 7 p Presented at the 33rd Annual Meeting of Human Factors Society, Denver, CO, 16-20 Oct. 1989
(Contract W-7405-ENG-48)
(DE89-015707; UCRL-101061-REV-1; CONF-8910155-2-REV-1)
Avail: NTIS HC A02/MF A01

We believe that a failure to incorporate human performance measures into system test protocols will result in imprecise and incomplete data when attempting to estimate field test performance from a total systems perspective. Traditional methods of evaluating local area network (LAN) performance generally refer to the network's throughput, time delays, data rate (BIPS), or media access protocol efficiency. These measures are quite acceptable when determining point-to-point benchmark network performance but do not take into account the more global man-machine performance issues associated with people using network systems to perform tasks and execute functions concurrently within a total systems context. This paper experimentally compares differences in human productivity and efficiency while using: an existing data gathering system consisting of several geographically distributed, unconnected, and disparate mainframes; and a prototype Intelligent Gateway connecting mainframes and offering the user less complexity in procedure execution and an easy to use interface. Tests were conducted with volunteer users in a repeated measures experimental design. Each test subject was randomly assigned to each of two conditions and required to execute routine tasks with each of two systems. Analysis of variance (ANOVA) results revealed significant differences in task completion times and human error rates between the two systems. An increase in human productivity/efficiency was observed using the gateway LAN. We propose to extend the traditional computer performance measurement boundaries, which now encompass only the network hardware, to include an overall input-to-output LAN performance measure, combining both measures of user productivity and network performance. A discussion of trade-offs between unidimensional assessment methods using large sample sizes and multiple methods with small sample sizes is also presented.

DOE

N90-14792*# Software Productivity Solutions, Inc., Melbourne, FL.
IMPACT OF DOMAIN ANALYSIS ON REUSE METHODS
KATHY GILROY *In* NASA, Langley Research Center, Software Reuse Issues p 33-39 Dec. 1989
Avail: NTIS HC A08/MF A01 CSCL 09/2

The SPS is performing a study for the U.S. Army CECOM on the impact of domain analysis on reuse methods. Domain analysis is the first activity that should be performed in the development of reusable software. It identifies the commonalities between systems within a given problem (such as navigation systems or database management). In the software arena these commonalities are implemented as software components that can be reused by new systems within that application domain. The objectives of the study are to develop an approach that makes domain analysis practical and effective for the Army, to reinforce the importance of domain analysis for software reuse programs, and to summarize and coalesce domain analysis information into a single reference source. Existing methods and tools are being analyzed, critical issues identified, and key automation issues addressed. Based on these, a methodology and set of guidelines for domain analysis are being developed. Potential automated tools will be identified for each activity in the methodology.

Author

N90-14799*# National Aeronautics and Space Administration, Washington, DC.
SSFP APPROACH TO SOFTWARE REUSE
PEG SNYDER *In* NASA, Langley Research Center, Software Reuse Issues p 89-96 Dec. 1989
Avail: NTIS HC A08/MF A01 CSCL 09/2

This talk began by presenting the Space Station Freedom Program (SSFP) definitions of software commonality and software reuse. Software commonality is the use of identical, interchangeable, functionally compatible, or similar software items to satisfy different sets of functionally similar requirements. The Software Support Environment (SSE) and the Data Management System (DMS) of onboard computing facilities are examples of SSFP common software. Software reuse is the use of identical, compatible, or similar software items in either modified or unmodified form to satisfy development activities at any point in the software life cycle; in other words, taking an existing item and applying it to another development activity. Software commonality has been mandated in several critical areas (such as the SSE and DMS) and a policy directive is under review. A software reuse study group was established in May 1988 to gather background information (see Level 2 Software Reuse Study that follows by Scott Herman). The SSFP Program Definition and Requirements Document contains requirements for SSE support in the area of software reuse. The SSE is a collection of tools and rules, and provides the common environment to be used for the life cycle management of all SSFP operational software.

Author

N90-14804*# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
APPLICATION OF REUSABLE SOFTWARE COMPONENTS AT THE SEI
ROBERT HOLIBAUGH *In* NASA, Langley Research Center, Software Reuse Issues p 135-145 Dec. 1989
Avail: NTIS HC A08/MF A01 CSCL 09/2

Robert Holibaugh of the Software Engineering Institute described a project which is studying the application of reusable software components. The primary goals are to gain practical experience with state-of-the-art reusable components, methods, and tools and to capture the lessons learned in the application of reuse technology. In addition the project will assess the impact of reuse on the software development process and products and will identify and validate the information that facilities software reuse during system development. The project includes two tasks - a reuse experiment and a redevelopment effort. The reuse experiment will define a life cycle and a methodology for reuse-based development, and define and implement a data collection mechanism for measuring the development. The redevelopment effort will construct a reuse test bed and will redevelop and realistically test subsystems from an embedded mission-critical real-time application. The reuse experiment will produce several products including a tested real-time application, reuse-based components and tools evaluation, a reuse-based development method, a framework for data collection, a framework for measuring productivity, and lessons learned data. Successful development with reusable components will require a rich set of

components and an integrating methodology. The Tomahawk Land Attack Missile system is the application for the redevelopment effort. Author

N90-14985*# Howard Univ., Washington, DC. School of Engineering.
A DYNAMIC SYSTEMS ENGINEERING METHODOLOGY RESEARCH STUDY. PHASE 2: EVALUATING METHODOLOGIES, TOOLS, AND TECHNIQUES FOR APPLICABILITY TO NASA'S SYSTEMS PROJECTS
ARTHUR S. PAUL, TEPPER L. GILL, and ARLENE P. MACLIN 10 Oct. 1989 145 p
(Contract NAG5-995)
(NASA-CR-181319; NAS 1.26:181319) Avail: NTIS HC A07/MF A01 CSCL 05/1

A study of NASA's Systems Management Policy (SMP) concluded that the primary methodology being used by the Mission Operations and Data Systems Directorate and its subordinate, the Networks Division, is very effective. Still some unmet needs were identified. This study involved evaluating methodologies, tools, and techniques with the potential for resolving the previously identified deficiencies. Six preselected methodologies being used by other organizations with similar development problems were studied. The study revealed a wide range of significant differences in structure. Each system had some strengths but none will satisfy all of the needs of the Networks Division. Areas for improvement of the methodology being used by the Networks Division are listed with recommendations for specific action. J.P.S.

N90-15593# Dynamics Research Corp., Wilmington, MA.
MANPRINT METHODS MONOGRAPH: AIDING THE DEVELOPMENT OF MANNED SYSTEM PERFORMANCE CRITERIA Final Report, Nov. 1986 - May 1987
JONATHAN D. KAPLAN Jun. 1989 269 p
(Contract MDA903-86-C-0412; MDA903-86-C-0414; MDA903-86-C-0416)
(AD-A213543) Avail: NTIS HC A12/MF A02 CSCL 23/2

This monograph consists of three papers on a common subject: The development of complete, rigorous, and operationally measurable performance criteria for manned systems. Each of these papers presents a concept for building an aiding method. The U.S. Army Research Institute for the Behavioral and Social Sciences began the program to develop methods to integrate available operations and maintenance personnel with hardware and software. The first stage of this process was to develop three alternate, competitive concepts for each method. The three concept papers in this monograph were written in response to requirements for a method to develop rigorous and ultimately measurable performance criteria. These criteria would enable hardware and software designers to better understand what a manned, fully integrated system would have to do to achieve operations and maintenance success. Success would be described in terms of required performance levels of operations and maintenance tasks under specified conditions. The concept papers written in response to this requirement have three significantly different focuses and bring powerful but different approaches to the problem of developing rigorous and meaningful performance criteria. Ultimately, the ARI study advisory group decided to implement the concept proposed by Micro-Analysis and Design. GRA

N90-15600# Rochester Univ., NY. Dept. of Computer Science.
THE IMPLEMENTATION OF A COHERENT MEMORY ABSTRACTION ON A NUMA (NON-UNIFORM MEMORY ACCESS) MULTIPROCESSOR: EXPERIENCES WITH PLATINUM (PLATFORM FOR INVESTIGATING NON-UNIFORM MEMORY)
ALAN L. COX and ROBERT J. FOWLER 6 May 1989 27 p Revised
(Contract DACA76-85-C-0001; N00014-84-K-0655; NSF CCR-87-04492)
(AD-A213909; TR-263) Avail: NTIS HC A03/MF A01 CSCL 12/5

PLATINUM is an operating system kernel with a novel memory management system for Non-uniform Memory Access (NUMA) multiprocessor architectures. This memory management system implements a coherent memory abstraction. Coherent memory is uniformly accessible from all processors in the system. When used by applications coded with appropriate programming styles it appears to be nearly as fast as local physical memory and it reduces memory contention. Coherent memory makes programming NUMA multiprocessors easier for the user while attaining a level of performance comparable with hand-tuned programs. The design of the PLATINUM memory management system is described with emphasis on the implementation of coherent memory and the factors that affect its performance. The cost is measured of basic operations implementing coherent memory. Also measured is the performance of a set of application programs running on PLATINUM. Finally, the interaction between architecture and the coherent memory system is measured. Platinum currently runs on the BBN Butterfly Plys (TM) Multiprocessor. GRA

N90-15614# Pacific Northwest Lab., Richland, WA.
THE COMPONENTS OF SCIENTIFIC VISUALIZATION
T. D. DESMARAIS Oct. 1989 6 p Presented at the Supercomputing World Conference, San Francisco, CA, 17-20 Oct. 1989
(Contract DE-AC06-76RL-01830)
(DE90-001992; PNL-SA-17406; CONF-8910103-2) Avail: NTIS HC A02/MF A01

The purpose of scientific visualization is to improve the ability of a human to analyze and understand data. A goal of visualization is improving productivity. If we measure the success of our visualization by measuring only the increase in productivity, we are missing a key capability of proper visualization: the improvement in our ability to discover through exploration. This paper presents a breakdown of the components that improve the success of visualization as measured in both productivity and discovery. Important concepts associated with these components are described in order to give the supercomputer user practical guidelines during construction of a visualization system. DOE

N90-16404# *Royal Signals and Radar Establishment, Malvern (England).*
THE SMITE APPROACH TO SECURITY
P. F. TERRY Aug. 1989 63 p
(Contract RSRE-A94C/2711)
(RSRE-89014; BR111536; ETN-90-96125; AD-A213421)
Copyright Avail: NTIS HC A04/MF A01

SMITE is a novel computer architecture implementing a new security policy model. It is the name of the third phase of the secure communications processor research program and is proposed as the best available technology. It may be used to develop information systems for operational use where high assurance of complex confidentialty and integrity based security policies is required. The results of work carried out are reported. A review of the architecture proposals, the essential architectural elements and the security oriented top level model, are considered. A baseline definition of SMITE to aid the future way forward for the project, is provided. ESA

N90-16593# Department of Energy, Washington, DC. Office of Organization and Management Systems.
FY 1989 UPDATE TO THE INFORMATION RESOURCES MANAGEMENT REVIEW PLAN Report, FY 1989 - FY 1991
Nov. 1989 125 p
(DE90-004185; DOE/MA-0364) Avail: NTIS HC A06/MF A01

The Federal Information Resources Management (IRM) Review Program was initiated in fiscal year (FY) 1986 to ensure that federal agencies' IRM activities are selectively reviewed at least once during a triennial review cycle. This requirement is satisfied predominantly by agency-conducted reviews, the primary purpose being to improve the management of information resources so that the agency can accomplish its missions more efficiently and effectively. The Department's first triennial cycle covered the period FY 1986 to FY 1988. The current cycle covers the period FY

1989 to 1991. IRM reviews may encompass any or all activities of planning, budgeting, organizing, directing, training, and control associated with the creation, collection, processing, transmission, dissemination, use, storage, and disposition of information by agencies. Agencies have been encouraged to take advantage of all ongoing review activity in the IRM area, such as reviews preparing for or resulting from the Office of Management and Budget spring planning and management reviews and/or fall budget reviews; vulnerability assessments and internal control reviews; financial management systems reviews; performance of commercial activity reviews; privacy and security reviews; information collection reviews; records management assessments; and internal audits, among others. DOE

N90-17333# Bolt, Beranek, and Newman, Inc., Cambridge, MA.
RESEARCH AND DEVELOPMENT IN NATURAL LANGUAGE UNDERSTANDING AS PART OF THE STRATEGIC COMPUTING PROGRAM Final Report
DAMARIS AYUSO, MADELEINE BATES, ROBERT BOBROW, MARIE METEER, LANCE A. RAMSHAW, VARDA SHAKED, and RALPH M. WEISCHEDEL 1988 51 p
(Contract N00014-85-C-0016; ARPA ORDER 5257)
(AD-A214611; BBN-7191) Avail: NTIS HC A04/MF A01 CSCL 05/7

A collection of reprints reporting natural language research is presented. The problem of acquiring linguistic knowledge is the chief obstacle to widespread use of natural language technology. Results are reported of five to tenfold increase in the productivity in moving the Janus and Parlance natural language shells to new application domains. The ability of natural language systems to cooperatively handle novel, errorful, or incomplete forms is also critical; new techniques are reported for intelligently and graceful response to such forms. An implementation of a discourse module for understanding definite reference is also reported. GRA

N90-17505# Office of Technology Assessment, Washington, DC.
FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION IN AN ELECTRONIC AGE: OPPORTUNITIES AND CHALLENGES
Oct. 1989 42 p
(PB90-114414) Avail: NTIS HC A03/MF A01 CSCL 05/2

The Federal Government is the largest single source of scientific and technical information (STI) in the world. Scientific advancement and technological innovation depend on the open exchange of STI. The House Committee on Science, Space and Technology asked the Office of Technology Assessment (OTA) to examine the opportunities and challenges facing the Federal Government with respect to the dissemination of STI. The staff paper presents the results of OTA's inquiry. OTA found that the government does not have an overall strategy on dissemination of STI. An overall strategy would help: (1) maximize the return on the substantial federal research and development investment; and (2) meet other national goals to which STI can contribute - such as improving the education of U.S. scientists and engineers, the international competitiveness of U.S. industry, and the strength of the U.S. civilian technology base. The paper answers questions within a framework for an overall strategy on STI dissemination, and identifies key elements that could be useful in such a strategy. A follow up OTA report (Spring 1990) will analyze selected strategic elements in greater depth. GRA

N90-17511# Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.
A GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR THE SOUTHERN LOUISIANA DELTAIC ENVIRONMENTS Final Report
A. N. WILLIAMSON and L. D. BRITSCH Oct. 1989 26 p Presented at the Annual Convention of the American Society for Photogrammetry and Remote Sensing and the American Congress on Surveying and Mapping, 2-7 Apr. 1989
(AD-A214676; WES/MP/GL-89-25) Avail: NTIS HC A03/MF A01 CSCL 08/6

Concern for the coastal zone throughout the United States has prompted implementation of geographic information systems (GIS) that can store the vast amounts of information on the infrastructure of these delicate environments, access and use the stored data to analyze changes that are occurring, and portray the results of analyses in the form of tables and/or maps and map overlays. A specific GIS of interest to the U.S. Army Engineer Waterways Experiment Station has been one that can be used to analyze land-loss conditions within the deltaic environments of Southern Louisiana. This GIS will allow Zenith, Model 248, or equivalent, microcomputers to be used to portray depletion in terms of the time period over which it has been occurring, where it has occurred, and the rate at which it is, or has been, occurring. This paper discusses some of the basic decisions that were made prior to implementing the GIS, the structure of the GIS, and some capabilities provided by the GIS using the stored data. GRA

N90-17811*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE APPLICATION OF A COMPUTER DATA ACQUISITION SYSTEM FOR A NEW HIGH TEMPERATURE TRIBOMETER
CHARLES D. BONHAM (Sverdrup Technology, Inc., Cleveland, OH.) and CHRISTOPHER DELLACORTE 1990 38 p Proposed for presentation at the Annual Meeting for the Society of Tribologists and Lubrication Engineers, Denver, CO, 7-11 May 1990
(NASA-TM-102508; E-5310; NAS 1.15:102508) Avail: NTIS HC A03/MF A01 CSCL 07/1

The two data acquisition computer programs are described which were developed for a high temperature friction and wear test apparatus, a tribometer. The raw data produced by the tribometer and the methods used to sample that data are explained. In addition, the instrumentation and computer hardware and software are presented. Also shown is how computer data acquisition was applied to increase convenience and productivity on a high temperature tribometer. Author

N90-18157# National Academy of Sciences - National Research Council, Washington, DC. Commission on Engineering and Technical Systems.
ADAPTING SOFTWARE DEVELOPMENT POLICIES TO MODERN TECHNOLOGY Final Report, Jun. - Aug. 1988
Jul. 1989 104 p
(AD-A213391) Avail: NTIS HC A06/MF A01 CSCL 12/5

The problem of developing reliable software that is capable of performing its intended function has persisted since the advent of digital computers. The subject has been reviewed many times. Are newer methods of software development now being introduced for large, high technology systems outstripping conventional software acquisition techniques and policies. The committee reviewed recent software studies to learn why they did not adequately solve the problem. Also, the committee assessed current and past development programs, investigated methods for the user and developer to work more closely, evaluated software process models as alternatives to the water fall model, evaluated incremental development, evolutionary development, prototyping, etc. GRA

N90-18158# Office of Software Development, Falls Church, VA. Federal Software Management Support Center.
PREPARING SOFTWARE CONVERSION STUDIES
Dec. 1989 62 p
Avail: NTIS HC A04/MF A01

The purpose of this document is to provide Government agencies with a guideline for preparing software conversion studies. Software conversion, as defined in FIRMR 201-2.001, is the transformation, without functional change, of computer programs or data elements to permit their use on a replacement or changed ADP equipment system or teleprocessing service. In accordance with FIRMR 201-30.012-1, a software conversion study is required for all acquisitions to ensure that the user's needs are met competitively at the lowest overall cost, price, and other factors considered including the cost and other factors associated with conversion activities. A comprehensive software conversion study

is required for each augmentation or replacement ADPE or ADP services acquisition if one of the following conditions exists: (1) The estimated purchase price of the equipment, system, or estimated system life cost of the ADP service is expected to exceed $2.5 million; or (2) The cost of conversion is to be used as the primary justification for a compatibility-limited requirement when the estimated value of the acquisition exceeds $300,000. The study should be prepared as early in the procurement process as possible since it is one of the major aids in determining the procurement strategy of the agency. This document is an update of report number OIT/FCSC-84/001, Preparing Software Conversion Studies, (dated Jan. 1984). It contains an outline for software conversion studies that the Federal Software Management Support Center has found to be most successful. Each chapter required by the FIRMR is specified. Section 1 contains the introduction to the software conversion study; Section 2 describes the current environment; Section 3 describes the target environment; Section 4 documents conversion cost estimating; Section 5 contains a summary of findings; and Section 6 provides the procurement and implementation schedule. Author

N90-18159# Princeton Univ., NJ. Dept. of Computer Science.
FINDING MINIMUM-COST FLOWS BY DOUBLE SCALING
RAVINDRA K. AHUJA, ANDREW V. GOLDBERG, JAMES B. ORLIN, and ROBERT E. TARJAN (Bell Telephone Labs., Inc., Murray Hill, NJ.) Jun. 1988 31 p Sponsored in part by Analog Devices; Apple Computer, Inc.; Prime Computer, Inc.; and IBM
(Contract N00014-87-K-0467; NSF ECS-84-51517; NSF CCR-88-58097; NSF DCR-86-05962; AF-AFOSR-0088-88)
(AD-A214498; PU-CS-TR-164-88) Avail: NTIS HC A03/MF A01 CSCL 09/2

Several researchers have recently developed new techniques that give fast algorithms for the minimum cost flow problem. Several of these techniques are combined to yield an algorithm running in O(nm log log U(nC)) time on networks with n vertices, m arcs, maximum arc capacity U, and maximum arc cost magnitude C. The major techniques used are the capacity scaling approach of Edmonds and Karp, the excess scaling approach of Goldberg and Tarjan, and the dynamic tree data structure of Sleator and Tarjan. For nonsparse graphs with large maximum arc capacity, a similar but slight better bound is obtained. A slightly better bound is also obtained for the (uncapacitated) transportation problem. In addition, a capacity bounding approach to the minimum cost flow problem is discussed. Author

N90-18192# Army Inst. for Research in Management Information and Computer Sciences, Atlanta, GA.
TECHNOLOGY ASSESSMENT OF OPERATING SYSTEMS
JOSEPH NEALON 13 Feb. 1989 15 p
(AD-A216893; ASQBG-I-89-023) Avail: NTIS HC A03/MF A01 CSCL 12/5

With the introduction of the Intel 80386 microprocessor (a 32 bit processor as compared to the 8 and 16 bit processors of the past), the scope and capabilities associated with microcomputers has changed dramatically. The 80386 allows for multitasking and a virtual mode, making it possible for a micro to function as though it were several micros of the previous generation. However, in order to fully realize the potential of this hardware, the software which runs on it must be specifically designed to take advantage of the services provided. The four major operating systems for microcomputers on the market today are MS-DOS, Macintosh, OS/2, and UNIX. GRA

N90-18321# Defense Technical Information Center, Alexandria, VA.
SOURCE HIERARCHY LIST. VOLUME 1: A THROUGH D
Annual Report, Jan. 1988 - Nov. 1989
CLAUDINE S. LONG Dec. 1989 839 p Supersedes DTIC/TR-88/10-Vol-1
(AD-A216050; DTIC/TR-89/22-VOL-1; DTIC/TR-88/10-VOL-1)
Avail: NTIS HC A99/MF A02 CSCL 05/2

This is the second of three volumes of an alphabetical listing of corporate authors as used for announcement of reports received in the Defense Technical Information Center (DTIC). Former names of organizations are included and displayed below the current source name used by DTIC. Cross references direct the user from sub-element organizations to the major source level entry where they are also displayed. Major and sub-hierarchies are preceded and ended by a row of asterisks. This list is used in conjunction with and is not a replacement for DTIC's Source Header List, Volume 1, AD-A216000, and Volume 2, AD-A216001. It displays only those source names from the Source Header List for which hierarchical linkages are pertinent. GRA

N90-18322# Defense Technical Information Center, Alexandria, VA.
SOURCE HIERARCHY LIST. VOLUME 2: E THROUGH N
Annual Report, Jan. 1988 - Nov. 1989
CLAUDINE S. LONG Dec. 1989 750 p Supersedes DTIC/TR-88/10-Vol-2
(AD-A216051; DTIC/TR-89/22-VOL-2; DTIC/TR-88/10-VOL-2)
Avail: NTIS HC A99/MF A02 CSCL 05/2

This is the second of three volumes of an alphabetical listing of corporate authors as used for announcement of reports received in the Defense Technical Information Center (DTIC). Former names of organizations are included and displayed below the current source name used by DTIC. Cross referenced direct the user from sub-element organizations to the major source level entry where they are also displayed. major and sub-hierarchies are preceded and ended by a row of asterisks. This list is used in conjunction with and is not a replacement for DTIC's Source Header List, Volume 1, AD-A216000, and Volume 2, AD-A216001. It displays only those source names from the Source Header List for which hierarchical linkages are pertinent. GRA

N90-18901# Alabama Univ., Huntsville. Dept. of Computer Science.
A PERSPECTIVE OF SOFTWARE REUSE Report, Sep. 1988 - Jan. 1989
JAMES W. HOOPER Mar. 1989 66 p
(Contract DAAL03-86-D-0001)
(AD-A216911; ASQBG-I-89-025) Avail: NTIS HC A04/MF A01 CSCL 12/5

In 1980, the U.S. Department of Defense (DOD) spent over $3 billion on software; by 1990, their expenses are expected to grow to $30 billion per year. Even though expenditures are escalating, productivity is falling behind the demand for new software. The same trends are perceivable throughout the software industry--in private companies and government agencies. Jones (1984) estimates that of all the code written in 1983, probably less than 15 percent is unique, novel, and specific to individual applications. Estimates are that on the average only about five percent of code is reused. Thus we see an obvious candidate area for increasing productivity and reducing cost--that is, to reuse existing software products to achieve all or part of the redundant 85 percent of the development. Even a one percent gain, relative to DOD's projected $30 billion, could save $300 million In addition to increases in productivity and reduction in costs, software quality should increase due to the greater use and testing of individual components, with the resulting isolation and correction of any problems discovered. GRA

N90-19065# Prodata, Inc., Alexandria, VA.
DEFENSE TECHNICAL INFORMATION CENTER EXECUTIVE INFORMATION SYSTEM: DOCUMENTATION AND USER'S MANUAL
JOHN E. FELCH and JOSEPH C. METZGER Nov. 1989 110 p Prepared for Control Data Corp., Alexandria, VA
(Contract MDA903-88-C-0186)
(AD-A216235) Avail: NTIS HC A06/MF A01 CSCL 05/2

Technical documentation and a user's manual are presented. DTIC's Tactical Plan for Automated Management Information Systems, March 1987, defines the need for statistical decision making information and trend reporting. A DTIC-EIS prototype was developed from the SMDR and Checkbook Systems. The prototype

was extended to include active use within specific DTIC-L application areas. Data capture for three applications with data organized in an EIS database, supported by presentation methods was accomplished. Hardware and software constraints are presented in order to complete a fully operational DTIC-EIS.
GRA

N90-19757*# Houston Univ., Clear Lake, TX. Research Inst. for Computing and Information Systems.
DEVELOPMENT OF AN ADA PROGRAMMING SUPPORT ENVIRONMENT DATABASE SEAD (SOFTWARE ENGINEERING AND ADA DATABASE) ADMINISTRATION MANUAL
MORRIS LIAW and DONNA EVESSON (GHG Corp., Houston, TX.) Dec. 1988 161 p
(Contract NCC9-16)
(NASA-CR-186064; NAS 1.26:186064) Avail: NTIS HC A08/MF A01 CSCL 09/2

Software Engineering and Ada Database (SEAD) was developed to provide an information resource to NASA and NASA contractors with respect to Ada-based resources and activities which are available or underway either in NASA or elsewhere in the worldwide Ada community. The sharing of such information will reduce duplication of effort while improving quality in the development of future software systems. SEAD data is organized into five major areas: information regarding education and training resources which are relevant to the life cycle of Ada-based software engineering projects such as those in the Space Station program; research publications relevant to NASA projects such as the Space Station Program and conferences relating to Ada technology; the latest progress reports on Ada projects completed or in progress both within NASA and throughout the free world; Ada compilers and other commercial products that support Ada software development; and reusable Ada components generated both within NASA and from elsewhere in the free world. This classified listing of reusable components shall include descriptions of tools, libraries, and other components of interest to NASA. Sources for the data include technical newletters and periodicals, conference proceedings, the Ada Information Clearinghouse, product vendors, and project sponsors and contractors. Author

N90-20113*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. VOLUME 1: OVERVIEW AND SUMMARY Final Technical Report, Aug. 1988 - Oct. 1989
31 Oct. 1989 61 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumann Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-183840; NAS 1.26:183840; TRW-SCS-89-T7-VOL-1) Avail: NTIS HC A04/MF A01 CSCL 22/2

NASA's Space Station Freedom Program (SSFP) planning efforts have identified a need for a payload training simulator system to serve as both a training facility and as a demonstrator to validate operational concepts. The envisioned Marshall Space Flight Center (MSFC) Payload Training Complex (PTC) required to meet this need will train the space station payload scientists, station scientists, and ground controllers to operate the wide variety of experiments that will be onboard the Space Station Freedom. The Simulation Computer System (SCS) is the computer hardware, software, and workstations that will support the Payload Training Complex at MSFC. The purpose of this SCS study is to investigate issues related to the SCS, alternative requirements, simulator approaches, and state-of-the-art technologies to develop candidate concepts and designs. This study was performed August 1988 to October 1989. Thus, the results are based on the SSFP August 1989 baseline, i.e., pre-Langley configuration/budget review (C/BR) baseline. Some terms, e.g., combined trainer, are being redefined. An overview of the study activities and a summary of study results are given here. Author

N90-20114*# TRW, Inc., Huntsville, AL. System Development Div.
SPACE STATION SIMULATION COMPUTER SYSTEM (SCS) STUDY FOR NASA/MSFC. VOLUME 2: CONCEPT DOCUMENT Final Technical Report
31 Oct. 1989 151 p Prepared in cooperation with Essex Corp., Huntsville, AL and Grumann Data Systems Corp., Woodbury, NY
(Contract NAS8-37745)
(NASA-CR-183841; NAS 1.26:183841; MSFC-SPEC-1764-VOL-2) Avail: NTIS HC A08/MF A01 CSCL 22/2

The Simulation Computer System (SCS) concept document describes and establishes requirements for the functional performance of the SCS system, including interface, logistic, and qualification requirements. The SCS is the computational communications and display segment of the Marshall Space Flight Center (MSFC) Payload Training Complex (PTC). The PTC is the MSFC facility that will train onboard and ground operations personnel to operate the payloads and experiments on board the international Space Station Freedom. The requirements to be satisfied by the system implementation are identified here. The SCS concept document defines the requirements to be satisfied through the implementation of the system capability. The information provides the operational basis for defining the requirements to be allocated to the system components and enables the system organization to assess whether or not the completed system complies with the requirements of the system.
Author

N90-20511# Pacific Northwest Lab., Richland, WA.
INFORMATION MANAGEMENT SYSTEMS FOR INTEGRATING THE TECHNICAL DATA AND REGULATORY REQUIREMENTS OF ENVIRONMENTAL RESTORATION ACTIVITIES
C. A. GEFFEN, B. A. GARRETT, and M. B. WALTER Mar. 1990 11 p Presented at the 16th Annual Waste Management Symposium: Working Towards a Cleaner Environment, Tucson, AZ, 25 Feb. - 1 Mar. 1990
(Contract DE-AC06-76RL-01830)
(DE90-008622; PNL-SA-17283; CONF-900210-29) Avail: NTIS HC A03/MF A01

Current environmental regulations require that comprehensive planning be conducted before remediating a hazardous waste site to characterize the nature and extent of site contamination, calculate the risk to the public, and assess the effectiveness of various remediation technologies. Remediation of Department of Energy (DOE) sites contaminated with hazardous or mixed wastes will require the effective integration of scientific and engineering data with regulatory and institutional requirements. The information management challenge presented by waste site cleanup activities goes beyond merely dealing with the large quantity of data that will be generated. The information must be stored, managed, and presented in a way that provides some consistency in approach across sites, avoids duplication of effort, and facilitates responses to requests for information from the regulators and the public. Background information is provided on the regulatory requirements for data gathering and analysis for environmental restoration activities, and outlines the data and information management requirements for completing the pre-remediation phases of an environmental restoration project. Information management systems for integrating the regulatory and institutional requirements of the environmental restoration process with the technical data and analysis requirements are also described. DOE

N90-20655*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
KNOWLEDGE REPRESENTATION IN SPACE FLIGHT OPERATIONS
CARL BUSSE *In* NASA, Lyndon B. Johnson Space Center, Graphics Technology in Space Applications (GTSA 1989) p 25-31 Aug. 1989
Avail: NTIS HC A11/MF A02 CSCL 09/2

In space flight operations rapid understanding of the state of the space vehicle is essential. Representation of knowledge depicting space vehicle status in a dynamic environment presents

a difficult challenge. The NASA Jet Propulsion Laboratory has pursued areas of technology associated with the advancement of spacecraft operations environment. This has led to the development of several advanced mission systems which incorporate enhanced graphics capabilities. These systems include: (1) Spacecraft Health Automated Reasoning Prototype (SHARP); (2) Spacecraft Monitoring Environment (SME); (3) Electrical Power Data Monitor (EPDM); (4) Generic Payload Operations Control Center (GPOCC); and (5) Telemetry System Monitor Prototype (TSM). Knowledge representation in these systems provides a direct representation of the intrinsic images associated with the instrument and satellite telemetry and telecommunications systems. The man-machine interface includes easily interpreted contextual graphic displays. These interactive video displays contain multiple display screens with pop-up windows and intelligent, high resolution graphics linked through context and mouse-sensitive icons and text. Author

N90-20679*# Lockheed Missiles and Space Co., Huntsville, AL.
SES CUPOLA INTERACTIVE DISPLAY DESIGN ENVIRONMENT
BANG Q. VU and KEVIN R. KIRKHOFF *In* NASA, Lyndon B. Johnson Space Center, Graphics Technology in Space Applications (GTSA 1989) p 205-214 Aug. 1989
Avail: NTIS HC A11/MF A02 CSCL 09/2

The Systems Engineering Simulator, located at the Lyndon B. Johnson Space Center in Houston, Texas, is tasked with providing a real-time simulator for developing displays and controls targeted for the Space Station Freedom. These displays and controls will exist inside an enclosed workstation located on the space station. The simulation is currently providing the engineering analysis environment for NASA and contractor personnel to design, prototype, and test alternatives for graphical presentation of data to an astronaut while he performs specified tasks. A highly desirable aspect of this environment is to have the capability to rapidly develop and bring on-line a number of different displays for use in determining the best utilization of graphics techniques in achieving maximum efficiency of the test subject fulfilling his task. The Systems Engineering Simulator now has available a tool which assists in the rapid development of displays for these graphic workstations. The Display Builder was developed in-house to provide an environment which allows easy construction and modification of displays within minutes of receiving requirements for specific tests. Author

N90-21526# Office of Technology Assessment, Washington, DC.
HIGH PERFORMANCE COMPUTING AND NETWORKING FOR SCIENCE
Sep. 1989 52 p
(PB90-131228; OTA-BP-CIT-59; LC-89-600758) Avail: NTIS HC A04/MF A01; also available SOD HC $2.25 as 052-003-01164-6 CSCL 09/2

Key issues concerning the Federal role in supporting national high performance computing facilities and in developing a national research and education network are explored. Author

N90-21532*# Maryland Univ., College Park. Inst. for Advanced Computer Studies.
INTEGRATING AUTOMATED SUPPORT FOR A SOFTWARE MANAGEMENT CYCLE INTO THE TAME SYSTEM
TOSHIHIKO SUNAZUKA (Nippon Electric Co. Ltd., Tokyo, Japan) and VICTOR R. BASILI Jul. 1989 21 p Sponsored in part by Nippon Electric Co., Ltd.
(Contract NSG-5123)
(NASA-CR-186457; NAS 1.26:186457; UMIACS-TR-89-75; CS-TR-2289) Avail: NTIS HC A03/MF A01 CSCL 09/2

Software managers are interested in the quantitative management of software quality, cost and progress. An integrated software management methodology, which can be applied throughout the software life cycle for any number purposes, is required. The TAME (Tailoring A Measurement Environment) methodology is based on the improvement paradigm and the goal/question/metric (GQM) paradigm. This methodology helps generate a software engineering process and measurement environment based on the project characteristics. The SQMAR (software quality measurement and assurance technology) is a software quality metric system and methodology applied to the development processes. It is based on the feed forward control principle. Quality target setting is carried out before the plan-do-check-action activities are performed. These methodologies are integrated to realize goal oriented measurement, process control and visual management. A metric setting procedure based on the GQM paradigm, a management system called the software management cycle (SMC), and its application to a case study based on NASA/SEL data are discussed. The expected effects of SMC are quality improvement, managerial cost reduction, accumulation and reuse of experience, and a highly visual management reporting system. Author

N90-21543*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SOFTWARE MANAGEMENT ENVIRONMENT (SME) CONCEPTS AND ARCHITECTURE
WILLIAM DECKER and JON VALETT Aug. 1989 67 p
(NASA-TM-103306; NAS 1.15:103306; SEL-89-003) Avail: NTIS HC A04/MF A01 CSCL 09/2

The concepts and architecture of the Software Management Environment (SME) currently under development for the Systems Development Branch of the Flight Dynamics Division of the Goddard Space Flight Center (GSFC) are presented. The SME will provide an integrated set of management tools that can assist software development managers in the management and planning of flight dynamics software development projects. Author

N90-22295*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE APPLICATION OF CONNECTIONISM TO QUERY PLANNING/SCHEDULING IN INTELLIGENT USER INTERFACES
NICHOLAS SHORT, JR. and LOKENDRA SHASTRI (Pennsylvania Univ., Philadelphia.) *In its* The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 3-16 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

In the mid nineties, the Earth Observing System (EOS) will generate an estimated 10 terabytes of data per day. This enormous amount of data will require the use of sophisticated technologies from real time distributed Artificial Intelligence (AI) and data management. Without regard to the overall problems in distributed AI, efficient models were developed for doing query planning and/or scheduling in intelligent user interfaces that reside in a network environment. Before intelligent query/planning can be done, a model for real time AI planning and/or scheduling must be developed. As Connectionist Models (CM) have shown promise in increasing run times, a connectionist approach to AI planning and/or scheduling is proposed. The solution involves merging a CM rule based system to a general spreading activation model for the generation and selection of plans. The system was implemented in the Rochester Connectionist Simulator and runs on a Sun 3/260. Author

N90-22302*# Colorado Univ., Boulder. Lab. for Atmospheric and Space Physics.
SURE (SCIENCE USER RESOURCE EXPERT): A SCIENCE PLANNING AND SCHEDULING ASSISTANT FOR A RESOURCE BASED ENVIRONMENT
NANCY E. THALMAN and THOMAS P. SPARN *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 105-113 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

SURE (Science User Resource Expert) is one of three components that compose the SURPASS (Science User Resource Planning and Scheduling System). This system is a planning and scheduling tool which supports distributed planning and scheduling, based on resource allocation and optimization. Currently SURE is being used within the SURPASS by the UARS (Upper Atmospheric Research Satellite) SOLSTICE instrument to build a daily science

plan and activity schedule and in a prototyping effort with NASA GSFC to demonstrate distributed planning and scheduling for the SOLSTICE II instrument on the EOS platform. For the SOLSTICE application the SURE utilizes a rule-based system. Development of a rule-based program using Ada CLIPS as opposed to using conventional programming, allows for capture of the science planning and scheduling heuristics in rules and provides flexibility in inserting or removing rules as the scientific objectives and mission constraints change. The SURE system's role as a component in the SURPASS, the purpose of the SURE planning and scheduling tool, the SURE knowledge base, and the software architecture of the SURE component are described. Author

N90-22303*# Howard Univ., Washington, DC. Dept. of Electrical Engineering.
A KNOWLEDGE-BASED APPROACH TO IMPROVING OPTIMIZATION TECHNIQUES IN SYSTEM PLANNING
J. A. MOMOH and Z. Z. ZHANG *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 115-122 May 1990 Sponsored by DOE and Los Angeles Dept. of Water and Power, CA
(Contract NSF ECS-86-57559)
Avail: NTIS HC A15/MF A02 CSCL 09/2

A knowledge-based (KB) approach to improve mathematical programming techniques used in the system planning environment is presented. The KB system assists in selecting appropriate optimization algorithms, objective functions, constraints and parameters. The scheme is implemented by integrating symbolic computation of rules derived from operator and planner's experience and is used for generalized optimization packages. The KB optimization software package is capable of improving the overall planning process which includes correction of given violations. The method was demonstrated on a large scale power system discussed in the paper. Author

N90-22317*# Naval Research Lab., Washington, DC.
ADAPTIVE PATTERN RECOGNITION BY MINI-MAX NEURAL NETWORKS AS A PART OF AN INTELLIGENT PROCESSOR
HAROLD H. SZU *In* NASA, Goddard Space Flight Center, The 1990 Goddard Conference on Space Applications of Artificial Intelligence p 287-306 May 1990
Avail: NTIS HC A15/MF A02 CSCL 09/2

In this decade and progressing into 21st Century, NASA will have missions including Space Station and the Earth related Planet Sciences. To support these missions, a high degree of sophistication in machine automation and an increasing amount of data processing throughput rate are necessary. Meeting these challenges requires intelligent machines, designed to support the necessary automations in a remote space and hazardous environment. There are two approaches to designing these intelligent machines. One of these is the knowledge-based expert system approach, namely AI. The other is a non-rule approach based on parallel and distributed computing for adaptive fault-tolerances, namely Neural or Natural Intelligence (NI). The union of AI and NI is the solution to the problem stated above. The NI segment of this unit extracts features automatically by applying Cauchy simulated annealing to a mini-max cost energy function. The feature discovered by NI can then be passed to the AI system for future processing, and vice versa. This passing increases reliability, for AI can follow the NI formulated algorithm exactly, and can provide the context knowledge base as the constraints of neurocomputing. The mini-max cost function that solves the unknown feature can furthermore give us a top-down architectural design of neural networks by means of Taylor series expansion of the cost function. A typical mini-max cost function consists of the sample variance of each class in the numerator, and separation of the center of each class in the denominator. Thus, when the total cost energy is minimized, the conflicting goals of intraclass clustering and interclass segregation are achieved simultaneously. Author

N90-22440# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Technical Information Panel.
ELECTRONIC TRANSFER OF INFORMATION AND ITS IMPACT ON AEROSPACE AND DEFENCE RESEARCH AND DEVELOPMENT
Mar. 1990 190 p Meeting held in Brussels, Belgium, 17-19 Oct. 1989
(AGARD-CP-466; ISBN-92-835-0550-6; AD-A221596) Copyright
Avail: NTIS HC A09/MF A02; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Topics discussed include the present state and trends in the electronic transfer of information in Europe, North America, and Japan; operational and experimental systems for electronic storage and delivery of information; operational and experimental systems of electronic publishing and communication; and applications in the aerospace community. Included are papers on proposed telecommunications networks, Integrated Services Digital Network (ISDN) and satellite networks, plans for an integrated system for a large technical library, automation plans of the European Patent Office, optical disc systems, desk-top publishing, Standard Generalized Markup Language (SGML), electronic mail, computer conferencing and the U.S. Defense Department's Computer-aided Acquisition and Logistics Support (CALS) program.

N90-22441# Commission of the European Communities (Luxembourg). Directorate General Telecommunications.
TECHNOLOGIES FOR ELECTRONIC TRANSFER OF INFORMATION: THE PRESENT STATE AND TRENDS IN EUROPE
F. MASTRODDI *In* AGARD, Electronic Transfer of Information and its Impact on Aerospace and Defence Research and Development 10 p Mar. 1990
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The emergence of new data storage and transfer media is having a growing effect on the electronic information industry. Two decades ago, there were only a handful of bibliographic databases, operated over dedicated online networks. Today the mass storage possibilities of new technologies, potential cost/benefit ratios, integration with personal computers and telecommunications networks are typical perceived benefits. There are several hundred optical disc applications running in Europe, in business, in education, leisure and research. A Commission of the European Community (CEC)-sponsored survey has identified many of these, and has gathered the opinions of market leaders on present and future trends. The consensus of opinion points to a promising market potential for this sector, depending on overcoming a set of key barriers - technical, economic and organizational and on the introduction of new telecommunications facilities. The European Commission (EC), under its new telecommunications and information market programs, aims to encourage the rapid development of this sector and to help overcome the barriers to growth. A call for proposals for pilot/demonstration projects held in early 1989 is one example of EC action. Author

N90-22442# National Federation of Abstracting and Indexing Services, Philadelphia, PA.
TECHNOLOGY FOR ELECTRONIC TRANSFER OF INFORMATION: THE PRESENT AND FUTURE IN NORTH AMERICA
BETTY UNRUH *In* AGARD, Electronic Transfer of Information and Its Impact on Aerospace and Defence Research and Development 11 p Mar. 1990
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Developments in the electronic transfer of information are largely led by advances in technology. This has been true and continues to be so today. The technologies of today, how they have advanced, and what effect those advancements have had

on the products being delivered as well as on the information industry and its member companies are addressed. The successful delivery of information, however, is not completely dependent on technology. Successful products (and the technologies they utilize) are firmly rooted in the markets they serve. The importance of a product meeting a market need cannot be overlooked. How products, born of technology, have addressed market demands (when successful) or not addressed (when unsuccessful) will be included for both the past and present with an eye to what the lessons learned portend for the future. Author

N90-22443# GMD Bureau Tokyo, Akasaka (Japan). Deutsches Kulturzentrum.

TECHNOLOGIES FOR ELECTRONIC TRANSFER OF INFORMATION: THE PRESENT STATE AND TRENDS IN JAPAN

U. WATTENBERG *In* AGARD, Electronic Transfer of Information and its Impact on Aerospace and Defence Research and Development 10 p Mar. 1990

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A full picture of electronic transfer of information in Japan is given. The huge number (6000) of Kanji characters caused many difficulties for the information industry: a Japanese-Japanese dictionary is needed for inputting characters via the keyboard; the characters require high resolution screens, etc. Having solved these problems, Japan has turned such disadvantages into advantages: it is leading in the production of high resolution screens and fax machines. Together with China and Korea, Japan is establishing a 2-byte standard character set for up to 65000 characters. The Japan Information Center of Science and Technology (JICST) is one of the largest hosts and document supply centers in the world. The JICST file on science and technology e.g., grows by 700,000 documents per year and the number of documents copied per year 700,000 too. 100,000 documents per year are translated into machine English; machine translation systems are applied mainly for translations from English into Japanese. JICST hosts one of the STN nodes (Columbus, Karlsruhe, Tokyo) through which the JICST databases are worldwide accessible, those in English really, and those in Japanese in principle. Of high importance are also the activities of the Japan Patent Information Organization (JAPIO) which cooperates with the U.S. Patent and Trade Mark Office and the European Patent Office in establishing a worldwide image file of all patents since 1920. Instead of the traditional 16 mm microfilm and microfiche the JAPIO now distributes to its subscribers 12 cm CD-ROM including full text images and index data. There is a sophisticated retrieval system for trade marks. And patents can be applied now either online, or on floppy disk, or in printed form. Japanese newspaper companies now hold their journals in electronic form. There is a data base with 500,000 photos on CD-ROM. Each day 500 new photos enter the database. Author

N90-22451# Information Technology Applications S.A. (Luxembourg).

ELECTRONIC MAIL SYSTEMS

BARRY MAHON *In* AGARD, Electronic Transfer of Information and its Impact on Aerospace and Defence Research and Development 3 p Mar. 1990

Copyright Avail: NTIS HC A09/MF A02; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Electronic mail, or the use of computers and telecommunications networks for transferring messages, has been available to users of computer systems for a number of years. It's early availability was restricted to specialists and to those who had ready access to telecommunications facilities. More recently it has become widely available with a number of competing public services, many originating in the USA. A new CCITT/ISO standard known as X400 was agreed which is designed to facilitate the interaction between previously incompatible electronic messaging systems. It is expected that the availability of services supporting the X400 standard will contribute to the wider use of electronic messaging as a business and technical communication tool. However, in the same time frame, the general availability of equipment for productivity enhancement based on microprocessors, generally classified as the Information Technologies, has left many users or potential users of messaging systems with a bewildering choice of facilities. The developments are briefly reviewed and then the integration of message handling in the more advanced systems is presented. In so doing the emphasis is on the different functions which can be and should be covered by planners of messaging services. Direct services such as telex, fax, and interpersonal messaging are treated as well as the indirect facilities of gateways to external databases, intelligent interfacing and personal information management. A number of different scenarios are presented which illustrate how existing equipment and infrastructure can be more efficiently utilized to provide integrated services. Author

N90-22453# Defense Technical Information Center, Alexandria, VA.

APPLICATIONS TO THE AEROSPACE AND DEFENSE R AND D COMMUNITY: THE DOD COMPUTER-AIDED ACQUISITION AND LOGISTICS SUPPORT (CALS) INITIATIVE

KURT N. MOLHOLM *In* AGARD, Electronic Transfer of Information and its Impact on Aerospace and Defence Research and Development 8 p Mar. 1990

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The U.S. Department of Defense (DoD) Computer-aided Acquisition and Logistics support (CALS) initiative is directed toward improving the design, development, and support of weapons systems through the use of current and emerging computer technology. CALS emphasizes greater utilization of information contained in DoD and contractor databases to provide optimum, economic weapon system support using electronic transfer of information to the maximum amount possible. Author

N90-22455# British Aerospace Public Ltd. Co., Preston (England). Project Management Systems.

INFORMATION TECHNOLOGY APPLICATIONS: A BRITISH AEROSPACE MILITARY AIRCRAFT LTD VIEW

K. HALL *In* AGARD, Electronic Transfer of Information and its Impact on Aerospace and Defence Research and Development 16 p Mar. 1990

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A view of the use and impact of information technology in BAe Military Aircraft Ltd is presented. A precis of the current and expected business market place is included to give perspective to the importance of this industrial sector. The current situation is described with reference to typical conflicting requirements and the dynamic, competitive background. An example of a high level integrated business architecture is included which comprises a basic element of information flow in a company. Many of the components of an IT system focus in the project management activity, and consequently a system used for the management of projects is described in more detail. This illustrates in more depth the nature and complexity of one of the main activities in aerospace, and gives in addition an indication of the investment and timescales involved in such large - scale projects. Some conclusions are presented for consideration as policy guidelines for adoption by the AGARD panel. Author

N90-23114# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.

DURRA: A TASK-LEVEL DESCRIPTION LANGUAGE REFERENCE MANUAL, VERSION 2 Final Report

MARIO R. BARBACCI and JEANNETTE M. WING Sep. 1989 54 p

(Contract F19628-85-C-0003)

(AD-A219293; CMU/SEI-89-TR-34; ESD-TR-89-45) Avail: NTIS HC A04/MF A01 CSCL 12/5

Durra is a programming language designed to support the development of large-grained parallel programming applications. These applications are often computation-intensive, or have real-time requirements that require efficient concurrent execution of multiple tasks, devoted to specific pieces of the application. During execution time the application tasks run on possibly separate processors, and communicate with each other by sending messages of different types across various communication links. The application developer is responsible for prescribing a way to manage all of these resources. This prescription is called a task-level application description. It describes the tasks to be executed, the possible assignments of processes to processors, the data paths between the processors, and the intermediate queues required to store the data as they move from source to destination processes. Durra is a task-level description language, a notation in which to write these application descriptions. The syntax and semantics of the language is described and all the language changes introduced as a result of the experiences writing task and application descriptions in Durra are included. GRA

N90-23116# Naval Ocean Systems Center, San Diego, CA.
RF NETWORK SELECTION IN A RULE-BASED SYSTEM. NOSC PROJECT ZE68: COST METRIC ALGORITHMS FOR INTERNETWORK APPLICATIONS Final Report, for FY 1988 - 89
R. A. DILLARD and D. E. OLSEN Sep. 1989 51 p
(AD-A219389; NOSC/TR-1318) Avail: NTIS HC A04/MF A01 CSCL 25/2

Algorithms were investigated for dynamically selecting good radio frequency (RF) subnet resources to service transmission requests in a multi-internet environment. The selection algorithms were based on the communications architecture of the 1990 Unified Networking Technology (UNT) Advanced Technology Demonstration. Candidate subnet-selection algorithms were implemented in a rule-based expert system, the C-Language Integrated Production System (CLIPS), and were tested on representative examples of transmission requests. Weighted fuzzy-logic methods were compared with a weighted-average method. GRA

N90-23366*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MULTIPROCESSING ON SUPERCOMPUTERS FOR COMPUTATIONAL AERODYNAMICS
MAURICE YARROW (Sterling Federal Systems, Inc., Palo Alto, CA.) and UNMEEL B. MEHTA May 1990 38 p Presented at the 28th Aerospace Sciences Meeting, Reno, NV, 8-11 Jan. 1990 Revised Original contains color illustrations
(NASA-TM-102806; A-90121; NAS 1.15:102806; AIAA-90-0337) Avail: NTIS HC A03/MF A01; 5 functional color pages CSCL 01/1

Very little use is made of multiple processors available on current supercomputers (computers with a theoretical peak performance capability equal to 100 MFLOPs or more) in computational aerodynamics to significantly improve turnaround time. The productivity of a computer user is directly related to this turnaround time. In a time-sharing environment, the improvement in this speed is achieved when multiple processors are used efficiently to execute an algorithm. The concept of multiple instructions and multiple data (MIMD) through multi-tasking is applied via a strategy which requires relatively minor modifications to an existing code for a single processor. Essentially, this approach maps the available memory to multiple processors, exploiting the C-FORTRAN-Unix interface. The existing single processor code is mapped without the need for developing a new algorithm. The procedure for building a code utilizing this approach is automated with the Unix stream editor. As a demonstration of this approach, a Multiple Processor Multiple Grid (MPMG) code is developed. It is capable of using nine processors, and can be easily extended to a larger number of processors. This code solves the three-dimensional, Reynolds averaged, thin-layer and slender-layer Navier-Stokes equations with an implicit, approximately factored and diagonalized method. The solver is applied to generic oblique-wing aircraft problem on a four processor Cray-2 computer. A tricubic interpolation scheme is developed to increase the accuracy of coupling of overlapped grids. For the oblique-wing aircraft problem, a speedup of two in elapsed (turnaround) time is observed in a saturated time-sharing environment. Author

N90-23462*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
GEOMETRIC PROGRAMMING PREDICTION OF DESIGN TRENDS FOR OMV PROTECTIVE STRUCTURES
R. A. MOG (Science Applications International Corp., Huntsville, AL.) and J. R. HORN Washington Jun. 1990 20 p
(NASA-TM-4206; M-632; NAS 1.15:4206) Avail: NTIS HC A03/MF A01 CSCL 22/2

The global optimization trends of protective honeycomb structural designs for spacecraft subject to hypervelocity meteroid and space debris are presented. This nonlinear problem is first formulated for weight minimization of the orbital maneuvering vehicle (OMV) using a generic monomial predictor. Five problem formulations are considered, each dependent on the selection of independent design variables. Each case is optimized by considering the dual geometric programming problem. The dual variables are solved for in terms of the generic estimated exponents of the monomial predictor. The primal variables are then solved for by conversion. Finally, parametric design trends are developed for ranges of the estimated regression parameters. Results specify nonmonotonic relationships for the optimal first and second sheet mass per unit areas in terms of the estimated exponents. Author

N90-23634# Sandia National Labs., Albuquerque, NM.
CMOS IC I(SUB DDQ) TESTING FOR THE 1990S
JERRY M. SODEN, CHARLES F. HAWKINS (New Mexico Univ., Albuquerque.), RONALD R. FITZENMEIER, and JOHN R. GUTH 1990 4 p Presented at the VLSI Test Symposium, Atlantic City, NJ, 10-11 Apr. 1990
(Contract DE-AC04-76DP-00789)
(DE90-009508; SAND-90-0613C; CONF-9004174-1) Avail: NTIS HC A01/MF A01

Significant improvements in CMOSIC quality, reliability, and fabrication yield can be readily achieved in the 1990s by appropriate implementation of tests for quiescent power supply current (I(sub DDQ)). As part of an overall quality management program, I(sub DDQ) testing incorporated with design for testability and modified conventional logic response testing enables 100 percent stuck-at fault coverage, quality improvement goals of defective levels less than 100 PPM, and reliability greater than 0.999 for 30 years. DOE

N90-23976*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
DISTRIBUTED USER SERVICES FOR SUPERCOMPUTERS
HENRY A. SOWIZRAL 1 Apr. 1989 22 p
(Contract NCC2-387)
(NASA-CR-180370; NAS 1.26:180370; RIACS-TR-89.18) Avail: NTIS HC A03/MF A01 CSCL 09/2

User-service operations at supercomputer facilities are examined. The question is whether a single, possibly distributed, user-services organization could be shared by NASA's supercomputer sites in support of a diverse, geographically dispersed, user community. A possible structure for such an organization is identified as well as some of the technologies needed in operating such an organization. Author

N90-24178# National Defence Research Establishment, Linkoeping (Sweden). Div. of Information Technology.
ACTIVITIES REPORT OF THE DIVISION OF INFORMATIONS SYSTEMS (FOA 37) Annual Report, Fiscal Year 1988 - 1989
GUNILLA SIVERSKOG, ed. and EVA TOLLER, ed. Dec. 1989 55 p

(FOA-C-30552-3.4; ISSN-0347-3708; ETN-90-96589) Avail: NTIS HC A04/MF A01; Research Inst. of National Defence, P.O. Box 1165, S-581 11 Linkoeping, Swedish, 50 Swedish crowns

An overview of the work carried out at the Information Systems Division is presented. Research projects, including knowledge based techniques, autonomous systems, computer security, space technology, computer vision, C3I systems, and anti-submarine warfare are described. The computer center and image processing laboratory are outlined. Research exchange, conference contributions and participation, committee participation, seminars and reports are discussed. ESA

N90-24339# Midwest Research Inst., Golden, CO.
A LOW-COST PC-BASED TELEMETRY DATA-REDUCTION SYSTEM
D. A. SIMMS and C. P. BUTTERFIELD Apr. 1990 8 p Presented at the 4th National Conference on Microcomputer Applications in Energy, Tucson, AZ, 25-27 Apr. 1990
(Contract DE-AC02-83CH-10093)
(DE90-000330; SERI/TP-257-3737; CONF-9004110-1) Avail: NTIS HC A02/MF A01

The Solar Energy Research Institute's (SERI) Wind Research Branch is using Pulse Code Modulation (PCM) telemetry data-acquisition systems to study horizontal-axis wind turbines. PCM telemetry systems are used in test installations that require accurate multiple-channel measurements taken from a variety of different locations. SERI has found them ideal for use in tests requiring concurrent acquisition of data-reduction system to facilitate quick, in-the-field multiple-channel data analysis. Called the PC-PCM System, it consists of two basic components. First, AT-compatible hardware boards are used for decoding and combining PCM data streams. Up to four hardware boards can be installed in a single PC, which provides the capability to combine data from four PCM streams directly to PC disk or memory. Each stream can have up to 62 data channels. Second, a software package written for the DOS operating system was developed to simplify data-acquisition control and management. The software provides a quick, easy-to-use interface between the PC and PCM data streams. Called the Quick-Look Data Management Program, it is a comprehensive menu-driven package used to organize, acquire, process, and display information from incoming PCM data streams. This paper describes both hardware and software aspects of the SERI PC-PCM system, concentrating on features that make it useful in an experiment test environment to quickly examine and verify incoming data. Also discussed are problems and techniques associated with PC-based telemetry data acquisition, processing, and real-time display. DOE

N90-24367*# Iowa State Univ. of Science and Technology, Ames.
EXPERIMENTS AND OTHER METHODS FOR DEVELOPING EXPERTISE WITH DESIGN OF EXPERIMENTS IN A CLASSROOM SETTING
JOHN W. PATTERSON *In* NASA, Langley Research Center, National Educators' Workshop: Update 1989 Standard Experiments in Engineering Materials Science and Technology p 119-131 May 1990
Avail: NTIS HC A09/MF A02 CSCL 05/4

The only way to gain genuine expertise in Statistical Process Control (SPC) and the design of experiments (DOX) is with repeated practice, but not on canned problems with dead data sets. Rather, one must negotiate a wide variety of problems each with its own peculiarities and its own constantly changing data. The problems should not be of the type for which there is a single, well-defined answer that can be looked up in a fraternity file or in some text. The problems should match as closely as possible the open-ended types for which there is always an abundance of uncertainty. These are the only kinds that arise in real research, whether that be basic research in academe or engineering research in industry. To gain this kind of experience, either as a professional consultant or as an industrial employee, takes years. Vast amounts of money, not to mention careers, must be put at risk. The purpose here is to outline some realistic simulation-type lab exercises that are so simple and inexpensive to run that the students can repeat them as often as desired at virtually no cost. Simulations also allow the instructor to design problems whose outcomes are as noisy as desired but still predictable within limits. Also the instructor and the students can learn a great deal more from the postmortum conducted after the exercise is completed. One never knows for sure what the true data should have been when dealing only with real life experiments. To add a bit more realism to the exercises, it is sometimes desirable to make the students pay for each experimental result from a make-believe budget allocation for the problem. Author

N90-25586*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
TOOLS FOR DISTRIBUTED APPLICATION MANAGEMENT
KEITH MARZULLO, ROBERT COOPER, MARK WOOD, and KENNETH P. BIRMAN Jun. 1990 32 p
(Contract NAG2-593)
(NASA-CR-186711; NAS 1.26:186711; TR-90-1136) Avail: NTIS HC A03/MF A01 CSCL 09/2

Distributed application management consists of monitoring and controlling an application as it executes in a distributed environment. It encompasses such activities as configuration, initialization, performance monitoring, resource scheduling, and failure response. The Meta system (a collection of tools for constructing distributed application management software) is described. Meta provides the mechanism, while the programmer specifies the policy for application management. The policy is manifested as a control program which is a soft real-time reactive program. The underlying application is instrumented with a variety of built-in and user-defined sensors and actuators. These define the interface between the control program and the application. The control program also has access to a database describing the structure of the application and the characteristics of its environment. Some of the more difficult problems for application management occur when preexisting, nondistributed programs are integrated into a distributed application for which they may not have been intended. Meta allows management functions to be retrofitted to such programs with a minimum of effort. Author

N90-25587*# Research Triangle Inst., Research Triangle Park, NC. Dept. of Software Research and Development.
GSC CONFIGURATION MANAGEMENT PLAN
B. EDWARD WITHERS May 1990 15 p
(Contract NAS1-17964)
(NASA-CR-182044; NAS 1.26:182044) Avail: NTIS HC A03/MF A01 CSCL 09/2

The tools and methods used for the configuration management of the artifacts (including software and documentation) associated with the Guidance and Control Software (GCS) project are described. The GCS project is part of a software error studies research program. Three implementations of GCS are being produced in order to study the fundamental characteristics of the software failure process. The Code Management System (CMS) is used to track and retrieve versions of the documentation and software. Application of the CMS for this project is described and the numbering scheme is delineated for the versions of the project artifacts. Author

N90-25588*# Research Triangle Inst., Research Triangle Park, NC.
SOFTWARE QUALITY ASSURANCE PLAN FOR GCS
STEPHEN E. DUNCAN and ELIZABETH K. BAILEY May 1990 28 p
(Contract NAS1-17964)
(NASA-CR-182045; NAS 1.26:182045) Avail: NTIS HC A03/MF A01 CSCL 09/2

The software quality assurance (SQA) function for the Guidance and Control Software (GCS) project which is part of a software error studies research program is described. The SQA plan outlines all of the procedures, controls, and audits to be carried out by the SQA organization to ensure adherence to the policies, procedures, and standards for the GCS project. Author

N90-25692*# Cornell Univ., Ithaca, NY. Dept. of Computer Science.
TOOLS FOR DISTRIBUTED APPLICATION MANAGEMENT
KEITH MARZULLO, MARK WOOD, ROBERT COOPER, and KENNETH P. BIRMAN 1990 30 p
(Contract NAG2-593)
(NASA-CR-186646; NAS 1.26:186646) Avail: NTIS HC A03/MF A01 CSCL 05/1

Distributed application management consists of monitoring and controlling an application as it executes in a distributed environment. It encompasses such activities as configuration, initialization, performance monitoring, resource scheduling, and failure response. The Meta system is described: a collection of tools for constructing distributed application management software. Meta provides the mechanism, while the programmer specifies the policy for application management. The policy is manifested as a control program which is a soft real time reactive program. The underlying application is instrumented with a variety of built-in and user defined sensors and actuators. These define the interface between the control program and the application. The control program also has access to a database describing the structure of the application and the characteristics of its environment. Some of the more difficult problems for application management occur when pre-existing, nondistributed programs are integrated into a distributed application for which they may not have been intended. Meta allows management functions to be retrofitted to such programs with a minimum of effort. Author

N90-25695*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TECHNICAL GUIDE ON DOCUMENTATION REQUIREMENTS FOR OPEN MARKET CONTRACT ACQUISITIONS OF INFORMATION RESOURCES
ASA L. SHAW, JR., WILLIAM R. KIVETT, and JAMES Y. TAYLOR Jun. 1990 36 p
(NASA-TM-102650; NAS 1.15:102650) Avail: NTIS HC A03/MF A01 CSCL 05/1

A guide is presented to assist requestors in formulating and submitting the required Complete Package for Information Resources (IR) acquisitions. Advance discussions with cognizant procurement personnel are strongly recommended for complex IR requirements or for those requestors new to the acquisition process. Open Market means the requirement either is not available on GSA Schedule Contract or exceeds the $300,000 threshold and/or the quantity Maximum Order Limitation of the GSA Schedule Contract. Only open market contract acquisitions (i.e., in excess of the $25,000 small purchase threshold), are addressed. Author

N90-25699# Pacific Northwest Lab., Richland, WA.
OBJECT-ORIENTED DESIGN: DERIVING CONCEPTUAL SOLUTIONS TO LARGE-SCALE INFORMATION PROCESSING PROBLEMS
M. A. WHITING May 1990 22 p
(Contract DE-AC06-76RL-01830)
(DE90-011189; PNL-7279) Avail: NTIS HC A03/MF A01

The Vertical Integration of Science, Technology, and Applications (VISTA) Project is a long-term effort conducted by the Pacific Northwest Laboratory (PNL) directed toward accelerating the process of making research results (data, models, advanced concepts) usable and available to R and D applications. The initial goal of the program is to develop a software-based information system to guide the assessment and remediation process for hazardous waste sites at the U.S. Department of Energy (DOE) facilities. The information system will link users (DOE, laboratories, and remediation contractors) to computer models and technical data available at PNL, to speed up the remediation process, while decreasing costs and accelerating the deployment of new technologies. This report describes a methodology used to design components of the VISTA information system based on an object-oriented computing model. DOE

N90-25702*# Dartmouth Coll., Hanover, NH. Dept. of Mathematics and Computer Science.
THEFT OF INFORMATION IN THE TAKE-GRANT PROTECTION MODEL
MATT BISHOP 1989 45 p Revised
(Contract NAG2-480)
(NASA-CR-186638; NAS 1.26:186638; PCS-TR88-137-REV)
Avail: NTIS HC A03/MF A01 CSCL 05/2

Questions of information flow are in many ways more important than questions of access control, because the goal of many security policies is to thwart the unauthorized release of information, not merely the illicit obtaining of access rights to that information. The Take-Grant Protection Model is a theoretical tool for examining such issues because conditions necessary and sufficient for information to flow between two objects, and for rights to objects to be obtained or stolen, are known. These results are extended by examining the question of information flow from an object the owner of which is unwilling to release that information. Necessary and sufficient conditions for such theft of information to occur are derived, and bounds on the number of subjects that must take action for the theft to occur are presented. To emphasize the usefulness of these results, the security policies of complete isolation, transfer of rights with the cooperation of an owner, and transfer of information (but not rights) with the cooperation of the owner are presented; the last is used to model a simple reference monitor guarding a resource. Author

N90-26526*# Maryland Univ., College Park. Dept. of Computer Science.
AUTOPLAN: A SELF-PROCESSING NETWORK MODEL FOR AN EXTENDED BLOCKS WORLD PLANNING ENVIRONMENT Final Technical Report
C. LYNNE DAUTRECHY, JAMES A. REGGIA, and FRANK MCFADDEN Jun. 1990 49 p
(Contract NAG1-885; NSF IRI-84-51430)
(NASA-CR-186733; NAS 1.26:186733; UMIACS-TR-90-78; CS-TR-2483) Avail: NTIS HC A03/MF A01 CSCL 09/2

Self-processing network models (neural/connectionist models, marker passing/message passing networks, etc.) are currently undergoing intense investigation for a variety of information processing applications. These models are potentially very powerful in that they support a large amount of explicit parallel processing, and they cleanly integrate high level and low level information processing. However they are currently limited by a lack of understanding of how to apply them effectively in many application areas. The formulation of self-processing network methods for dynamic, reactive planning is studied. The long-term goal is to formulate robust, computationally effective information processing methods for the distributed control of semiautonomous exploration systems, e.g., the Mars Rover. The current research effort is focusing on hierarchical plan generation, execution and revision through local operations in an extended blocks world environment. This scenario involves many challenging features that would be encountered in a real planning and control environment: multiple simultaneous goals, parallel as well as sequential action execution, action sequencing determined not only by goals and their interactions but also by limited resources (e.g., three tasks, two acting agents), need to interpret unanticipated events and react appropriately through replanning, etc. Author

N90-26556# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
INNOVATIVE DESIGN SYSTEMS: WHERE ARE WE, AND WHERE DO WE GO FROM HERE
D. NAVINCHANDRA 12 Jan. 1990 48 p
(AD-A222586; AD-E951478; CMU-RI-TR-90-01) Avail: NTIS HC A03/MF A01 CSCL 12/5

The state of the art in systems that innovate are reviewed. The review concentrates more on the techniques used in these systems rather than what the system actually did. Some of the important issues are reviewed for DA systems that work in domains requiring non-routine and innovative approaches to problem solving. This part covers issues such as analogy and metaphor, exploration

and discovery and creativity. Before talking about tools and techniques, innovative designs are characterized. Earlier definitions of innovative design have tended to finess over details. For example, innovative design has been defined as any design that is: new or different or elegant or uses new ideas or is an improvement over its peers. Such a definition is correct, but it does not tell us how to measure newness. How new is something. A little more light is shed on the problem of trying to distinguish between innovative and routine design. No definition will ever be complete or accurate, but something is better than nothing. The real purpose of trying to define innovative design is to try and identify the characteristics of innovative design. With a list of such characteristics, research efforts can be better focused. If DA systems that emulate some of the characteristics of innovative design can be built, then, such systems can be said to have some form of innovative behavior. GRA

N90-26702# Argonne National Lab., IL.
A METHODOLOGY FOR BENCHMARKING DISTRIBUTED DATABASE MANAGEMENT SYSTEMS
CYRIL U. ORJI 1990 24 p Presented at the 16th International Conference on Very Large Databases, Brisbane, Australia, 13-16 Aug. 1990 Sponsored in part by Veterans Benefits Administration
(Contract W-31-109-ENG-38)
(DE90-007801; CONF-900875-1) Avail: NTIS HC A03/MF A01

A methodology for benchmarking distributed database management systems is proposed. A distributed environment is characterized in terms of the communication costs incurred in data movement between sites, the number of nodes that participate in processing a query and the data distribution scheme used in the network. These are used as a basis for identifying eight query types that capture the query performance characteristics in the network. Finally, an experimental outline is sketched to illustrate the steps in validating the methodology. DOE

N90-27274# European Space Agency, Paris (France).
ECOS: THE ESA COSTING SOFTWARE
NORMAN LONGDON, ed. Dec. 1988 32 p Original contains color illustrations
(ESA-BR-56; ISSN-0250-1589) Avail: NTIS HC A03/MF A01

The European Space Agency (ESA) has developed the ESA Costing Software (ECOS) as a data processing tool for the preparation and presentation of cost proposals. Because ESA's projects are shared by member countries, and the work is divided into many parts, the best integrated price tendered for a given project is difficult to judge. Each project is divided into products by the Work Breakdown Structure. Each product node is further broken down, via a Product Tree, into components such as flight hardware, software, and support equipment. The primary contractor works with a hierarchy of subcontractors who, in turn, have their own subcontractors. ECOS permits the orderly entering of costing data, its analysis, and the evaluation of an integrated price proposal for any project. ECOS also supports ESA's policies of using the latest technology and obtaining the best possible value for ESA's member nations' taxpayers. J.P.S.

N90-27286*# Boeing Computer Support Services, Inc., Huntsville, AL. Artificial Intelligence Center.
A KNOWLEDGE-BASED APPROACH TO CONFIGURATION LAYOUT, JUSTIFICATION, AND DOCUMENTATION
F. G. CRAIG, D. E. CUTTS, T. R. FENNEL, C. CASE, and J. R. PALMER (Boeing Aerospace Co., Huntsville, AL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications p 95-101 May 1990
Avail: NTIS HC A25/MF A04 CSCL 09/2

The design, development, and implementation is described of a prototype expert system which could aid designers and system engineers in the placement of racks aboard modules on Space Station Freedom. This type of problem is relevant to any program with multiple constraints and requirements demanding solutions which minimize usage of limited resources. This process is generally performed by a single, highly experienced engineer who integrates all the diverse mission requirements and limitations, and develops an overall technical solution which meets program and system requirements with minimal cost, weight, volume, power, etc. This system architect performs an intellectual integration process in which the underlying design rationale is often not fully documented. This is a situation which lends itself to an expert system solution for enhanced consistency, thoroughness, documentation, and change assessment capabilities. Author

N90-27373# Rochester Univ., NY. Dept. of Computer Science.
ARMTRAK: A DOMAIN FOR THE UNIFIED STUDY OF NATURAL LANGUAGE, PLANNING, AND ACTIVE VISION
N. G. MARTIN, J. F. ALLEN, and C. M. BROWN Jan. 1990 46 p
(Contract N00014-82-K-0193; N00014-80-C-0197; F30602-85-C-0008; AF-AFOSR-0222-89)
(AD-A221701; TR-324) Avail: NTIS HC A03/MF A01 CSCL 05/7

ARMTRAK is a micro-world, based on the control of model trains, designed to integrate work in natural language, planning, vision and robotics. The primary advantage of the domain is it provides examples that involve only few objects but that require sophisticated analysis. Because the examples involve few objects, the complex reasoning required is not intractable. On the other hand, more objects can be introduced to study techniques for tractable reasoning. Simple and complex examples in the same domain allow work at different levels to take place simultaneously. As a planning domain, ARMTRAK allows exercising planners in a real time domain about which the planner has only imperfect knowledge. As a domain for natural language research, it allows research into the grounding of language in real situations, and the problem of coordinating the behavior of agents through language. As a domain for active vision research, it is challenging because it requires extracting information whose parameters cannot be completely specified beforehand. Two implementations of ARMTRAK were developed: a simulation and a version using the Rochester Robot. The simulation allows work on real time planning, and a robot version shows the feasibility of a real working system based on model trains. GRA

N90-27420# Yale Univ., New Haven, CT. Dept. of Computer Science.
PARALLEL PERFORMANCE OF DOMAIN-DECOMPOSED PRECONDITIONED KRYLOV METHODS FOR PDES WITH ADAPTIVE REFINEMENT
WILLIAM D. GROPP (Argonne National Lab., IL.) and DAVID E. KEYES Apr. 1990 18 p Submitted for publication
(Contract N00014-86-K-0310; W-31-109-ENG-38; NSF DCR-85-21451; NSF EET-87-07109; NSF ECS-89-57475)
(AD-A222339; YALEU/DCS/RR-773) Avail: NTIS HC A03/MF A01 CSCL 12/1

Preconditioners based on domain decomposition appear natural for the Krylov solution of implicitly discretized partial differential equations on parallel computers. Two-scale preconditioners (involving independent subdomain solves and a global crosspoint system, as well as independent solves over interfaces of lower physical dimension) have been known since the early 1980's to be near optimal in the sense of providing a bounded or at most logarithmically growing iteration count as the mesh is refined. However, overall computational complexity depends on the components of the preconditioner as well as the iteration count. The cost of exact subdomain solves grows superlinearly in arithmetic complexity, and that of the crosspoint system superlinearly in communication complexity. These factors make the preconditioner granularity and the choice of its components problem- and machine-dependent compromises. Numerical experiments are presented on both shared and distributed memory computers for convection-diffusion problems at modest Peclet (or Reynolds) numbers, without recirculation. Due to the development of boundary layers, these problems benefit from local mesh refinement, which is straightforward to accommodate within the domain decomposition framework in a locally uniform sense, but

which introduces load balancing as a further consideration in choosing the granularity of the preconditioner. GRA

N90-27548*# National Aeronautics and Space Administration, Washington, DC.
INFORMATION RESOURCES MANAGEMENT, 1984-1989: A BIBLIOGRAPHY WITH INDEXES
May 1990 202 p
(NASA-SP-7079; NAS 1.21:7079) Avail: NTIS HC A10 CSCL 05/2

This bibliography contains 768 annotated references to reports and journal articles entered into the NASA scientific and technical information database 1984 to 1989. Author

N90-27556# Surveillance Research Lab., Salisbury (Australia).
STATUS REPORT ON IMAGE INFORMATION SYSTEMS AND IMAGE DATA BASE TECHNOLOGY
M. J. FIEBIG Dec. 1989 66 p
(AD-A221488; SRL-0047-TM; DODA-AR-005-968) Avail: NTIS HC A04/MF A01 CSCL 12/5

The contents of this report form part of a study to determine guideline's for the establishment of databases containing digital imagery and ancillary information. It begins with an introduction to the basic concepts of databases. This provides the background to the terminology commonly used in this report and other related literature. A review of current commercially available database systems is made, drawing principally on a market study conducted in mid 1989. Of specific interest is the extent to which image databases are being utilized and the applications which use digital imagery (or pictures) in database management systems (DBMS). Finally, there is an overview of image compression techniques, considering the current trends and future directions of the field. GRA

N90-27634# Flight Data Co., London (England).
REPLAY AND TRANSMISSION OF AIMS-DATA TO MAINFRAME COMPUTER USING REMOTE TRANSCRIBERS
PETER WALLER *In* DLR, Aircraft Integrated Monitoring Systems p 351-369 Jan. 1990
Avail: NTIS HC A25/MF A04; DLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, 160 Deutsche marks

Each engineer who makes decisions about aircraft and their operation has a desktop computer terminal. Each terminal allows access to a database of raw and processed information on all aspects of the operation. Part of this database contains the analyzed results from Aircraft Integrated Monitoring Systems (AIMS) data, and the full extent of the raw data recorded on each aircraft. To place the data into the mainframe with minimum manpower and delay, an actual system is described. It reads up to three data cartridges simultaneously and transcribes all data through a fiber optic link into the mainframe. Present performance and future growth capability are discussed. ESA

N90-28354# Army Construction Engineering Research Lab., Champaign, IL.
A CONCEPT FOR INTEGRATING COMPUTER-AIDED DRAFTING AND DESIGN WITH COST ENGINEERING AND SPECIFICATION PREPARATION Final Report
DONALD K. HICKS, JOHN H. WILLIAMSON, ROBERT D. BLACKMON, ROBERT D. NEATHAMMER, and MICHAEL R. SHAMSIE Jun. 1990 21 p
(AD-A223150; CREL-TR-P-90/13) Avail: NTIS HC A03/MF A01 CSCL 12/5

A concept is outlined for developing a system to integrate computer-aided drafting and design (CADD) and cost estimating through automated data processing methods. The result of this combination will be twofold: designers will have continuous, real time access to cost estimating information, and will know the implications of design decisions upon construction duration time and costs; and cost engineers/estimators will be freed from most of the laborious analysis of labor, equipment, and material, allowing them more time to evaluate cost estimates on the basis of local market conditions. A fully automated integration of the CADD environment and cost estimating data will reduce the cost of preparing cost estimates, improve the accuracy of estimates, and reduce redesign costs due to cost overruns. GRA

N90-28355# Institute for Defense Analyses, Alexandria, VA.
COMPUTER SUPPORT FOR CONDUCTING SUPPORTABILITY TRADE-OFFS IN A TEAM SETTING
WILLIAM E. CRALLEY, DAVID DIEROLF, and KAREN J. RICHTER Jan. 1990 120 p
(Contract MDA903-89-C-0003)
(AD-A222002; AD-E501219; IDA-P-2313; IDA/HQ-89-34868)
Avail: NTIS HC A06/MF A01 CSCL 15/5

The results are presented of a research project that had the objective of demonstrating how the conceptual approach of the Boothroyd and Dewhurst Design for Assembly (DFA) process could be applied to developing products which are more easily supported in the field. In this project, a specific methodology was developed which allows a product development team to make system-level trade-offs between redundant part selection and scheduled maintenance visits in order to achieve both low life cycle cost (LCC) and high operational readiness of the resulting system. This methodology was demonstrated for a subsystem of a ground-based radar and evaluated by participants in the demonstration. GRA

N90-28372# National Inst. of Standards and Technology, Gaithersburg, MD. National Computer Systems Lab.
REPORT OF THE INVITATIONAL WORKSHOP ON DATA INTEGRITY
ZELLA G. RUTHBERG, ed. and WILLIAM T. POLK, ed. Sep. 1989 377 p Workshop held in Gaithersburg, MD, 25-27 Jan. 1989
(PB90-148123; NIST/SP-500/168; LC-89-600756) Avail: NTIS HC A17/MF A02 CSCL 09/2

The proceedings of the second invitational workshop on computer integrity issues are presented as is the second response to the Clark/Wilson paper entitled, A Comparison of Military and Commercial Data Integrity Policy. The NIST Computer and Telecommunications Security Council established a Working Group on Data Integrity as the subject of the second workshop. The Planning Committee outlined the scope of the workshop as discussions of: (1) Integrity Framework Elements, (2) Implementation Requirements and Approaches, and (3) Implementation/Models in the light of the agreed upon integrity framework. The five discussion groups covered: Operating Systems and Systems, Telecommunications, System Services, Applications, and Implementations/Models. No consensus was reached on the definition of data integrity but consensus was reached on quality oriented policy and objectives, and mechanisms. Author

N90-28444# Wente (Van A.), Bethesda, MD.
SCIENTIFIC AND TECHNICAL INFORMATION MANAGEMENT
VAN A. WENTE *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 149-167 1990 Previously announced in IAA as A90-34045
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

The NASA Scientific and Technical Information (STI) Program is examined. The history of the NASA STI program is reviewed and the organizational structure of the STI program is outlined. The relationship between the NASA STI program and the Americal Institute of Aeronautics and Astronautics (AIAA) Technical Information Service is described. Consideration is given to the documentation, of aeronautics and space research, the dissemination of NASA STI, the acquisition of information of NASA research and development, and the managerial aspects of the NASA STI Program. The role of NASA/Recon, the Aerospace Database, and abstract journals such as International Aerospace Abstracts (IAA) and Scientific and Technical Aerospace Reports (STAR) in processing STI for utilization in research programs is discussed. Author

N90-28445*# National Aeronautics and Space Administration, Washington, DC.
NASA SCIENTIFIC AND TECHNICAL INFORMATION FOR THE 1990S
GLADYS A. COTTER *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 169-173 1990 Previously announced in IAA as A90-34046
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

Projections for NASA scientific and technical information (STI) in the 1990s are outlined. NASA STI for the 1990s will maintain a quality bibliographic and full-text database, emphasizing electronic input and products supplemented by networked access to a wide variety of sources, particularly numeric databases. Author

N90-28449*# National Aeronautics and Space Administration, Washington, DC.
COMMUNICATIONS AND MEDIA SERVICES
JAMES W. MCCULLA and JAMES F. KUKOWSKI *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 211-218 1990 Previously announced in IAA as A90-34050
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

NASA's internal and external communication methods are reviewed. NASA information services for the media, for the public, and for employees are discussed. Consideration is given to electron information distribution, the NASA TV-audio system, the NASA broadcast news service, astronaut appearances, technology and information exhibits, speaker services, and NASA news reports for internal communications. Also, the NASA worldwide electronic mail network is described and trends for future NASA communications and media services are outlined. Author

N90-28455# Oak Ridge National Lab., TN.
BUILDING A USER INTERFACE USING SQL*FORMS AND AN INTERMEDIATE TABLE
TERESA L. JAMES (Tennessee Univ., Knoxville.) 13 Jun. 1990 11 p Presented at the International ORACLE User Group Conference, Anaheim, CA, 24-28 Sep. 1990
(Contract DE-AC05-84OR-21400)
(DE90-012729; CONF-9009176-1) Avail: NTIS HC A03/MF A01

There is usually a trade-off between flexibility and ease of use when a user interface is designed. This paper discusses a data retrieval interface that does not require end users to be ORACLE Structural Query Language ((SQL) asterisk Plus programmers or to understand the structure of the database and offers them a very powerful and flexible access to the database. This interface is the front-end to a decision support system being designed and prototyped at Oak Ridge National Laboratory (ORNL). The interface develops the where clause of a SQL select statement for the user based on selections the user makes and stores and then uses those choices to query a target table. Through SQL asterisk Forms screens, reference data tables are used as a source of values from which users choose data or by which user entries are validated. The user's choices are stored in an intermediate table. Then the system builds a query for the target table(s) using an operating system script in which the value and column names in the intermediate table are used to form the where clause. The query is executed and data are retrieved. DOE

N90-29087# Army War Coll., Carlisle Barracks, PA.
THE PERSONAL COMPUTER: AN UNTAPPED SOURCE FOR THE UNITED STATES ARMY WAR COLLEGE
CHARLES E. PERSYN 2 May 1990 42 p
(AD-A223976) Avail: NTIS HC A03/MF A01 CSCL 12/6

This essay examines the dramatic changes made in the use of personal computers in civilian universities, and explores the concept of educational computing. The author presents the idea of an educational computing model and its application in the United States Army War College (USAWC). Department of Defense Policy and Army Information Management Regulations are discussed where applicable. Finally, the author presents some recommendations based on known fiscal constraints, an analysis of the present computer system at the USAWC, and on lessons learned in business and civilian universities. GRA

N90-29245# National Inst. of Standards and Technology, Gaithersburg, MD. Information Systems Engineering Div.
INFORMATION MANAGEMENT DIRECTIONS: THE INTEGRATION CHALLENGE Final Report
ELIZABETH N. FONG and A. H. GOLDFINE 1989 178 p
(PB90-219866; NIST/SP-500/167; LC-89-600755) Avail: NTIS HC A09/MF A01; also avail. SOD as SN003-003-02973-4 CSCL 05/2

The results of a 3-day workshop on the integration challenge of information management are given. The workshop was the fifth in the Information Management Directions series. The purpose of these workshops is to examine, in depth, key trends and strategies that affect the future of the information management profession. The focus of the fifth workshop was on issues related to integration and productivity. The 72 workshop participants were organized into five working panels, which met to discuss the integration of knowledge and data management; the integration of technical and business data management; the integration of systems planning, development, and maintenance tools and methods; the integration of distributed, heterogeneous computing environments; and architectures and standards for information management. GRA

N90-29247# Wichita State Univ., KS. National Inst. for Aviation Research.
INTERNATIONAL AIRCRAFT OPERATOR DATA BASE MASTER REQUIREMENTS AND IMPLEMENTATION PLAN Final Report, Sep. 1989 - Jul. 1990
GARY OTT, JOHN ELLIS, RAJ SUNDERRAMAN, JOHN J. HUTCHINSON, and FRANK H. MACHEERS Aug. 1990 45 p
(Contract DTFA03-89-C-00057)
(DOT/FAA/CT-90/17) Avail: NTIS HC A03/MF A01

This International Aircraft Operator Data Base Master Requirements and Implementation Plan describes the Federal Aviation Administration's (FAA) requirements for aircraft operator information as well as a plan for addressing these requirements. In order to carry out this responsibility the FAA requirements include a unique description of each aircraft along with the name, address, telephone number, and a fax number of the aircraft operator. It was determined that the FAA has other ad hoc requirements for aircraft operator related information. It was also determined that information needed by the FAA to carry out this responsibility is available through the private sector. The software and computer networking capability is developed to make effective use of this information. The main task of this program is to create an information system which will facilitate and enhance communication between the FAA and the aircraft operator data base suppliers. The plan is presented to make use of these commercial data suppliers to create an aircraft operator information system.
Author

N90-29531# Army Construction Engineering Research Lab., Champaign, IL.
AUTOPAVER: A SOFTWARE PACKAGE FOR AUTOMATED PAVEMENT EVALUATION Final Report
MARK D. GINSBERG, M. Y. SHAHIN, and JEANETTE A. WALTHER Jul. 1990 22 p
(Contract DA PROJ. 4A1-62731-AT-41)
(AD-A224176; CERL-TR-M-90/15) Avail: NTIS HC A03/MF A01 CSCL 12/5

This research developed a method that improves data collection and reduces data entry times for Pavement Condition Index (PCI) surveys for use with PAVER, a pavement maintenance management system. The method, AutoPAVER, is a microcomputer software package used to analyze pictures of pavement surfaces and to forward the resulting analysis to PAVER. The user works

interactively with the system to identify and classify pavement distresses. Distress measurement and data entry are done on the computer. GRA

06

RESEARCH AND DEVELOPMENT

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

A90-13287#
THE JEM PROGRAM - START OF DEVELOPMENT
K. MATSUMOTO, N. SAITO, and M. SAITO (National Space Development Agency of Japan, Tokyo) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 6 p.
(IAF PAPER 89-067)

Recent progress of the JEM program and near-term future activities are described. The revised Japanese national space development policy is reviewed. The elements of the JEM PM(pressurized module)/ELM(experiment logistics module) pressurized section are shown, a program documentation tree is presented, and the JEM development schedule and the NASDA flight experiment schedule are depicted. Design reference missions and the Japanese crew operations schedule are outlined. C.D.

A90-13385#
SPACE TRANSPORTATION PROPULSION APPLICATION - A DEVELOPMENT CHALLENGE
RUDI BEICHEL, CHARLES J. O'BRIEN, and JAMES P. TAYLOR (Aerojet TechSystems Co., Sacramento, CA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 10 p. refs
(IAF PAPER 89-224) Copyright

This paper presents an approach to achieving a cost-effective vertical takeoff, horizontal landing earth-to-orbit vehicle. The key propulsion system problems are addressed. The approach leads to a near-term rocket-powered single-stage-to-orbit system. A flying test-bed vehicle development program is described which allows the orderly development of vital advanced propulsion system and vehicle structural technology within a reasonable cost. The experimental (X-n) vehicle approach also allows the development of operational procedures that result in airline-type costs to space, and permits concepts, such as heavy-lift flight configurations, to be tested in a stepwise manner. Thrust modulation, instead of gimballed engines, allows a significant weight reduction in the propulsion system. Air-breathing airturborocket engines are used for loiter and landing to ensure safe return to earth. Author

A90-13420#
ION PROPULSION RESEARCH AND DEVELOPMENT IN THE UK
D. G. FEARN (Royal Aerospace Establishment, Space Dept., Farnborough, England), A. R. MARTIN (Culham Laboratory, Abingdon, England), and P. SMITH (Marconi Space Systems, Ltd., Propulsion Group, Portsmouth, England) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 15 p. refs
(IAF PAPER 89-274) Copyright

The status of two Kaufman-type ion thruster systems under development in the UK along with the associated development of power conditioning and control equipment as well as propellant supply and monitoring equipment is reported. Both the UK-10 and the UK-25 ion propulsion systems have made good progress since the last status report. The UK-10 system has been characterized at up to 70 mN thrust, and development is continuing at 10 and 25 mN for specific applications, with the latter being downrated to 18 mN for the SAT-2 spacecraft. The thruster and propellant feed systems have engineering model status, whereas the power conditioning and control systems have not yet reached that position. Lifetesting of components and a thruster at 10 mN is about to begin. The UK-25 thruster is now available in engineering model form, having shown great promise in earlier tests of the laboratory version. Power conditioning concepts have been evaluated and decisions have been made as to the circuits to be tested in the next phase of the work. C.E.

A90-13678#
SPOT AND COMMERCIALIZATION - SPIN-OFF BENEFITS
PIERRE BESCOND (SPOT Image Corp., Reston, VA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 4 p.
(IAF PAPER 89-691) Copyright

The SPOT remote sensing system is examined as an example of a spin-off technology, and spin-off applications resulting from the use of SPOT are discussed. In particular, it is shown that SPOT is the spin-off result of the continued development of several related and unrelated technological fields that were ultimately combined into a commercial satellite sensing system. In turn, the technical capabilities and the commercial approach of the SPOT system are driving the development of spin-off applications in such areas as mapping, resource planning, environmental monitoring, and news gathering. The commercial success of SPOT is explained by the fact that it provides a cost-effective replacement for traditional information gathering, monitoring, and mapping activities. V.L.

A90-16024
THE GREEN BANK TELESCOPE: A RADIO TELESCOPE FOR THE TWENTY-FIRST CENTURY: FINAL PROPOSAL JUNE 1989
Charlottesville, VA, National Radio Astronomy Observatory, 1989, 117 p. No individual items are abstracted in this volume.

The scientific goals, design, and projected performance of a 100-m-aperture steerable radio telescope to be built at Green Bank, WV are discussed in a proposal to the NSF. The goals considered include observations of pulsars, stars and the solar system; studies of Galactic and extragalactic H I, spectroscopic studies, measurements of continuum radiation; and VLBI observations. Detailed attention is given to the antenna, electronics, control and monitor system, data processing, operational factors, the telescope site, and cost estimates. Drawings, diagrams, sample images, and tables of numerical data are provided. T.K.

A90-16025
SCIENTIFIC CONSIDERATIONS FOR THE DESIGN OF A REPLACEMENT FOR THE 300-FOOT RADIO TELESCOPE; PROCEEDINGS OF THE WORKSHOP, GREEN BANK, WV, DEC. 2, 3, 1988
ROBERT L. BROWN, ED. and FREDERIC R. SCHWAB, ED. (National Radio Astronomy Observatory, Charlottesville, VA) Workshop supported by NSF,. Charlottesville, VA, National Radio Astronomy Observatory, 1989, 64 p. No individual items are abstracted in this volume.
(Contract NSF AST-88-14515)
Copyright

The replacement of the Green Bank radio telescope after its collapse in November 1988 is discussed. Sections are devoted to the scientific impact of the collapse; technical requirements for a replacement telescope; schedules and costs; observations of neutral atomic hydrogen; observations of pulsars, radio stars and the solar system; spectroscopic observations; and observations of continuum radiation. Diagrams, graphs, and maps are provided. T.K.

A90-16300
KEEPERS OF THE FLAME
T. A. HEPPENHEIMER Air and Space (ISSN 0886-2257), vol. 4,

Dec. 1989-Jan. 1990, p. 88-95.
Copyright

A development history is presented for the emergence of supersonic combustion ramjet, or 'scramjet' concepts from ramjet research, with emphasis on the extent to which military interest and funding has paced and sometimes retarded this avenue of advanced propulsion research. Scramjets are able to generate thrust efficiently at speeds above Mach 5, and perhaps as high as the Mach 25 required (at extreme altitudes) to enter earth orbit. Scramjets typically use liquid hydrogen fuel, which is uniquely capable of diffusing into their supersonic internal flow and combusting at comparable speeds. O.C.

A90-16528
MARS IS OURS - STRATEGIES FOR A MANNED MISSION TO MARS
TIINA O'NEIL, DANIEL THURS, MICHAEL NARLOCK, and SHAWN LAATSCH IN: The case for Mars III: Strategies for exploration - Technical. San Diego, CA, Univelt, Inc., 1989, p. 13-28. refs
(AAS PAPER 87-228) Copyright

The societal, engineering, and scientific aspects of a manned mission to Mars are investigated, as part of a NASA/University of Wisconsin sponsored high school student contest. The societal concerns cover the economic perspective of a multinational venture providing more resources, ideas, and personnel than a unilateral effort. Engineering issues consist of ship design, propulsion, and support systems; propelled by liquid rockets, the Mars Transit Vehicle (MTV) is conceived as a modular craft composed of several pods; the space crew would inhabit the first two pods. The scientific aspect concerns the major questions, means, and requirements to be answered for a manned Mars mission, with objectives that would include the determination of location and potability of Martian water deposits. C.E.

A90-17728
ANNUAL SPACE: TECHNOLOGY, COMMERCE AND COMMUNICATIONS CONFERENCE, 2ND, HOUSTON, TX, NOV. 1-4, 1988, PROCEEDINGS
Boston, MA, T. F. Associates, Inc., 1988, 224 p. For individual items see A90-17729 to A90-17733.

Papers on space technology, commerce, and communications are presented covering topics such as space insurance considerations, the selection of a commercial launch site in Hawaii, the development of a spaceport in Florida, and satellites and the television industry. Other topics include research in the LEO environment, the commercial space market in West Germany, risk management for space ventures and the Hermes program. Additional topics include marketing space services, Radarsat remote sensing system, sources of capital for commercial space ventures, research at the Center for Low-Gravity Fluid Mechanics and Transport Phenomena, and the development of large inflatable/rigidized structures. R.B.

A90-20680
OPERATIONAL AND TECHNOLOGICAL DEVELOPMENTS FOR UKIRT
T. J. LEE (Royal Observatory, Edinburgh, Scotland) (Group of Optical and Infrared Astronomers in Japan, Astronomical Society of Japan, Inamori Foundation, et al., International Symposium on the Japanese National Large Telescope and Related Engineering Developments, Tokyo, Japan, Nov. 29-Dec. 2, 1988) Astrophysics and Space Science (ISSN 0004-640X), vol. 160, no. 1-2, Oct. 1989, p. 249-253. refs
Copyright

There are a number of parallels between the UKIRT and the JNLT both of which are major astronomical facilities of nations which do not have premier observing sites in their own country. Some elements of experience with UKIRT relevant to the JNLT are described. These include matters related to personnel and to instruments. Author

A90-21714
EUROFIGHTER FIGHTS BACK
GUY NORRIS Flight International (ISSN 0015-3710), vol. 137, Jan. 3, 1990, p. 24-27.
Copyright

The European Fighter Aircraft (EFA) program is examined. The current stage of development and future consideration for the EFA are discussed. The contributions by West Germany, Italy, Spain and the UK to the EFA program, and the awarding of contracts for the development of aircraft systems are described. Applications for the EFA and economic benefits provided by the program are also discussed. I.F.

A90-24767
THE NEED FOR MORE INTERNATIONAL COOPERATION IN SPACE
JOHN RHEA IN: Space: National programs and international cooperation. Boulder, CO, Westview Press, 1989, p. 111-114.
Copyright

Issues related to international cooperation in space endeavors are reviewed. The development of separate national space programs are compared. The benefits of international cooperation for the U.S. space program are outlined. The role of international cooperation in a manned mission to Mars and the construction of the Space Station are briefly discussed. R.B.

A90-25611#
INTELSAT VII PROGRAM AND THE FUTURE
P. J. MADON and D. K. SACHDEV (INTELSAT, Washington, DC) IN: AIAA International Communication Satellite Systems Conference and Exhibit, 13th, Los Angeles, CA, Mar. 11-15, 1990, Technical Papers. Part 1. Washington, DC, American Institute of Aeronautics and Astronautics, 1990, p. 74-77. refs
(AIAA PAPER 90-0785) Copyright

The evolution of the Intelsat VII spacecraft is discussed. The role of competitive procurement process in this evolution is addressed, and the overall system-level features of the spacecraft are reviewed. The time frame for the five Intelsat VII missions is summarized, and follow-up projects to Intelsat VII are discussed. C.D.

A90-25934#
ARIANE PROGRAM PLANS AND OUTLOOK FOR COMMERCIAL LAUNCH SERVICES
D. A. HEYDON (Arianespace, Inc., Washington, DC) AIAA, International Communication Satellite Systems Conference and Exhibit, 13th, Los Angeles, CA, Mar. 11-15, 1990. 9 p.
(AIAA PAPER 90-0890) Copyright

An overview of the current status of the Ariane program is presented. This is coupled with a discussion of the overall outlook for commercial launch services in the Soviet Union and China as well as the West. It is noted that work is already well underway on the next generation of launch vehicle, the Ariane 5. This version will represent a departure from the evolutionary step-by-step growth pattern of the Ariane 1-4 series, since it involves a completely different design philosophy for the main core stage. It is foreseen that the changing political environment, in the U.S., in Europe, and in the rest of the world, will have a greater impact on the commercial launch services market than will the traditional concerns of launch vehicle performance and availability. R.E.P.

A90-26974#
THE INTEGRATED TEST VEHICLE, (I.T.V.) - A VEHICLE FOR COST-EFFECTIVE HYPERSONIC TESTING
JAMES R. HEYES and RICHARD D. NEUMANN (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) AIAA, Aerospace Sciences Meeting, 28th, Reno, NV, Jan. 8-11, 1990. 11 p. refs
(AIAA PAPER 90-0630)

The concept of the integrated test vehicle (ITV) is proposed. The ITV concept needs to combine the collection and analysis of heat transfer, pressure, and force and moment balance data. The phase development and validation of the hardware are described. Test data from phase I reveal that the ITV concept is technically possible, but upgrades are required. The advantages of the ITV

concept compared to traditional wind tunnel testing techniques are discussed. Consideration is given to dynamic instrumentation, smart sensors, micromachining techniques, the use of work stations to display data, and applying AI to the acquisition of wind tunnel data. I.F.

A90-28379
VARIABLES INFLUENCING THE PERFORMANCE OF DEFENSE R&D CONTRACTORS
SIMEON B. TUBIG (USAF, Los Angeles, CA) and PIER A. ABETTI (Rensselaer Polytechnic Insttute, Troy, NY) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, Feb. 1990, p. 22-30. refs
Copyright

Several variables affect the performance of contractors on defense research and development (R&D) contracts. These variables can be classified as endogenous or exogenous. Endogenous variables are influenced by the project manager and the contracting officer, while exogenous variables are not. In the present work, the effects of four endogenous variables on contractor performance are examined. These variables are: type of R&D, type of solicitation, type of contract, and size of business of the contractor. Surveys were conducted in 1978 and 1986 on completed R&D contracts. The measurement factors used were technical performance, schedule, quality of reports/products, cost, and overall assessment. A two-way analysis of variance was used to examine how the endogenous variables influenced the contractor performance. The authors conclude that, except for size of business, all variables had an effect on some of the performance factors. The recommendations include a proposed new contracting approach for major development contracts. This approach is based upon life-cycle cost minimization, and it favors the use of cost contracts over fixed price in the later stages of development. I.E.

A90-28714
CAN SATELLITE SERVICING PAY?
STEPHANE CHENARD Interavia Space Markets (ISSN 0258-4212), vol. 6, Jan.-Feb. 1990, p. 29-35.
Copyright

The planning and development by NASA of new tools and vehicles which could soon bring satellite servicing into the commercial arena is reviewed. The smartest systems are designed for intervention in LEO, mostly in conjunction with Space Station Freedom. Studies now in progress leading to the definition of a Space Transfer Vehicle are presented. These include the Orbital Maneuvering Vehicle (OMV), the Short-Range Vehicle, and the Flight Telerobotic Servicer. Various Canadian, European, Soviet, and Japanese studies are also mentioned. By itself, the OMV has an altitude range of up to 2300 km and can make plane changes of up to 8 dgs. It is noted that scientific satellites are seldom replaced when they fail, nor are they normally insured. Even with a dedicated OMV and launch cost, the cost of servicing is much less than that of a new spacecraft. In any case, servicing is unlikely to become widespread before the end of the current generation of satellites. It is concluded that NASA is about to address the question whether things will change once robot servicers enter the geostationary world. R.E.P.

A90-28715
THE LURE OF LIGHTSATS. I
Interavia Space Markets (ISSN 0258-4212), vol. 6, Jan.-Feb. 1990, p. 37-40.
Copyright

The evolutionary trend in spacecraft design has been one of growth, in terms of mass, payload capacity, power generation capability, and mission duration. However, recent years have seen the beginnings of a reversal in the satellite growth trend. In the case of commercial (chiefly communications) programs, the new pocket satellites remain basically drawing boards. NASA has used small scientific spacecraft, such as the early Explorers and the Orbiting Solar Observatory series, when these suited its mission requirements and long after available launch capability permitted bigger platforms. It is planning to fly four Small Explorers in the first half of this decade. The most promising launcher for small satellites destined for low orbit is almost certainly the Pegasus air-launched vehicle. Pegasus is optimized for carrying payloads (which may be multiple) in the 135-360 kg mass class to low altitudes, including polar orbits. Several European lightsats are also being developed in the UK and France. It is noted that the numerical majority of 'reasonably firm launch intentions' fell in the 100-200 kg mass class, a slightly smaller quantity in the 400-600 kg bracket, and about half as many in the 800-1000 kg category. R.E.P.

A90-31247#
SUKHOI AND GULFSTREAM GO SUPERSONIC
RICHARD DEMEIS Aerospace America (ISSN 0740-722X), vol. 28, April 1990, p. 40-42.
Copyright

A Soviet-American cooperative program to develop a supersonic business jet is described. The program, between Gulfstream Aerospace and the Sukhoi Design Bureau, is intended to develop a supersonic jet with a cruise speed of Mach 2.0, a tailored aircraft shape, and a size and weight that are smaller than current supersonic transports. It is suggested that the final design will produce lesser shock waves and sonic booms than previous supersonic jets. The configuration proposed by the Sukhoi Design Bureau, which is 114-ft long with an arrow-shaped 56-ft wing span, is described and illustrated. R.B.

A90-31882
THERMOPLASTIC COMPOSITES, PAST, PRESENT AND FUTURE
G. R. GRIFFITHS (Westland Helicopters, Ltd., Yeovil, England) IN: Materials and processing - Move into the 90's; Proceedings of the Tenth International European Chapter Conference of SAMPE, Birmingham, England, July 11-13, 1989. Amsterdam, Elsevier Science Publishers, 1989, p. 101-109.
Copyright

The current status of thermoplastic composites and the work that needs to be completed in order to establish large-scale production of thermoplastic composites are briefly reviewed. In particular, attention is given to the advantages and disadvantages of thermoplastic components, potential application areas, principal manufacturing processes, and prospects for cost-effective automated large volume production. The design aspects of thermoplastic composite components and joining techniques are also discussed. V.L.

A90-35950
DEVELOPMENT OF MONOLITHIC AND COMPOSITE CERAMICS AT ALLIED-SIGNAL AEROSPACE COMPANY
M. D. MEISER (Allied-Signal Aerospace Co., Garrett Ceramic Components Div., Torrance, CA) IN: MRS International Meeting on Advanced Materials, 1st, Tokyo, Japan, May 31-June 3, 1988, Proceedings. Volume 5. Pittsburgh, PA, Materials Research Society, 1989, p. 187-199.
Copyright

An overview of development programs on monolithic silicon nitride and silicon nitride matrix composites is presented. Results are given from a study on the processing of silicon nitride and studies to develop high-temperature monolithic Si3N4. The development of ceramic composites consisting of silicon carbide whiskers dispersed in a silicon nitride matrix is examined. R.B.

A90-37854* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
INDIUM PHOSPHIDE SOLAR CELLS - RECENT DEVELOPMENTS AND ESTIMATED PERFORMANCE IN SPACE
IRVING WEINBERG and DAVID J. BRINKER (NASA, Lewis Research Center, Cleveland, OH) Space Power - Resources, Manufacturing and Development (ISSN 0883-6272), vol. 9, no. 1, 1990, p. 3-14. refs
Copyright

The current status of indium phosphide solar cell research is

reviewed. In the NASA research program, efficiencies of 18.8 percent were achieved for standard n/p homojunction InP cells while 17 percent was achieved for ITO/InP cells processed by sputtering n-type indium tin oxide onto p-type indium phosphide. The latter represents a cheaper, simpler processing alternative. Computer modeling calculations indicate that efficiencies of over 21 percent are feasible. Relatively large area cells are produced in Japan with a maximum efficiency of 16.6 percent. Author

A90-38528#
TACTICAL TILT ROTOR
JOHN P. MAGEE (Bell Helicopter Textron, Inc., Fort Worth, TX) IN: National Technical Specialists' Meeting on Tactical V/STOL, New Bern, NC, Sept. 19-21, 1989, Proceedings. Alexandria, VA, American Helicopter Society, 1989, 12 p.

The application of tiltrotor technology to the next generation of tactical aircraft is examined. Preliminary design data for a gunship and utility aircraft are presented with comparisons of size and maneuverability with the existing fleet. Emphasis is placed on the gunship's engine/power train, structural concept, weapon/stores options, acceleration/deceleration performance, and mission cost/risk control. With respect to the utility aircraft, focus is on cabin seat options and productivity in a critical resupply mission. Operational scenario comparisons are made for antiarmor, direct air support, resupply, and medevac roles. In addition, the tiltrotor blade loads in aggressive maneuvers, the tactical use of speed, and survivability against ground/air defenses are covered. The paper concludes with a discussion of technology development and flight test needed to bring these design concepts to maturity. V.T.

A90-39046
PAMELA - HIGH DENSITY SEGMENTATION FOR LARGE, ULTRA-LIGHT, HIGH-PERFORMANCE MIRRORS
J. D. G. RATHER, B. L. ULICH (Kaman Aerospace Corp., Bloomfield, CT), G. AMES, A. LAZZARINI (Kaman Instrumentation Corp., Colorado Springs, CO), E. K. CONKLIN et al. IN: Reflective optics II; Proceedings of the Meeting, Orlando, FL, Mar. 27-29, 1989. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1989, p. 195-203.

The PAMELA (Phased Array Mirror, Extendable Large Aperture) optical technology, which provides important new possibilities for constructing very large telescopes, is described. The PAMELA approach leads directly to the ability to build rugged, diffraction-limited optical telescopes or beam expanders for ground-based or orbital deployment which have unprecedentedly low weight. Such systems will be fault-tolerant, leading to large expected savings in overall system cost and complexity. C.D.

A90-39739
MMIC PRODUCTION USING MBE - PRESENT AND FUTURE
THOMAS L. COOPER (Varian Associates, Santa Clara, CA) Microwave Journal (ISSN 0192-6225), vol. 33, June 1990, p. 105, 106, 108-110 (4 ff.).

The MBE process for producing epitaxial material for HBT and HEMT MMICs is described, and results are presented. The impact of production issues such as yield, equipment cost, and throughput are discussed in terms of models that deal with both high- and moderate-volume production. The key equipment parameters driving affordable epitaxial material in each of these cases are identified, and the outlook for the future is discussed, including the potential impact of gas-source MBE and metal-organic MBE. Author

A90-41110#
TECHNOLOGICAL PREPARATIONS OF CIVIL AIRCRAFT PROGRAMS
HUBERT LIESE Dornier Post (ISSN 0012-5563), no. 2, 1990, p. 6, 7.

Civil aircraft development programs must be closely tied to competitive criteria such as mission fulfillment, economics, environmental control and safety. Economics is certainly one of the most important criteria for the commercial operator. Fuel and maintenance costs, depreciation of aircraft unit price, along with interest rates and insurance costs, are all critical factors in the economic analysis. Technological considerations in civil aircraft development studies include aerodynamics, configuration, structures and designs, propulsion, and equipment, including avionics and controls. Finally, all of these criteria must be used to identify relevant fields of technology and to evaluate them with respect to their effects on future aircraft utilization. R.E.P.

A90-41112#
EUROMART - THE EUROPEAN AVIATION RESEARCH AND TECHNOLOGY PROGRAM
JOHANNES SPINTZYK Dornier Post (ISSN 0012-5563), no. 2, 1990, p. 22, 23.

A study was required by the EEC in 1987 on the status of the European aeronautics industry and its future requirements. Follow-on studies were developed into five areas of work: (1) technologies for advanced materials, (2) design methods and quality assurance for products and procedures, (3) application of production technologies, (4) technology for production methods, and (5) special aviation activities. More than 50 aviation-specific projects have been selected within the five major work areas. Helicopter, engine, and equipment companies, as well as Euromart companies and research institutes and universities are all participating in this research and technology program. R.E.P.

A90-41188
DESIGN AND ANALYSIS AID FOR EVALUATING AIRCRAFT STRUCTURES
DIANA C. FISHER and TU D. HGUYEN (General Dynamics Corp., Fort Worth, TX) IN: IEA/AIE-89; Proceedings of the Second International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, Tullahoma, TN, June 6-9, 1989. Volume 1: Tullahoma, TN, University of Tennessee, 1989, p. 469-472.

A prototype system was developed during the definition of the Structural Design Evaluator methodology. The system includes three modules: structural integrity analysis; cost/producibility; and reliability, maintainability, and supportability (RM&S). The structural integrity analysis module provides design prediction through stress analysis, fatigue and fracture analysis, and fastening recommendations. The cost/producibility analysis module estimates product cost based on the material cost, the manufacturiang process and the design producibility factors. The RM&S analysis module, on the other hand, assists design engineers to identify potential RM&S weakesses then provides recommendations. The expert design knowledge in the existing prototype system focuses on a machined parts family composed of functional features such as webs, flanges, stiffeners, and circular holes. Author

A90-41614
THE LINEAR R&D PROJECT SELECTION PROBLEM - AN ALTERNATIVE TO NET PRESENT VALUE
JEFFREY L. RINGUEST and SAMUEL B. GRAVES (Boston College, Chestnut Hill, MA) IEEE Transactions on Engineering Management (ISSN 0018-9391), vol. 37, May 1990, p. 143-146. refs

An alternative to the net present value (NPV) formulation of the objective in problems involving choice between cash flows over time is presented. This approach is illustrated in an R&D project selection problem. It is shown that the NPV formulation is a special case of optimizing a multiattribute value function. This special case requires restrictive assumptions about the decision-maker's preferences over time. It is suggested that multiobjective linear programming methods be used to produce a set of nondominated solutions. This methodology is analytically

tractable and requires no assumptions about the decision-maker's time preferences. I.E.

A90-42209#
ADVANCED UPPER STAGE, A CONCEPTUAL UPPER STAGE DESIGN FOR ALS
DAVID J. KIM, JOSEPH ADAMS, C. S. GRANT, INKI A. MIN, and JASON J. CHIANG (Aerospace Corp., Los Angeles, CA) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 11 p.
(AIAA PAPER 90-2701) Copyright

The development of the proposed advanced upper stage (AUS) is discussed. The AUS is optimized for the planned advanced launch systems (ALS) and the solid rocket motor upgrade/Titan-IV (SRMU/T-IV). The requirements for the SRMU/T-IV and ALS are described. Consideration is given to the design of the engine, thermal control system, engine actuator, tank configuration, material, inertial navigation unit, the battery, built-in-test equipment, and propellant. The operation of the AUS is analyzed using Launch Operations Proficiency. The costs of R&D and full-scale development of the AUS are estimated. Diagram of various AUS designs are provided. I.F.

A90-42254#
SMALL LAUNCH VEHICLE SS-88-35
ROSARIO NICI and CLAY CHUN (U.S. Air Force Academy, Colorado Springs, CO) IN: Annual AIAA/Utah State University Conference on Small Satellites, 2nd, Logan, UT, Sept. 18-21, 1988, Proceedings. Logan, UT, Utah State University, 1988, 5 p. refs

A 15,000 pound small launch vehicle (SLV) which can carry a 250 kg payload into LEO is designed. The objective is to develop a system to provide the SLV capability at a low cost. A preliminary analysis has determined size and weight, and a development plan is established for further refinement of the design. The SLV is a two-stage liquid oxygen/liquid hydrogen booster. Alternative fuels and engines are being investigated. Author

A90-42656#
DEVELOPING THE CANADAIR REGIONAL JET AIRLINER
ROBERT A. WOHL (Canadair, Regional Jet Div., Montreal, Canada) IN: Annual General Meeting of the Canadian Aeronautics and Space Institute, 36th, Ottawa, Canada, May 15, 16, 1989, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1989, p. 8-1 to 8-9.

An account is given of the benefits accruing to Canadair's Regional Jet (RJ) predevelopment activities from a formally defined design/marketing-phase approach. The RJ is a 50-passenger derivative of the current Challenger 601-series business jet. Preliminary design changes encompass a total of 240 inches in fuselage extensions, increased wing area, strengthened landing gear and brakes, and modification of the flight control system. The design/marketing phase resulted in signed customer commitments for 62 aircraft, leading to approval of the RJ program. O.C.

A90-43763
THE PROPFAN . . . WHAT FUTURE NOW?
KEN FULTON Air International (ISSN 0306-5634), vol. 38, Feb. 1990, p. 59-64.
Copyright

Various propfan engine and research and development programs involving work undertaken by U.S., European, and Soviet industry are presented. In general, it appears that all the researchers involved in this effort are adopting more and more of a drift away from an early introduction of the propfan for commercial application. This results from the underlying problem that the development and production costs of new or even derivative propfan transports would make the aircraft too expensive for the commercial operators to back as long as the price of aviation fuel remains at its current level. In addition, it is probable that new, more efficient, aircraft designs may be needed in order to take full advantage of the propfan's large reduction in specific fuel consumption. The different approaches taken by the major international aircraft and engine manufacturers are discussed. R.E.P.

A90-45511
THE USE OF THE CFM56 ENGINE IN THE KC-135 TANKER
G. A. AGRICOLA (CFM International, Inc., Cincinnati, OH) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Sept. 25-28, 1989. 7 p.
(SAE PAPER 892362) Copyright

The use of a commercially designed and developed product for the installation and utilization in an existing military application offers new, interesting and fresh challenges. Aside from the normal minor tailoring and modification of the product required to meet the user's specifications, one must also consider variations in the standard maintenance and support patterns and procedures necessitated by the introduction of a commercial turbofan engine. However, the challenges were workable and solutions were established so that the use of the commercial CFM56 engine in this military KC-135 application has developed into a very successful marriage. Author

A90-46960#
RECENT DEVELOPMENTS IN ROTOR DYNAMICS METHODOLOGY IN THE U.S. INDUSTRY
ROBERT SOPHER (Sikorsky Aircraft, Stratford, CT) IN: AHS National Specialists' Meeting on Rotorcraft Dynamics, Arlington, TX, Nov. 13, 14, 1989, Proceedings. Alexandria, VA, American Helicopter Society, 1989, 19 p. refs

Recent developments in rotor dynamics methodology in the U.S. industry are reviewed. Newly developed or modified analyses and their capabilities are discussed, including the development of new rotor dynamic analyses based to varying degrees on substructure decomposition of the dynamical system, the application of software development methodology, and introduction of executive based systems. Progress is reported in the development and validation of codes which address the need to handle configurations of increased complexity relative to the first generation codes. It is noted that the high cost of developing and validating new codes has led manufacturers to use prevalidated older codes to complement new codes. Recent university developments are reviewed and it is noted that universities have apparently advanced beyond industry in the development of finite element based codes applicable to composite materials and have applied these to a variety of problems to predict loads and stability. A series of diagrams and comprehensive explanatory graphs are included. L.K.S.

A90-46984
THE FLAT ANTENNA - NOW A REALITY
DANIEL R. WELLS (COMSAT, Clarksburg, MD) Space Communication and Broadcasting (ISSN 0167-9368), vol. 6, Sept. 1989, p. 457-460.
Copyright

A practical, high-performance, low-cost, consumer-oriented flat antenna is described. Advantages of the flat antenna include a thin profile which is less obtrusive than a parabolic dish, features less expensive shipping and installation costs due to its light weight, has the ability to squint the beam, and has improved aperture control for sidelobe suppression. R&D focuses on development of monolithic microwave integrated circuts which will be embedded into the array, thus adding the potential features of amenability to integrated electronics (which will improve noise performance and avoid the necessity of appending an external low-noise converter), and electronic steerability to the list of flat antenna advantages. The basic construction of the flat panel and the intended market for the first flat antennas and the subsequent effect on product design are discussed. Initial market results in Japan, and planned development of European and American markets are discussed. L.K.S.

A90-49764
A NICKEL/HYDROGEN BATTERY FOR PV SYSTEMS

DONALD M. BUSH (Sandia National Laboratories, Albuquerque, NM) IEEE Aerospace and Electronic Systems Magazine (ISSN 0885-8985), vol. 5, Aug. 1990, p. 27-30. Previously announced in STAR as N90-15358.
(Contract DE-AC04-76DP-00789)
Copyright

The nickel/hydrogen battery was developed in the early 1970's as an energy storage subsystem for commercial communication satellites. The advantages offered by nickel/hydrogen batteries, including long life, low maintenance and high reliability, make it very attractive for terrestrial applications such as stand-alone photovoltaic systems. The major drawback to the wider use of the nickel-hydrogen battery is its high initial cost. Sandia National Laboratories has placed cost-shared contracts with Comsat Laboratories and Johnson Controls, Inc., to reduce the cost, and a battery consisting of prismatic cells in a common pressure vessel has evolved. A 7-kWh battery has been on test at Sandia since January 1988 using a flat-plate photovoltaic array for charging. Author

N90-10037*# General Electric Co., Cincinnati, OH. Aircraft Engines.
PMR GRAPHITE ENGINE DUCT DEVELOPMENT Final Report
C. L. STOTLER and S. A. YOKEL Aug. 1989 190 p LIMITED REPRODUCIBILITY: More than 20% of this document may be affected by foldouts
(Contract NAS3-21854)
(NASA-CR-182228; NAS 1.26:182228) Avail: NTIS HC A09/MF A01 CSCL 21/5

The objective was to demonstrate the cost and weight advantages that could be obtained by utilizing the graphite/PMR15 material system to replace titanium in selected turbofan engine applications. The first component to be selected as a basis for evaluation was the outer bypass duct of the General Electric F404 engine. The operating environment of this duct was defined and then an extensive mechanical and physical property test program was conducted using material made by processing techniques which were also established by this program. Based on these properties, design concepts to fabricate a composite version of the duct were established and two complete ducts fabricated. One of these ducts was proof pressure tested and then run successfully on a factory test engine for over 1900 hours. The second duct was static tested to 210 percent design limit load without failure. An improved design was then developed which utilized integral composite end flanges. A complete duct was fabricated and successfully proof pressure tested. The net results of this effort showed that a composite version of the outer duct would be 14 percent lighter and 30 percent less expensive that the titanium duct. The other type of structure chosen for investigation was the F404 fan stator assembly, including the fan stator vanes. It was concluded that it was feasible to utilize composite materials for this type structure but that the requirements imposed by replacing an existing metal design resulted in an inefficient composite design. It was concluded that if composites were to be effectively used in this type structure, the design must be tailored for composite application from the outset. Author

N90-10134*# General Dynamics Corp., San Diego, CA. Space Systems Div.
LIQUID ROCKET BOOSTER STUDY. VOLUME 2, BOOK 5, APPENDIX 9: LRB ALTERNATE APPLICATIONS AND EVOLUTIONARY GROWTH Final Report, Aug. 1988 - Jan. 1989
Feb. 1989 83 p
(Contract NAS8-37137)
(NASA-CR-183604; NAS 1.26:183604) Avail: NTIS HC A05/MF A01 CSCL 21/8

The analyses performed in assessing the merit of the Liquid Rocket Booster concept for use in alternate applications such as for Shuttle C, for Standalone Expendable Launch Vehicles, and possibly for use with the Air Force's Advanced Launch System are presented. A comparison is also presented of the three LRB candidate designs, namely: (1) the LO2/LH2 pump fed, (2) the LO2/RP-1 pump fed, and (3) the LO2/RP-1 pressure fed propellant systems in terms of evolution along with design and cost factors, and other qualitative considerations. A further description is also presented of the recommended LRB standalone, core-to-orbit launch vehicle concept. E.R.

N90-10137*# General Dynamics Corp., San Diego, CA. Space Systems Div.
LIQUID ROCKET BOOSTER STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report, Oct. 1987 - Jan. 1989
Mar. 1989 57 p
(Contract NAS8-37137)
(NASA-CR-183599; NAS 1.26:183599) Avail: NTIS HC A04/MF A01 CSCL 21/8

The purpose of this study was to determine the feasibility of Liquid Rocket Boosters (LRBs) replacing Solid Rocket Boosters on the Space Shuttle program. The major findings are given. The most significant conclusion is that LRBs offer significantly safety and performance advantages over the SRBs currently used by the STS without major impact to the ongoing program. E.R.

N90-10138*# General Dynamics Corp., San Diego, CA. Space Systems Div.
LIQUID ROCKET BOOSTER STUDY. VOLUME 2, BOOK 6, APPENDIX 10: VEHICLE SYSTEMS EFFECTS Final Report
24 Mar. 1989 129 p Prepared in cooperation with Eagle Engineering, Inc., Houston, TX
(Contract NAS8-37137)
(NASA-CR-183605; NAS 1.26:183605) Avail: NTIS HC A07/MF A01 CSCL 21/8

Three tasks were undertaken by Eagle Engineering as a part of the Liquid Rocket Booster (LRB) study. Task 1 required Eagle to supply current data relative to the Space Shuttle vehicle and systems affected by an LRB substitution. Tables listing data provided are presented. Task 2 was to evaluate and compare shuttle impacts of candidate LRB configuration in concert with overall trades of analysis activity. Three selected configurations with emphasis on flight loads, separation dynamics, and cost comparison are presented. Task 3 required the development of design guidelines and requirements to minimize impacts to the Space Shuttle system from all LRB substitution. Results are presented for progress to date. E.R.

N90-10242# Titan-Aluminum-Feinguss G.m.b.H., Bestwig (Germany, F.R.).
THIN WALLED CAST HIGH-STRENGTH STRUCTURAL PARTS
CH. LIESNER *In* AGARD, Castings Airworthiness 6 p May 1989
Copyright Avail: NTIS HC A07/MF A01

Production and reproducibility in series of thin-walled high-strength structural parts out of aluminum and titanium alloys produced to the investment casting process are reported. Limits referring to dimensions of parts, wall thicknesses and mechanical properties will be shown on choosen examples. Actions of quality assurance for reproducibility in series are necessary. First of all these include pre-material, melt, casting, ceramic coating, heat treatment. Also the good compatibility of the material combination titanium and CFA will be considered. Author

N90-10272# Science Applications International Corp., McLean, VA.
JAPANESE STRUCTURAL CERAMICS RESEARCH AND DEVELOPMENT
J. B. WACHTMAN, JR., R. C. BRADT, R. F. DAVIS, R. RAJ, D. W. RICHERSON, N. J. TIGHE, BARBARA L. MCKENNEY, ed., MOIRA MCGRAIN, ed., and RENEE G. TAUB, ed. Jul. 1989 256 p
Avail: NTIS HC A12/MF A02

Japanese work on structural ceramics is reviewed in comparison with work in the United States. Key organizations involved in planning and conducting ceramics research and development are presented along with national plans for ceramics research. General themes including the Japanese commitment to ceramics and their

approach to marketing and product development are discussed. Specific families of ceramic materials (silicon carbide, silicon nitride, zirconia, mullite, and alumina) are reviewed. Subjects that deal with more than one class of materials (hard coatings, e.g., diamond and cubic boron nitride, fabrication technology, borides and mixed compositions) are covered. It is concluded that Japanese and U.S. positions on science and technology are comparable but it is likely that the Japanese will be first in the introduction of significant load-bearing high-temperature parts in engines. K.C.D.

N90-10793# Office of the Under Secretary of Defense (Acquisitions), Washington, DC.
DOMESTIC TECHNOLOGY TRANSFER PROGRAM REGULATION Regulation Report
D. APPLER Dec. 1988 15 p
(PB89-195374; DOD-3200.12-R-4) Avail: NTIS HC A03/MF A01 CSCL 05/1

This regulation authorizes the DoD Domestic Technology Transfer Program and responds to the requirements of Public Law 96-480, the Federal Technology Transfer Act of 1986, and Executive Order 12591. Its purpose is to ensure the full use of the nation's federal investment in research and development, stimulating improved use by state and local governments and the private sector. GRA

N90-11320# Department of Energy, Washington, DC. Office of Transportation Systems.
ADVANCED TURBINE TECHNOLOGY APPLICATIONS PROGRAM, (ATTAP): A PLAN FOR IMPROVING THE PROTOTYPE PRODUCTION OF CERAMIC COMPONENTS FOR THE GAS TURBINE ENGINE, 1988--1992
Apr. 1989 18 p
(DE89-015566; DOE/CE-0257) Avail: NTIS HC A03/MF A01

This Advanced Turbine Technology Applications Project (ATTAP) Plan is intended to advance the technological readiness for commercialization of an automotive ceramic gas turbine engine, the feasibility of which was established and demonstrated during the recently concluded AGT Project. DOE

N90-11891# Navy Clothing and Textile Research Facility, Natick, MA.
NEW FABRIC DEVELOPMENT PROGRAM Final Report, Dec. 1985 - May 1987
RUTH TOMPKINS, ROY DILLARD, and NORMAN AUDET Feb. 1989 73 p
(AD-A211549; NCTRF-170) Avail: NTIS HC A04/MF A01 CSCL 11/5

This report details an evaluation of potential candidate replacement fabrics for the Navy's 100 percent texturized polyester Certified Navy Twill (CNT) fabric for use in all L-1 and E-1 summer dress white uniforms and in E-1 dinner dress white and summer khaki uniforms. The Navy Clothing and Textile Research Facility (NCTRF) was directed by the Naval Military Personnel Command (NMPC) to conduct this study. GRA

N90-12387# Defense Logistics Agency, Alexandria, VA. Operations Research and Economic Analysis Office.
FORECASTING CONTRACTING WORKLOAD Final Report
KURT F. SCHWARZ and THOMAS L. BROOKS, IV Apr. 1989 25 p
(AD-A211935) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study explored the possibility of forecasting Defense Logistics Agency (DLA) contracting workload from indicators of service activity. The premise of this analysis is that DLA's contracting workload is somehow related to Service activity; an increase in Service activity will lead to a corresponding increase in DLA workload. We examined the use of regression analysis and mathematical modeling for forecasting DLA workload. We found that we could not forecast DLA's contracting workload directly from service activity (given the variables we examined). We were able to forecast DLA's supply operations workload (expressed by item demand) from Service activity in some cases. Then, we could forecast some of DLA's stocked item contracting workload indirectly by using the forecasts of item demand, but we were unable to forecast any of DLA's nonstocked contracting workload. Based upon the inability to accurately forecast DLA's contracting workload from service activity, we recommend continued use of DLA's current workload forecasting techniques. GRA

N90-12407# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
FEDERAL FUNDS FOR RESEARCH AND DEVELOPMENT: FISCAL YEARS 1986, 1987, AND 1988. VOLUME 36: DETAILED STATISTICAL TABLES
1988 264 p
(PB89-223523; NSF-87-314-VOL-36) Avail: NTIS HC A12/MF A02 CSCL 05/3

The 163 tables present data on Federal research and development (R and D) funding for the 1986 through 1988 period. The data, provided by Federal agencies through an annual survey, cover research and development by individual agency, character of work (basic research, applied research, and development), and performing sector. Research funding by field of science/engineering is available for all performing sectors and for research performed at universities and colleges. Data are provided on R and D plant obligations by agency and also for R and D and R and D plants at individual Federally Funded Research and Development Centers. In addition, data are available on foreign performers and the distribution of R and D obligations by State. Historical data for major categories is provided for the 1967 through 1988 period. Author

N90-12408# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
FEDERAL FUNDS FOR RESEARCH AND DEVELOPMENT. FISCAL YEARS 1987, 1988, AND 1989. VOLUME 37: DETAILED STATISTICAL TABLES
1989 113 p
(PB89-223531; NSF-89-304-VOL-37) Avail: NTIS HC A06/MF A01 CSCL 05/3

The tables present data on Federal research and development (R and D) funding for the 1987 through 1989 period. The data, provided by Federal agencies through an annual survey, cover research and development by individual agency, character of work (basic research, applied research, and development), and performing sector. Research funding by field of science/engineering is available for all performing sectors and for research performed at universities and colleges. Data are provided on R and D plant obligations by agency and also for R and D and R and D plants at individual Federally Funded Research and Development Centers. In addition, data are available on foreign performers and the distribution of R and D obligations by State. Historical data for major categories is provided for the 1968 through 1989 period. Data for 1988 and 1989 are estimated since they do not represent final actions. Author

N90-12496# Institute for Defense Analyses, Alexandria, VA.
THE NASA EXPERIENCE IN AERONAUTICAL R AND D: THREE CASE STUDIES WITH ANALYSIS Final Report, Jan. 1985 - May 1987
JOHN S. LANGFORD, III Mar. 1989 227 p
(AD-A211486; AD-E501144; IDA-R-319; IDA/HQ-87-32596) Avail: NTIS HC A11/MF A02 CSCL 01/1

Recent policy studies have failed to provide adequate guidance for planning and evaluating the nation's program of aeronautical research and development. In particular, the government's use of experimental systems to bridge the gap between laboratory research and operational systems remains controversial. This thesis used retrospective examinations of NASA's work in aircraft noise reduction, powered-lift technology, and hypersonic flight technology to analyze the impact and effectiveness of such programs under four general circumstances that may justify government involvement in a market-driven economy. It concludes that the NASA proof-of-concept program has had mixed results, with technical goals more successfully accomplished than policy goals. The public

benefits of the successes, however, far outweigh the costs of the disappointments. The thesis concludes that such demonstration programs in aeronautical research and development should continue, with a series of analytical and institutional changes to couple them more closely with policy goals. GRA

N90-13322# European Space Agency, Paris (France).
EUROPEAN SPACE TECHNOLOGY: CELEBRATING TWENTY-FIVE YEARS OF RESEARCH AND DEVELOPMENT
M. BRISCOE, J. TOUSSAINT, H. KUMMER, and NORMAN LONGDON, ed. Jun. 1989 105 p Original contains color illustrations
(ESA-BR-55; ISBN-92-9092-003-3; ISSN-0250-1589; ETN-89-95388) Copyright Avail: NTIS HC A06/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 30 Dutch guilders

The research and development history of the European community since 1965 is described. Special attention is given to specific spacecraft components developed by the European Space Agency since is was formed in 1975. Momentum wheels, tribology, thermal control and life support, propulsion, solar power generation, spacecraft power distribution systems, energy storage and batteries are some of the research and development areas covered. Spinoffs of European space research such as solar cells, heat pipes and carbon fiber technology are discussed. Future programs and developments are presented. ESA

N90-13499# European Space Agency, Paris (France).
THE HIPPARCOS MISSION. PRELAUNCH STATUS. VOLUME 1: THE HIPPARCOS SATELLITE
M. A. C. PERRYMAN, H. HASSAN, T. BATUT, K. D. BOCK, C. J. BURROWS, K. CLAUSEN, P. E. DAVIES, A. DHERBECOURT, H. EGGEL, A. ERRINGTON et al. Jun. 1989 360 p Original contains color illustrations
(ESA-SP-1111-VOL-1; ISBN-92-9092-016-5; ISSN-0379-6566; ETN-90-95527) Copyright Avail: NTIS HC A16/MF A03; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The Hipparcos project is reported. In particular, the design, development and performance tests of the prelaunching phase are presented. The following topics are included: the operating principle, the payload structure, the telescope mirrors and related optical equipment, the thermal control, the baffles and the detectors. The spacecraft structure, along with thermal, mechanical and electrical subsystems, is described. The data handling systems, and the attitude and orbit control systems are analyzed. The tests carried out for the calibration of the payload and to ascertain the influence of the performance in orbit on the ultimate accuracy of the measurements are included.

ESA

N90-14126*# National Aeronautics and Space Administration, Washington, DC.
SMALL BUSINESS INNOVATION RESEARCH: PROGRAM SOLICITATION
28 Jun. 1989 108 p
(NASA-TM-101869; NAS 1.15:101869; SBIR-89-1) Avail: NTIS HC A06/MF A01 CSCL 05/1

This, the seventh annual SBIR solicitation by NASA, describes the program, identifies eligibility requirements, outlines the required proposal format and content, states proposal preparation and submission requirements, describes the proposal evaluation and award selection process, and provides other information to assist those interested in participating in NASA's SBIR program. It also identifies the Technical Topics and Subtopics in which SBIR Phase 1 proposals are solicited in 1989. These Topics and Subtopics cover a broad range of current NASA interests, but do not necessarily include all areas in which NASA plans or currently conducts research. High-risk high pay-off innovations are desired.
Author

N90-14131# Defense Logistics Agency, Alexandria, VA.
TOTAL QUALITY MANAGEMENT: DIRECTORATE OF CONTRACT MANAGEMENT MASTER PLAN
Jul. 1989 18 p
(AD-A212867) Avail: NTIS HC A03/MF A01 CSCL 05/1

This document describes the Directorate of Contracting Management Total Quality Management implementing plan. It includes a description of the TQM concept, the structure established to complement TQM and goals established by the Directorate of Contract Management to implement TQM. TQM goals within the directorate focus on three primary areas: TQM training, harmonizing contract management policies and procedures with the TQM philosophy, and enhancing communication and feedback. GRA

N90-14159# National Academy of Sciences - National Research Council, Washington, DC.
THE EXPLORER PROGRAM FOR ASTRONOMY AND ASTROPHYSICS
BLAIR D. SAVAGE, ERIC E. BECKLIN, JOSEPH P. CASSINELLI, ANDREA K. DUPREE, JAMES L. ELLIOT, WILLIAM F. HOFFMANN, HUGH S. HUDSON, MICHAEL JURA, JAMES KURFESS, STEPHEN S. MURRAY (Smithsonian Astrophysical Observatory, Cambridge, MA.) et al. 1986 60 p Original contains color illustrations
Avail: NTIS HC A04/MF A01

This report was prepared to provide NASA with a strategy for proceeding with Explorer-class programs for research in space astronomy and astrophysics. The role of Explorers in astronomy and astrophysics and their past accomplishments are discussed, as are current and future astronomy and astrophysics Explorers. Specific cost needs for an effective Explorer program are considered. K.C.D.

N90-14183# Naval Academy, Annapolis, MD.
SUMMARY OF RESEARCH ACADEMIC DEPARTMENTS, 1987-1988 Annual Report, Jul. 1987 - Jun. 1988
FRED FETROW Dec. 1988 271 p
(AD-A213252; USNA-3910-3-13) Avail: NTIS HC A12/MF A02 CSCL 05/6

This annual report summarizes the research work of the Naval Academy faculty and midshipmen for the period July 1987 through June 1988. Sponsored and independent research projects are listed by title, followed by the names of the investigators and an abstract. A list of publications and their abstracts are included as well as presentations at professional meetings, conferences, and seminars. Contents include: Division of Engineering and Weapons; Division of English and History; Division of Mathematics and Science; Division of Professional Development and Division of U.S. and International Studies. GRA

N90-14213# Committee on Science, Space and Technology (U.S. House).
REVIEW OF THE AEROSPACE SAFETY ADVISORY PANEL REPORT FOR NASA FISCAL YEAR 1990 AUTHORIZATION
1989 113 p Hearing before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, 101st Congress, 1st Session, no. 69, 28 Sep. 1989
(GPO-24-234) Avail: Subcommittee on Space Science and Applications, Washington, D.C. 20510 HC free; SOD HC $3.50 as 552-070-07499-6

The Panel identified five main categories of findings under the National Space Transportation System (NSTS), including management structure, safety enhancements, advanced solid rocket motor, logistics and support, and space shuttle elements. The Panel found that the NSTS management structure has been clarified and strengthened, and that the safety, reliability, maintainability, and quality assurance function is now stronger, more visible, better staffed, and better funded. It was recommended that these funds be protected to maintain safety. It was also recommended that lists of safety enhancements that are maintained be kept current and prioritized. NASA's decision to develop an advanced solid rocket motor was questioned. Implementation

should be deferred until other alternatives have been evaluated. The NSTS logistics and support systems showed a satisfactory trend, but an improvement in overhaul and repair turnaround time was recommended. A program to improve solid rocket motors and boosters was also recommended, as well as tests to determine design corrections to meet original requirements for the booster aft skirt. The Panel recommended continued emphasis on developing and using strong risk assessment and management procedures. The Space Station Freedom Program is ungoing a complete review to accommodate anticipated reduced funding levels. Flight safety procedures for all NASA Centers are to be reviewed to determine their adequacy. J.P.S.

N90-14376# Lawrence Livermore National Lab., CA. Dept. of Chemistry and Materials Science.
CHALLENGES IN PROCESSING FOR POLYMER COMPOSITES
LEROY CHIAO and T. T. CHIAO 13 Sep. 1989 23 p Presented at the 36th Sagamore Conference on Thick Section Composites, Plymouth, MA, 23-26 Oct. 1989
(Contract W-7405-ENG-48)
(DE90-002224; UCRL-102028; CONF-8910290-1) Avail: NTIS HC A03/MF A01

Processing technology is considered to be the key for future cost and performance improvement in fiber composite structures. The challenges are discussed in two broad areas: engineering and research. In engineering, the challenge is to reduce cost while maintaining the state-of-the-art quality of composite structures. This can be done through innovative process development work. In research, the challenge is to concentrate on processing science. We need to reexamine and focus on basic issues such as voids, fiber wetting and filament/tow collimation, fiber/resin ratio, uniform fiber distribution and cure effects. These issues, combined and interactive in a laminate, have created many confusing topics such as composite toughness, low transverse failure strain and poor compression properties. To date, processing technology is considered the weak link in the chain of a fiber composite system, which also includes good design practices and proper material selections. This is because process studies in composites have traditionally been considered mundane by many researchers; furthermore, this type of work is very difficult to do in universities. We strongly believe, however, that the highest potential for cost reduction for composites is clearly in processing technology. DOE

N90-14401# National Science Foundation, Washington, DC. Div. of Science Resources Studies.
SCIENCE AND TECHNOLOGY RESOURCES IN US INDUSTRY: SURVEYS OF SCIENCE RESOURCES SERIES, 1975-1986
Dec. 1988 111 p
(PB90-107194; NSF-88-321) Avail: NTIS HC A06/MF A01 CSCL 13/2

American industrial scientific and technological (ST) resources are explored and summarized in terms of two of the most important parameters of innovation: research and development (R and D) activities, and employment and utilization of scientists, engineers, and technicians. Industry has the predominant role in setting current and future demand for science and engineering personnel. In 1986, industry employed 1.2 million scientists and 1.9 million engineers, representing 55 and 80 percent, respectively, of all personnel in the fields. Between 1976 and 1986, employment of scientists in industry increased 10.7 percent/year, and of engineers, 6.6 percent/year. Industrial firms spend 3/4 of the funds financing R and D performed in the U.S. Author

N90-14489# Idaho National Engineering Lab., Idaho Falls.
BATTERY TECHNOLOGY ASSESSMENT AND R AND D PLAN
GARY L. HENRIKSEN 1989 11 p Presented at the Electric and Hybrid Vehicle Contractors' Meeting, Idaho Falls, ID, 6-8 Sep. 1989
(Contract DE-AC07-76ID-01570)
(DE90-002007; EGG-M-89361; CONF-8909181-6) Avail: NTIS HC A03/MF A01

To guide future EV battery R and D programs, the U.S. Department of Energy (DOE) commissioned a comprehensive assessment of secondary battery technologies. A total of 67 battery developers -- from the United States, Canada, Europe, Asia, and Africa -- were solicited to submit battery design concepts for an Improved Dual-Shaft Electric Propulsion (IDSEP) van. A team of 10 consultants and 7 representatives from DOE laboratories evaluated 42 developer responses and consultant-prepared designs. Using six criteria -- five technical/economic criteria and a maturity/technical barriers criterion -- the assessment identified 12 most-promising batteries. Employing a generic EV-battery development-process framework, the assessment results were used to formulate multi-year R and D plans and schedules for the most-promising developmental batteries. DOE

N90-14897# Westinghouse Hanford Co., Richland, WA.
INTRODUCTORY TESTIMONY: HEARING ON NUCLEAR POWER IN SPACE
JOHN NOLAN Sep. 1989 61 p
(Contract DE-AC06-87RL-10930)
(DE90-001137; WHC-SA-0727) Avail: NTIS HC A04/MF A01

The uses of nuclear power in space are examined. Various systems are discussed and an outline of a slide presentation is given. The testing and safety of these programs is also briefly mentioned. DOE

N90-14961# Argonne National Lab., IL. Energy and Environmental Systems Div.
APPLICATIONS OF SUPERCONDUCTOR TECHNOLOGIES TO TRANSPORTATION
D. M. ROTE, J. S. HERRING (Idaho National Engineering Lab., Idaho Falls.), and T. P. SHEAHEN Jun. 1989 92 p
(Contract W-31-109-ENG-38)
(DE90-000856; ANL/CNSV-68) Avail: NTIS HC A05/MF A01

This report assesses transportation applications of superconducting devices, such as rotary motors and generators, linear synchronous motors, energy storage devices, and magnets. Among conventional vehicles, ships appear to have the greatest potential for maximizing the technical benefits of superconductivity, such as smaller, lighter, and more-efficient motors and, possibly, more-efficient generators. Smaller-scale applications include motors for pipeline pumps, all-electric and diesel-electric locomotives, self-propelled rail cars, and electric highway vehicles. For diesel-electric locomotives, superconducting units would eliminate space limitations on tractive power. Superconducting magnetic energy storage devices appear most suitable for regenerative braking or power assistance in grade climbing, rather than for long-term energy storage. With toroidal devices (especially for onboard temporary energy storage), external fields would be eliminated. With regard to new vehicle technologies, the use of superconducting devices would only marginally enhance the benefits of inductive-power-coupled vehicles over conventional electric vehicles, but could enable magnetically levitated (maglev) vehicles to obtain speeds of 520 km/h or more. This feature, together with the quiet, smooth ride, might make maglev vehicles an attractive alternative to intercity highway-vehicle or airlane trips in the range of 100 to 600 miles. Electromagnetic airport applications are not yet feasible. DOE

N90-15040*# New World Services, Inc., FL.
CHRONOLOGY OF KSC AND KSC RELATED EVENTS FOR 1988 Annual Report, 1988
KEN NAIL, JR., ed. Mar. 1989 116 p
(Contract NAS10-10600)
(NASA-TM-101915; NAS 1.15:101915; KSC-KHR-13) Avail: NTIS HC A06/MF A01 CSCL 05/4

A record of KSC events and a reference source for historians and other researchers is given. Arrangements is by day and month and individual articles are attributed to published sources. An index has been added to this edition. Author

N90-15370# Argonne National Lab., IL. Materials and Components Technology Div.
RECENT ADVANCES IN MAGNETIC HEAT PUMP TECHNOLOGY
KENNETH L. UHERKA, JOHN R. HULL, and PAUL E. SCHEIHING (Department of Energy, Washington, DC.) 1989 20 p Presented at the 1989 ASME Winter Annual Meeting, San Francisco, CA, 10-15 Dec. 1989
(Contract W-31-109-ENG-38)
(DE89-013289; CONF-891208-7) Avail: NTIS HC A03/MF A01

Magnetic heat pump (MHP)/refrigeration systems, incorporating state-of-the-art superconducting magnet technology, were assessed for industrial applications ranging from the liquefaction of gases (20 K to 100 K range) to cold storage refrigeration for food preservation (250 K to 320 K range). Initial market penetration of MHP technology is anticipated to occur in the gas liquefaction sector, since the performance advantages of magnetic refrigeration cycles relative to gas compression cycles and other conventional systems are more pronounced in the lower temperature ranges. Design options for rotary MHP devices include alternative regeneration schemes to obtain the temperature spans necessary for industrial applications. The results of preliminary design assessment studies indicate that active magnetic regenerator concepts, in which the magnetic working material also serves as the regenerative medium, offer advantages over alternative MHP designs for industrial applications. DOE

N90-15894*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURAL DYNAMICS DIVISION RESEARCH AND TECHNOLOGY ACCOMPLISHMENTS FOR FY 1989 AND PLANS FOR FY 1990
JACQUELINE G. SMITH and JAMES E. GARDNER Jan. 1990 190 p
(NASA-TM-101683; NAS 1.15:101683) Avail: NTIS HC A09/MF A01 CSCL 01/1

The purpose is to present the Structural Dynamics Division's research accomplishments for FY 1989 and research plans for FY 1990. The work under each Branch (technical area) is described in terms of highlights of accomplishments during the past year and highlights of plans for the current year as they relate to five year plans for each technical area. This information will be useful in program coordination with other government organizations and industry in areas of mutual interest. Author

N90-15961# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
PRODUCTIVITY AND CRYOGENIC WIND TUNNELS
J. CHRISTOPHE *In* AGARD, Special Course on Advances in Cryogenic Wind Tunnel Technology 14 p Nov. 1989
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After a brief review of the situation of existing cryogenic wind tunnels, the thermal balance of five wind tunnels is discussed. This discussion of the thermal balance is then generalized to suggest guidelines for the designers of future cryogenic wind tunnels. Finally, with the same concern, unconventional schemes are examined. Author

N90-16584# Oak Ridge National Lab., TN.
INVENTION AND INNOVATION: ALTERNATIVE MECHANISMS FOR ENHANCING ORGANIZATIONAL COMPETITIVENESS
TERRY LYNN PAYNE and DONALD TIPPETT 1989 7 p Presented at the 2nd International Conference on Technology Management, Miami, CA, 28 Feb. - 2 Mar. 1990
(Contract DE-AC05-84OR-21400)
(DE89-015858; CONF-900215-1) Avail: NTIS HC A02/MF A01

This paper explores the concepts of invention and innovation as mechanisms which play a vital role in achieving a firm's strategic objectives. Too often the terms invention and innovation are used interchangeably. However, a definition for each is provided that clearly shows their distinguishing characteristics. Included is a comparison of the environments that support invention and innovation. Similarities, such as the fact that neither is highly compatible with sustaining operations, are described and discussed. Key differences inherent in the fact that invention is an event and innovation is a process are also discussed. This paper includes a statement of the impacts of innovation and invention on organizational competitiveness. Also included are guidelines for considering innovation and invention as distinct strategic alternatives in the strategic planning process. DOE

N90-16783# Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.).
KEYNOTE ADDRESS
HEINZ RIESENHUBER *In* ESA, Progress in Space Transportation p 7-8 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

The success of the Ariane space venture is discussed. Plans for Ariane 4 and 5 are outlined. The importance of the Hermes space shuttle and of the Columbus space station is stressed. The specific plans of the Federal Republic of Germany in meeting these aerospace challenges is outlined. ESA

N90-16800# British Aerospace Public Ltd. Co., Stevenage (England). Space Systems Group.
HOTOL: A FUTURE LAUNCHER FOR EUROPE
PETER J. CONCHIE *In* ESA, Progress in Space Transportation p 143-148 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

The need for a European aerospace plane is presented. The role of HOTOL in raising the profile of such an aerospace plane is described. The current status of the HOTOL program is outlined. Diagrams of the HOTOL aerospace plane are presented. Vehicle configuration interactions, command and control issues, and aerodynamic design criteria are illustrated. Concerning budget, operational support systems are calculated to be the biggest single item in determining HOTOL costs. ESA

N90-16801# Air Force Systems Command, Wright-Patterson AFB, OH.
NATIONAL AERO-SPACEPLANE STATUS AND PLANS
TOM J. GREGORY and H. WRIGHT *In* ESA, Progress in Space Transportation p 149-156 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

Preliminary results of tests carried out in the design phase of the National Aero-Spaceplane Program are described. The fundamental economic considerations for the development of spaceplanes are reviewed. The advantages and disadvantages of international cooperation in the development of an aero-spaceplane are addressed. The importance of cost considerations in the design of the next generation of launch vehicles is stressed. ESA

N90-16841# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Stuttgart (Germany, F.R.).
THE DLR TECHNOLOGY PROGRAMME ON SPACE TRANSPORTATION
MARTIN MAILAENDER and C.-J. WINTER *In* ESA, Progress in Space Transportation p 479-483 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

Three DLR (German Aerospace Research Establishment) programs related to the Hermes project, the Saenger project, and the Columbus and Ariane projects, are described. Selected examples of recent achievements and plans for future research in these three projects are presented. Relations with national and international partners are outlined. Various aspects of participation in current programs and the development of future technologies are discussed. ESA

N90-17079# Oak Ridge National Lab., TN.
ASSESSMENT OF GROUND-COUPLED HEAT PUMPS Foreign Trip Report
V. C. MEI 5 Dec. 1989 4 p
(Contract DE-AC05-84OR-21400)
(DE90-003977; ORNL/FTR-3492) Avail: NTIS HC A01/MF A01

The objectives of the third working meeting were to assess the accomplishments to date in direct-expansion ground-coupled heat exchanger study and to discuss what should be done in the future. DOE

N90-17695*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
CHALLENGES FOR FUTURE SPACE POWER SYSTEMS
HENRY W. BRANDHORST, JR. *In* ESA, European Space Power, Volume 1 p 133-136 Aug. 1989 Previously announced as N89-25506
Copyright Avail: NTIS HC A19/MF A03 CSCL 10/2

Forecasts of space power needs are presented. The needs fall into three broad categories: survival, self-sufficiency, and industrialization. The cost of delivering payloads to orbital locations and from Low Earth Orbit (LEO) to Mars are determined. Future launch cost reductions are predicted. From these projections the performances necessary for future solar and nuclear space power options are identified. The availability of plentiful cost effective electric power and of low cost access to space are identified as crucial factors in the future extension of human presence in space. ESA

N90-17706# Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
THE HERMES FUEL CELL POWER PLANT
H. GEHRKE and U. KNOEBEL *In* ESA, European Space Power, Volume 1 p 203-209 Aug. 1989
Copyright Avail: NTIS HC A19/MF A03

An overview of the technical status of the Hermes fuel cell power plant development program is presented. The results of a 1988 selection study to find the most promising fuel cell technology are described. The characteristics of the immobile system chosen as best suited for space applications are outlined. A development schedule for the overall Hermes project is presented. ESA

N90-18325# Chapman Research Group, Inc., Littleton, CO.
AN EXPLORATION OF BENEFITS FROM NASA SPINOFF
RICHARD L. CHAPMAN, LORETTA C. LOHMAN, and MARILYN J. CHAPMAN Jun. 1989 66 p
(Contract NERAC-88-01)
Avail: NTIS HC A04/MF A01

A retrospective analysis of the applications of NASA technology reported in the annual publication Spinoff was conducted. The primary objective of the study was to identify and, where possible, quantify the benefits resulting from those applications. Interviews were conducted with various contacts from companies, institutions, and agencies mentioned in Spinoff articles or included in Spinoff files. Approximately 600 useful interviews from 400 companies were obtained. The results revealed six principle avenues by which NASA facilitates the transfer of technology of practical utilization and commercialization. Those avenues included: direct use of NASA technology, creation of markets, facilitation of commercial acceptance, assistance through NASA-sponsored Industrial Applications Centers, transfer of NASA employees, spinoff to other public agencies, and spinoffs from regular NASA R and D activities. Estimates of sales and savings benefits realized from NASA technology are presented for nine general categories of end use. Other non-quantifiable benefits are also discussed including: extension of knowledge and technologies of a critical or valuable nature; identification of new opportunities; helping companies increase their competitiveness; safety, regulatory, and quality-of-life improvements; and helping companies to avoid R and D dead-ends. M.G.

N90-18806# Sandia National Labs., Albuquerque, NM.
ADVANCED BATTERY DEVELOPMENT
1989 31 p
(Contract DE-AC04-76DP-00789)
(DE90-006073; SAND-89-1489) Avail: NTIS HC A03/MF A01

In order to promote national security by ensuring that the United States has an adequate supply of safe, assured, affordable, and environmentally acceptable energy, the Storage Batteries Division at Sandia National Laboratories (SNL), Albuquerque, is responsible for engineering development of advanced rechargeable batteries for energy applications. This effort is conducted within the Exploratory Battery Technology Development and Testing (ETD) Lead center, whose activities are coordinated by staff within the Storage Batteries Division. The ETD Project, directed by SNL, is supported by the U.S. Department of Energy, Office of Energy Systems Research, Energy Storage and Distribution Division (DOE/OESD). SNL is also responsible for technical management of the Electric Vehicle Advanced Battery Systems (EV-ABS) Development Project, which is supported by the U.S. Department of Energy's Office of Transportation Systems (OTS). The ETD Project is operated in conjunction with the Technology Base Research (TBR) Project, which is under the direction of Lawrence Berkeley Laboratory. Together these two projects seek to establish the scientific feasibility of advanced electrochemical energy storage systems, and conduct the initial engineering development on systems suitable for mobile and stationary commercial applications. DOE

N90-19073# Vinten Instruments Ltd., Weybridge (England).
THE BRINGING TO MARKET OF THE RF ALERT (A CASE STUDY IN TECHNOLOGY TRANSFER)
R. CURRY *In* ESA, Promotion of European Space Technology Transfer p 21-22 Nov. 1989
Copyright Avail: NTIS HC A04/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 20 Dutch guilders

Events which resulted in the bringing of the RF alert to market from its beginnings as a spinoff from a piece of military research are chronicled. Market surveys and target product specification are discussed. To start the process of technology transfer the need for access to finance for under taking market surveys and proof-of-principle demonstrations is highlighted. To be effective the broker must have a long term view on the returns and a long term involvement. ESA

N90-19075# Commission of the European Communities (Luxembourg).
INTRODUCTORY REMARKS FOR THE PANEL DISCUSSIONS ON TECHNOLOGY TRANSFER
B. B. GOODMAN *In* ESA, Promotion of European Space Technology Transfer p 27-28 Nov. 1989
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The steps in the technology transfer process are introduced. They include identification; protection; preliminary evaluation; dissemination; and exploitation process which encompasses definition of market needs, identification of partners, technico-economic merit verification, business plan preparation, and implementation. ESA

N90-19076# Defence Technology Enterprises Ltd., Milton Keynes (England).
METHODOLOGY PANEL
R. S. HOLDOM *In* ESA, Promotion of European Space Technology Transfer p 31-33 Nov. 1989
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Methods, techniques and the problems experienced in the following four main steps of the technology transfer process are presented: finding sources of technology to meet particular needs and finding surplus technology within an organization for wider exploitation outside; evaluating cases and prioritizing before marketing; finding the outlets; and choosing the right licensees and technology transfer route. ESA

N90-19079# Societe Bertin et Cie, Plaisir (France).
THE IMPROVEMENT OF TECHNOLOGY TRANSFER FROM SPACE TO INDUSTRY
G. MORDCHELLES-REGNIER and J. L. LAFON *In* ESA, Promotion of European Space Technology Transfer p 49-52 Nov. 1989
Copyright Avail: NTIS HC A04/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 20 Dutch guilders

Three conditions are included to be of utmost importance. Appropriate transfer agents, such as the Contract Research Organization, must be inserted inside research and development. A small but significant part of the budget must be reserved for the necessary adaptation to non space applications. It is essential to think in terms of real time transfer rather than valorization of past results. ESA

N90-19653# Westinghouse Electric Corp., Pittsburgh, PA. Advanced Energy Conversion Dept.
SOLID OXIDE FUEL CELL COGENERATION SYSTEM CONCEPTUAL DESIGN, PROGRAM 2 Final Report, 30 Apr. 1987 - 31 Jul. 1989
W. L. LUNDBERG Jul. 1989 119 p
(Contract GRI-5086-294-1273)
(PB90-114968; REPT-1273-15; GRI-89/0162) Avail: NTIS HC A06/MF A01 CSCL 10/1

Results of a solid oxide fuel cell cogeneration system conceptual design study are presented. The baseline system, rated at 200 kWe net power and fueled by natural gas, is applied in a baseloaded electric mode at a commercial site. The system satisfies part of the site's needs for ac power and supplies exhaust heat to generate 170 C (338 F) saturated steam for site use. In evaluating cogeneration system economics, it is assumed that this steam is supplied directly to an existing steam-driven chiller. Solid oxide fuel cell cogeneration systems rated at 50, 500, and 2000 kWe are also evaluated. The 2000 kWe system is assumed to be sited in a small industrial application. GRA

N90-19883# Executive Office of the President, Washington, DC.
NATIONAL ACTION PLAN ON SUPERCONDUCTIVITY RESEARCH AND DEVELOPMENT
Dec. 1989 79 p
(PB89-138512) Avail: NTIS HC A05/MF A01 CSCL 20/12

The Superconductivity Action Plan pursuant to the Superconductivity and Competitiveness Act of 1988 is presented. The plan draws upon contributions from leaders in the technical community of the Federal Government responsible for research and development in superconductivity programs, as well as from the report of the Committee to Advise the President on Superconductivity. Input from leaders in the private sector was obtained during the formulation and review of the plan. Some contents: Coordination of the plan; Technical areas (high temperature superconductivity materials in general, high temperature superconductivity films for sensors and electronics, magnets, large area high temperature superconductivity films, bulk conductors); and Policy areas. Author

N90-19926# Office of Science and Technology, Washington, DC.
SCIENCE AND TECHNOLOGY REPORT AND OUTLOOK, 1985-1988
1989 195 p Prepared in cooperation with NSF, Washington, DC
(PB90-115270) Avail: NTIS HC A09/MF A02 CSCL 05/1

A comprehensive statement is provided of science and technology policy and priorities for the years 1985 through 1988. Chapter 1 describes the significant decisions and actions in science and technology during the reporting period. Chapter 2 developes the outlook in selected areas of science and development programs, with indications of results or achievements, as appropriate. Finally, Chapter 4 describes the international cooperation aspects of federal research and development programs, with a summary of the associated negotiations. Author

N90-20127*# Thiokol Corp., Brigham City, UT. Space Operations.
THIOKOL/WASATCH INSTALLATION EVALUATION OF THE REDESIGNED FIELD JOINT PROTECTION SYSTEM (CONCEPTS 1 AND 3) Final Report
M. COOK 13 Dec. 1989 45 p
(Contract NAS8-30490)
(NASA-CR-183860; NAS 1.26:183860; TWR-50138) Avail: NTIS HC A03/MF A01 CSCL 21/8

The procedures, performance, and results obtained from the Thiokol Corporation/Wasatch Redesigned Field Joint Protection System (FJPS) Installation Evaluation are documented. The purpose of the evaluation was to demonstrate and develop the procedures required to install two different concepts (referred to as Concepts 1 and 3) of the redesigned FJPS. The processing capability of each configuration was then evaluated and compared. The FJPS is installed on redesigned solid rocket motors (RSRM) to protect the field joints from rain intrusion and to maintain the joint temperature sensor measurement between 85 and 122 F while the boosters are on the launch pad. The FJPS is being redesigned to reduce installation timelines at KSC and to simplify or eliminate installation processing problems related to the present design of an EPDM moisture seal/extruded cork combination. Several installation techniques were evaluated, and a preferred method of application was developed for each concept. The installations were performed with the test article in the vertical (flight) position. Comparative timelines between the two concepts were also developed. An additional evaluation of the Concept 3 configuration was performed with the test article in the horizontal position, to simulate an overhead installation on a technical evaluation motor (TEM). Author

N90-20394# Argonne National Lab., IL. Industrial Cogeneration Program.
A TECHNICAL AND ECONOMIC EVALUATION OF OXYGEN-ENRICHED COMBUSTION IN DIESEL ENGINES USING WATER-EMULSIFIED FUELS
R. L. COLE, T. J. MARCINIAK, R. R. SEKAR, and F. STODOLSKY Jan. 1990 75 p
(Contract W-31-109-ENG-38)
(DE90-008095; ANL/ESD/TM-2) Avail: NTIS HC A05/MF A01

The technical and economic feasibility of using oxygen-enriched air and low-grade fuels in diesel cogeneration systems is reported. The effects of oxygen enrichment, low-grade fuels, and water addition on the combustion process were studied using first principles of combustion theory; the effects of oxygen enrichment and water addition on diesel engine performance were analyzed with a computer model; air separation technologies were evaluated; the coupling of the oxygen plant to the diesel engine was studied; and the internal rate of return for several system options was determined. The greatest improvement in economic benefits is obtained primarily from fuel switching, and the optimal oxygen enrichment is the minimum that will enable medium- and high-speed diesel engines to use low-grade fuels. Two oxygen-enrichment technologies, selective membranes and pressure-swing adsorption, were identified as being both technically and economically feasible. Oxygen enrichment increases the power of the diesel engine by allowing an increased fueling rate, although increased pressures and temperatures may decrease engine life. Oxygen enrichment decreases CO, smoke, and particulate emissions from the engine but increases NO sub x emissions. However, the NO sub x emissions, pressures, and temperatures can be controlled by water addition and fuel-injection timing adjustments. DOE

N90-21607# California Univ., Berkeley. Lawrence Berkeley Lab.
CURRENT EXPERIMENTS IN ELEMENTARY PARTICLE PHYSICS
C. G. WOHL, F. E. ARMSTRONG, T. G. TRIPPE, G. P. YOST, Y. OYANAGI, D. C. DODDER, YU. G. RYABOV, S. R. SLABOSPITSKY, R. FROSCH, and A. OLIN (Tri-Univ. Meson Facility, Vancouver, British Columbia) Sep. 1989 179 p
(Contract DE-AC03-76SF-00098)
(DE90-008062; LBL-91-REV-9/89) Avail: NTIS HC A09/MF A01

This report contains summaries of 736 current and recent experiments in elementary particle physics (experiments that finished taking data before 1982 are excluded). Included are experiments at Brookhaven, CERN, CESR, DESY, Fermilab, Tokyo Institute of Nuclear Studies, Moscow Institute of Theoretical and

Experimental Physics, Joint Institute for Nuclear Research (Dubna), KEK, LAMPF, Novosibirsk, PSI/SIN, Saclay, Serpukhov, SLAC, and TRIUMF, and also several underground experiments. Also given are instructions for searching online the computer database (maintained under the SLAC/SPIRES system) that contains the summaries. Properties of the fixed-target beams at most of the laboratories are summarized. DOE

N90-21709# Lawrence Livermore National Lab., CA. Special Studies Program.
MARS IN THIS CENTURY: THE OLYMPIA PROJECT
RODERICK A. HYDE, MURIEL Y. ISHIKAWA, and LOWELL L. WOOD 1988 17 p Presented at the 4th National Space Symposium, Colorado Springs, CO, 12-15 Apr. 1988
(Contract W-7405-ENG-48)
(DE90-008356; UCRL-98567; CONF-8804105-2) Avail: NTIS HC A03/MF A01

Manned exploration of the inner solar system, typified by a manned expedition of Mars, this side of the indefinite future involves fitting a technical peg into the political hole. If Apollo-level resources are assumed unavailable for such exploratory programs, then non-Apollo means and methods must be employed, involving greater technical and human risks, or else such exploration must be deferred indefinitely. Sketched here is an example of such a relatively high risk alternative, one which could land men on Mars in the next decade, and return them to earth. Two of its key features are a teleoperated rocket fuel generating facility on the lunar surface and an interplanetary mission staging space station at L(sub 4), which would serve to enable a continuing solar system exploratory program, with annual mission commencements to points as distant as the Jovian moons. The estimated cost to execute this infrastructure building manned Mars mission is $3 billion, with follow on missions estimated to cost no more than $1 billion each. DOE

N90-22142# Midwest Research Inst., Golden, CO.
PHOTOVOLTAIC PROGRAM BRANCH Annual Report, FY 1989
K. A. SUMMERS, ed. Mar. 1990 280 p
(Contract DE-AC02-83CH-10093)
(DE90-000318; SERI/TP-211-3643) Avail: NTIS HC A13/MF A02

This report summarizes the progress of the Photovoltaic (PV) Program Branch of the Solar Energy Research Institute (SERI) from October 1, 1988, through September 30, 1989. The branch is responsible for managing the subcontracted portion of SERI's PV Advanced Research and Development Project. In fiscal year (FY) 1989, this included nearly 50 subcontracts, with a total annualized funding of approximately $13.1 million. Approximately two-thirds of the subcontracts were with universities, at a total funding of nearly $4 million. The six technical sections of the report cover the main areas of the subcontracted program: Amorphous Silicon Research, Polycrystalline Thin Films, Crystalline Silicon Materials Research, High-Efficiency Concepts, New Ideas, and University Participation. Technical summaries of each of the subcontracted programs provide a discussion of approaches, major accomplishments in FY 1989, and future research directions. Each report will be cataloged individually. DOE

N90-22528*# National Aeronautics and Space Administration, Washington, DC.
RESEARCH AND TECHNOLOGY OBJECTIVES AND PLANS SUMMARY (RTOPS) Research and Technology Program, FY 1988
Jan. 1988 200 p
(NASA-TM-89662; NAS 1.15:89662) Avail: NTIS HC A09/MF A02 CSCL 05/1

This publication represents the NASA research and technology program for FY88. It is a compilation of the Summary portions of each of the RTOPs (Research and Technology Objectives and Plans) used for management review and control of research currently in progress throughout NASA. The RTOP Summary is designed to facilitate communication and coordination among concerned technical personnel in government, in industry, and in universities. The first section containing citations and abstracts of the RTOPs is followed by four indexes: Subject, Technical Monitor, Responsible NASA Organization, and RTOP Number. Author

N90-22713# Office of Naval Research European Office, FPO New York, NY.
THE RACE (RESEARCH AND DEVELOPMENT IN ADVANCED TECHNOLOGIES FOR EUROPE) PROGRAM: A 1989 UPDATE
J. F. BLACKBURN 15 Dec. 1989 10 p
(AD-A218509; ONREUR-ESNIB-9-13-R) Avail: NTIS HC A02/MF A01 CSCL 25/2

Plans for the program called Research and Development in Advanced Communications Technologies for Europe (RACE) were reported in ESN 39-3:122-123 (1985), a comprehensive description of the work of the definition phases carried out in 1986 was given in ONRL Report No. 8-014-R (August 1988), and the RACE Program in 1988 was described in ONREUR Report 9-7-C (March 1989). The work in RACE addresses the technical and economic options for the development of an advanced information infrastructure. However, strategic analyses of demand for powerful and cost-effective services determines the orientation of the technical work. GRA

N90-23417*# Naval Academy, Annapolis, MD. Div. of Engineering and Weapons.
PROJECT LONGSHOT: A MISSION TO ALPHA CENTAURI Final Report
CURTIS WEST, SALLY CHAMBERLAIN, NEFTALI PAGAN, and ROBERT STEVENS 1989 90 p Prepared for Universities Space Research Association, Houston, TX
(Contract NASW-4435)
(NASA-CR-186052; NAS 1.26:186052) Avail: NTIS HC A05/MF A01 CSCL 22/1

Project Longshot, an exercise in the Advanced Design Program for Space, had as its destination Alpha Centauri, the closest star system to our own solar system. Alpha Centauri, a trinary star system, is 4.34 light years from earth. Although Project Longshot is impossible based on existing technologies, areas that require further investigation in order to make this feat possible are identified. Three areas where advances in technology are needed are propulsion, data processing for autonomous command and control functions, and reliability. Propulsion, possibly by antimatter annihilation; navigation and navigation aids; reliable hardware and instruments; artificial intelligence to eliminate the need for command telemetry; laser communication; and a reliable, compact, and lightweight power system that converts energy efficiently and reliably present major challenges. Project Longshot promises exciting advances in science and technology and new information concerning the universe. J.P.S.

N90-23418*# National Academy of Sciences - National Research Council, Washington, DC.
HUMAN EXPLORATION OF SPACE: A REVIEW OF NASA'S 90-DAY STUDY AND ALTERNATIVES
H. GUYFORD STEVER, ROBERT H. CANNON, JR., JOSEPH G. GAVIN, JACK L. KERREBROCK, LOUIS J. LANZEROTTI, ELLIOTT C. LEVINTHAL, JAMES W. MAR, JOHN H. MCELROY, DUANE T. MCRUER, WILLIAM J. MERRELL, JR. (Texas A&M Univ., Galveston.) et al. 1990 41 p
(Contract NASW-4003)
(NASA-CR-186394; NAS 1.26:186394) Avail: NTIS HC A03/MF A01 CSCL 22/1

The National Research Council (NRC) examines the NASA Report of the 90-Day Study on Human Exploration of the Moon and Mars, and alternative concepts. Included in this paper, prepared for the National Space Council, are the answers to a challenging set of questions posed by the Vice President. Concerns addressed include: the appropriate pace, the scope of human exploration, the level of long-term support required, the technology development available and needed, the feasibility of long-duration human spaceflight in a low-gravity environment, scientific objectives, and other considerations such as costs and risks. J.P.S.

N90-24171# National Academy of Sciences - National Research Council, Washington, DC. Committee on Promoting Research Collaboration.
INTERDISCIPLINARY RESEARCH: PROMOTING COLLABORATION BETWEEN THE LIFE SCIENCES AND MEDICINE AND THE PHYSICAL SCIENCES AND ENGINEERING
1990 49 p
Avail: NTIS HC A03/MF A01

This is a report by the Committee on Promoting Research Collaboration presenting the need for, and the methods for achieving, better communication between researchers in life sciences and medicine, as well as between physical scientists - including mathematicians and computer scientists - and engineers. Advances in one field often can profoundly affect research in another field. The committee identified the general, institutional, educational, financial, and communication factors needed to create an analytic framework for understanding the problems and successes of individuals and groups who conduct interdisciplinary research. Ways of reducing barriers to such collaboration are discussed and specific proposals are made to facilitate communication and exchange. The flow of information across discipline boundaries is urgently needed and strongly recommended. J.P.S.

N90-24218# National Science Foundation, Washington, DC.
NATIONAL PATTERNS OF RESEARCH AND DEVELOPMENT RESOURCES: 1989 Final Report
Jan. 1989 72 p
(NSF-89-308) Avail: NTIS HC A04/MF A01

This is a summary of information from each sector of the economy engaged in supporting research and development (R and D). The National Science Foundation monitors the health of U.S. science and technology in these sectors, i.e., government, industry, academia, and other nonprofit institutions, because the nation's ability to compete effectively in international markets must be shared by all. Here, the National Science Foundation assembles and analyzes comprehensive measures of the financial and human resources that each of these sectors devotes to R and D activities. The 1989 data presented reflect estimates for R and D programs contained in the Federal 1989 budget as proposed by the Administration. Author

N90-24222# Joint Research Centre of the European Communities, Ispra (Italy).
ACTIVITIES REPORT OF THE JOINT RESEARCH CENTRE Annual Report, 1988
1989 95 p Original contains color illustrations
(EUR-12305-EN; ETN-90-96776) Copyright Avail: NTIS HC A05/MF A01

Specific research programs, exploratory research, scientific and technical support for the Commission of the European Communites, and work for external third parties are identified as the main activities. Main achievements and financial resources are detailed. ESA

N90-24680# Department of Energy, Washington, DC. Office of Program Analysis.
SUMMARY RESULTS OF AN ASSESSMENT OF RESEARCH PROJECTS IN THE NATIONAL PHOTOVOLTAICS PROGRAM
Mar. 1990 8 p
(DE90-008222; DOE/ER-0443) Avail: NTIS HC A02/MF A01

The Photovoltaics Technology Division of the Department of Energy (DOE) is responsible for the management of the National Photovoltaics (PV) Program. This program sponsors research and development in photovoltaics energy technology. The program is designed to facilitate accumulation of a base of scientific and technical data and experience from which private enterprise can choose options for further development and competitive application in electrical markets in the United States. At request of the Director, Photovoltaics Technology Division, the Office Program Analysis (OPA) undertook an assessment of 129 projects managed by his Division. The primary objective of the assessment was to obtain a measure of the quality of the research or development in each project. Each panel consisted of five to eight scientific or technical reviewers collectively knowledgeable in all of the photovoltaics energy technology areas touched on by the projects being assessed. The purpose of this assessment was to obtain sufficient information for DOE managers to determine the following: what quality research sponsored by the Photovoltaics Technology Division, is represented by its individual projects; what the impact of individual projects is within the Photovoltaic Technology Division on the mission of Solar Renewables; and what the priority research targets and opportunities for future sponsorship are. DOE

N90-24684# Sandia National Labs., Albuquerque, NM.
PHOTOVOLTAIC CONCENTRATOR TECHNOLOGY DEVELOPMENT
E. C. BOES 1990 8 p Presented at the 21st IEEE Photovoltaic Specialists Conference, Kissimmee, FL, 21-25 May 1990
(Contract DE-AC04-76DP-00789)
(DE90-011479; SAND-89-2454C; CONF-900542-6) Avail: NTIS HC A02/MF A01

The progress made in the past 18 months in the area of photovoltaic concentrator technology development is summarized. A brief description of the status of two new photovoltaic concentrator power systems, the 300 kW ENTECH-3M-Austin system, and the single-pedestal Alpha Solarco system is given. Considerable progress in the area of photovoltaic concentrator module development is reported. The module development acitivities are emphasized that have resulted in significantly higher conversion efficiencies or new module design concepts. Included is a brief discussion of the major gains in concentrator cell efficiencies, especially the increased efficiencies for multijunction cells, and their implications for the technology. Also, discussed are the most significant recent developments for PV concentrator components, including refractive secondary optical elements and a self-contained, electronic, array-tracking controller. Finally, the outlook for markets and sales for photovoltaic concentrators is discussed and a new program in the United States, the Photovoltaic Concentrator Initiative is briefly discussed. DOE

N90-25234# Argonne National Lab., IL. Energy Systems Div.
OUTLOOK FOR CERAMICS IN HEAT ENGINES, 1990 - 2010: A TECHNICAL AND ECONOMIC ASSESSMENT BASED ON A WORLDWIDE DELPHI SURVEY
R. P. LARSEN, A. D. VYAS, A. P. S. TEOTIA, and L. R. JOHNSON Feb. 1990 141 p Revised
(Contract W-31-109-ENG-38)
(DE90-011262; ANL/ESD-5) Avail: NTIS HC A07/MF A01

The role of advanced ceramic materials in heat engines used in transportation applications was assessed from technical and economic perspectives. Key results are presented from a 1986 worldwide Delphi survey on the expected timing and rate of market development for ceramic engine components and ceramic-intensive engines. Also presented are the benefits of and barriers to the use of ceramic technology in heat engines and factors influencing its rate of adoption. The survey projects that by the mid-1990s, a substantial number of ceramic engine components will be in production and ceramic-intensive engines will be introduced. From the survey data, a computer model produced market penetration curves for individual ceramic engine components in both light- and heavy-duty applications. The model results were combined with price projections to estimate microeconomic effects by component. When aggregated; these projections of economic activity were used as inputs to a macroeconomic model of the U.S. economy, which projected overall economic effects under different scenarios of ceramic technology development. The level of international competition in developing this technology is presented, with implications for economic and technical leadership in this field. Finally, the conditions required for the rapid development of heat engine markets for ceramic technology are discussed. DOE

N90-25706# General Accounting Office, Washington, DC. Resources, Community, and Economic Development Div.
TECHNOLOGY TRANSFER: US AND FOREIGN PARTICIPATION IN R AND D AT FEDERAL LABORATORIES Briefing report to the Honorable Lloyd Bentsen, US Senate
Aug. 1988 77 p
(GAO/RCED-88-203BR; B-221997) Avail: NTIS HC A05/MF A01

The principal mechanism for non-Federal U.S. and foreign participation in Federal research and development (R and D) laboratories is through programs that bring in researchers from outside organizations to work for 6 months to 1 year. To obtain information about the extent of this participation, and the laboratories' policies regarding foreign access, a questionnaire was sent to 52 laboratories in 7 Federal agencies, which were selected with the assistance of agency officials. Fifty laboratories responded. They employed 43,902 researchers and had a total R and D operating budget of over 50 percent of the budget for Federal laboratories for fiscal year 1986. Foreigners comprised 30 percent of their outside researchers. Eight laboratories whose research and development results could have important commercial applications were visited. In general, the Federal laboratories support open exchanges in areas of basic research, but have restrictions on foreign access to technologies with commercial potential. Managers at the visited sites stated that their researchers have not had difficulty getting access to foreign laboratories and that, except for some isolated instances, foreign researchers have readily exchanged information with Federal laboratory researchers. This report provides background information and more details about the study's objectives, scope, and methodology, information about the extent of U.S. and foreign participation, Federal laboratories' policies, reciprocity in the exchange of information, and the implications of these issues for U.S. policy on foreign access. The research managers and administrators did not perceive a need for additional guidance or authority regarding foreign access to the Federal laboratories. J.P.S.

N90-26361*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STRUCTURAL MECHANICS DIVISION RESEARCH AND TECHNOLOGY PLANS FOR FY 1990 AND ACCOMPLISHMENTS FOR FY 1989
KAY S. BALES Apr. 1990 99 p
(NASA-TM-102654; NAS 1.15:102654) Avail: NTIS HC A05/MF A01 CSCL 20/11

The Objectives, FY 1990 Plans, Approach, and FY 1990 Milestones for the Structural Mechanics Division's research programs are presented. FY 1989 Accomplishments are presented where applicable. This information is useful in program coordination with other governmental organizations in areas of mutual interest. Author

N90-26373*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
STRUCTURAL DYNAMICS BRANCH RESEARCH AND ACCOMPLISHMENTS Report, FY 1989
Jul. 1990 51 p
(NASA-TM-102488; E-5279; NAS 1.15:102488) Avail: NTIS HC A04/MF A01 CSCL 20/11

Summaries are presented of fiscal year 1989 research highlights from the Structural Dynamics Branch at NASA Lewis Research Center. Highlights from the branch's major work areas include aeroelasticity, vibration control, dynamic systems, and computation structural methods. A listing of the fiscal year 1989 branch publications is given. Author

N90-26725# Max-Planck-Inst. for Foreign and International Patent, Copyright and Competition Law, Munich (Germany, F.R.).
PRODUCTION ACTIVITIES IN SPACE: THE PROBLEMS OF PROTECTION
D. STAUDER *In* ESA, Manned Space Stations: Legal Aspects p 117-121 Jan. 1990
Copyright Avail: NTIS HC A10/MF A02; also available from EPD, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

The issue of patent law in its role of protecting technical innovations or inventions made on space stations, objects, labs, or modules is addressed. The legal problems within patent law in protecting knowledge and inventions are described. The difficulties caused by the application of different national patent systems in the very confined area of a space station are discussed. The notions of unlawful misappropriation of knowledge are defined. Contracts of confidentiality are described. Contracts of co-inventorship are discussed. Territoriality and infringing acts are considered. ESA

N90-26788# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD HIGHLIGHTS 90/1
Mar. 1990 57 p
Copyright Avail: NTIS HC A04/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Progress made in AGARD programs is reported. Topics addressed include: the Turkish defense industry; Turkish aviation and the aeronautical industry; structures and materials in the 90s; the collaborative role of AGARD in recent advances in rotorcraft system identification; and new defense research document policy. B.G.

N90-26963*# National Materials Advisory Board, Washington, DC.
STATUS AND APPLICATIONS OF DIAMOND AND DIAMOND-LIKE MATERIALS: AN EMERGING TECHNOLOGY Report,for 1987 - 1990
30 Apr. 1990 114 p Sponsored by NASA, Washington
(Contract MDA903-89-K-0078)
(NASA-CR-186935; NAS 1.26:186935; AD-A222986; NMAB-445; LC-90-60384; ISBN-0-309-04196-1) Avail: NTIS HC A06/MF A01 CSCL 08/7

Recent discoveries that make possible the growth of crystalline diamond by chemical vapor deposition offer the potential for a wide variety of new applications. This report takes a broad look at the state of the technology following from these discoveries in relation to other allied materials, such as high-pressure diamond and cubic boron nitride. Most of the potential defense, space, and commercial applications are related to diamond's hardness, but some utilize other aspects such as optical or electronic properties. The growth processes are reviewed, and techniques for characterizing the resulting materials' properties are discussed. Crystalline diamond is emphasized, but other diamond-like materials (silicon carbide, amorphous carbon containing hydrogen) are also examined. Scientific, technical, and economic problem areas that could impede the rapid exploitation of these materials are identified. Recommendations are presented covering broad areas of research and development. GRA

N90-27043# Department of Energy, Washington, DC. Office of Transportation Systems.
ELECTRIC AND HYBRID VEHICLES PROGRAM Annual Report No. 13, fiscal year 1989
Apr. 1990 41 p
(DE90-013560; DOE/CE-0285P) Avail: NTIS HC A03/MF A01

This thirteenth annual report on the implementation of the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 (Public Law 94-413), referred to as the Act, complies with the reporting requirements established in section 14 of the Act. In addition to informing Congress of the progress and plans of the Department of Energy's Electric and Hybrid Vehicles Program, this report is intended to serve as a communication link between the Department and all of the public and private interests involved in making the program a success. During FY 1989, significant progress was made in this program. There has been continuing interest shown by both the automobile manufacturers and supply sectors of our economy in electric and hybrid vehicles. The three major domestic automobile

manufacturers all are devoting some effort towards electric vehicles. Their participation includes cost-shared contracts with Department of Energy and the Electric Power Research Institute as well as independently funded activities. Research and development efforts in batteries and propulsion components continue to achieve significant progress in providing industry with technology that will result in vehicles that will be more economically competitive. DOE

N90-27049*# National Materials Advisory Board, Washington, DC.
MATERIALS FOR HIGH-DENSITY ELECTRONIC PACKAGING AND INTERCONNECTION Report, 1987 - 1990
10 Apr. 1990 154 p Sponsored by NASA, Washington
(Contract MDA903-89-K-0078)
(NASA-CR-186934; NAS 1.26:186934; AD-A222985; NMAB-449; LC-90-60385; ISBN-0-309-04233-X) Avail: NTIS HC A08/MF A01 CSCL 09/1

Electronic packaging and interconnections are the elements that today limit the ultimate performance of advanced electronic systems. Materials in use today and those becoming available are critically examined to ascertain what actions are needed for U.S. industry to compete favorably in the world market for advanced electronics. Materials and processes are discussed in terms of the final properties achievable and systems design compatibility. Weak points in the domestic industrial capability, including technical, industrial philosophy, and political, are identified. Recommendations are presented for actions that could help U.S. industry regain its former leadership position in advanced semiconductor systems production. GRA

N90-27546# Federal Aviation Administration, Atlantic City, NJ.
FEDERAL AVIATION ADMINISTRATION SMALL BUSINESS INNOVATION RESEARCH 5-YEAR PROJECT SUMMARIES Final Report, 1985 - 1989
JAMES H. REMER Feb. 1990 102 p
(AD-A221590; DOT/FAA/CT-90/5) Avail: NTIS HC A06/MF A01 CSCL 05/1

This document contains a summary of all Small Business Innovation Research (SBIR) Phase 1 and Phase 2 contract awards sponsored, either fully or on a shared cost basis, by the FAA. The research projects contained in this document provide information on each project, including company, principal investigator, contract number, period of performance, FAA technical monitor, and either a summary of the proposed research and anticipated results or a summary of the completed research. This document covers research conducted over a 5-year period from 1985 through 1989. GRA

N90-27612# Navy Personnel Research and Development Center, San Diego, CA.
INDEPENDENT RESEARCH AND INDEPENDENT EXPLORATORY DEVELOPMENT PROGRAMS Annual Report, FY 1989
WILLIAM E. MONTAGUE, ed. and CARMEN C. SCHEIFERS, ed. Mar. 1990 87 p
(AD-A222690; NPRDC-AP-90-6) Avail: NTIS HC A05/MF A01 CSCL 05/1

The Acting Technical Director encourages scientists and engineers at the Navy Personnel Research and Development Center (NPRDC) to generate new and innovative proposals to promote scientific and technological growth in the organization and the development of knowledge and technology of interest to the Navy. Support for this provided by discretionary funding furnished by the Independent Research (IR) and Independent Exploratory Development (IED) programs of the Office of Naval Research and Office of Naval Technology. These programs support initial research and development of interest to the Navy with emphasis on the NPRDC mission areas of the acquisition, training, and effective utilization of personnel. Funds are provided to the Technical Directors of Navy Laboratories to support innovative and promising research and development outside the procedures required under normal funding authorization. The funds are to encourage creative efforts important to mission accomplishment. They enable promising researchers to spend a portion of their time on examining the feasibility of self-generated new ideas and scientific advances. They can provide important and rapid test of promising new technology and can help fill gaps in the research and development program. This may involve preliminary work on speculative solutions too risky to be funded from existing programs. GRA

N90-27679# Bundesanstalt fuer Flugsicherung, Frankfurt am Main (Germany, F.R.).
R AND D ASPECTS OF THE FUTURE OPERATIONAL CONCEPT OF THE BFS
K. PLATZ *In* DLR, Integrated Air Traffic Management 18 p Dec. 1989
Avail: NTIS HC A15/MF A02; DLR, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, 105 Deutsche marks

A new operational concept for Air Traffic Control (ATC) system is described. The ATC system of the future must satisfy the requirements and be able to cope with demand. Some aspects of the capacity, the components of the operational concept for the future system are described. The system is to be used as a guideline for the evolutionary development. The major areas for research work are given. The activities in the navigational field, air traffic management service, air traffic flow management, and monitoring are underlined. A concept for the replacement of the printed control strips is evaluated. ESA

N90-27789# Office of Naval Research Liaison Office, Far East, APO San Francisco, CA.
INORGANIC COMPOSITE MATERIALS IN JAPAN: STATUS AND TRENDS
MICHAEL J. KOCZAK, KARL M. PREWO, ANDREAS MORTENSEN, STEVEN G. FISHMAN, M. BARSOUM, and ROBERT J. GOTTSCHALL (Department of Energy, Washington, DC.) Nov. 1989 61 p Prepared in cooperation with Air Force Office of Scientific Research Liaison Office, Far East, APO San Francisco, CA and Army Research Office, Far East Liason Office, APO San Francisco, CA
(PB90-174392; ONRFE-M7) Avail: NTIS HC A04/MF A01 CSCL 11/4

Japan's high performance composite research activities and applications are reviewed by six authors who teamed as a study group in September 1988 to assess selected research areas of composite activities. Metal and ceramic matrix composites and high temperature ceramic reinforcements, excluding carbon fibers and polymer matrix composites, are examined. It is the intention to capture the current trends and scientific accomplishments of university, government research laboratories and, to a lesser extent, selected industrial laboratories in the research areas. In addition, an interpretation and forecast of future directions is considered in each topic area based on current activities and perceived trends. Author

N90-27959# National Inst. of Standards and Technology, Gaithersburg, MD. *Center for Electronics and Electrical Engineering.*
CENTER FOR ELECTRONICS AND ELECTRICAL ENGINEERING TECHNICAL PROGRESS BULLETIN COVERING CENTER PROGRAMS, JULY TO SEPTEMBER 1989, WITH 1990 CEEE EVENTS CALENDER
E. JANE WALTERS, comp. Feb. 1990 42 p
(PB90-188095; NISTIR-90/4236) Avail: NTIS HC A03/MF A01 CSCL 09/3

Abstracts are presented for all Center papers released for publication by the National Institute of Standards and Technology in the quarter and citations and abstracts for Center papers published in the quarter. Technical topics addressed include: semiconductor technology; fast signal acquisition, processing, and transmission; electrical systems; and radiated electromagnetic interference. Author

N90-28133# Wattsun Corp., Albuquerque, NM.
DESIGN OPTIMIZATION OF SHORT FOCAL LENGTH PHOTOVOLTAIC MODULES Final Technical Report
VIRGIL ERBERT, JOHN E. DOHERTY, and RONALD P. CORIO Jan. 1990 79 p Sponsored in part by New Mexico Research and Development Inst., Santa Fe
(Contract SNL-75-7300)
(PB90-182221; NMRDI-2-77-5609) Avail: NTIS HC A05/MF A01 CSCL 10/1

The first tasks completed were design optimization of sub-module components resulting in selection of a final module design for production. Performance testing was conducted by Sandia National Laboratories and analysis of automated manufacturing techniques was begun. A cost analysis, following the Department of Energy's guidelines, was completed along with the successful development and testing of a low cost prototype tracking system. Author

N90-28446# *Rose (Lester J.), Newport News, VA.*
TECHNOLOGY UTILIZATION: MANAGING THE TRANSFER OF NASA AEROSPACE TECHNOLOGY TO OTHER INDUSTRIES
LESTER J. ROSE *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 175-183 1990 Previously announced in IAA as A90-34047
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

The NASA Technology Utilization Program to transfer NASA technology to other industries is examined. Consideration is given to the various activities of the program, including the dissemination of new technology, industrial outreach, applications engineering projects, and repository services. Studies assessing the Technology Utilization Program are reviewed. The advantages of spinoff technology from NASA projects are discussed and a partial list of spinoffs for composite materials is presented to demonstrate the variety of applications for NASA aerospace technology. Author

N90-28710# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Dept. of Materials Science.
HIGH TEMPERATURE PROTECTIVE COATINGS: RECENT TRENDS
REMY MEVREL *In* AGARD, High Temperature Surface Interactions 10 p Nov. 1989 Previously announced in IAA as A90-21039
Copyright Avail: NTIS HC A11/MF A02; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Major types of currently used high-temperature protective coatings, including modified aluminides, MCrAlY overlays, and ceramic thermal barrier coatings are described, and recent trends in the coating field research reviewed. These research trends include studies of high-temperature corrosion degradation mechanisms, the mechanical properties of coated components, and the diffusional stability of coating/substrate systems. Particular attention is given to the development of high-performance ceramic coatings and to alternative coating processes, such as the deposition of MCrAlY alloys by electrophoresis and coelectro-deposition, cladding, or replacing Pt by Pd in modified aluminide coatings. Author

N90-28895# Helsinki Univ. of Technology, Espoo (Finland).
FUEL CELLS: THEIR APPLICATIONS, TECHNOLOGICAL STATUS, MARKET AND OPPORTUNITY
M. YAO (Yao International, Inc., Clarendon Hills, Il.) Oct. 1988 109 p
(DE90-796158; NEMO-4) Avail: NTIS (US Sales Only) HC A06/MF A01

Fuel cell applications are reviewed along with the global status of fuel cell development and demonstration, and the potential market and opportunity. A recommendation is made of potential strategies for Finnish industries and the government's role in the application and development of fuel cell technology in Finland. DOE

N90-28899# Sandia National Labs., Albuquerque, NM. Dept. of Power Sources.
DEVELOPMENT OF THE SODIUM/SULFUR TECHNOLOGY FOR ENERGY STORAGE
ALBERT LANDGREBE (Department of Energy, Washington, DC.) and NICHOLAS J. MAGNANI 1990 6 p Presented at the 8th Beta Battery Workshop, Chester, England, 12-18 Jun. 1990
(Contract DE-AC04-76DP-00789)
(DE90-014329; SAND-90-1829C; CONF-9006243-1) Avail: NTIS HC A02/MF A01

The sodium-sulfur programs have focused on progressing core aspects of the technology and completing initial battery engineering for both mobile and stationary applications. An overview of the Office of Energy Management (OEM) activities is presented. Two major development programs were active: the first with Ford *Aerospace and Communications Corporation (1975 to 1985)*, and the second with Chloride Silent Power Limited (1985 to 1990). With the completion this year of the qualification of a cell suitable for initial Solar Energy Systems (SES) applications, the emphasis of future DOE/OEM sodium/sulfur programs will shift to SES-battery engineering and development. The initial effort will resolve a number of issues related to the feasibility of utilizing the sodium/sulfur technology in these large scale applications. This multi-year activity represents an integrated program to produce a commercially viable battery system. DOE

N90-28910# National Inst. of Standards and Technology, Gaithersburg, MD. Center for Fire Research.
LONG-RANGE PLAN FOR A RESEARCH PROJECT ON CARBON MONOXIDE PRODUCTION AND PREDICTION
WILLIAM M. PITTS Oct. 1989 45 p
(PB90-209602; NISTIR-89/4185) Avail: NTIS HC A03/MF A01 CSCL 13/2

A five-year plan for the Center for Fire Research (CFR) Priority Research Project on Carbon Monoxide Prediction is given. Sections of the report provide a justification for the priority project, assess the current state of knowledge, summarize current relevant CFR research efforts, discuss specific research needs, list major assumptions utilized in formulating the research program, outline a research plan designed to meet the goals of the project and address the specific research needs, provide a rough timetable and budget, and present a discussion of the project philosophy and management. GRA

N90-29240# Army War Coll., Carlisle Barracks, PA.
HOW CAN RESEARCH AND DEVELOPMENT LEADTIME BE REDUCED
ANDREW C. FOLLMER 11 Apr. 1990 58 p
(AD-A224063) Avail: NTIS HC A04/MF A01 CSCL 15/5

Recognizing that the country that can rapidly convert advanced technology into superior weapon systems has a marked advantage, we have continuously increased funding of Research, Development, and Acquisition programs over the last three decades. During this period the leadtime for the development of new equipment has tripled. During the 1960's the stated leadtime objective of the Army was four years or less from initiation of development effort to type classification of the system as standard. This goal was never reached within the Army; instead the acquisition cycle leadtime has grown to ten to fifteen years. As a result of these long leadtimes many of our weapon systems cost too much and have obsolete technology by the time they are fielded. In addition to the premise that any reduction in leadtime means cost savings and a more qualitative combat force for the Army, why is it essential

now that we minimize leadtime. The prominent reason is that the military budget will no doubt be significantly reduced due to the changing political environment of the world. Preparing and executing a modernization plan that supports our national security strategy for the present and the future will become complicated by the need for fiscal restraint. GRA

N90-29559# Atomic Energy of Canada Ltd., Pinawa (Manitoba). Nuclear Research Establishment.
THE NUCLEAR BATTERY
K. S. KOZIER and H. E. ROSINGER 1988 22 p
(DE90-630400; AECL-9570; ISSN-0067-0367) Avail: NTIS (US Sales Only) HC A03/MF A01

The evolution and present status of an Atomic Energy of Canada Limited program to develop a small, solid-state, passively cooled reactor power supply known as the Nuclear Battery is reviewed. Key technical features of the Nuclear Battery reactor core include a heat-pipe primary heat transport system, graphite neutron moderator, low-enriched uranium TRISO coated-particle fuel and the use of burnable poisons for long-term reactivity control. An external secondary heat transport system extracts useful heat energy, which may be converted into electricity in an organic Rankine cycle engine or used to produce high-pressure steam. The present reference design is capable of producing about 2400 kW(t) (about 600 kW(e) net) for 15 full-power years. Technical and safety features are described along with recent progress in component hardware development programs and market assessment work. DOE

N90-30139# Pacific Northwest Lab., Richland, WA.
THE TECHNOLOGY TRANSFER PROCESS: BACKGROUND FOR THE NATIONAL ENERGY STRATEGY
D. E. DEONIGI and N. L. MOORE Jun. 1990 18 p Presented at the 15th Annual Technology Transfer Society Meeting, Dayton, OH, 25-28 Jun. 1990
(Contract DE-AC06-76RL-01830)
(DE90-015301; PNL-SA-17857; CONF-9006221-3) Avail: NTIS HC A03/MF A01

This paper is based on our White Paper, which was background for the technology transfer section of the U.S. Department of Energy's (DOE) National Energy Strategy (NES), and a subsequent survey, which was conducted to characterize the technology transfer programs throughout DOE. From 172 selected technology transfer case studies, Pacific Northwest Laboratory characterized DOE's 7 major programs. This paper describes the objectives, strategies, and mechanisms that DOE and its laboratories use in their technology transfer programs. Technology transfer is defined for the purposes of this paper as the process by which technology, knowledge, and/or information developed in one organization, in one area, or for one purpose is applied and used in another organization, in another area, or for another purpose. The end user may be the public, industry, another Federal laboratory, or any other technology developer. Technology information can be a simple energy conservation practice for public use, databases, a patent of an invention, a report on the properties of a magnetic field, an improved industrial process, or a new procedure for handling a hazardous material. Some technologies are identified as potential commercial successes and are transferred to the private sector early in the development process; other technologies are not transferred until they are fully developed and tested. Mechanisms to facilitate technology transfer by providing feedback from the end user to the developer, such as advisory groups with potential users as members, tend to be effective ways to accelerate transfer and technology utilization. DOE

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.

A90-13367#
THIS IS COMMERCIAL TITAN, INC
F. L. VAN RENSSELAER, R. D. SLOVIKOSKI, and T. C. ABELS (Martin Marietta Commercial Titan, Inc., Denver, CO) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 9 p.
(IAF PAPER 89-199) Copyright

Out of a quarter-century heritage of eminently successful expendable launch vehicle history with the U.S government, a commercial launch services enterprise which challenges the corporation as well as the competition has been launched within the Martin Marietta Corporation. This paper is an inside look at the philosophy, structure, and success of the new subsidiary, Commercial Titan, Inc., which is taking on its U.S. and foreign rocket-making competitors to win a share of the international communication satellite market as well as the U.S. government commercial launch services market. Author

A90-13440*# National Aeronautics and Space Administration, Washington, DC.
THE COST OF PERFORMANCE - A COMPARISON OF THE SPACE TRANSPORTATION MAIN ENGINE AND THE SPACE SHUTTLE MAIN ENGINE
B. B. BARISA (NASA, Washington, DC), G. D. FLINCHBAUGH (USAF, Washington, DC), and A. T. ZACHARY (Aerospace Corp., Los Angeles, CA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 8 p.
(IAF PAPER 89-300) Copyright

This paper compares the cost of the Space Shuttle Main Engine (SSME) and the Space Transportation Main Engine (STME) proposed by the Advanced Launch System Program. A brief description of the SSME and STME engines is presented, followed by a comparison of these engines that illustrates the impact of focusing on acceptable performance at minimum cost (as for the STME) or on maximum performance (as for the SSME). Several examples of cost reduction methods are presented. I.S.

A90-13590#
THE ECONOMIC AND SOCIAL BENEFITS OF SPACE COMMUNICATION - A GLOBAL OVERVIEW OF PAST, PRESENT, AND FUTURE APPLICATIONS
JOSEPH N. PELTON (Colorado, University, Boulder) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 12 p.
(IAF PAPER 89-527) Copyright

The benefits provided by satellite communications are estimated in economic terms, using two approaches: one based on tariff services and their pyramidal values and one in which the derived benefits are estimated on a sector-by-sector basis to total the economic values of satellite services. The results produce an order of magnitude estimate for direct and indirect benefits of satellites of 380 billion U.S. dollars per year, or about 2 percent of the global economy. Also, the social benefits of satellite communications are examined, including peacekeeping, disaster warning and relief, and education. The services provided by global and regional communication satellite systems are listed. R.B.

A90-13679*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RELIABILITY AND COST CONSIDERATIONS IN LAUNCH VEHICLES

JOSEPH P. LOFTUS, JR. (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 7 p. refs
(IAF PAPER 89-693) Copyright

The inherent reliability of a space launch system, or lack thereof, is pointed out to often be a more significant determinant of access to orbit than the nominal cost. System improvements that enhance inherent reliability may accordingly represent the most economical approach to follow. At some point, the limitations of launch technologies currently in use must be acknowledged and novel methods developed. The dearth of systematic research efforts toward superior technology in launcher propulsion over the last 20 years is identified as a major limitation in the search for near-term options. O.C.

A90-13686#
FEASIBILITY OF SPACE TOURISM - 'COST STUDY FOR SPACE TOUR'
SHINJI MATSUMOTO, YOSHIHIKO AMINO, TOHRU MITSUHASHI, KENJI TAKAGI, and HIDEKI KANAYAMA (Shimizu Corp., Tokyo, Japan) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 7 p. refs
(IAF PAPER 89-700) Copyright

Development of space tourism will bring space closer to the average person while expanding the space industry. A space station hotel that meets various conditions for space tourism in the second development stage is presented. The proposed hotel was used as a model in cost simulation, indicating that transportation cost reduction by approximately 4.3 percent is the key for space tourism to be a successful business. The feasibility of space tourism is studied with emphasis placed on the transportation costs of construction materials into space. C.E.

A90-13688#
COMMERCIAL INTERESTS IN MPS
S. C. SHARMA, M. J. NAIR, and K. V. NAGARAJAN (ISRO, Vikram Sarabhai Space Centre, Trivandrum, India) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 11 p. refs
(IAF PAPER 89-704) Copyright

Market analysts forecast revenues worth tens of billions of U.S. dollars from worldwide sale of material products manufactured in space by the year 2000 AD. Electronic and bio-materials have vast potential for the commercialization of materials processing in space(MPS). Ga As and Hg Cd Te single crystals and as many as thirteen life-saving drugs and pharmaceuticals, as it emerges from preliminary surveys, will be the likely candidates for production in space. Upcoming trends also show promise for markets to exist for novel glasses, ceramics, alloys, composites and polymers processed in microgravity conditions of space. Author

A90-13690*# Princeton Synergetics, Inc., NJ.
TRANSPORTATION COST - IMPACTS ON COMMERCIAL USERS
JOEL S. GREENBERG, CAROLE GAELICK (Princeton Synergetics, Inc., NJ), and BARBARA STONE (NASA, Office of Commercial Programs, Washington, DC) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 14 p. refs
(IAF PAPER 89-707) Copyright

The potential impact of transportation price on the financial performance of space business ventures is analyzed. Business plans for generic space facilities (both STS based and free-flying), space processing, and communications satellite businesses were developed. Impacts were established parametrically for return on investment and customer product/service price as a function of transportation price. The following businesses were considered: communications satellite; shuttle based and free-flying space facilities; and space pharmaceuticals manufacturing and minilab leasing. C.E.

A90-13691#
REMOTE SENSING - IS THERE A MARKET, AND IF SO, HOW CAN WE DEVELOP IT
ROBERT W. SCHICK (KPMG Peat Marwick, Washington, DC) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 11 p.
(IAF PAPER 89-709)

A market analysis of an advanced civil remote sensing system supported by the Department of Commerce is presented. The survey is based on assumptions by individuals from representative government agencies and industry who were asked to define and qualify future market opportunities. Supported by remote sensing experts, the study team developed assessments based on possible market scenarios reflecting current industry practices or interpreting prevailing opinion within the industry. An estimate of market needs and potential size is presented, identifying the market development barriers, most of which are well documented. The need for strategic thinking and a plan for market development are also discussed. The primary assumption is that a coordinated, concerted effort must be made if remote sensing technology is to ever reach its full potential. C.E.

A90-13693#
SPOT REMOTE SENSING - A MODEL FOR SPACE COMMERCIALIZATION
PIERRE BESCOND (SPOT Image Corp., Reston, VA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 6 p.
(IAF PAPER 89-712) Copyright

SPOT's successful development of the commercial remote sensing industry has set the standards for future systems and has established a strong foundation for future growth and market development. The basis of the system is a strong commercial perspective in every aspect of the program, from technical design, to well-defined and distinct government/private sector roles, to management of worldwise operations. Because of the unique markets and the advanced nature of the U.S. user community, SPOT's U.S. experience offers a valuable case study of the implementation of such a commercialized space program. Author

A90-16529
THE DEVELOPMENT OF SPACE - THE ECONOMIC CASE FOR MARS
DANA RICHARD ROTEGARD (Rotegard and Associates, Minneapolis, MN) IN: The case for Mars III: Strategies for exploration - Technical. San Diego, CA, Univelt, Inc., 1989, p. 45-58. refs
(AAS PAPER 87-230) Copyright

The decision to mount an expedition to the Mars system in the near future will involve a major commitment of resources by large corporate bodies, both public and private. This paper is an exposition of some of the reasons that the Mars system will be of economic importance to the human economy in the 21st Century. This paper is not a formal investment analysis or a cost benefit study, but attempts to presage a more rigorous analysis. Correct framing of policy questions is important to the future of the American space program. Author

A90-16655
FINANCING A MARS PROGRAM
CHANDLER C. SMITH (Ball Corp., Ball Aerospace Systems Group, Boulder, CO) IN: The case for Mars III: Strategies for exploration - General interest and overview. San Diego, CA, Univelt, Inc., 1989, p. 83-106. refs
(AAS PAPER 87-184) Copyright

The prospects for financing a Mars program are evaluated, including estimates of the approximate amount of money required to implement a program. The financial issues related to other large-scale efforts, such as the Apollo program, the Manhattan project, and the Tennessee Valley Authority are reviewed and compared with the financing of a Mars program. Consideration is given to economic base forecasts, government spending predictions, the impact of an aging population, and the possibility of nontraditional sources of revenue for a Mars program. R.B.

A90-20390
THE AIRSHIP - AN ECONOMICAL ANSWER TO AIR CARGO
ROY P. GIBBENS Huntsville Association of Technical Societies, Annual Technical and Business Exhibition and Symposium, 5th, Huntsville, AL, May 16, 17, 1989. 7 p.
(TABES PAPER 89-1203) Copyright

At present, large and small aircraft provide for less than 2 percent of total freight moved in the world. This paper considers the potential role of airships as economical freight haulers. It is emphasized that, although the airship flies at only 100 mph, as compared to the aerodyne's 600 mph, airship is still much faster than any surface mode of transportation and have many advantages over the aerodyne. Airships are large and carry loads internally and externally, can operate from almost any large open area including lakes, and can hover to load and unload cargo. Airships could increase air carbo volume by 50 percent, a potenltial billion dollar industry. I.S.

A90-20891
FINANCING A SPACE VENTURE
CHRIS ELLIOTT (Smith Associates, Ltd., Guildford, England) Space (ISSN 0267-954X), vol. 5, Sept.-Oct. 1989, p. 12-14.
Copyright

The potential profitability of commercial space projects is investigated. A business plan for a space project involving in-orbit manufacturing is presented. The net value and return on investment for the project are examined. The effects of a space project problem, such as a launch failure, on the return on investment are discussed. I.F.

A90-24770
CONDUCTING BUSINESS AND SCIENTIFIC EXPERIMENTS IN SPACE
JOHN J. EGAN (Egan Group, Washington, DC) IN: Space: National programs and international cooperation. Boulder, CO, Westview Press, 1989, p. 135-142.
Copyright

Problems associated with commercial space operations are reviewed. Consideration is given to commercial launchers, the commercial use of the microgravity environment, and the question of refurbishing or replacing satellites. International competition in the commercial use of microgravity processing is examined. Also, the role of the government in commercial space activities is discussed. R.B.

A90-24823#
AN INDEPENDENT MARS EXPEDITION FUNDED BY TV RIGHTS AND CORPORATE SPONSORSHIPS
DAVID P. GUMP (HDTV Data Corp., Great Falls, VA) IN: Space manufacturing 7 - Space resources to improve life on earth; Proceedings of the Ninth Princeton/AIAA/SSI Conference, Princeton, NJ, May 10-13, 1989. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 358-361.
Copyright

A nonprofit enterprise with worldwide support can mount a Mars expedition long before the U.S. or Soviet governments are ready. Research shows that more than $6 billion can be raised for the expedition through sale of TV rights and other sources. Preliminary cost estimates show this is sufficient to cover expenses of a frugally managed private effort. Author

A90-28206
NEW TECHNOLOGIES AND COST MANAGEMENT ISSUES
EDWARD P. LAUGHLIN (U.S. Army, Aviation Systems Command, Saint Louis, MO) IN: AHS, Annual Forum, 45th, Boston, MA, May 22-24, 1989, Proceedings. Alexandria, VA, American Helicopter Society, 1989, p. 729-735.
Copyright

Methods of coping with the impact of new technologies, concepts, and trends on the DOD are discussed. Issues concerning advanced materials and cost management are emphasized. The impact of functional specialists in coping with the new trends is addressed. C.D.

A90-28210
CREATING A COMMERCIAL TILTROTOR (CTR) SYSTEM (PRODUCT SUPPORT PERSPECTIVES)
THOMAS K. FLEMING, GEORGE M. POWELL, RON R. REBER (Bell Helicopter Textron, Inc., Fort Worth, TX), and SAM MAYER (Boeing Helicopters, Philadelphia, PA) IN: AHS, Annual Forum, 45th, Boston, MA, May 22-24, 1989, Proceedings. Alexandria, VA, American Helicopter Society, 1989, p. 771-786. refs
Copyright

The opportunities and areas for emphasis during the next 10 years of developing the products and infrastructure of a commercial tilt rotor (CTR) system are examined. The issues of safety dispatch, mission, maintenance reliability, cost of operations, product maturity cycle, and customer satisfaction are addressed in terms of the CTR design and support objectives. It is concluded that the CTR has the potential for mass transport success, but that strict attention must be paid to the successes and lessons learned from helicopter operation, from fixed wing short and long hauls, and from corporate programs. Recommendations and priorities for the success of the CTR through customer support perspectives are highlighted. C.D.

A90-30784
COST OF QUALITY AS A BASELINE FOR TOTAL QUALITY MANAGEMENT (TQM) IMPLEMENTATION
WILLIAM J. GRUNENWALD (ADM Consultants, Inc., Fairborn, OH) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1611-1613.
Copyright

The author presents the concept of using cost of quality as an effective tool in implementation of a total-quality-management (TQM) approach. The essence of TQM is defined as the search for opportunities for improvement. TQM implementation and the need for baseline are discussed. The requirements for establishing a baseline are discussed, with the focus on cost of quality. The use of the cost-of-quality baseline is detailed, with emphasis on its continuous value. The establishment of certain Åuniversal truths' which address the use of TQM and cost of quality in a given environment is examined. I.E.

A90-33076
INTERNATIONAL SAMPE TECHNICAL CONFERENCE, 21ST, ATLANTIC CITY, NJ, SEPT. 25-28, 1989, PROCEEDINGS
RAYMOND F. WEGMAN, ED. (Adhesion Associates, Ledgewood, NJ), HOWARD S. KLIGER, ED., and EDWARD HOGAN, ED. Covina, CA, Society for the Advancement of Material and Process Engineering (International SAMPE Technical Conference Series. Volume 21), 1989, 1103 p. For individual items see A90-33077 to A90-33148.
Copyright

The present conference discusses topics in prospective advanced materials market trends, advanced fabrication techniques, adhesives technologies, state-of-the-art reinforcements and fillers for composites, damage and failure mechanisms is novel materials, DoD and NASA marketing opportunities for aerospace matrials, testing and quality control methods, advanced materials repair technologies, and toughened thermosetting resins. Also discussed are materials processing-related health and safety issues, design methods for high-performance composites, high-temperature thermoplastic polymers, fiber and fabric technologies for composite reinforcements, metal-matrix composites, industrial uses of composites, composites for ballistic applications, and high temperature-resistant thermosetting polymers. O.C.

A90-33148
GRAPHITE FIBERS, STATUS 1989
N. W. HANSEN and T. E. CLANCY (Hercules, Inc., Magna, UT) IN: International SAMPE Technical Conference, 21st, Atlantic City, NJ, Sept. 25-28, 1989, Proceedings. Covina, CA, Society for the

Advancement of Material and Process Engineering, 1989, p. 1053-1057.
Copyright

In the 1980s, the use of carbon/epoxy composites moved from secondary to primary aircraft structures, with some designs exceeding 50 percent of the structural weight. This expanding market place has benefitted from advancements in material properties. Fiber strengths and moduli have increased and matrix toughness and service temperatures have improved. The challenge of the 90s and beyond will be the development of systems (fiber and resin) that possess a better balance of properties than are currently available. Author

A90-36022#
SYSTEMS COST REDUCTION - DEALING WITH STRUCTURAL IMPEDIMENTS
PETER R. WILKINSON (Rockwell International Corp., Pittsburgh, PA) IAA, Symposium on Space Systems Cost Estimation Methodologies and Applications, San Diego, CA, May 10, 11, 1990, Paper. 6 p.

The possible role of structural impediments in the problem of reducing the costs of acquiring DoD systems is examined. The relationship between the government and private industry with government contracts is discussed, focusing on the use of the government's reference concept and cost estimation by private industry. It is suggested that, because the reference concept and cost estimation are based on previous experience, they do not encourage industry to develop new and better ways to build systems. Possible solutions to the problem are considered, including breaking the cycle of expectations early in the program or insisting that competing contractors implement an agressive Design to Life Cycle Cost estimation using concurrent engineering. R.B.

A90-36849
THE NEW SPACE RACE
ELIZABETH CORCORAN and TIM BEARDSLEY *Scientific* American (ISSN 0036-8733), vol. 263, July 1990, p. 72-77, 80, 82, 84, 85.
Copyright

A comparative evaluation is made of the payload performance, availability, and economic viability of manned and unmanned spacecraft launch vehicles and associated services currently available throughout the world. Attention is given to the relative advantages currently enjoyed by the USA's NASA and private-enterprise launch vehicles, the emerging commercialization of Soviet and Chinese launchers, and the development status of Japanese launch vehicles. An account is given of the rocket propulsion systems employed both by multistage launchers, to achieve LEO and GEO, and launcher upper stages and satellites, to maneuver into the desired orbit. O.C.

A90-40218
THERMOPLASTIC COMPOSITE MANUFACTURING COST ANALYSIS FOR THE DESIGN OF COST EFFECTIVE AUTOMATED SYSTEMS
MICHAEL FOLEY and EDWARD BERNARDON (Charles Stark Draper Laboratory, Inc., Cambridge, MA) SAMPE Journal (ISSN 0091-1062), vol. 26, July-Aug. 1990, p. 67-74. Research supported by the Charles Stark Draper Laboratory, Inc. refs
Copyright

The high cost of fabricating advanced thermoplastic composite structures can potentially be reduced through the application of automation. Cost effectiveness should be a primary driver in the design of new automated systems to insure that they will provide measurable benefits to the end user. A cost estimation model has been developed to analyze various thermoplastic composite material forms and processing methods to help guide in the design of new, cost effective automated systems. The model was used to evaluate the fabrication of a composite skin. Results of this analysis, and in particular, their relevance to increasing cost effectiveness in systems design, are discussed. Author

A90-40646#
TOTAL BOOSTER RECOVERY CONCEPT FOR ACHIEVING A REUSABLE PROPULSION SYSTEM
D. STEINMEYER, N. HOWARD, and M. LANNING (McDonnell Douglas Space Systems Co., Huntington Beach, CA) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 16 p.
(AIAA PAPER 90-2685) Copyright

Reducing Space Transportation cost has become increasingly important in today's budgetary constraints. Therefore, a new expendable launch vehicle was proposed. This launch vehicle, named the Advanced Launch System (ALS), was designed to meet a cost target of $300/lb to low earth orbit (LEO). However, conceptual design trade studies have shown that payload costs of $300/lb (to LEO) can only be achieved with engine costs approaching $2 M per engine, per launch. At present, The Space Transportation Engine Program (STEP) has not produced engine cost projections approaching this goal. As a result, booster engine recovery and reuse was evaluated in order to potentially reduce the average engine cost per launch. Author

A90-42203*# Aerojet General Corp., Huntsville, AL.
ENGINE COSTS FOR REUSABILITY
CARLA M. SCHINDLER and JOHN LANSAW (Aerojet, Propulsion Div., Huntsville, AL) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 7 p. Research supported by NASA.
(AIAA PAPER 90-2689) Copyright

The advanced Launch System (ALS) program goals demand an order-of-magnitude reduction in costs over existing launch vehicle propulsion systems. Studies suggest that reusable engines provide cost advantages over expendable propulsion systems. Early studies are quantifying operations costs, and cost sensitivities to engine production and operations variables. ALS production and operations philosophies enhance the potential of an affordable, operationally flexible launch vehicle propulsion system. The assumptions made and criteria set during the initial planning for the operations phase of the ALS highlight the changes for implementing such a system. Author

A90-42204#
STATISTICAL EXPERIMENTAL DESIGN AND ITS ROLE IN AEROSPACE VEHICLE DESIGN EFFORTS
J. A. SCHNACKEL and R. H. DOVENMUEHLE (Martin Marietta Corp., Astronautics Group, Denver, CO) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 11 p. refs
(Contract F04701-88-C-0109)
(AIAA PAPER 90-2692) Copyright

The particular application and benefits of statistical experimental techniques to aerospace propulsion analysis are reviewed. Total Quality Management has become the main initiative in commercial, industrial, and government organizations. A method for multivariate analysis in the experimental design process was provided and focussed variables to optimum levels. Statistical experimental design has identified many benefits from the propulsion trade study application. Information was enhanced by the addition of pareto and interaction data. As illustrated, the 27 case application did not provide significant time savings, while the nine-case trade showed a 33 percent reduction in time savings. Both instances show an improved understanding of total system effects. R.E.P.

A90-42260#
A FRAMEWORK FOR ANALYZING THE MARKET AND SUPPORTING INFRASTRUCTURE FOR SMALL SATELLITES AND ASSOCIATED SYSTEMS
STEPHEN L. MORGAN (Florida Institute of Technology, Melbourne) IN: Annual AIAA/Utah State University Conference on Small Satellites, 2nd, Logan, UT, Sept. 18-21, 1988, Proceedings. Logan, UT, Utah State University, 1988, 12 p. Research supported by the Florida Technological Research and Development Authority. refs

A conceptual framework is proposed which may be useful in

the analysis of space activities, in order to better understand the relationships among them, their organizational participants, and current technological and institutional constraints on their further developments. An analysis of the small satellite community is conducted within this framework. It is established that the needs of consumers drive the development of enabling technologies, which are then used by organizations within the institutional support base of the space infrastructure to allow space-derived products and services to be produced. O.C.

A90-42653#
DESIGN OF AEROENGINES IN A LOW-FUEL PRICE SCENARIO
S. J. HARTROPP (Rolls Royce, PLC, Derby, England) and K. W. BUSHELL (Rolls Royce, Inc., Atlanta, GA) IN: Annual General Meeting of the Canadian Aeronautics and Space Institute, 36th, Ottawa, Canada, May 15, 16, 1989, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1989, p. 1-1 to 1-15.

The driving parameters for aircraft engine design have been reassessed to account for the stabilization of fuel price in the vicinity of 50 cents per gallon. A program embracing studies in the fields of operating cost analysis, reliability research and engine-specific thrust effects established principles reflecting the relative importance of engine direct operating cost. The same factors (which are fuel consumption, weight, first cost, and maintenance cost) influence the aircraft life-cycle cost and market considerations such as legislative compliance, operator acceptance, and passenger appeal. The effect of applying these principles to a new powerplant and the ongoing development of current powerplants is being evaluated. Author

A90-42664#
THE DASH 8 SERIES 400 REGIONAL AIRLINER
DAVID M. SCHENCK (Boeing Canada, de Havilland Div., Downsview) IN: Annual General Meeting of the Canadian Aeronautics and Space Institute, 36th, Ottawa, Canada, May 15, 16, 1989, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1989, p. 26-1 to 26-16.

The Dash 8 regional airliner's Series 400 design and performance specifications were formulated on the basis of intensive market research, which encompassed numerous interviews with more than sixty airlines operating throughout the world. Strong market demand was ascertained for a 66-70 passenger aircraft that combined excellent large-turboprop economics with the 350-kt cruise speed required for longer regional airline routes emerging in the 1990s. The next-generation turboprop engines under consideration for the Series 400 will turn novel six-bladed propellers designed for high efficiency and low noise. O.C.

A90-42814#
THE LF500 AND THE REGIONAL AIRLINE MARKET
K. R. DULY (Textron Lycoming, Stratford, CT) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 5 p.
(AIAA PAPER 90-2521) Copyright

The discussion deals with the 'lessons learned' in operating the ALF502 turbofan engine in the Regional Airline Marketplace. Particularly, the maintainability, reliability, cost of ownership and durability issues are addressed and how these 'lessons learned' have been applied to the current product. In addition, the growth of the LF500 to higher thrust classes wil be addressed and how this will be achieved in light of experience gained in the operating environment. Author

A90-42816#
REUSABLE PROPULSION SYSTEM CONCEPT UTILIZING A RECOVERY MODULE
HENRY HILLBRATH (Boeing Co., Kent, WA) and JORGE CONCEPCION (Boeing Co., Huntsville, AL) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 15 p.
(AIAA PAPER 90-2686) Copyright

A number of concepts for propulsion system recovery and reuse have been studied. A ballistically recoverable module which returns the main engines as well as other propulsion systems and the vehicle avionics has been defined and analyzed in detail. This concept is applicable to either booster or core (orbital) stage configurations and can be recovered either on land or in water. The P/A module concept results in major cost savings and has low nonrecurring costs so that these savings are realized for very small numbers of flights and at low launch rates. Requirements for recoverable propulsion systems have been considered and reliability, low operations cost, cost effective performance, and low production cost have been found to be of high importance. Author

A90-43715#
GLOBAL SATELLITE NAVIGATION SYSTEMS - INTERNATIONAL FINANCING AND INSTITUTIONAL ARRANGEMENTS
MAURICE A. GAMESTER (National Air Traffic Services, London, England) IN: Institute of Navigation Satellite Division, International Technical Meeting, 2nd, Colorado Springs, CO, Sept. 27-29, 1989, Proceedings. Washington, DC, Institute of Navigation, 1989, p. 389-391.

The proposal of the Future Air Navigation System Committee regarding a satellite-based Communications, Navigation, Surveillance (CNS) system are discussed. ICAO's policies on financing the planned CNS system are examined. I.F.

A90-48841#
CONCEPTUAL DESIGN AND FEASIBILITY STUDY OF VERY LARGE PASSENGER AIRCRAFT
P. M. SAGDEO (Western Michigan University, Kalamazoo, MI) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 9 p. refs
(AIAA PAPER 90-3220) Copyright

The paper presents designs of two very large capacity passanger transports. These aircraft are seen as the solution to the problem of air traffic congestion at major airports around the world. These aircraft will potentially reduce the number of flights of heavy aircraft to as few as 25 percent of the current flights. Two designs are presented: one for a 1000-passenger, 5000-mile range aircraft and another for a 2000-passenger, 6000-mile range aircraft. Both are based on the conventional aft-tail design to emphasize simplicity of design and construction and utilize only the projected development in the aerodynamics, propulsion, control and materials technology to reduce the risk factors involved. A very simple cost analysis shows that these aircraft are viable at appropriate load factors. Author

A90-48842#
FIGHTER DESIGN ECONOMETRICS = OWNERSHIP AFFORDABILITY?
JIM BENNETT (McDonnell Aircraft Co., Saint Louis, MO) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 7 p. refs
(AIAA PAPER 90-3223) Copyright

Over the years the variety of fighter types has been reduced. Cost growth has also reduced the quantities. Schedule stretching, the other alternative, further inflates unit cost by prorating research and development over fewer airplanes. In addition, the cost of operation and support has been climbing with fighter flyaway cost. The increasing importance of fighter economics intensifies the need for effort in the opening hours of concept formulation. The fighter effectiveness indexes of exchange ratio, sortie rate, combat readiness and mission reliability are discussed. First steps to meet ownership cost goals begin with operational requirements studies, major trades at conception and making the tough choices for the effectiveness/economic balance and affordability. Author

A90-48843#
COMMERCIAL AIRCRAFT DOC METHODS
GEORGE W. VAN BODEGRAVEN (Being Commercial Airplanes,

Seattle, WA) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 7 p. (AIAA PAPER 90-3224) Copyright

The Air Transport Association (ATA) Direct Operating Cost (DOC) formula was last updated in 1967. This paper summarizes what Boeing has done since then. Improvements in methodology such as evaluating ownership costs of an airplane on a Life Cycle Cost (LCC) basis are included. The DOC method is a vital tool used by the manufacturers as well as the airlines in their airplane decision process. Author

A90-49032
GLOBAL CLAIM-STAKING AND LATECOMER COST IN THE ORBIT SPECTRUM RESOURCE
HARVEY J. LEVIN (Hofstra University, Hempstead, NY) Space Communications (ISSN 0924-8625), vol. 7, Aug. 1990, p. 195-211. Research supported by NSF.
Copyright

Research and analysis of the origin and magnitude of geosynchronous claim-staking, or latecomer costs, are examined. Key factors that give rise to latecomer cost handicaps include the inferior propagation characteristics of the more recently developed, higher radio frequencies; costly increases in transmission power and electronic equipment required to overcome the impairment of signal quality when the lower, less expensive spectrum bands are already saturated; the higher equipment costs associated with newer spectral bands where the economies of large-scale manufacturing have not yet been fully realized; the high nonrecurring R&D and engineering costs incurred to open up new spectral regions; and the higher coordination costs of adjusting coverage patterns and equipment design to those of firstcomers in a given spectral region. It is pointed out that these costs are offset in part by the benefits which latecomers derive from any firstcomer's cost-reducing innovations and learning curve. L.K.S.

A90-49034
A SERIES OF OPTIMIZING SATELLITE SYSTEMS. III - COST SAVINGS FROM EXTENDING THE DESIGN LIFETIME OF COMMUNICATIONS SATELLITES
MARCELLUS S. SNOW (Hawaii, University, Honolulu) Space Communications (ISSN 0924-8625), vol. 7, Aug. 1990, p. 229-235. refs
Copyright

A model of cost-minimizing capacity expansion (Chenery, Manne, Srinivasan, Snow) is presented. It assumes exponentially growing demand, in-orbit depreciation, scale economies, equally spaced launches, and an infinite time horizon. By assumption, spacecraft with a 10-year nominal lifetime are replaced by 15-year spacecraft. A Poisson process models the exponential capacity decay rate, taking into account the fundamental uncertainty as to when a communications satellite will fail. A grid search comparing minimized discounted capital costs under the 10- and 15-year alternatives is then conducted for the 36 hypothetical cases generated by 6 scale economy values and 6 traffic growth rates. Capital savings of from 7 to 14 percent are found to result from extending the lifetime of INTELSAT satellites. Author

A90-49706
PLANNING AN ADVANCED COMMERCIAL REMOTE SENSING SYSTEM - EVALUATION OF SPACEBORNE, ENVIRONMENTAL REMOTE SENSING SENSOR-TYPES THAT ADDRESS THE CIVIL AND MILITARY MARKETS
D. BROWN, C. A. HOOD, D. OKERSON, M. SCHWALLER, R. SURESH (Science Application International Corp., Washington, DC) et al. (IEEE, Canadian Remote Sensing Society, URSI, et al., Quantitative remote sensing: An economic tool for the Nineties - 1989 International Geoscience and Remote Sensing Symposium and Canadian Symposium on Remote Sensing, 12th, (IGARSS'89), Vancouver, Canada, July 10-14, 1989) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 28, July 1990, p. 771-773.
Copyright

Choosing an optimal suite of sensors as a payload for a commercial remote-sensing satellite requires an analytic method to help sort through the various sensor combinations. The method should be able to integrate sensor performance parameters with data and information requirements derived from market surveys and projections. A description is given of such a simplified approach to this problem, and some results based on sample market data are presented. I.E.

A90-50196
CONCURRENT ENGINEERING - ENABLING A NEW MATERIAL SUPPLIER/CUSTOMER RELATIONSHIP
JON A. SHUPE, E. DOUGLAS DICKENS, JR., DAVID C. BONNER (B.F. Goodrich Co., Brecksville Research and Development Center, OH), and STEVEN R. LECLAIR (USAF, Materials Laboratory, Wright-Patterson AFB, OH) IN: International SAMPE Symposium and Exhibition, 35th, Anaheim, CA, Apr. 2-5, 1990, Proceedings. Book 2. Covina, CA, Society for the Advancement of Material and Process Engineering, 1990, p. 1852-1860.
Copyright

In the 1990s and beyond, material suppliers will need to extend their 'customer-horizon' in order to market specialty materials in a globally competitive environment. The supplier will need to be capable of timely, demand-driven research and development of specialty materials for an expanding product-base. Further, the material supplier will become a partner in the 'demand-driven' engineering of specialty materials. The supplier will become more involved in addressing the needs of the customer at all levels in the chain. That is, consideration of product requirements, product processing requirements, maintenance and retirement requirements - requirements traversing the complete life-cycle of the product and the material from which it is made. Ultimately, the supplier must have an organization that can interact with the customer(s) at each product level. Author

A90-50633*# National Aeronautics and Space Administration, Washington, DC.
COMPENDIUM OF SMALL CLASS ELV CAPABILITIES, COSTS, AND CONSTRAINTS
KAREN S. PONIATOWSKI (NASA, Washington, DC) IN: Annual AIAA/Utah State University Conference on Small Satellites, 3rd, Logan, UT, Sept. 26-28, 1989, Proceedings. Logan, UT, Utah State University, 1989, 19 p. refs

Both NASA and DARPA are investigating programs to provide flight demonstration opportunities for new commercially developed rockets. Development of such rockets will be decisive for the success of expendable launch vehicle (ELV) commercialization. The costs and capabilities associated with the various vehicles are discussed here, emphasizing the constraints on their development and widespread utilization. An overview is presented of related international launch vehicle development plans, and the market for small ELVs in the 1990s is discussed. C.D.

N90-11655# Oak Ridge National Lab., TN. Energy Div.
THE TRANSFER AND DIFFUSION OF NEW TECHNOLOGIES: A REVIEW OF THE ECONOMICS LITERATURE
T. RANDALL CURLEE and RAJEEV K. GOEL Jun. 1989 54 p (Contract DE-AC05-84OR-21400)
(DE89-015671; ORNL/TM-11155) Avail: NTIS HC A04/MF A01

A general overview is presented of the economics literature on technological change and focuses particularly on the interface between the public and private sectors in promoting the transfer and diffusion of new technologies. The ability to transfer and diffuse new technologies is generally recognized as a key to increased productivity in the United States and this country's ability to compete internationally. A great deal of research was done on technology transfer and diffusion by various disciplines and from numerous perspectives. Unfortunately, the policy implications of those different works are not always consistent. Further, the different disciplines have difficulty in communicating even when addressing the same issues and drawing the same general conclusions. The primary objective is to lessen the chasm among the disciplines with respect to technology transfer and diffusion

by summarizing the perspectives presented in the economics literature. The document is intended primarily for an interdisciplinary audience. DOE

N90-11904# Allied-Signal Aerospace Co., Kansas City, MO.
MANUFACTURING AND THE MANUFACTURING ENGINEER IN THE YEAR 2000, REVISION
LAROUX K. GILLESPIE Aug. 1989 20 p Presented at the Curricula 2000 Workshop, Southfield, MI, 16-18 Apr. 1989 Revised
(Contract DE-AC04-76DP-00613)
(DE89-017707; KCP-613-4025-REV; CONF-8904270-1-REV)
Avail: NTIS HC A03/MF A01

The recently completed Society of Manufacturing Engineer (SME) Profile 21 study provided a number of insights into the future world of manufacturing and the manufacturing engineer. This presentation provides an overview of the issues and solutions and compellingly sets a much faster pace than we have followed. It presents both shop floor and engineering insights in a manner that commands attention. DOE

N90-12406# Systems Control Technology, Inc., Arlington, VA.
ROTORCRAFT LOW ALTITUDE CNS BENEFIT/COST ANALYSIS: ROTORCRAFT OPERATIONS DATA Final Report
BRIAN E. MEE, DEBORAH PEISEN, and MARGARET B. RENTON Sep. 1989 160 p
(Contract DTFA01-87-C-00014)
(DOT/FAA/DS-89/9; SCT-89RR-47; AD-A214113; PB90-125113)
Avail: NTIS HC A08/MF A01

Communications, navigation, and surveillance (CNS) services are readily available at the altitudes flown by most fixed wing aircraft. They are not, however, always available at the lower altitudes at which most rotary wing aircraft operate. The objective is to determine if there is an economic basis for improvement of these low altitude CNS services within the National Airspace System (NAS) in order to better support rotorcraft operations. The Rotorcraft Master Plan advocates the establishment of additional CNS facilities as well as the analysis and development of systems to satisfy the increasing demand for widespread IFR rotorcraft operations within the NAS. The findings will aid the FAA decisionmaking in that regard. In view of prior implementation decisions on Loran-C, the emphasis is on communications and surveillance. Background data is provided on the rotorcraft industry as it exists today, as well as forecasts to the year 2007 for the purpose of providing operational data for analysis of long term CNS benefits and costs. Rotorcraft missions are described; those most likely to benefit from increased availability of CNS services are selected; the probability is identified of various combinations within selected rotorcraft operating areas; and an inventory is presented of rotorcraft activity by mission and location. Author

N90-13283# Committee on Science, Space and Technology (U.S. House).
FISCAL YEAR 1990 AUTHORIZATION REQUEST AND BUDGET ESTIMATES FOR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
1989 367 p
(GPO-96-945) Avail: Document Room, House of Representatives, Washington, D.C. 20515 HC free; SOD HC $11.00 as 552-070-06558-0

A draft bill was submitted to the subcommittee on the House Committee on Science, Space, and Technology to authorize appropriations to the National Aeronautics and Space Administration for research and development; space flight, control, and data communications; construction of facilities; and research and program management. B.G.

N90-13285# Committee on Science, Space and Technology (U.S. House).
THE 1990 NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION
1989 1287 p
(GPO-98-466) Avail: Subcommittee on Space Science and Applications, House of Representatives, Washington, DC 20515 HC free; SOD HC $31.00 as 552-070-068-50-3

Hearings before a subcommittee of the House Committee on Science, Space, and Technology are presented along with the budget estimates for the National Aeronautics and Space Administration for the fiscal year 1990. All written testimony and submittals for the record are also included. The budget estimates provide a detailed outline of budgetary information and justifications for research and development, construction of facilities, space flight and communications, and research and program management. B.G.

N90-13288# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1990
Washington GPO 3 Jan. 1989 32 p A bill, S.916, referred to the Committee on Commerce, Science and Transportation, 101st Congress, 1st Session, 3 May 1989
(S-REPT-101-157) Avail: Document Room, Senate, Washington, DC 20510 HC free

A bill was presented to the Senate to authorize appropriations to the National Aeronautics and Space Administration for research and development, space flight, control and data communications, construction of facilities, and research and program management; and for other purposes. B.G.

N90-13289# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, FISCAL YEAR 1990
Washington GPO 1989 70 p Report on S.916 presented to the Committee on Commerce, Science and Transportation, 101st Congress, 1st Session, 3 Oct. 1989
(S-REPT-101-157; GPO-22-382) Avail: Document Room, Senate, Washington, DC 20510 HC free

The report on the appropriations to the National Aeronautics and Space Administration by the Committee on Commerce, Science, and Transportation was submitted to the Senate. The budgetary estimates provide a detailed outline of budgetary information and justifications for research and development, construction of facilities, space flight and communications, and research and program management. B.G.

N90-14148# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MULTIYEAR AUTHORIZATION ACT OF 1989
1989 50 p An act, H.R. 1759, referred to the Committee on Commerce, Science and Transportation, 101st Congress, 1st Session, 25 Sep. 1989
Avail: Document Room, House of Representatives, Washington, D.C. 20515 HC free

A bill was submitted to the Senate of the United States to authorize appropriations to the National Aeronautics and Space Administration (NASA) for research and development, space flight, control and data communications, construction of facilities, and research and program management, and for other purposes. B.G.

N90-14149# Committee on Commerce, Science, and Transportation (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION
1989 594 p
(S-HRG-101-348; GPO-99-657) Avail: Subcommittee on Science, Technology, and Space, Senate, Washington, D.C. 20510 HC free; SOD HC $17.00 as 552-070-073-40-0

Hearings before a subcommittee of the Senate Commitee on Commerce, Science, and Transportation are presented for the National Aeronautics and Space Administration budget requests for FY 1990 and FY 1991. All written testimony and submittals for

the record are also included. The budget estimates provide a detailed outline of budetary information and justifications for reserach and development, construction of facilities, space flight and communications, and research and program management.
B.G.

N90-14152*# National Aeronautics and Space Administration, Washington, DC.
NASA COMMERCIAL PROGRAMS Progress Report, 1988
1988 26 p Original contains color illustrations
(NASA-TM-101853; NAS 1.15:101853) Avail: NTIS HC A03/MF A01 CSCL 05/1

An expanded role for the U.S. private sector in America's space future has emerged as a key national objective, and NASA's Office of Commercial Programs is providing a focus for action. The Office supports new high technology commercial space ventures, the commercial application of existing aeronautics and space technology, and expanded commercial access to available NASA capabilities and services. The progress NASA has made in carrying out its new assignment is highlighted. B.G.

N90-14396# Department of Energy, Washington, DC. Office of Policy Integration.
ASSESSMENT OF COSTS AND BENEFITS OF FLEXIBLE AND ALTERNATIVE FUEL USE IN THE US TRANSPORTATION SECTOR. TECHNICAL REPORT THREE: METHANOL PRODUCTION AND TRANSPORTATION COSTS
Nov. 1989 46 p
(DE90-002625; DOE/PE-0093) Avail: NTIS HC A03/MF A01

The Department of Energy (DOE) in 1988 undertook a comprehensive technical analysis of a flexible-fuel transportation system in the United States. To keep interested parties informed about the progress of the DOE Alternative Fuels Assessment, the Department periodically publishes reports dealing with particular aspects of this complex study. An analysis of the expected costs to produce methanol and of several related issues are provided.
DOE

N90-14623# Argonne National Lab., IL. Center for Transportation Research.
MARKETS FOR HIGH-SPEED INTERCITY MAGLEV TECHNOLOGY: A SYSTEMS ANALYSIS APPROACH
HOWARD T. COFFEY and LARRY R. JOHNSON Jun. 1989 18 p Presented at the SAE Conference and Expo on Future Transportation Technology, Vancouver, British Columbia, 6-10 Aug. 1989
(Contract W-31-109-ENG-38)
(DE89-017683; CONF-8908144-2) Avail: NTIS HC A03/MF A01

The technical feasibility of constructing and operating maglev vehicles at speeds of 250 to 300 mph has been amply demonstrated and is accepted here as a reality. Herein, the markets into which passenger or freight carrying systems based on this technology can be introduced with economic reasonableness are evaluated. The characteristics and capabilities (particularly the capacity and comparative costs) of the system are enumerated and discussed from the points of view of the passengers, the airlines (as potential operators), and the traveling public. It is shown that if the system is integrated into the existing transportation system as a supplement to the airline system, it meets the criteria required for the introduction of any new product or service into a market. The financial enhancement of the maglev system resulting from the use of trunk routes with feeder lines diverging to various ultimate destinations becomes an extremely important consideration. DOE

N90-15838*# Wisconsin Univ., Madison.
ANALYSIS OF THE FINANCIAL FACTORS GOVERNING THE PROFITABILITY OF LUNAR HELIUM-3
G. L. KULCINSKI, H. THOMPSON, and S. OTT *In* NASA, Langley Research Center, Report of NASA Lunar Energy Enterprise Case Study Task Force p 40-55 Jul. 1989
Avail: NTIS HC A09/MF A02 CSCL 03/2

Financial factors influencing the profitability of the mining and utilization of lunar helium-3 are examined. The analysis addressed the following questions: (1) which financial factors have the greatest leverage on the profitability of He-3; (2) over what range can these factors be varied to keep the He-3 option profitable; and (3) what ultimate effect could this energy source have on the price of electricity for U.S. consumers. Two complementary methods of analysis were used in the assessment: rate of return on incremental investment required and reduction revenue requirements (total cost to customers) achieved. Some of the factors addressed include energy demand, power generation costs with and without fusion, profitability for D-He(3) fusion, annual capital and operating costs, launch mass and costs, He-3 price, and government funding. Specific conclusions are made with respect to each of the companies considered: utilities, lunar mining company, and integrated energy company. M.G.

N90-15876# Los Alamos National Lab., NM. Earth and Environmental Sciences Div.
A QUASI-ECONOMIC ROLE FOR LUNAR SCIENCE
ERIC M. JONES 1989 12 p Presented at the 40th Congress of the International Astronautical Federation, Malaga, Spain, 7-13 Oct. 1989
(Contract W-7405-ENG-36)
(DE90-000679; LA-UR-89-3288; CONF-8910229-1) Avail: NTIS HC A03/MF A01

In broad economic terms, the development of lunar products will begin with a sequence of technology, production, and delivery demonstrations which will have to precede the emergence of markets. Economically viable products will tend to be those for which the sum of production and transport costs are lower for lunar suppliers than for terrestrial suppliers. As long as lunar production costs exceed terrestrial production costs - as will be the case for most lunar products until such time as lunar development has reached a mature stage - the most viable industries will be those producing low-tech products for lunar markets. The scale of initial lunar markets will depend on the size of a lunar base and/or its rate of growth. For a given level of public support, maximum base size can be achieved through the conduct, at the base, of a vigorous program of scientific and engineering research making use of as much local production and as many permanently-resident support staff as feasible.
DOE

N90-16803# British Aerospace Public Ltd. Co., Stevenage (England). Space Systems Group.
COST OPTIMISATION OF REUSABLE AEROSPACEPLANE TRANSPORTATION SYSTEMS
ROBERT C. PARKINSON *In* ESA, Progress in Space Transportation p 163-169 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

A detailed parametric cost model for vehicle development, production and operations, designed for the HOTOL project, is described. The use of this model in comparing different engineering solutions is outlined. Vehicle reliability and abort strategies are integral parts of the model. The high development costs of recoverable vehicles are included in the overall equation. Using this operational costs model, the attractiveness of a single-stage-to-orbit vehicle using an integrated airbreathing and rocket propulsion system is demonstrated. ESA

N90-16832*# Aerospace Corp., Los Angeles, CA.
THE JOINT DOD/NASA ADVANCED LAUNCH SYSTEM (ALS) PROGRAMME
M. G. WOLFE *In* ESA, Progress in Space Transportation p 397-404 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03 CSCL 22/2

The joint Department of Defense (DOD)/NASA Advanced Launch Systems (ALS) program is described. The ALS is cost rather than performance optimized. It will use advanced technology and innovative management and design approaches to achieve a congressionally mandated cost goal of $300 per pound to low-earth orbit by the year 2005. The space system acquisition approach is described. The influence of acquisition and technological

innovations on other U.S. space transportation, programs such as commercial programs and the National Aero-Space Plane, is discussed. Diagrams of possible launch configurations are presented. ESA

N90-16848*# National Aeronautics and Space Administration, Washington, DC.
AN ASSESSMENT OF POTENTIAL MARKETS FOR SMALL SATELLITES
LAWRENCE H. STERN, KEVIN J. LACOBIE, and ZENON X. ZYGMONT (George Mason Univ., Fairfax, VA.) Nov. 1989 114 p
(NASA-TM-101943; NAS 1.15:101943; LC-89-51915; ISBN-0-9625101-0-6) Copyright Avail: NTIS HC A06/MF A01 CSCL 22/2

A number of economic and technological issues associated with the dynamic field of small satellite systems and applications are addressed. Current activities are described in the design and development of small satellites, and assesses potential commercial markets for these satellites and their services. The research includes a history of the small satellite industry, current activities of satellite manufacturers, support services for small satellite systems, including launch vehicles and ground control, potential users of small satellites, the availability of various enabling technologies, and other factors which might enable small satellites to be commercially successful. Also addressed are the potential difficulties of small satellite development and production. Based upon an extensive overview of existing literature, and in-depth interviews with the entire breadth of the industry, this study represents up-to-date information regarding this growing area of commercial space activity. Author

N90-17518# Army Aviation Systems Command, Saint Louis, MO.
IMPROPER USE OF ECONOMIC ANALYSIS IN MATERIEL COST COMPARISON STUDIES
BERNARD J. BAUER, JR. Sep. 1989 10 p Presented at the 23rd DOD Cost and Analysis Symposium, Leesburg, VA, 6-8 Sep. 1989
(AD-A214888) Avail: NTIS HC A02/MF A01 CSCL 05/3

Economic Analysis is defined in Army Regulation 11-28 as a systematic approach to the problem of choosing how best to employ scarce resources. This approach is an investigation of the full implications of achieving a given objective in the most effective manner. Economic analysis is utilized to examine various alternatives to solve a problem so that the decision maker can select the best option. Cost and benefits for each alternative are analyzed and compared. When employed properly, economic analysis is a powerful tool for the decision maker. When not prepared properly, the EA can lead to the wrong decision. The cost-benefit analysis is the basis for reviewing the various alternatives. This analysis enables the decision maker to examine the costs, weigh the benefits and to determine the feasibility of implementing each alternative. All options which are not viable are eliminated from further consideration. Those which survive the initial test of feasibility are compared to each other showing both costs and benefits. GRA

N90-18797# Pacific Northwest Lab., Richland, WA.
ENERGY MARKETS IN THE 1990'S AND BEYOND: A COMPARISON OF ENERGY INTENSITY IN THE UNITED STATES AND JAPAN
S. C. MCDONALD Oct. 1989 12 p Presented at the 11th Annual North American Conference of the International Association for Energy Economics, Los Angeles, CA, 16-18 Oct. 1989
(Contract DE-AC06-76RL-01830)
(DE90-005535; PNL-SA-17325; CONF-8910162-6) Avail: NTIS HC A03/MF A01

A comparative analysis is provided of energy intensity in the U.S. and Japan. According to aggregate International Energy Agency (IEA) data, the U.S. has one of the most energy-intensive economies while Japan has one of the least. Energy-intensity measures are constructed and examined which that are more detailed than aggregate measures used by the IEA to see if they can better explain these differences. The year chosen for this analysis is 1985. The issue of energy intensity may become particularly critical if scientific findings on global climate change and greenhouse emissions lead to negotiations on restricting carbon emissions. The burning of fossil fuels is the most important anthropogenic source of carbon emissions. As shown by this analysis, developing a consistent and fair set of goals for each country for carbon emissions, which are interlocked with energy intensity, may be a difficult task. DOE

N90-19078# Battelle Memorial Inst., Geneva (Switzerland).
IDENTIFICATION OF AND RESPONSE TO MARKET DEMAND
A. SFILIGOJ *In* ESA, Promotion of European Space Technology Transfer p 41-45 Nov. 1989
Copyright Avail: NTIS HC A04/MF A01; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 20 Dutch guilders

Technology transfer can be defined as the process of exchanging know how among companies that consider a given technology as having a commercial potential that can only be tapped completely by adding the different marketing skills. While space related technologies are very close to defense, the diffusion of know how to wider industrial sectors takes place only rarely. The steps that have to be undertaken in the identification process, and some major alternatives that can be adopted in the response phase, are described. ESA

N90-19293# Los Alamos National Lab., NM. Space Science Div.
LOW-COST SMALL SATELLITES FOR ASTROPHYSICAL MISSIONS
WILLIAM C. PRIEDHORSKY 1989 6 p Presented at the NASA Workshop on High Energy Astrophysics, Taos, NM, 10-14 Dec. 1989
(Contract W-7405-ENG-36)
(DE90-007625; LA-UR-90-443; CONF-891276-4) Avail: NTIS HC A02/MF A01

A miniature satellite is a low-cost platform to support a small space experiment. Space astrophysics has been hindered by decades-long delays in important experiments. With miniature satellites, one hopes to reduce both experiment cost and lead time to an affordable level. Miniature satellites are not a new idea. The first scientific satellites, including Explorer I, were small and developed on a timescale of months. Important science was done by these pioneer missions. Though the easy discoveries have been made, important missions in exploration and follow-up can still be carried out from small platforms. Successful small satellite programs continue to this day. These include the OSCAR amateur radio satellite program, in which 12 small satellites, built by amateurs, have been flown over 25 years with no satellite failures (Fleeter, 1988). Two small free-flyers, GLOMAR and NUSAT, were ejected from the Shuttle in 1985. GLOMAR, a radio-relay experiment, was built in less than a year for under $1 million, and operated over a year in orbit. Small satellite projects continue to this day. NASA has started a small explorer program, beginning with SAMPEX, a solar and magnetospheric particle explorer; FAST, a fast auroral snapshot experiment; and SWAS, a submillimeter astronomy experiment. DOE

N90-19526# Heat Pump Technology Center of Japan, Tokyo.
SURVEY ON THE SOCIAL AND ECONOMIC INFLUENCES OF WIDE-SPREADING HEAT-PUMP TECHNOLOGY
KOZO KATAYAMA Jul. 1988 127 p
(DE89-782294; HPTC-05) Avail: NTIS (US Sales Only) HC A07/MF A01

A survey was conducted on the current status of utilization, trends in technical development for future and policy of heat pumps (HP). Heat pumps exceeded 65 pct of shipment of air conditioners for home and 70 pct for business. Proportion of installation was 20 pct per household and a 4.8 pct per room in 1984. It was already applied to industrial processes. Technological developments are in progress on HP for cold regions, multisystem for air conditioning/hot water supply, and absorption-type HP in

order to widen its application. In political aspects, its proliferation is promoted by the financial aids and favorable charging system. The use of HP in 2000 is estimated as 26 to 51 pct per room for air conditioning, 40 to 64 pct of total heat demands for air conditioning, and 7 to 17 pct in heat demands for hot water supply. Share of HP in business application will be 39 to 68 pct for air conditioning, and 3 to 9 pct for hot water supply. About 2.3 to 5.0 pct of demands for industrial process will be filled with HP. HP will have a significant influence on energy conservation and environmental improvement. DOE

N90-19927# Mohawk Research Corp., Rockville, MD.
FROM INVENTION TO INNOVATION: COMMERCIALIZATION OF NEW TECHNOLOGY BY INDEPENDENT AND SMALL BUSINESS INVENTORS
15 May 1989 91 p Prepared for Argonne National Lab., IL
(Contract W-31-109-ENG-38)
(DE90-006944; DOE/NBB-0087) Avail: NTIS HC A05/MF A01

This handbook emerged from the commitment of Energy-Related Inventions Program personnel to supporting the commercialization efforts of independent and small business inventors with new technologies. As you read this document, you will face questions that may seem far removed from technological concerns--questions about the market, your competition, your business structure, and about legal and regulatory requirements. These may seem peripheral to your present and future work. But, make no mistake, you must carefully and honestly consider and answer these if you expect to penetrate the market in sustained way and profit from your work. Over four hundred of your peers--some by success, others by failure--have shown us the lessons incorporated in this volume. By using it, and by commenting on it, you benefit from their collective experience, and make invaluable additions to it. DOE

N90-22439# Office of Management and Budget, Washington, DC. Office of Information and Regulatory Affairs.
CURRENT INFORMATION TECHNOLOGY RESOURCE REQUIREMENTS OF THE FEDERAL GOVERNMENT: MAJOR SYSTEMS ACQUISITIONS AND PLANNED RESOURCES
12 Jan. 1990 693 p
(PB90-146820) Avail: NTIS HC A99/MF A04; also available in set of 2 reports HC E99/MF E99 as PB90-149980 CSCL 05/2

The document is based on information submitted in support of the Budget of the United States Government for Fiscal Year 1990 and consists of a compilation of individual agency information technology acquisition plans for the period 1989 through 1994. It should be noted that resources information is subject to change as congressional action on the budget and other changes cause priorities to be reevaluated and allocations to shift. GRA

N90-24172*# National Aeronautics and Space Administration, Washington, DC.
SPACE STATION FREEDOM PRE-WORKSHOP SESSION
1988 245 p Workshop held in Denver, CO, 25 Oct. 1988
(NASA-TM-102913; NAS 1.15:102913) Avail: NTIS HC A11/MF A02 CSCL 05/1

This is a report of a pre-workshop session held before the 1988 Space Station Workshop; it details space station opportunities for commercial users and providers. Aspects covered are: an overview of commercial uses of space; and overview of the Space Station Freedom Program; attributes of space and some practical uses of them; a description of commercial space activities by country, including various statistics; information on each of NASA's Centers for Commercial Development; and monetary and other resources available to help support commercial ventures in space. J.P.S.

N90-25074# Naval Postgraduate School, Monterey, CA.
AIRCRAFT MODIFICATIONS COST ANALYSIS. VOLUME 1: OVERVIEW OF THE STUDY Final Report
DAN C. BOGER and SHU S. LIAO Feb. 1990 37 p
(AD-A220764; NPS-54-90-005) Avail: NTIS HC A03/MF A01 CSCL 01/3

As the budget for the development and production of new military aircraft tightens, modification of existing aircraft (MOD) has become increasingly important. This shift in emphasis has created a need for a high level parametric cost estimating method to estimate the cost of a MOD program early in the planning cycle. This report is the first volume of a series of reports documenting a multi-year project to support Naval Air Systems Command initiative to develop parametric cost estimating models for MOD programs. This volume provides an overview of the project, including a review of prior studies, the structure of data to be collected, and the forms used in data collection. Due to the proprietary nature of MOD program cost data, distribution of all future volumes of the report series except for the summary volume will be limited to selected Department of Defense agencies only. (jg) GRA

N90-25705*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ESTIMATING THE COST OF MAJOR ONGOING COST PLUS HARDWARE DEVELOPMENT PROGRAMS
J. C. BUSH Jun. 1990 33 p
(NASA-TM-100401; NAS 1.15:100401) Avail: NTIS HC A03/MF A01 CSCL 05/3

Approaches are developed for forecasting the cost of major hardware development programs while these programs are in the design and development C/D phase. Three approaches are developed: a schedule assessment technique for bottom-line summary cost estimation, a detailed cost estimation approach, and an intermediate cost element analysis procedure. The schedule assessment technique was developed using historical cost/schedule performance data. Author

N90-26231*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Software Product Assurance Section.
LONG-RANGE PLANNING COST MODEL FOR SUPPORT OF FUTURE SPACE MISSIONS BY THE DEEP SPACE NETWORK
J. S. SHERIF, D. S. REMER (Harvey Mudd Coll., Claremont, CA.), and H. R. BUCHANAN *In its* The Telecommunications and Data Acquisition Report p 179-190 15 May 1990
Avail: NTIS HC A10/MF A02 CSCL 05/3

A simple model is suggested to do long-range planning cost estimates for Deep Space Network (DSP) support of future space missions. The model estimates total DSN preparation costs and the annual distribution of these costs for long-range budgetary planning. The cost model is based on actual DSN preparation costs from four space missions: Galileo, Voyager (Uranus), Voyager (Neptune), and Magellan. The model was tested against the four projects and gave cost estimates that range from 18 percent above the actual total preparation costs of the projects to 25 percent below. The model was also compared to two other independent projects: Viking and Mariner Jupiter/Saturn (MJS later became Voyager). The model gave cost estimates that range from 2 percent (for Viking) to 10 percent (for MJS) below the actual total preparation costs of these missions. Author

N90-27547# Office of Technology Assessment, Washington, DC.
COPYRIGHT AND HOME COPYING: TECHNOLOGY CHALLENGES THE LAW
Oct. 1989 295 p
(PB90-151309; OTA-CIT-422; LC-89-600714) Avail: NTIS HC A13/MF A02; SOD HC $13.00 as 052-003-01169-7 CSCL 05/2

Home recording technologies are examined. Then, focusing primarily on audiotaping, the ambiguous legal status of home copying is examined. The economic effects that home audiotaping may have on the recording industry, contrasted to the effects that restricting home taping might have on consumers, are considered. Finally, a range of actions that either Congress or the industry might pursue are identified. Included are the results of a national survey of home taping and copying behavior conducted in the autumn of 1988. In this survey, 1,500 members of the public responded to a range of questions about their own audio- and

video-taping behaviors and their attitudes toward various policy approaches related to home taping. Author

N90-27549# Office of Technology Assessment, Washington, DC.
HELPING AMERICA COMPETE: THE ROLE OF FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
Jul. 1990 77 p
(OTA-CIT-454) Avail: NTIS HC A05/MF A01; also available SOD HC $3.75 as 052-003-01196-4

The U.S. Government spends 65 billion dollars per year on research and development. A major product of this expenditure is scientific and technical information (STI) essential for understanding, identifying, and solving everyday health, transportation, climate change, product development, and other problems. STI is a prime ingredient of innovation and can help the U.S. maintain its leadership and stay competitive in world markets. An assessment is made of how STI can contribute to a more competitive America and what actions are needed to realize this potential. Recommendations include the establishment of Congressional information dissemination policies, improvements in education, more standards, and the creation and use of directories. J.P.S.

N90-28439# General Accounting Office, Washington, DC.
SPACE PROJECTS: IMPROVEMENTS NEEDED IN SELECTING FUTURE PROJECTS FOR PRIVATE FINANCING
Sep. 1990 40 p
(GAO/NSIAD-90-147; B-240473) Avail: NTIS HC A03/MF A01

The Office of Management and Budget (OMB) and NASA jointly selected seven projects for commercialization to reduce NASA's fiscal year 1990 budget request and to help achieve the goal of increasing private sector involvement in space. However, the efforts to privately finance these seven projects did not increase the commercial sector's involvement in space to the extent desired. The General Accounting Office (GAO) determined that the projects selected were not a fair test of the potential of increasing commercial investment in space at an acceptable cost to the government, primarily because the projects were not properly screened. That is, neither their suitability for commercialization nor the economic consequences of seeking private financing for them were adequately evaluated before selection. Evaluations and market tests done after selection showed that most of the projects were not viable candidates for private financing. GAO concluded that projects should not be removed from NASA's budget for commercial development until after careful screening has been done to determine whether adequate commercial demand exists, development risks are commercially acceptable and private financing is found or judged to be highly likely, and the cost effectiveness of such a decision is acceptable. Premature removal of projects from NASA's budget ultimately can cause project delays and increased costs when unsuccessful commercialization candidates must be returned to the budget. NASA also needs to ensure appropriate comparisons of government and private financing options for future commercialization projects. J.P.S.

N90-28450*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ENHANCING US COMPETITIVENESS THROUGH FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION: ISSUES AND OPPORTUNITIES
THOMAS E. PINELLI *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 219-228 1990 Previously announced in IAA as A90-34051
Avail: NTIS HC A07/MF A01; *also available from JAI Press, Inc.*, Greenwich, CT at subscription rates CSCL 05/2

The possibility of using Federally funded scientific and technical information (STI) to increase U.S. industrial innovation and productivity is discussed. The history of Federally funded research and development in the fields of agriculture and aviation is reviewed as an example of successful government-sponsored research. Issues related to the production and utilization of information are considered and Federal STI policy is outlined. Issues related to the transfer of knowledge between government agencies and industry are examined and a model depicting the transfer of STI in aerospace research and development is presented. Also, consideration is given to the problem of open communication versus restricted access to STI. Author

N90-28580# National Academy of Sciences - National Research Council, Washington, DC. Building Research Board.
PROCEEDINGS OF A WORKSHOP ON FUTURE AIRPORT PASSENGER TERMINALS
A. C. LEMER 1989 45 p Workshop held in Washington, DC, 6-7 Jun. 1989; sponsored in part by Building Research Board and the Transportation Research Board
(PB90-213620) Avail: NTIS HC A03/MF A01 CSCL 01/5

A report of a workshop on future airport passenger terminals, sponsored by the Building Research Board in cooperation with the Transportation Research held in the Washington Metropolitan Area Transit Authority (WMATA) is given. An introduction is given to the factors any jurisdiction has to look at when investing in transportation facilities. After reviewing the funding mechanisms and debt service already being borne by WMATA to set the context, the financial condition of each of the WMATA major funding contributors is examined in detail. Each jurisdiction's writeup includes its credit rating from Moody's and Standard and Poor's, its current mass transit service revenue commitment to the transit system, its economic situation, its current tax base and taxing rate restrictions, the composition of its general fund, its borrowing history (both in terms of amounts borrowed and from whom), and projected expenditures. Although oriented toward large projects, the document can introduce assessment of ability to pay to governments of any size. Author

N90-29238# Royal Signals and Radar Establishment, Malvern (England).
GUIDE TO CHARGING FOR THE CCF
R. F. BATEMAN Dec. 1989 26 p
(RSRE-89022; BR113096; ETN-90-97061) Copyright Avail: NTIS HC A03/MF A01

The method by which the Royal Signals and Radar Establishment (RSRE) Central Computing Facility (CCF) costs are fully recovered using the CCF charging mechanism is reported. The costs to be recovered are capital assets, support, maintenance, consumables and non-distributed, and these are recovered by charging for services i.e., CPU (Central Processing Unit), storage allocated and direct support to tasks, divisions and RSRE. More services will be added which will reduce the existing service charges proportionally. ESA

N90-29256# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Science.
EXTENSIONS TO THE LEARNING CURVE: AN ANALYSIS OF FACTORS INFLUENCE UNIT COST OF WEAPON SYSTEMS
O. DOUGLAS MOSES May 1990 67 p Prepared for Naval Sea Systems Command, Washington, DC
(AD-A224119; NPS54-90-016) Avail: NTIS HC A04/MF A01 CSCL 05/3

The use of learning curves to analyze unit costs experienced during the manufacture of items produced from a repetitive process is widespread. The assumption implicit in the use of learning curves is that cumulative quantity produced is the primary factor influencing the pattern of unit costs. This paper adds to the learning curve model variables reflecting production rate, company-wide activity and fixed costs, and industry activity. Empirical tests conducted using data from missile weapon systems show that each variable enhances the explanation of unit cost but the importance of the variables depends on the nature of the cost series being analyzed. Additional tests examine the influence of broader economic and political factors on weapon system unit cost. GRA

N90-29257# Congressional Budget Office, Washington, DC.
PRELIMINARY ANALYSIS OF NASA COMMERCIALIZATION INITIATIVES
D. H. MOORE and M. SIEVERTS 17 Feb. 1989 18 p
(PB90-202706) Avail: NTIS HC A03/MF A01 CSCL 05/1

The NASA budget request includes support for industry and university collaboration in exploring the potential uses of space for future economic gain and for procurement of launch services from the private sector for NASA missions, and announces NASA's intention to seek private-sector financing for portions of its space transportation and space station programs. The intention to seek private financing for NASA facilities and hardware programs represents a new direction for the NASA program. It would defer some budgetary outlays to the future by means of service contracts and leases to private investors. A complete analysis of these space commercialization initiatives must await more specific information concerning the proposed agreements between the government and private investors, since a variety of options would be open to both parties. Nevertheless, the initiatives included in the 1990 budget raise a number of general issues. Some of these issues are addressed in examining the larger policy behind the proposals, estimating their cost to the government, and briefly examining some budgetary and scoring concerns. GRA

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.

A90-13297*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE PRINCIPLE OF COMMONALITY AND ITS APPLICATION TO THE SPACE STATION FREEDOM PROGRAM
GEORGE D. HOPSON, L. DALE THOMAS, and CHARLES C. DANIEL (NASA, Marshall Space Flight Center, Huntsville, AL) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 5 p. refs
(IAF PAPER 89-081) Copyright

The principle of commonality has achieved wide application in the communication, automotive, and aircraft industries. By the use of commonality, component development costs are minimized, logistics are simplified, and the investment costs of spares inventory are reduced. With space systems, which must be maintained and repaired in orbit, the advantages of commonality are compounded. Transportation of spares is expensive, on-board storage volume for spares is limited, and crew training and special tools needed for maintenance and repair are significant considerations. This paper addresses the techniques being formulated to realize the benefits of commonality in the design of the systems and elements of the Space Station Freedom Program, and include the criteria for determining the extent of commonality to be implemented. Author

A90-13681#
MAN-INTO-ORBIT TRANSPORTATION COST - HISTORY AND OUTLOOK
DIETRICH E. KOELLE and WOLFGANG KLEINAU (MBB GmbH, Munich, Federal Republic of Germany) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 5 p.
(IAF PAPER 89-695) Copyright

The paper deals first with the assessment of the initial cost of launching astronauts with ballistic capsules like Mercury, Gemini, and Apollo (about $100 million per astronaut), via the Space Shuttle (some $16 million), in order to show the potential cost reduction in the future. Such a reduction to some $4 million per crew member could be realized by a dedicated launch vehicle for manned operations. The second area of analysis is the specific transportation cost per man-day in orbit. The Space Shuttle provides an 8-day capability for 8 persons for about $2 million per man-day. In connection with a manned space station and a launch frequency of 60 days, these costs could be reduced to some $350,000 per man-day. Author

A90-13684#
APPLICATION OF COMPUTER SIMULATION/LIFE CYCLE COST MANAGEMENT TO MINIMIZE SPACE TRANSPORTATION SYSTEM COST
S. A. GREENBERG (USAF, Space Systems Div., Los Angeles Air Force Station, CA) and R. B. NICOL (Martin Marietta Corp., Denver, CO) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 10 p.
(IAF PAPER 89-698)

An approach currently being undertaken in order to automate the design, test, and operation analysis function of the Space Transportation System (STS) is discussed. This Advanced Launch System Model (ALSYM) provides for an integrated total system simulation of all program phases. Life cycle cost management for STS is addressed by two basic approaches. The first involves changing the philosophy of the STS from a custom, performance-driven carrier to space 'truck'. The implementation of Total Quality Management (TQM) principles, which encompass simultaneous engineering, statistical process control, and variability reduction techniques, is examined as the second important way of attaining life cycle cost management. C.D.

A90-13685#
SPACE TRANSPORTATION COSTS, RELIABILITY, AND RESILIENCY
SCOTT PACE (RAND Corp., Santa Monica, CA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 10 p. refs
(IAF PAPER 89-699) Copyright

Resiliency is defined as the ability of a launch system to recover from the effects of flight failures and resulting delays. This paper addresses how vehicle unreliability and system resiliency are related to the total costs of space transportation. A resiliency measure is derived as a function of system standdown times (following an accident), surge flight rates, payload backlogs, and nominal flight rates. Example calculations show that a diverse mix of launch vehicles and excess capacity are important to insuring a resilient launch system. Historical data on launch vehicles and payloads show that payload costs dominate launch and unreliability costs (excluding opportunity costs for failed payloads). The use of large payload volumes, as proposed for heavy-lift launch vehicles, will require commensurate increases in launch vehicle reliability. Author

A90-17729#
SELECTING A LAUNCH SITE IN HAWAII FOR COMMERCIAL USE
HARRY G. FODEN (Arthur D. Little, Inc., Cambridge, MA) IN: Annual Space: Technology, Commerce and Communications Conference, 2nd, Houston, TX, Nov. 1-4, 1988, Proceedings. Boston, MA, T. F. Associates, Inc., 1988, 8 p.

The development of a commercial launch site in Hawaii is proposed. The market for commercial launch services is evaluated. The advantages and disadvantages of locating a site in Hawaii are listed. An approach for establishing a launch facility is recommended and possible sites are analyzed. It is suggested that the preferable location for a launch site in Hawaii is Palima Point. R.B.

A90-24761
RESTORING U.S. LAUNCH CAPACITY
ROBERT A. ZIRKLE IN: Space: National programs and international cooperation. Boulder, CO, Westview Press, 1989, p.

3-32. refs
Copyright

Issues related to the process of choosing the appropriate set of launch vehicles to meet the requirements of future U.S. space programs are discussed. The use of the Space Shuttle as a launch vehicle is discussed and the capacity of U.S. launch services is compared with the demand for launches. The commercialization of launch services is considered and the decision to close the Vandenberg Shuttle Complex is assessed. The role of launch services in developing the Space Station and space-based defense systems (SDI) is examined. R.B.

A90-24811#
LSA FOR MARS CLASS MISSIONS
WILLIAM C. LEWIS (Grand Valley State University; Western Michigan, Research and Technology Institute, Grand Rapids, MI) IN: Space manufacturing 7 - Space resources to improve life on earth; Proceedings of the Ninth Princeton/AIAA/SSI Conference, Princeton, NJ, May 10-13, 1989. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 274-278. refs
Copyright

Preliminary logistic support analysis (LSA) suggests that the cost of manned spacecraft could be less than the cost of unmanned spacecraft for moderately complex Mars class missions if technology to enable component level repair of equipment by flight crew is available. It is shown that component level repair by flight crew is an enabling technology for manned Mars class missions. Necessity of this enabling technology is proved by quantitative analysis of reliability and supply support requirements. Elements of the enabling technology are described. Author

A90-25574
AIRCRAFT INTERFACE WITH THE FUTURE ATC SYSTEM
DELMAR M. FADDEN and ROBERT W. SCHWAB (Boeing Commercial Airplanes, Seattle, WA) IEEE, Proceedings (ISSN 0018-9219), vol. 77, Nov. 1989, p. 1745-1751. refs
Copyright

The authors address the next transition period for navigation by outlining how the advantages of improved navigational accuracy can benefit both the individual aircraft and the air transportation system despite a mixed environment. The development of advanced navigation, flight planning, performance optimization, automatic guidance, and other capabilities in current and future flight management systems, together with the availability of digital communications between the airplane and ATC (air traffic control), suggests the need to review the potential airplane contributions to the ATC system of the future. A number of application areas utilizing current airborne flight management technology have been proposed for use with ATC that could provide significant operational benefits. These include: time-navigation applications in traffic management; multisensor navigation to provide automatic dependent surveillance; improved precision for approach, missed approach, and departure procedures; and improved navigational accuracy supporting reduced airway widths, holding pattern airspace, and aircraft separation standards. Several examples of operational benefits for operators and ATC during the transition period are identified, and the need for integrating these features into future ATC capabilities and procedures is stressed. The public's investment in the National Airspace System (NAS) plan, together with the airlines' investments in modern flight management technology, requires commensurate improvements in total air transportation system performance. I.E.

A90-26865
METAL MATRIX COMPOSITES - READY FOR TAKE-OFF?
D. CHARLES (British Aerospace, PLC, Airbus Div., London, England) Metals and Materials (ISSN 0266-7185), vol. 6, Feb. 1990, p. 78-82. refs
Copyright

An evaluation is made of the development status, associated performance gains, and potential economic viability of the application of metal-matrix composite (MMC) materials to aircraft engines and airframes. Channel-section MMC extrusions used as electrical racking have already been shown to outperform both conventional Al alloy and CFRP alternatives, while yielding significant weight-savings over both alternatives. Attention is given to possible MMC applications in the National Aerospace Plane and various gas turbine engine components. The high cost of MMCs is identified as a continuing barrier to further market expansion. O.C.

A90-28346
ATE SELF TEST
ARNOLD M. GREENSPAN IN: AUTOTESTCON '89 - IEEE International Automatic Testing Conference, Philadelphia, PA, Sept. 25-28, 1989, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 284-288.
Copyright

The ability of automatic test equipment (ATE) to introspectively assess its own well-being as well as assess the well-being of the UUTs (units under test) external to itself has long been understood to be a major advantage of offline ATE. The author argues that this inherent potential ATE system capability has not been used effectively. It has been treated as an afterthought and implemented by the most prosaic of methods. The results of this inadequate and inappropriate treatment of ATE self-test has been stagnation in improved MTBF of new ATE systems and regression in MTTR. The maintenance and training problems for new and modern ATE have been exacerbated rather than reduced. The author contends that this situation is a result of neglect and apathy on the part of ATE systems developers who have failed to be innovative or attentive to modern system techniques in the design of self-test for their ATE. The author proposes a five-phase ATE self-test approach that he hopes can resolve the above-mentioned problems. The phases are: (1) pre-ATE planning, (2) ATE planning, (3) self-test implementation, (4) self-test maturity and evaluation, and (5) self-test feedback/archiving. I.E.

A90-28351
NOW WE HAVE ATE - WHO'S GOING TO MAINTAIN IT?
DAVID M. GRANT (RESTOR Industries, Inc., Beaverton, OR) IN: AUTOTESTCON '89 - IEEE International Automatic Testing Conference, Philadelphia, PA, Sept. 25-28, 1989, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 323-326.
Copyright

The authors discuss original equipment manufacturer maintenance and self-maintenance with emphasis on hardware maintenance of in-circuit ATE (automatic test equipment). Issues such as software and fixture maintenance are also addressed. Maintenance is analyzed from an economics standpoint, and issues of jeopardy and practicality are discussed. I.E.

A90-52857
AIRPORT TECHNOLOGY INTERNATIONAL 1989/1990
MAURICE G. HUDSON, ED. London, Sterling Publications, Ltd., 1989, 336 p. No individual items are abstracted in this volume.
Copyright

Topics presented include an air transport policy for the European Community, the essential elements in a U.S. transportation policy, solutions to airport and airspace capacity shortage, air transport growth in the Asia-Pacific region, and the competition between air and high-speed rail. Also presented are the world issues in heliport development, an airport commercial review, the design of effective national aviation security systems, and aircraft anti-icing fluid technology and application. Attention is also given to controlling run-up noise in the 1990s, the potential hazards of poor runway surfaces, the work of the ECAC Technical Committee, and civil air transport training for military pilots. R.E.P.

N90-12572 Civil Aviation Authority, London (England). Air Traffic Control Evaluation Unit.
DEVELOPMENT AND EVALUATION AT ATCEU OF EXECUTIVE AND SUPPORT OPERATIONS, PHASE 4A/3D
M. J. DOWSETT, A. E. JOHNSON, and C. S. NARBOROUGH-HALL (Royal Air Force, London, England) Dec. 1988 95 p

(CAA-PAPER-88017; EU404; REPT-508; ETN-89-95246)
Copyright Avail: Civil Aviation Authority, Greville House, 37 Gratton Road, Cheltenham, United Kingdom

The phase 3c and phase 4a and 3d simulations, concerned with developing and evaluating the executive and support mode (ES) of controller operation proposed in the London air traffic control center development plan are described. Phase 3c examines civil aspects of the ES operation. It concentrates on display and message formats and on automatic coordination procedures. Phase 4a and 3d study problems associated with joint civil/military use of the concepts. Recommendations about areas requiring further development and study are made. ESA

N90-13370*# Douglas Aircraft Co., Inc., Long Beach, CA. New Commercial Programs.
STUDY OF HIGH-SPEED CIVIL TRANSPORTS Final Report
Washington NASA Dec. 1989 182 p
(Contract NAS1-18378)
(NASA-CR-4235; NAS 1.26:4235) Avail: NTIS HC A09/MF A01 CSCL 01/3

A systems study to identify the economic potential for a high-speed commercial transport (HSCT) has considered technology, market characteristics, airport infrastructure, and environmental issues. Market forecasts indicate a need for HSCT service in the 2000/2010 time frame conditioned on economic viability and environmental acceptability. Design requirements focused on a 300 passenger, 3 class service, and 6500 nautical mile range based on the accelerated growth of the Pacific region. Compatibility with existing airports was an assumed requirement. Mach numbers between 2 and 25 were examined in conjunction with the appropriate propulsion systems, fuels, structural materials, and thermal management systems. Aircraft productivity was a key parameter with aircraft worth, in comparison to aircraft price, being the airline-oriented figure of merit. Aircraft screening led to determination that Mach 3.2 (TSJF) would have superior characteristics to Mach 5.0 (LNG) and the recommendation that the next generation high-speed commercial transport aircraft use a kerosene fuel. The sensitivity of aircraft performance and economics to environmental constraints (e.g., sonic boom, engine emissions, and airport/community noise) was identified together with key technologies. In all, current technology is not adequate to produce viable HSCTs for the world marketplace. Technology advancements must be accomplished to meet environmental requirements (these requirements are as yet undetermined for sonic boom and engine emissions). High priority is assigned to aircraft gross weight reduction which benefits both economics and environmental aspects. Specific technology requirements are identified and national economic benefits are projected. Author

N90-13597*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
THE MATERIALS DIVISION: A CASE STUDY
SALVATORE J. GRISAFFE and CARL E. LOWELL 1989 13 p Presented at the Quality Improvement Prototype Workshop, Washington, DC, 6 Sep. 1989
(NASA-TM-102380; E-5119; NAS 1.15:102380) Avail: NTIS HC A03/MF A01 CSCL 07/1

The Materials Division at NASA's Lewis Research Center has been engaged in a program to improve the quality of its output. The division, its work, and its customers are described as well as the methodologies developed to assess and improve the quality of the Division's staff and output. Examples of these methodologies are presented and evaluated. An assessment of current progress is also presented along with a summary of future plans. Author

N90-14212*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
CALIFORNIA AIR TRANSPORTATION STUDY: A TRANSPORTATION SYSTEM FOR THE CALIFORNIA CORRIDOR OF THE YEAR 2010
22 May 1989 195 p
(Contract NASW-4435)
(NASA-CR-186219; NAS 1.26:186219) Avail: NTIS HC A09/MF A02 CSCL 01/3

To define and solve the problems of transportation in the California Corrider in the year 2010, the 1989 California Polytechnic State University Aeronautical Engineering Senior Design class determined future corridor transportation needs and developed a system to meet the requirements. A market study, which included interpreting travel demand and gauging the future of regional and national air travel in and out of the corridor, allowed the goals of the project to be accurately refined. Comprehensive trade-off studies of several proposed transporation systems were conducted to determine which components would form the final proposed system. Preliminary design and further analysis were performed for each resulting component. The proposed system consists of three vehicles and a special hub or mode mixer, the Corridor Access Port (CAP). The vehicles are: (1) an electric powered aircraft to serve secondary airports and the CAP; (2) a high speed magnetic levitation train running through the CAP and the high population density areas of the corridor; and (3) a vertical takeoff and landing tilt rotor aircraft to serve both intercity and intrametropolitan travelers from the CAP and city vertiports. The CAP is a combination and an extension of the hub, mode mixer, and Wayport concepts. The CAP is an integrated part of the system which meets the travel demands in the corridor, and interfaces with interstate and international travel. Author

N90-14330# Royal Aircraft Establishment, Farnborough (England). Materials and Structures Dept.
DIFFUSION BONDING OF METALS
P. G. PARTRIDGE *In* AGARD, Superplasticity 29 p Sep. 1989
Copyright Avail: NTIS HC A11/MF A02

The need to reduce the cost and weight of aerospace metallic structures has led to increased interest in solid state and liquid phase diffusion bonding processes, especially in combination with superplastic forming. The bonding mechanisms and bonding techniques are reviewed and the process variables that affect metals. The importance of quality control and the limitations of current NDE techniques for diffusion bonding are emphasized. Finally some trends and priorities in diffusion bonding technology are indicated. Author

N90-16348# Oak Ridge National Lab., TN. Energy Div.
FEDERAL ROLES TO REALIZE NATIONAL ENERGY-EFFICIENCY OPPORTUNITIES IN THE 1990S
ERIC HIRST Oct. 1989 47 p
(Contract DE-AC05-84OR-21400)
(DE90-004410; ORNL/CON-290) Avail: NTIS HC A03/MF A01

Improving energy efficiency throughout the U.S. economy is a vital component of our nation's energy future, with many benefits. Improving efficiency can: save money consumers, increase economic productivity and international competitiveness, reduce oil and gas prices by reducing the demand for foreign oil, enhance national security by lowering oil imports, reduce the adverse environmental consequences of fuel cycles, especially acid rain and global warming, add diversity and flexibility to the nation's portfolio of energy resources, respond to public interest in, and support of, energy efficiency. The primary purpose of this report is to suggest expanded roles for the U.S. Department of Energy (DOE) in improving energy efficiency during the 1990s. In an ideal world, the normal workings of the market place would yield optimal energy-efficiency purchase and operating decisions. Unfortunately, distortions in fuel prices, limited access to capital, misplaced incentives, lack of information, and difficulty in processing information complicate energy-related decision making. Thus, consumers in all sectors of the economy underinvest in energy-efficient systems. These market barriers, coupled with growing concern about environmental quality, justify a larger Federal role. DOE

N90-16785# Arianespace, Evry (France).
THE INTERNATIONAL SPACE TRANSPORTATION MARKET: A EUROPEAN PERSPECTIVE

KLAUS ISERLAND *In* ESA, Progress in Space Transportation p 15-20 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

The future of space transportation is examined in four areas: the launching of satellites and space probes, the launch of payloads for microgravity and technological experiments, the transport into low orbit of space structures, modules etc. used in building space stations, and later, space factories, and regular transport of men and materials to and from these stations and repair and maintenance missions. These four areas are analyzed in terms of their market aspects from a European viewpoint. Conclusions are made regarding the future structure of space transportation. ESA

N90-16786# European Space Agency, Paris (France).
ESA'S SPACE TRANSPORTATION PROGRAMME
JOERG FEUSTEL-BUEECHL *In its* Progress in Space Transportation p 23-37 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

The Ariane 5 development program is described. Its technical data sheet and component parts are presented. The Ariane 5 launch complex in Kourou, French Guiana, is described and illustrated. The schedule and cost of the Ariane 5 development scheme is given in detail. The objectives of the program are listed. Illustrations of the Hermes spaceplane and of the Hermes space suit for extra-vehicular activities are provided. A timetable for the different developmental projects is presented. Future plans beyond Ariane 5 and Hermes are presented. ESA

N90-16833*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
THE LIQUID ROCKET BOOSTER AND ITS POTENTIAL FOR THE STS
PAUL H. BIALLA (General Dynamics Corp., San Diego, CA.) and J. E. HUGHES *In* ESA, Progress in Space Transportation p 405-410 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03 CSCL 21/8

Results of the liquid rocket booster study initiated by NASA to define an alternative to solid rocket boosters, are presented. The prime study contractors, Martin Marietta Corporation and General Dynamics, have identified liquid rocket booster configurations that can increase shuttle performance to 70 klb. These boosters will provide improved reliability, hold down, verification prior to vehicle release, engine-out and abort capabilities. Phasing of these boosters into Space Transportation System (STS) operations without adversely affecting flight rate is described. ESA

N90-16836# Societe Europeenne de Propulsion, Saint-Medard-en-Jalles (France).
MATERIAL TECHNOLOGY CHALLENGES IN SPACE TRANSPORTATION
DIDIER G. DESNOYER *In* ESA, Progress in Space Transportation p 429-438 Aug. 1989
Copyright Avail: NTIS HC A22/MF A03

The factors and requirements guiding material technology for space applications are described. The increasingly wide range of flight characteristics, namely manned or unmanned flight, mission duration, cyclic missions, and atmospheric composition, place different requirements on the materials used. Various high temperature materials are compared. Composite materials (C/C, C/SiC, SiC/SiC) and refractory alloys are compared in terms of mechanical and chemical properties. Their applications in the Hermes and Cassini programs are discussed. Their influence on design is shown. Cost evaluations are provided. ESA

N90-17891# Department of Energy, Washington, DC. Biofuels and Municipal Waste Technology Div.
HYDROGEN ENERGY COORDINATING COMMITTEE: SUMMARY OF DOE HYDROGEN PROGRAMS Annual Report, FY 1989
Jan. 1990 60 p
(DE90-004480; DOE/CE-0280) Avail: NTIS HC A04/MF A01

An ideal fuel for use in meeting the Nation's energy needs would be one that is virtually inexhaustible, clean burning, convenient, versatile, and free from foreign control. Hydrogen could be such a fuel, but it has limitations in that it is practically nonexistent in its free state and must be produced, consuming a primary energy source, such as gas, oil, or coal in the process. On the other hand, with existing technology for hydrogen utilization, hydrogen can serve as a fuel for all conventional energy uses, including industrial applications; electric power generation; and residential, commercial and transportation purposes. DOE

N90-18054# Southwest Research Inst., San Antonio, TX. Fuels and Lubricants Research Facility.
US ARMY METHANOL-FUELED ADMINISTRATIVE VEHICLE DEMONSTRATION PROGRAM Final Report, Mar. 1986 - Aug. 1989
BURL B. BABER, SIDNEY J. LESTZ, and MAURICE E. LEPERA (Army Belvoir Research and Development Center, Fort Belvoir, VA.) Aug. 1989 254 p
(Contract DAAK70-85-C-0007; DAAK70-87-C-0043; DA PROJ. 1L2-63001-D-150)
(AD-A216013; BFLRF-233) Avail: NTIS HC A12/MF A02
CSCL 21/4

A methanol-fueled fleet test demonstration program was conducted using administrative-type vehicles to determine the feasibility of using methanol as an alternative fuel. Over 1,026,000 miles were accumulated using 64 administrative-type vehicles. Approximately 750,000 of these miles were accumulated using M85 methanol fuel. Existing engines engineered for use with gasoline and special methanol engines engineered for use with M85 methanol fuel were included in the program. Fuel economy, in miles per gallon, obtained for vehicles using M85 fuel is shown to be approximately one-half that obtained using regular unleaded gasoline. When the costs of M85 fuel and unleaded gasoline are included in economic calculations, it is shown that using M85 increases the fuel cost by a factor of approximately 3.0. No catastrophic engine failure occurred using either fuel. Even though wear rates, indicated from used oil sample analyses, obtained when using M85 fuel appear to be 2 to 4 times those obtained using unleaded gasoline, actual wear, from inspections and measurements, does not appear to be as severe. No significant increase in individual vehicle maintenance, other than increased oil drains, was noted for the methanol vehicles. The M85 refueling stations were set up at four fleet test sites, and no significant operational problem, safety or otherwise, was encountered during the program. GRA

N90-18373# Federal Aviation Administration, Washington, DC.
NATIONAL AIRSPACE SYSTEM PLAN: FACILITIES, EQUIPMENT, ASSOCIATED DEVELOPMENT AND OTHER CAPITAL NEEDS Annual Report
Sep. 1989 380 p
(AD-A215882) Avail: NTIS HC A17/MF A02 CSCL 17/7

The National Airspace System (NAS) is the busiest and most complex in the world. It is a mixture of equipment, techniques, and skills that has evolved over 50 years. Without question, it is the world's safest and most efficient, yet, at the outset of this plan, its expansion capability was limited and adaptability to changing requirements was difficult. Aviation activity is forecast to increase substantially over the next two decades. Continuing growth in the number of aircraft operations, number of aircraft, enplanements, diversity of operations, DOD operations and sophistication of aircraft will place unprecedented demands on the NAS. Meeting this challenge requires improved and expanded services, additional facilities and equipment, improved work force productivity, and the orderly replacement of aging equipment. In December, 1981, the Federal Aviation Administration (FAA) chartered a comprehensive NAS Plan for modernizing and improving air traffic control and airway facilities services through the year 2000. This is the seventh annual update of the NAS Plan. The Plan addresses the compelling problems of how best to improve safety and efficiency, accommodate spiraling demands for aviation services, deal with the problems of aging or obsolete facilities, recognize the users desires for minimal restrictions on

the use of the airspace, allow for a reduced Federal role, and create a foundation for continued evolution which exploits newer technologies and developments. GRA

N90-18380# Federal Aviation Administration, Atlantic City, NJ.
DALLAS/FORT WORTH SIMULATION. VOLUME 2: APPENDIXES D, E, AND F
LLOYD HITCHCOCK, LEE E. PAUL, EPHRAIM SHOCKET, and RICHARD D. ALGEO Nov. 1989 289 p
(AD-A216613; DOT/FAA/CT-TN89/28-VOL-2) Avail: NTIS HC A13/MF A02 CSCL 01/5

A series of dynamic, real time, air traffic control simulations of selected aspects of the D/FW Metroplex Air Traffic System Plan were conducted. Using D/FW controllers as subjects, the simulations provided an opportunity to evaluate proposed changes in area flow patterns and traffic management and to experience simultaneous approaches to the four parallel runway configuration under consideration for D/FW. The results of these simulations demonstrated that, even when faced with up to twice their normal traffic load, the controllers could maintain a smooth and safe flow of traffic using the new configurations proposed for the D/FW area. The D/FW Evaluation Team declared that the parallel arrival routes, separate altitudes for high performance turboprops, increased departure routes, and stratified sectors all proved to be valuable controller tools. In addition, simulation of the four simultaneous parallel approaches led to the Evaluation Team to enthusiastically endorse the concept of four simultaneous approaches to the D/FW airport and to affirm that in each and every case the concept proved to be safe even though frequently challenged by the unlikely conditions of 30 degree blunders without communications. GRA

N90-20298# Pacific Northwest Lab., Richland, WA.
LIFE-CYCLE COST COMPARISONS OF ADVANCED STORAGE BATTERIES AND FUEL CELLS FOR UTILITY, STAND-ALONE, AND ELECTRIC VEHICLE APPLICATIONS
K. K. HUMPHREYS and D. R. BROWN Jan. 1990 422 p
(Contract DE-AC06-76RL-01830)
(DE90-008090; PNL-7203) Avail: NTIS HC A18/MF A03

A comparison is presented of battery and fuel cell economics for ten different technologies. To develop an equitable economic comparison, the technologies were evaluated on a life cycle cost (LCC) basis. The LCC comparison involved normalizing source estimates to a standard set of assumptions and preparing a lifetime cost scenario for each technology, including the initial capital cost, replacement costs, operating and maintenance (O and M) costs, auxiliary energy costs, costs due to system inefficiencies, the cost of energy stored, and salvage costs or credits. By considering all the costs associated with each technology over its respective lifetime, the technology that is most economical to operate over any given period of time can be determined. An analysis of this type indicates whether paying a high initial capital cost for a technology with low O and M costs is more or less economical on a lifetime basis than purchasing a technology with a low initial capital cost and high O and M costs. It is important to realize that while minimizing cost is important, the customer will not always purchase the least expensive technology. The customer may identify benefits associated with a more expensive option that make it the more attractive over all (e.g., reduced construction lead times, modularity, environmental benefits, spinning reserve, etc.). The LCC estimates presented in this report represent three end-use applications: utility load-leveling, stand-alone power systems, and electric vehicles. DOE

N90-21049# Systems Control Technology, Inc., Arlington, VA.
INDIANAPOLIS DOWNTOWN HELIPORT: OPERATIONS ANALYSIS AND MARKETING HISTORY Final Report
DEBORAH J. PEISEN and ROBERT B. NEWMAN Mar. 1990 91 p
(Contract DTFA01-87-C-00014)
(REPT-90RR-13; DOT/FAA/DS-89/32) Avail: NTIS HC A05/MF A01

In response to increasing helicopter demand, the FAA initiated the FAA/Industry National Prototype Heliport Demonstration and Development Program. Four cities were selected for the demonstration program. These were: New York, New Orleans, Los Angeles, and Indianapolis. In January 1985, the Indianapolis Downtown Heliport was the first of the demonstration heliports to open. The operational characteristics are analyzed of the Indianapolis Downtown Heliport from its opening in 1985 through March 1989, and the marketing techniques used during the planning and development stages of the heliport as well as the continuing marketing effort used to retain and increase business are studied. An analysis of operations at the heliport is performed using data collected by the heliport operators. The parameters examined concentrate on the types of missions, the variations and trends in the number of operations, the geographic distribution of the helicopters that use the facility, and the types of services required by the helicopter operators using the heliport. Due to limitations in the amount and accuracy of data available, only generalized trends rather than detailed statistical conclusions could be developed. Author

N90-21249# Computer Resource Management, Inc., Vienna, VA.
NATIONAL AIRSPACE SYSTEM AIR-GROUND COMMUNICATIONS OPERATIONAL CONCEPT
WILLIAM TRENT, RODNEY KUHN, and THOMAS PICKERELL Feb. 1990 46 p
(Contract DTFA01-88-Y-01073)
(DOT/FAA/DS-90/2; NAS-SR-1361) Avail: NTIS HC A03/MF A01

A requirement for the National Airspace System (NAS) is to provide for air-ground communications, as identified in the NAS System Requirement Specification, NAS-SR-1000. A concept of operations for air-ground communications is presented. Air-ground communications capabilities are described and the relationships are shown between subsystems, facilities, information, and operators/users. A common perspective is provided for personnel involved in air-ground communication activities. Assistance is provided for determining whether air-ground communications meet formal requirements and also for coordinating the organizations involved. Author

N90-22530# Federal Aviation Administration, Washington, DC. Office of Aviation Policy and Plans.
FAA (FEDERAL AVIATION ADMINISTRATION) AVIATION FORECASTS, FISCAL YEARS 1990-2001
Mar. 1990 250 p
(AD-A219165; FAA-AP0-90-1) Avail: NTIS HC A11/MF A02 CSCL 01/5

The Fiscal Years 1990 to 2001 Federal Aviation Administration (FAA) forecasts of aviation activity at FAA facilities is presented. These include airports with FAA control towers, air route traffic control centers, and flight service stations. Detailed forecasts were made for the four major users of the National Aviation System: air carriers, air taxi-commuters, general aviation and the military. The forecasts were prepared to meet the budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, by the aviation industry, and by the general public. The overall outlook for the forecast period is the continued economic growth, rising real fuel prices, and moderate inflation. Based upon these assumptions, aviation activity by fiscal year 2001 is forecast to increase by 29.0 percent at towered airports (commuters, 48.2 percent; air carriers, 33.6 percent; general aviation, 25.4 percent; military, 0.0 percent), 30.1 percent at air route traffic control centers (commuters, 51.9 percent; air carriers, 33.1 percent; general aviation 30.5 percent; military, 0.0 percent), and 5.1 percent in flight services performed. Hours flown by general aviation are forecast to increase 19.2 percent and revenue passenger miles (RPM's) are forecast to increase 67.8 percent, with scheduled international RPM's forecast to increase by 113.2 percent; and regionals/commuters RPM's forecast to increase by 157.1 percent. GRA

N90-24385# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).
LIMITS TO TODAY'S COMPOSITES: CHANCES FOR TOMORROW'S DEVELOPMENTS
H. KELLERER, J. BRANDT, R. MEISTRING, and R. RAUH 1989 55 p
(MBB-Z-0287-89-PUB; ETN-90-96971) Avail: NTIS HC A04/MF A01

The factors which limit the use of high performance composites in aerospace applications are discussed. The composite materials considered are carbon fiber reinforced carbon, aluminum matrix composites and carbon fiber reinforced plastics. The different possible fiber-matrix possibilities are discussed. The mechanical behavior of the fibers is investigated. The results of shear and fracture tests on different composite materials are presented. Impregnation techniques are described. Cost factors in the production and performance of composite materials are discussed. Extensive use of composite materials in areas other than aerospace is predicted. ESA

N90-25505*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
MOBILE TRANSPORTER PATH PLANNING
PAUL BAFFES and LUI WANG *In its* Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 51-59 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 09/2

The use of a genetic algorithm (GA) for solving the mobile transporter path planning problem is investigated. The mobile transporter is a traveling robotic vehicle proposed for the space station which must be able to reach any point of the structure autonomously. Elements of the genetic algorithm are explored in both a theoretical and experimental sense. Specifically, double crossover, greedy crossover, and tournament selection techniques are examined. Additionally, the use of local optimization techniques working in concert with the GA are also explored. Recent developments in genetic algorithm theory are shown to be particularly effective in a path planning problem domain, though problem areas can be cited which require more research. Author

N90-25568*# Air Force Human Resources Lab., Brooks AFB, TX. Manpower and Personnel Div.
SUCCESS IN TUTORING ELECTRONIC TROUBLESHOOTING
ELLEN M. PARKER *In* NASA, Lyndon B. Johnson Space Center, Third Annual Workshop on Space Operations Automation and Robotics (SOAR 1989) p 593-603 Mar. 1990
Avail: NTIS HC A99/MF A04 CSCL 09/2

Two years ago Dr. Sherrie Gott of the Air Force Human Resources Laboratory described an avionics troubleshooting tutor being developed under the Basic Job Skills Research Program. The tutor, known as Sherlock, is directed at teaching the diagnostic procedures necessary to investigate complex test equipment used to maintain F-15 fighter aircraft. Since Dr. Gott's presentation in 1987, the tutor has undergone field testing at two Air Force F-15 flying wings. The results of the field test showed that after an average of 20 hours on the tutor, the 16 airmen in the experimental group (who average 28 months of experience) showed significant performance gains when compared to a control group (having a mean experience level of 37 months) who continued participating in the existing on-the-job training program. Troubleshooting performance of the tutored group approached the level of proficiency of highly experienced airmen (averaging approximately 114 months of experience), and these performance gains were confirmed in delayed testing six months following the intervention. The tutor is currently undergoing a hardware and software conversion form a Xerox Lisp environment to a PC-based environment using an object-oriented programming language. Summarized here are the results of the successful field test. The focus is on: (1) the instructional features that contributed to Sherlock's success; and (2) the implementation of these features in the PC-based version of the avionics troubleshooting tutor. Author

N90-25964*# Ohio State Univ., Columbus. Cognitive Systems Engineering Lab.
ENROUTE FLIGHT PLANNING: THE DESIGN OF COOPERATIVE PLANNING SYSTEMS Final Report
PHILIP J. SMITH, CHUCK LAYTON, and ELAINE MCCOY (San Jose State Univ., CA.) Jul. 1990 153 p
(Contract NCC2-615; RF PROJ. 767591/722399)
(NASA-CR-186797; NAS 1.26:186797) Avail: NTIS HC A08/MF A01 CSCL 17/7

Design concepts and principles to guide in the building of cooperative problem solving systems are being developed and evaluated. In particular, the design of cooperative systems for enroute flight planning is being studied. The investigation involves a three stage process, modeling human performance in existing environments, building cognitive artifacts, and studying the performance of people working in collaboration with these artifacts. The most significant design concepts and principles identified thus far are the principle focus. Author

N90-25966*# Douglas Aircraft Co., Inc., Long Beach, CA. New Commercial Programs.
STUDY OF HIGH-SPEED CIVIL TRANSPORTS. SUMMARY Final Report
Washington NASA Aug. 1990 53 p
(Contract NAS1-18378)
(NASA-CR-4236; NAS 1.26:4236) Avail: NTIS HC A04/MF A01 CSCL 01/3

A systems study to identify the economic potential for a high-speed commercial transport has considered technology, market characteristics, airport infrastructure, and environmental issues. Market forecasts indicate a need for high speed civil transport (HSCT) service in the 2000/2010 time frame conditioned on economic viability and environmental acceptability. Design requirements focused on a 300 passenger, 3 class service, and 6500 nautical mile range based on the accelerated growth of the Pacific region. Compatibility with existing airports was an assumed requirement. Mach numbers between 2 and 25 were examined in conjunction with the appropriate propulsion systems, fuels, structural materials, and thermal management systems. Aircraft productivity was a key parameter with aircraft worth, in comparison to aircraft price, being the airline-oriented figure of merit. Aircraft screening led to determination that Mach 3.2 (TSJF) would have superior characteristics to Mach 5.0 (LNG) and the recommendation that the next generation high-speed commercial transport aircraft use a kerosene fuel. The sensitivity of aircraft performance and economics to environmental constraints (e.g., sonic boom, engine emissions, and airport/community noise) was identified together with key technologies. In all, current technology is not adequate to produce viable HSCTs for the world marketplace. Specific technology requirements have been identified which was the prime objective of this study. National economic benefits are projected. Author

N90-27672# Federal Aviation Administration, Atlantic City, NJ.
FLIGHT SERVICE AUTOMATION SYSTEM, MODEL 1 FULL CAPACITY, NAS OPERATIONAL TEST AND EVALUATION INTEGRATION TEST PLAN
FRANCES A. MACKUSE and ROBERT F. HAVEL (Data Transformation Corp., Silver Spring, MD.) Aug. 1990 45 p
(DOT/FAA/CT-TN90/4) Avail: NTIS HC A03/MF A01

The overall philosophy and approach for the National Airspace System (NAS) Operational Test and Evaluation (OT and E)/Integration Test of the Flight Service Automation System (FSAS) Model 1 Full Capacity (M1FC) are presented. The M1FC System consists of three subsystems: (1) the Aviation Weather Processor (AWP); (2) the Flight Service Data Processing System (FSDPS); and (3) the Automated Flight Service Station (AFSS). The integration requirements from the NAS Specifications (NAS-SS-1000), which will provide the basis for the OT and E/Integration testing of this particular subsystem, are discussed. This test plan addresses M1FC only, and does not address FSAS end-state interface requirements. The only interfaces to be tested are the Weather Message Switching Center (WMSC) and the

National Airspace Data Interchange Network 1A (NADIN 1A), as outlined in the Master Test Plan (MTP). The M1FC is not designed to satisfy the end-state Area Computer Control Complex (ACCC), Weather Message Switching Center Replacement (WMSCR), National Airspace Data Interchange 2 (NADIN 2), Traffic Management Processor (TMP), or Maintenance Processor Subsystem (MPS) interfaces. These end-state interface requirements are included in the NAS System Specification, and Project Compliance Plans were written stating that these interfaces will be implemented as separate enhancement to M1FC. Author

N90-28599*# Martin Marietta Corp., New Orleans, LA. Manned Space Systems.
LIQUID ROCKET BOOSTER (LRB) FOR THE SPACE TRANSPORTATION SYSTEM (STS) SYSTEMS STUDY. VOLUME 1: EXECUTIVE SUMMARY
Mar. 1989 55 p
(Contract NAS8-37136)
(NASA-CR-183822; NAS 1.26:183822) Avail: NTIS HC A04/MF A01 CSCL 21/8

The feasibility of replacing the Space Transportation System (STS) Solid Rocket Boosters (SRBs) with Liquid Rocket Boosters (LRBs) was studied. Feasibility required acceptable technical risk, program costs, and a program plan which supports STS requirements. Three major goals were identified to direct booster design and operation: increased STS safety and reliability; STS/LRB integration with minimum impact; and increased STS performance. Two booster engine designs were studied. The first engine design was a turbopump-fed engine with state-of-the-art design, and the second was a pressure-fed engine which might provide a lower cost alternative to the pump-fed concept. Both booster concepts were carried through to completion of conceptual design and all system impacts and program costs were identified. Applications for LRB use in the Advanced Launch System (ALS) program were studied using the pump-fed LRB baseline concept and variations on the baseline concept. Support for the Pressure-Fed Booster Test Bed (PFBTB) included test program planning and costs and technical support. Author

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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.

A90-13368*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
THE CASE FOR THE EVOLUTION OF THE SHUTTLE SYSTEM
AARON COHEN (NASA, Johnson Space Center, Houston, TX) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 7 p.
(IAF PAPER 89-200) Copyright

Examining the expendable and reusable space transportation systems currently in use, it appears that the service life of a launch system, with periodic upgrades, can be 30 to 40 years. It is also evident that both reliability and performance increase with flight experience. With a life expectancy of at least 30 years, the Shuttle system is today only in the first third of its potential service life. This paper addresses the issues of why Shuttle evolution is warranted, how the evolutionary process is managed, and how that process can improve system performance and reduce costs. Specific examples of enhancements currently under consideration are presented and discussed in terms of their relationship to the achievement of greater inherent reliability in the Shuttle system. Author

A90-13388#
THE ADVANCED LAUNCH SYSTEM - APPLICATION OF TOTAL QUALITY MANAGEMENT PRINCIPLES TO LOW-COST SPACE TRANSPORTATION SYSTEM DEVELOPMENT
M. G. WOLFE (Aerospace Corp., El Segundo, CA), T. G. ROTHWELL (USAF, Space Div., Los Angeles, CA), M. B. OLIVER (General Dynamics Corp., Space Systems Div., San Diego, CA), and D. A. ROSENBERG (ISX Corp., Thousand Oaks, CA) IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 12 p. refs
(IAF PAPER 89-229)

The Advanced Launch System (ALS) is a joint NASA/DOD program for the development of a vehicle with expanded payload capabilities and improved economics in the post-year 2000 time-frame. The two most significant initiatives being implemented within the ALS program are those of Total Quality Management (TQM) and the Unified Information System, designated 'Unis'; attention is presently given to the former. TQM encompasses a variety of techniques which minimize variability in the design, manufacturing, production, and operation of a system. TQM is being implemented in the current, system-definition phase of the ALS. O.C.

A90-13645#
CRITICALITY MANAGEMENT AND MISSION SUCCESS
RICHARD R. SOLEM IAF, International Astronautical Congress, 40th, Malaga, Spain, Oct. 7-13, 1989. 17 p.
(IAF PAPER 89-620)

Criticality and safety management in ground-based industries is reviewed, and the lessons learned that may benefit space industry are noted. A numerical mission success factor is defined and calculated. It is then demonstrated how dependability requirements can be derived in a systematic manner and through all phases in the development of a space project. A set of criticality management tools for the development and operational phases of a space project is described. The concept of the criticality management vector is introduced, and the establishment of a systems-related criticality index, a systems criticality list, and a corresponding critical items ranking list is also described. B.J.

A90-21659
COMPUTER EXPERIMENTS FOR QUALITY CONTROL BY PARAMETER DESIGN
WILLIAM J. WELCH (Waterloo, University, Canada), TAT-KWAN YU, SUNG MO KANG (Illinois, University, Urbana), and JEROME SACKS (Illinois, University, Champaign) Journal of Quality Technology (ISSN 0022-4065), vol. 22, Jan. 1990, p. 15-22. Research supported by the Semiconductor Research Corp., Joint Services Electronics Program, University of Illinois, and NSERC. refs
(Contract N00014-84-C-0149; N00014-85-K-0357; NSF DMS-86-09819; NSF DMS-87-03802)
Copyright

Taguchi's off-line quality control methods for product and process improvement (Taguchi and Wu, 1979; Taguchi, 1986) emphasize experiments to design quality into products and processes. In VLSI circuit design, computer modeling is invariably quicker and cheaper than physical experimentation. The present approach models quality characteristics generated by the computer simulation as functions of both the engineering and noise parameters. This single experimental design for both types of parameters typically requires far fewer runs. The model is used to predict the quality characteristics, from which loss statistics can also be predicted and optimized. Author

A90-30773
MANAGING QUALITY IMPROVEMENT
JOSEPH L. PONDER (United Technologies Corp., Pratt and Whitney Group, East Hartford, CT) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1475-1479.
Copyright

The reasons behind the quality explosion are discussed, with emphasis on response to the quality imperative. This long-term strategy, now in place, is called Quality Plus (Q+). It stands for quality, productivity, and participative involvement. The Q+ process began three years ago and, as of now, has trained more than 5000 employees, including executives and managers. The first phase involved awareness and the creation of a disciplined structure of teams representing all areas of company business. About 100 teams are now in place, managing all phases of quality improvement activities. The results to date have been excellent. For instance, product scrap and rework has been reduced by more than 50 percent, and a significant amount of waste has been removed by reducing hardware travel time from six miles on the factory floor to a quarter-mile. Processing time for class II engineering changes has been reduced from 180 days to 30 days, and the rejection rate for engineering drawings has been improved by 50 percent. I.E.

A90-30805
IMPACT OF FAULT-TOLERANT AVIONICS ON LIFE-CYCLE COSTS
ANDREI L. SCHOR, FRANK J. LEONG, and PHILIP S. BABCOCK, IV (Charles Stark Draper Laboratory, Inc., Cambridge, MA) IN: NAECON 89; Proceedings of the IEEE National Aerospace and Electronics Conference, Dayton, OH, May 22-26, 1989. Volume 4. New York, Institute of Electrical and Electronics Engineers, Inc., 1989, p. 1893-1899.
(Contract F04606-87-D-0051)
Copyright

The authors examine the effects of a fault-tolerant implementation of a mission-critical avionics function on aircraft life-cycle costs. A triplex redundant architecture is contrasted with a simplex implementation of the same function. The cost analysis used in this study accounts for the major contributors to the cost of ownership. It is shown that an increased mission readiness and a high function reliability during the mission combine to provide a much higher overall mission success level and consequently a significant cost advantage for the fault-tolerant architecture. A fault-tolerant implementation of an avionics function can significantly reduce life-cycle costs by reducing the number of additional aircraft required to achieve desired levels of mission readiness and success. The high fault coverage inherent in such an implementation increases the probability of mission success by reducing the probability of undetected faults prior to the start of the mission and mitigating the effects of faults during the mission. I.E.

A90-31715#
QUALITY - THE OLD AND THE NEW TESTAMENTS
T. J. CARTIN (Northrop Corp., Electronic Systems Div., Anaheim, CA) IN: AIAA/ADPA/NSIA National Total Quality Management Symposium, 1st, Denver, CO, Nov. 1-3, 1989, Technical Papers. Washington, DC, American Institute of Aeronautics and Astronautics, 1989, p. 225-228. refs
(AIAA PAPER 89-3241) Copyright

The approach of Shore (1988) to total quality management (TQM) is described. It involves participation by all organization members in defining structure and methodolgy with the primary emphasis on satisfying the customer. The differences between Feigenbaum's (1983) version of TQM and Shore's are discussed. Consideration is given to the definition of quality, quality planning, acceptable quality level, the manufacturing process, statistical process control, quality costs, corrective action systems, quality training, and supplier quality. I.F.

A90-37440
EQUIVALENT-INSPECTION CONCEPT FOR EVALUATING RADIOGRAPHIC TECHNIQUES
HARVEY E. PECK (Advanced Research Applications Corp., Sunnyvale, CA) Materials Evaluation (ISSN 0025-5327), vol. 48, June 1990, p. 721-724.
(Contract F033615-88-C-5404)
Copyright

A methodology called the equivalent-inspection concept is described that assures a new or proposed inspection technique is equivalent to or greater in value to the manufacturing process than the one it might replace. This concept normalizes the probability of detection of flaws for the entire volume of material inspected by the various nondestructive inspection (NDI) methods. A cost analysis can then be made as a function of the probability of detection. This paper discusses this approach by applying it to a comparison between film radiography, computed tomography (CT), and real-time radiography (RTR). The method is not limited to radiography methods, and it is hoped that other NDI techniques will be normalized by such a procedure before comparing method costs. Author

A90-39987#
POTENTIAL APPLICATION OF AUTOMOTIVE FATIGUE TECHNOLOGY IN ROTORCRAFT DESIGN
PETER J. FURMAN (MTS Systems Corp., Minneapolis, MN) IN: Fatigue methodology III; Proceedings of the AHS National Technical Specialists' Meeting on Advanced Rotorcraft Structures, Scottsdale, AZ, Oct. 3-5, 1989. Alexandria, VA, American Helicopter Society, 1989, 9 p. refs

Recent changes in fatigue design, analysis, and testing techniques for rotorcraft design and testing programs are reviewed. Consideration is given to the ground vehicle development process, durability assessment, and design techniques to ensure durability. Technologies for analyzing and testing durability are discussed, including service loads, laboratory simulations, materials testing, and damage analysis. R.B.

A90-40537#
BURNING RATE CHARACTERIZATION WITH PROGRESSIVE MOTORS
ROBERT L. GLICK and JOHN F. PIETZ (Talley Defense Systems, Inc., Mesa, AZ) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 9 p. Research supported by Talley Defense Systems, Inc. refs
(AIAA PAPER 90-1869) Copyright

A direct, easily implemented computational method for determining instantaneous and time mean burning rates from concurrent chamber pressure and thrust measurements is presented. The methodology applies to motors with and without ignition aids. Applications to a variety of propellants demonstrate results that are reproducible within 0.6 to 2.1 percent of the mean. Author

A90-42490#
A 'NEW' PHILOSOPHY OF STRUCTURAL RELIABILITY, FAIL SAFE VERSUS SAFE LIFE
KENNETH B. AMER (RAND Corp., Santa Monica, CA) Associazione Industrie Aerospaziali and Associazione Italiana di Aeronautica ed Astronautica, European Rotorcraft Forum, 14th, Milan, Italy, Sept. 20-23, 1988, Paper. 15 p. refs

An approach to helicopter design is proposed which combines fail-safe features with enhanced safe-life features and has potential for minimizing or eliminating both weight and cost penalties and reducing the probability of catastrophic failure. In particular, it is shown that the combined fail-safe/enhanced safe-life approach should provide the required 0.999999 reliability against catastrophic failure at no penalty in weight and only a small penalty in cost relative to current procedures. It is recommended that the approach proposed here be considered for all future helicopter developments. V.L.

A90-42817#
ALS - A UNIQUE SYSTEM APPROACH
STEVEN E. SASSO and STEVEN J. ISAKOWITZ (Martin Marietta Astronautics Group, Denver, CO) AIAA, SAE, ASME, and ASEE, Joint Propulsion Conference, 26th, Orlando, FL, July 16-18, 1990. 12 p.
(AIAA PAPER 90-2703) Copyright

The principal features of the Advanced Launch System (ALS) that set it apart from past development work are presented, and

some of the present achievements are discussed. The ALS is a flexible space launch system that is to provide the timely delivery of a wide range of payloads into orbit at a lowered cost. Design of a modular family of vehicles is based on the usage of advanced technology and concurrent engineering as well as operational efficiency. Analytical tools and principles of Total Quality Management, used in a disciplined systems-engineering process, were employed to develop the design approach. R.E.P.

A90-44809
MECHANICAL PROPERTIES OF ENGINEERING CERAMICS - TEST BARS VERSUS COMPONENTS
R. MORRELL (National Physical Laboratory, Teddington, England) IN: Ceramic materials research; Proceedings of the Symposium of the 1988 E-MRS Spring Conference, Strasbourg, France, May 31-June 2, 1988. Amsterdam and New York, Elsevier Science Publishers, 1989, p. 131-137. refs
Copyright

Mechanical properties of engineering ceramics are conventionally determined using test-pieces specially made for the purpose. Since the distribution of both internal and surface defects varies according to the method of manufacture, there is a risk that test-piece data will not be representative of the properties of fabricated components. Statistical extrapolation techniques may therefore not be valid for critical design purposes in which estimates of the risk of failure are made. This paper reviews the problem, and attempts to judge the usefulness of test-piece data for both quality control and design purposes. Developments in standardized mechanical testing are discussed. The advantages and difficulties of component testing, including overload proof-testing, are described. Author

A90-45430
CERTIFICATION OF COMPOSITES FOR COMMERCIAL AIRCRAFT
CURTIS R. DAVIES (Gulfstream Aerospace Corp., Savannah, GA) SAE, Aerospace Technology Conference and Exposition, Anaheim, CA, Sept. 25-28, 1989. 12 p. refs
(SAE PAPER 892212) Copyright

The increased use of composites in commercial aviation industry has created increased awareness of the effort required for development of certified structures. The criteria used to certify a structure has increased in complexity for certain requirements and eased in others. This is a result of the continuing use of advanced composites in commercially certified structures. While there is dispute over the extent of future advanced composite applications, it will be required on increasing amounts of commercial aviation structure. Current certification regulations and standard practices, used for compliance to those regulations, are reviewed. This paper is intended to give an overview for the scope of composite certification activity. Author

A90-46927#
THE IMPACT OF TOTAL QUALITY MANAGEMENT (TQM) AND CONCURRENT ENGINEERING ON THE AIRCRAFT DESIGN PROCESS
DANIEL P. SCHRAGE (Georgia Institute of Technology, Atlanta) IN: Vertical Lift Aircraft Design Conference, San Francisco, CA, Jan. 17-19, 1990, Proceedings. Alexandria, VA, American Helicopter Society, 1990, 21 p. refs

In the aerospace industry results from a recent American Institute of Aeronautics and Astronautics (AIAA) quality survey showed a broad-based recognition that quality is a major engineering issue, that basic systems engineering processes as presently practiced need to be improved, that there are significant shortfalls in engineering skills and basic engineering education needed to support quality improvement, and that AIAA as a professional society should get more involved in this issue. This paper will attempt to put in perspective the impact of TQM and concurrent engineering on the aircraft design process and review some of the essential features for successful incorporation. Author

A90-48840#
AGING FLEET STRUCTURES WORKING GROUP ACTIVITIES
T. J. COMERFORD (Boeing Commercial Airplanes, Seattle, WA) AIAA, AHS, and ASEE, Aircraft Design, Systems and Operations Conference, Dayton, OH, Sept. 17-19, 1990. 13 p.
(AIAA PAPER 90-3219) Copyright

Recent incidents involving older aircraft have focused worldwide attention on the safety of the aging jet transport fleet. This paper will provide a brief history of aging fleet activities at Boeing, review the background behind the formation of the aging fleet Structures Working Groups (SWG) and give a status report on their current activities. SWG tasks, as chartered by the industry steering committe (or Airworthiness Assurance Task Force), are to: (1) review service bulletins and make recommendations for mandatory modification; (2) develop an extensive corrosion prevention and control program; (3) review basic maintenance programs; (4) review the supplemental Structural Inspection programs for potential improvements; and (5) assess repair quality as it relates to aging aircraft. All SWG tasks, with the exception of the maintenance program review, are anticipated to result in regulatory actions. The first two tasks are complete and covered by FAA Airworthiness Directives or Notices of Proposed Rule Making. The remaining three tasks have been reviewed and defined by the SWGs and are currently in progress. Author

N90-10027# Boeing Advanced Systems Co., Seattle, WA.
COMPATIBILITY OF FUEL SYSTEM COMPONENTS WITH HIGH DENSITY FUEL Final Report, Apr. 1987 - Jan. 1989
A. F. GRENICH and A. M. JOHNSON May 1989 179 p
(Contract F33615-87-C-2711; AF PROJ. 2480)
(AD-A210381; WRDC-TR-89-2034) Avail: NTIS HC A09/MF A01 CSCL 21/4

Environmental and endurance tests were conducted to evaluate the performance of typical fuel system components when exposed to high density aviation turbine engine fuel. The environment tests simulated the extreme high and low temperatures encountered in hot and cold day missions. The results revealed that the high density fuel (HDF) would not have any fuel boiling or freezing problems but the pump power required for HDF was higher than for JP-4 fuel as was expected and the lower heat capacity of HDF resulted in noticeably higher heat exchanger discharge temperatures. The endurance tests revealed that the HDF would not cause abnormal wear or component leakage. Nothing in the test results suggested that current inputs to fuel system life cycle cost models should be modified if HDF is used. GRA

N90-10139*# General Dynamics Corp., San Diego, CA. Space Systems Div.
LIQUID ROCKET BOOSTER STUDY. VOLUME 2, BOOK 3, APPENDICES 2-5: PPIP, TRANSITION PLAN, AMOS PLAN, AND ENVIRONMENTAL ANALYSIS Final Report
18 May 1988 208 p
(Contract NAS8-37137)
(NASA-CR-183602; NAS 1.26:183602) Avail: NTIS HC A10/MF A02 CSCL 21/8

This Preliminary Project Implementation Plan (PPIP) was used to examine the feasibility of replacing the current Solid Rocket Boosters on the Space Shuttle with Liquid Rocket Boosters (LRBs). The need has determined the implications of integrating the LRB with the Space Transportation System as the earliest practical date. The purpose was to identify and define all elements required in a full scale development program for the LRB. This will be a reference guide for management of the LRB program, addressing such requirement as design and development, configuration management, performance measurement, manufacturing, product assurance and verification, launch operations, and mission operations support. E.R.

N90-10237# Aeritalia S.p.A., Turin (Italy). Direzione Tecnica.
EVALUATION OF TITANIUM CASTINGS FOR AEROSPACE COMPONENTS
G. ARSENTO *In* AGARD, Castings Airworthiness 18 p May

1989
Copyright Avail: NTIS HC A07/MF A01

A significant potential cost saving could be obtained by the introduction of titanium casting in lieu of parts machined from plate or conventional forging. In order to verify the production quality together with the behavior of the cast material and scatter of the results, a complete program of static, fatigue and cut-up tests has been performed. Three different structural components were analyzed in order to obtain a complete characterization of the cast material by dissection specimens and structural tests on full scale components. Parts were obtained using two different casting processes, rammed graphite and lost wax. The results obtained on the titanium cast parts in comparison to the machined ones. Author

N90-10240# Getti Speciali S.p.A., Turin (Italy).
COMBINED ADVANCED FOUNDRY AND QUALITY CONTROL TECHNIQUES TO ENHANCE RELIABILITY OF CASTINGS FOR THE AEROSPACE INDUSTRY
G. P. CAPELLO and M. CAROSSO *In* AGARD, Castings Airworthiness 10 p May 1989
Copyright Avail: NTIS HC A07/MF A01

Aspects of the technological innovation which can contribute, when fully inserted in the productive process, in improving the reliability of castings for use on aircraft are covered. Considered are: the development of processes and the use of means to ensure the absolute repeatability of the critical items with regard to the metallurgical condition of the castings; (mold filing hydraulics and thermal state of the casting; computer assisted management of specific chills; quality of liquid metal; and quenching conditions); and computerized quality control systems which guarantee systematic control of the qualitative conditions of the castings and non-destructive testing systems ensuring an adequate level of reading the internal soundness at acceptable costs (radioscopy linked to image processing systems and high-resolution equipment). Author

N90-10778# Director, Operational Test and Evaluation, Washington, DC.
DIRECTOR, OPERATIONAL TEST AND EVALUATION REPORT FY-88 Annual Report
JOHN E. KRINGS 19 Jan. 1989 325 p
(AD-A206784) Avail: NTIS HC A14/MF A02 CSCL 05/1

This is an unclassified version of the FY 1988 Annual Report of the Director, Operational Test and Evaluation. The original, classified version of this report was submitted to the Secretary of Defense and the House and Senate Committees on Armed Services and on Appropriations on 19 January 1989 pursuant to the provisions of Section 138, Title 10, U.S. Code. This unclassified version is published in order to promote wider understanding of the role of operational testing in the development and acquisition of effective and affordable weapon systems. GRA

N90-10872# Air Force Flight Test Center, Edwards AFB, CA.
THE AIR FORCE FLIGHT TEST CENTER FLIGHT TEST SAFETY PROGRAM
KELLY J. ADAMS and MARK R. CRAWFORD *In* AGARD, Flight Test Techniques 10 p Jul. 1989
Copyright Avail: NTIS HC A18/MF A03

The success of the AFFTC flight test safety program is based on: (1) careful attention to the safety planning aspects of testing by each program manager, with thorough review of any applicable formal safety analyses, investigation of more experienced personnel in the subject of test and review of past programs of similar nature for successful and faulty safety planning; (2) management review of the safety aspects, endorsement and approval of every new and modified test program; (3) the establishment of a staff system safety division which facilitates an independent review of every new and modified test program; (4) flexibility in the safety documentation when programmatic changes occur; (5) attention to test disciplines of control room procedures, conduct and communication; and (6) the presence of a Unit System Safety Officer at each project to review the safety documentation for completeness and accuracy. Author

N90-12385*# National Aeronautics and Space Administration, Washington, DC.
WORKING WITH PEOPLE TO IMPROVE PRODUCTIVITY AND QUALITY: A BIBLIOGRAPHY WITH INDEXES, 1984-1988
Oct. 1989 72 p
(NASA-SP-7078; NAS 1.21:7078) Avail: NTIS HC A04 CSCL 05/1

This bibliography contains 253 anotated references to reports and journal articles entered into the NASA scientific and technical information database 1984 to 1988. Author

N90-12386# Oak Ridge Gaseous Diffusion Plant, TN.
THE APPLICATION OF QUALITY ASSURANCE TO ENGINEERING MANAGEMENT
GEORGE J. KIDD, JR. Apr. 1989 11 p Presented at the 2nd International Conference on Engineering Management, Toronto, Ontario, 16-18 Oct. 1989
(Contract DE-AC05-84OT-21400)
(DE89-009955; K/QT-282; CONF-891075-1) Avail: NTIS HC A03/MF A01

The need for quality in the products that our industries produce has long been recognized and accepted. In recent years it has also been recognized that the concern for quality must also be applied to the raw materials going into the products and to the processes used to produce them. Only very recently has it been recognized that the same concern for quality must be applied during the engineering processes that precede the manufacturing phase of the product cycle. For this idea to be understood and accepted by the engineering community, it will be necessary to apply these same concepts of quality to the engineering-management function. This paper describes a systems-analysis-based approach of quality assurance that provides a simple, straightforward process for determining which outputs from the various management tasks are significant. It also relates what can and should be tracked and evaluated and who is responsible. The process has four aspects: system description, planning, execution, and evaluation. DOE

N90-12575# Royal Signals and Radar Establishment, Malvern (England).
SOFTWARE FAULT TOLERANCE
L. N. SIMCOX Jun. 1988 33 p Sponsored by the Civil Aviation Authority, London, England
(RSRE-MEMO-4237; BR108878; ETN-89-94842) Copyright Avail: NTIS HC A03/MF A01

The principles of software fault tolerance are presented. Various schemes for achieving it are described. Emphasis is placed on the N-version programming and the recovery blocks schemes. The areas of research include reliability modeling, version independence, and system simulation. A description of the use of software fault tolerance in aerospace applications is given. The cost effectiveness is addressed. The potential benefits to air traffic control systems are identified. Areas where further study and research are desirable, are indicated. ESA

N90-13383# RAND Corp., Santa Monica, CA.
A NEW VIEW OF WEAPON SYSTEM RELIABILITY AND MAINTAINABILITY: EXECUTIVE SUMMARY Interim Report
J. R. GEBMAN, D. W. MCIVER, and H. L. SHULMAN Jan. 1989 27 p
(Contract F49620-86-C-0008)
(AD-A213282; RAND/R-3604/1-AF) Avail: NTIS HC A03/MF A01 CSCL 15/5

The final results of the project Methods and Strategies for Improving Weapon System Reliability and Maintainability conducted within RAND's Project Air Force Resource Management Program are summarized. This project, sponsored by the Air Force Special Assistant for Reliability and Maintainability, examined tactical aircraft weapon systems. The Air Force Special Assistant for Reliability and Maintainability and The RAND Corporation jointly

developed the research plan that called for RAND to develop methods and strategies for improving weapon system reliability and maintainability (R and M). GRA

N90-13436*# Computer Sciences Corp., Silver Spring, MD.
ACTIVE RENDEZVOUS BETWEEN A LOW-EARTH ORBIT USER SPACECRAFT AND THE SPACE TRANSPORTATION SYSTEM (STS) SHUTTLE
H. L. HOOPER and J. R. HERRNSTEIN *In* NASA, Goddard Space Flight Center, Flight Mechanics/Estimation Theory Symposium, 1989 p 381-401 Oct. 1989
(Contract NAS5-31500)
Avail: NTIS HC A20/MF A03 CSCL 22/1

Active rendezvous of an unmanned spacecraft with the Space Transportation System (STS) Shuttle is considered. The various operational constraints facing both the maneuvering spacecraft and the Shuttle during such a rendezvous sequence are discussed. Specifically, the actively rendezvousing user spacecraft must arrive in the generic Shuttle control box at a specified time after Shuttle launch. In so doing it must at no point violate Shuttle separation requirements. In addition, the spacecraft must be able to initiate the transfer sequence from any point in its orbit. The four-burn rendezvous sequence incorporating two Hohmann transfers and an intermediate phasing orbit as a low-energy solution satisfying the above requirements are discussed. The general characteristics of the four-burn sequence are discussed, with emphasis placed on phase orbit altitude and delta-velocity requirements. The planning and execution of such a sequence in the operational environment are then considered. Factor crucial in maintaining the safety of both spacecraft, such as spacecraft separation and contingency analysis, are considered in detail. Author

N90-13522# European Space Agency, Paris (France).
PRODUCT ASSURANCE
K. HUEHN *In its* The Hipparcos Mission. Prelaunch Status. Volume 1: The Hipparcos Satellite p 247-250 Jun. 1989
Copyright Avail: NTIS HC A16/MF A03; ESA Publications Div., ESTEC, Noordwijk, Netherlands, 80 Dutch guilders

The procedures and implementation of the product assurance program applied in the Hipparcos satellite development are described. The top level requirements for the product assurance program include: the product assurance management; the quality assurance (hardware); the reliability assurance; the safety assurance; the maintainability and availability assurance; the components selection, procurement, and control; the materials and processes control; and the software quality assurance. Concerning the implementation, the prime contractor's commitments and objectives are detailed. ESA

N90-13687# General Accounting Office, Washington, DC. National Security and International Affairs Div.
ELECTRONIC WARFARE: RELIABLE EQUIPMENT NEEDED TO TEST AIR FORCE'S ELECTRONIC WARFARE SYSTEMS
Aug. 1989 27 p
(AD-A212952; GAO/NSIAD-89-137) Avail: NTIS HC A03/MF A01 CSCL 17/4

The Air Force equips its tactical aircraft with electronic warfare systems such as the ALR-56A radar warning receiver and the ALQ-135 jammer. The receiver alerts the pilot that the airplane is being tracked by enemy radar and the jammer transmits electronic signals to deceive enemy radars. The combat readiness of tactical aircraft and the capability to sustain combat operations has been impaired because of faulty and unreliable test equipment used to identify malfunctions in electronic warfare systems. The Air Force has not adhered to policies requiring that test equipment be developed and deployed simultaneously with electronic warfare systems. To deploy the warfare systems as quickly as possible, the Air Force has not taken steps to assure that the electronic warfare system can be adequately maintained in an operational environment. The Air Force's strategy may result in additional cost and will continue to place combat readiness at risk. In addition, the Air Force cannot perform its maintenance functions without relying extensively on civilian contractor technical assistance, which might not be available during combat operations. GRA

N90-15960*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SAFETY AND CRYOGENIC WIND TUNNELS
EDWARD J. RAY *In* AGARD, Special Course on Advances in Cryogenic Wind Tunnel Technology 18 p Nov. 1989
Copyright Avail: NTIS HC A16/MF A03; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive CSCL 14/2

The Langley 0.3-Meter Transonic Cryogenic Tunnel (0.3-m TCT) was placed in operation at NASA's Langley Research Center in 1973 as the world's first cryogenic pressure tunnel. The 0.3-m TCT can operate from ambient to cryogenic temperatures over an absolute pressure range from about 1 to 6 atmospheres. Three major test section concepts were developed and refined in this unique facility. The 0.3-m TCT is a leader in the development of various cryogenic pressure wind tunnel experimental techniques, instrumentation, control, model technology and safety standards. The safety experience gained is examined. During this period of advanced research, new operating techniques, training policies, and procedures had to be established. The paper deals with the Do's and Don'ts of cryogenic wind tunnel testing. Hazards and safety requirements which are unique to cryogenic testing are discussed. Highlights of experience and lessons learned with the 0.3-m TCT are reviewed. Author

N90-16100# Essex Corp., Westlake Village, CA.
MANPRINT (MANPOWER AND PERSONNEL INTEGRATION) EVALUATION: AN/TRC-170 DIGITAL TROPOSCATTER RADIO SYSTEM Final Report, Oct. 1986 - Jan. 1988
GREGORY S. KROHN and SAMUEL E. BOWSER Jun. 1989 78 p
(Contract MDA903-86-C-0341; DA PROJ. 793)
(AD-A211799; ARI-RR-1524) Avail: NTIS HC A05/MF A01 CSCL 23/2

This document describes the Manpower and Personnel Integration (MANPRINT) Evaluation of the AN/TRC-170 Digital Troposcatter Radio System. The MANPRINT evaluation was conducted in support of the AN/TRC-170 Follow-On Operational Test and Evaluation (FOT and E) by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI). The FOT and E was conducted by the U.S. Army Operational Test and Evaluation Agency (OTEA) at Fort Huachuca, AZ, from September 1986 through January 1987. The purpose of the MANPRINT Evaluation was to identify human factors engineering, system safety, health hazards, training, and manpower factors leading to refinements in the AN/TRC-170 system. The MANPRINT evaluation methodology included structured interviews, on-site observations of operations and maintenance, and measures of task performance times. There were 24 MANPRINT findings involving equipment assembly and disassembly, materials handling procedures, and safety during road marches. GRA

N90-17583# Cranfield Inst. of Tech., Bedford (England).
AIRCRAFT FIRES: A STUDY OF TRANSPORT ACCIDENTS FROM 1975 TO THE PRESENT
A. F. TAYLOR *In* AGARD, Aircraft Fire Safety 19 p Oct. 1989
Copyright Avail: NTIS HC A18/MF A03; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

A further study is being made, on a world-wide basis, of accident summaries and reports together with recent papers on the various aspects of fire safety. The aim is to compare the period since 1974 with the first twenty years of survivable accidents to turbine powered aircraft as presented to the 1975 AGARD Symposium in Rome. While the study is still far from complete it does seem that, although some lessons were learned and improvements were made or are on the way, crashworthiness, fire, and survival remain areas of major concern. Author

N90-17607# Royal Air Force Coll., Cranwell (England).
FIRE RESISTANCE AND BREAKDOWN OF COMPOSITE MATERIALS
K. W. SMITH *In* AGARD, Aircraft Fire Safety 4 p Oct. 1989
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Aspects of cabin fire safety and passenger protective breathing equipment are considered. The use of non-metallic composites in furnishings and structures is examined for advantages and future trends. Test requirements for fire resistance and breakdown are reviewed and suggestions are made in light of past accident experience. B.G.

N90-17697# Commissariat a l'Energie Atomique, Gif-sur-Yvette (France). Centre d'Etudes Nucleaires.
CNES-CEA COMPARATIVE EVALUATION STUDY OF VARIOUS CANDIDATE 20 KWE SPACE POWER SYSTEMS
F. CARRE, E. PROUST, and P. KEIRLE *In* ESA, European Space Power, Volume 1 p 143-149 Aug. 1989
Copyright Avail: NTIS HC A19/MF A03

A preliminary comparison study between radioisotopic, solar, and nuclear space power systems likely to supply 20 kWe in high earth orbit is presented. The criteria considered for this comparison include, launch safety, mass performance, operational reliability, integration with the launch vehicle, and estimated development and recurrent costs. The most promising candidates emerging from the study are the solar photovoltaic generator with AsGa cells and nickel/hydrogen batteries, and the nuclear power system. The major assets of the solar photovoltaic generator relate mainly to the absence of specific risk in case of launch abort and reentry into the atmosphere. The major advantages of the nuclear power system include autonomous operation, large scaling potential, and a recurrent cost estimated at 20 percent of that of an equivalent 20 kWe solar photovoltaic generator. ESA

N90-19009# EG and G Mound Applied Technologies, Miamisburg, OH.
SAFETY ANALYSIS FOR THE GALILEO LIGHT-WEIGHT RADIOISOTOPE HEATER UNIT
ERNEST W. JOHNSON 1990 8 p Presented at the 7th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 7-11 Jan. 1990
(Contract DE-AC04-88DP-43495)
(DE90-007147; MLM-3624-OP; CONF-900109-21) Avail: NTIS HC A02/MF A01

The Light-Weight Radioisotope Heater Unit (LWRHU) will be used on the NASA Galileo Mission to provide thermal energy to the various systems on the orbiter and probe that are adversely affected by the low temperature a spacecraft encounters during a long interplanetary mission. Using these plutonia-fueled sources in 1-W increments permits employment of a single design and provides the spacecraft user the option of how many to use and where to position them to satisfy the proper thermal environment for components requiring such consideration. The use of the radioisotope Pu 238 in these devices necessitates the assessment of postulated radiological risks which might be experienced in case of accidents or malfunctions of the space shuttle or the spacecraft during phases of the mission in the vicinity of the earth. Included are data for the design, mission descriptions, postulated accidents with their consequences, test data, and the derived source terms and personnel exposures for the various events. DOE

N90-19284# Nuclear Utility Services, Inc., Gaithersburg, MD.
SAFETY STATUS REPORT FOR THE ULYSSES MISSION: SUMMARY. GENERAL PURPOSE HEAT SOURCE RADIOSOTOPE THERMOELECTRIC GENERATOR PROGRAM
31 Jan. 1990 25 p
(Contract DE-AC01-87NE-32134)
(DE90-006828; NUS-5238) Avail: NTIS HC A03/MF A01

This document is a condensation of the important features of the Ulysses mission Safety Status Report (SSR). The SSR reports the best information available at this time on the accident and risk analysis for the Ulysses mission. These are ongoing analyses of SRB failure accidents which could alter the results. These updated analyses will be documented in the Final Safety Analysis Report, scheduled for completion in March 1990. Meanwhile NASA requires information on mission risks to support its Environmental Impact Statement and the Interagency Nuclear Safety Review Panel can use the SSR as initial input to its review process. The central estimate (base case) results of this interim risk assessment indicate that none of the postulated accidents of the mission would be expected to result in a health effect (fatal cancer). Calculated maximum radiation doses to individuals for the base case releases are low (in the millirem to tens of millirem range). Probabilities of an accident with a release in the launch area are below one in ten million. Therefore launch area risk to individuals is effectively zero. However, there is a potential, in the event of an accident release, of up to 26 sq. km of land area to require evaluation for the necessity of remedial action because of land contamination exceeding an EPA screening level. DOE

N90-19389*# National Aeronautics and Space Administration, Washington, DC.
AEROSPACE SAFETY ADVISORY PANEL Annual Report
Mar. 1989 105 p
(NASA-TM-101748; NAS 1.15:101748) Avail: NTIS HC A06/MF A01 CSCL 13/2

This report provides findings, conclusions and recommendations regarding the National Space Transportation System (NSTS), the Space Station Freedom Program (SSFP), aeronautical projects and other areas of NASA activities. The main focus of the Aerospace Safety Advisory Panel (ASAP) during 1988 has been monitoring and advising NASA and its contractors on the Space Transportation System (STS) recovery program. NASA efforts have restored the flight program with a much better management organization, safety and quality assurance organizations, and management communication system. The NASA National Space Transportation System (NSTS) organization in conjunction with its prime contractors should be encouraged to continue development and incorporation of appropriate design and operational improvements which will further reduce risk. The data from each Shuttle flight should be used to determine if affordable design and/or operational improvements could further increase safety. The review of Critical Items (CILs), Failure Mode Effects and Analyses (FMEAs) and Hazard Analyses (HAs) after the Challenger accident has given the program a massive data base with which to establish a formal program with prioritized changes. K.C.D.

N90-20092# Range Commanders Council, White Sands Missile Range, NM. Range Safety Group.
FLIGHT TERMINATION SYSTEM BATTERY GUIDELINES
Oct. 1989 20 p
(AD-A217310; RCC/RSG-318-89) Avail: NTIS HC A03/MF A01 CSCL 10/3

This document is intended to be used as a guide for range users requiring a flight termination battery. It will provide the user with guidelines for incorporating technical and safety criteria necessary to describe a power source (battery) which will be compatible with the mission critical needs of a flight termination system (FTS). All batteries used to provide the electrical power for an FTS shall have a proven performance reliability of .999 at the 95 percent confidence level. Performance reliability shall be established through statistically based testing. The battery specification, as a minimum, shall include all of the applicable operational, mechanical, electrical, and environmental characteristics of the FTS. As a final product, any battery to be used with an FTS shall be from those units for which lot-acceptance data is in compliance with the specification and the data evaluation requirements of this document. A quality assurance program, such as MIL-Q-9858, must be invoked in the purchase document and placed in operation concurrent with the qualification program so as to allow its assessment prior to beginning production. GRA

N90-20257# Lawrence Livermore National Lab., CA.
HIGH-EXPLOSIVES APPLICATIONS FACILITY (HEAF)

J. L. MORSE, comp. and R. C. WEINGART, comp. Mar. 1989 300 p
(Contract W-7405-ENG-48)
(DE90-008122; UCID-21864) Avail: NTIS HC A13/MF A01

This Safety Analysis Report (SAR) reviews the safety and environmental aspects of the High Explosives Applications Facility (HEAF). Topics covered include the site selected for the HEAF, safety design criteria, operations planned within the facility, and the safety and environmental analyses performed on this project to date. Provided in the Summary section is a review of hazards and the analyses, conclusions, and operating limits developed in this SAR. Appendices provide supporting documents relating to this SAR. This SAR is required by the LLNL Health and Safety Manual and DOE Order 5481.1B(2) to document the safety analysis efforts. The SAR was assembled by the Hazards Control Department, B-Division, and HEAF project personnel. This document was reviewed by B Division, the Chemistry Department, the Hazards Control Department, the Laboratory Associate Director for Administration and Operations, and the Associate Directors ultimately responsible for HEAF operations. DOE

N90-20260# Lawrence Livermore National Lab., CA.
A GUIDE TO PERFORMING AND DOCUMENTING SAFETY ANALYSES
EDWARD J. HALLINAN Feb. 1989 89 p
(Contract W-7405-ENG-48)
(DE90-008687; LLNL-M-243-VOL-1) Avail: NTIS HC A05/MF A01

Safety analysis has been one of the most volatile technical fields in recent times. In fact, some have questioned whether it qualifies as a technical field. Controversies have arisen because: safety analysis results are prophesies and not exact predictions; most of the results are qualitative rather than quantitative; exact quantitative criteria for comparison are scarce. Terms such as unlikely for event frequency and major for consequences are frequently used. These terms are hard to define and assess; data for predictions is also scarce, may not exactly apply, and is subject to large uncertainties; most accidents can involve human errors, and human response cannot be accurately estimated; safety analysis is a relatively new field with ever-changing rules and requirements; relatively few personnel were trained in safety analysis techniques and have operations experience, both in the organizations that perform the safety analyses and those that regulate how safety analyses are to be done; safety analysis budgets are usually controlled by line organizations that must also design, build, and operate the facility. Line organizations usually perceive such safety analysis costs as nonproductive and thus provide only minimum funding; in general, radiological impacts are overemphasized, and nonradiological impacts are superficially treated. This leads to inconsistencies in analyzing and designing against hazards; and safety analyses are not performed, reviewed, or documented consistently throughout the U.S. Department of Energy (DOE) complex. DOE

N90-20413# Oak Ridge National Lab., TN.
RESEARCH AND DEVELOPMENT QUALITY ASSURANCE PLANNING
PAUL B. HOKE 14 May 1990 6 p Presented at the 1990 American Society for Quality Control Congress, San Francisco, CA, 14 May 1990
(Contract DE-AC05-84OR-21400)
(DE90-003687; CONF-900566-1) Avail: NTIS HC A02/MF A01

Planning for quality assurance (QA) in research and development (R and D) is like stealing eggs without waking up the chickens. The QA program should be as unobtrusive as possible. Researchers require a QA program that affords them an environment capable of supporting repeatable experiments with accurate data without unduly stifling their creative abilities. Careful advance planning ensures that the intensity of control provided by quality-related systems is commensurate with the importance and scope of the activities being performed. Good scientific practices applied to small bench-scale projects may require minimal additional controls. As projects increase in size and complexity the controls imposed through planning must, by necessity, be increased. Research and development QA planning, just like any other planning, involves all affected individuals. The application of control systems is determined by factors such as customer or sponsor requirements, the importance of an item or activity to the experiment's success, and the organizational complexity of the project. Many larger experiments are highly dependent on quality-related support activities such as calibration, engineering design, and inspection provided by organizations outside the R and D group. DOE

N90-21530# National Inst. of Standards and Technology, Gaithersburg, MD. National Computer Systems Lab.
SOFTWARE VERIFICATION AND VALIDATION: ITS ROLE IN COMPUTER ASSURANCE AND ITS RELATIONSHIP WITH SOFTWARE PROJECT MANAGEMENT STANDARDS Report, Jul. 1988 - May 1989
DOLORES R. WALLACE and ROGER U. FUJII (Logicon, Inc., San Pedro, CA.) Sep. 1989 40 p
(PB90-111691; NIST/SP-500/165; LC-89-600754) Avail: NTIS HC A03/MF A01; SOD HC $2.25 as 003-003-02959-9 CSCL 09/2

How the software verification and validation (V and V) methodology and V and V standards provide a strong framework for developing quality software is described. First, software V and V is described along with objectives, recommended tasks, and guidance for selecting techniques to perform V and V. The difference is explained between V and V and quality assurance, development system engineering, and user organization functions. It is explained that V and V produces maximum benefits when it is performed independent of development functions and a brief discussion is provided of how V and V benefits change when embedded in quality assurance, development systems engineering, and user organizations. An analysis of two studies of V and V's cost effectiveness concludes that cost benefits of V and V's early error detection outweigh the cost of performing V and V. Author

N90-23372# Army Aviation Systems Command, Saint Louis, MO.
PEACETIME REPLACEMENT AND CRASH DAMAGE FACTORS FOR ARMY AIRCRAFT Final Report, 1975 - 1988
ROBERT L. BENSON May 1989 90 p
(AD-A218544; USAAVACOM-TR-89-F-2) Avail: NTIS HC A05/MF A01 CSCL 01/2

Army aircraft mishaps are among the highest concerns of Army management. The Army invests significant amounts of money into training aviators. The Worldwide Aviation Logistics Conference (WALC) meets annually at the U.S. Army Aviation Systems Command (USAAVSCOM) in St. Louis, Missouri. One of the issues that the WALC addresses is safety. The WALC uses factors to assess probable accident rates for proposed flying levels. The Peacetime Replacement Factor (PTRF) relates flying hours to the expected number of aircraft losses. The Crash Damage (CD) Factor relates flying hours to the expected number of crash damaged aircraft. Flying hours are expressed in a per 100,000 basis. Annual updates are made to these factors by the Operational Systems Analysis Division of the Directorate for Systems and Cost Analysis at AVSCOM. GRA

N90-23861*# National Aeronautics and Space Administration, Washington, DC. Div. of Life Sciences.
STRATEGIC IMPLEMENTATION PLAN
Apr. 1989 46 p
(NASA-TM-102907; NAS 1.15:102907) Avail: NTIS HC A03/MF A01 CSCL 06/3

The Life Science Division of the NASA Office of Space Science and Applications (OSSA) describes its plans for assuring the health, safety, and productivity of astronauts in space, and its plans for acquiring further fundamental scientific knowledge concerning space life sciences. This strategic implementation plan details OSSA's goals, objectives, and planned initiatives. The following areas of interest are identified: operational medicine; biomedical research; space biology; exobiology; biospheric research; controlled

ecological life support; flight programs and advance technology development; the life sciences educational program; and earth benefits from space life sciences. J.P.S.

N90-24660*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
UNIQUE FAILURE BEHAVIOR OF METAL/COMPOSITE AIRCRAFT STRUCTURAL COMPONENTS UNDER CRASH TYPE LOADS
HUEY D. CARDEN May 1990 32 p
(NASA-TM-102679; NAS 1.15:102679) Avail: NTIS HC A03/MF A01 CSCL 20/11

Failure behavior results are presented on some of the crash dynamics research conducted with concepts of aircraft elements and substructure which have not necessarily been designed or optimized for energy absorption or crash loading considerations. To achieve desired new designs which incorporate improved energy absorption capabilities often requires an understanding of how more conventional designs behave under crash type loadings. Experimental and analytical data are presented which indicate some general trends in the failure behavior of a class of composite structures which include individual fuselage frames, skeleton subfloors with stringers and floor beams but without skin covering, and subfloors with skin added to the frame-stringer arrangement. Although the behavior is complex, a strong similarity in the static/dynamic failure behavior among these structures is illustrated through photographs of the experimental results and through analytical data of generic composite structural models. It is believed that the thread of similarity in behavior is telling the designer and dynamists a great deal about what to expect in the crash behavior of these structures and can guide designs for improving the energy absorption and crash behavior of such structures. Author

N90-24725# Letterman Army Inst. of Research, San Francisco, CA. Div. of Ocular Hazards.
FIELD EVALUATION OF LASER PROTECTIVE EYEWEAR Report, Jun. - Aug. 1989
GEORGE R. MASTROIANNI, JEFFREY D. GUNZENHAUSER, DAVID A. STAMPER, KATHRYN H. M. KNUDSON, and BRUCE E. STUCK Oct. 1989 57 p
(AD-A221324; LAIR-445) Avail: NTIS HC A04/MF A01 CSCL 05/8

A group of seventy soldiers at the National Training Center were issued Ballistic and Laser Protective Spectacles (B-LPS). The soldiers were surveyed after 90 days of B-LPS use, and again after 180 days. A pencil and paper inventory addressing durability, compatibility, and acceptability was administered at both 90 and 180 days; in addition, a photographic analysis of fit was performed at the 90 day point. Results indicated good overall acceptability and excellent durability. Problem areas were identified as susceptibility to abrasion from dust, lack of protection against blowing dust, and incompatibility with the PASGT (Kevlar) and Combat Vehicle Crewman (CVC) helmets. Recommendations for design changes are suggested. GRA

N90-24974*# Houston Univ., TX. Dept. of Applied Mathematical Sciences.
A BAYESIAN APPROACH TO RELIABILITY AND CONFIDENCE Final Report
RON BARNES *In* Texas A&M Univ., NASA/ASEE Summer Faculty Fellowship Program-1989, Volume 1 11 p Dec. 1989
Avail: NTIS HC A09/MF A02 CSCL 14/4

The historical evolution of NASA's interest in quantitative measures of reliability assessment is outlined. The introduction of some quantitative methodologies into the Vehicle Reliability Branch of the Safety, Reliability and Quality Assurance (SR and QA) Division at Johnson Space Center (JSC) was noted along with the development of the Extended Orbiter Duration--Weakest Link study which will utilize quantitative tools for a Bayesian statistical analysis. Extending the earlier work of NASA sponsor, Richard Heydorn, researchers were able to produce a consistent Bayesian estimate for the reliability of a component and hence by a simple extension for a system of components in some cases where the rate of failure is not constant but varies over time. Mechanical systems in general have this property since the reliability usually decreases markedly as the parts degrade over time. While they have been able to reduce the Bayesian estimator to a simple closed form for a large class of such systems, the form for the most general case needs to be attacked by the computer. Once a table is generated for this form, researchers will have a numerical form for the general solution. With this, the corresponding probability statements about the reliability of a system can be made in the most general setting. Note that the utilization of uniform Bayesian priors represents a worst case scenario in the sense that as researchers incorporate more expert opinion into the model, they will be able to improve the strength of the probability calculations. Author

N90-25958# General Accounting Office, Washington, DC. Resources, Community, and Economic Development Div.
AVIATION SAFETY: CONDITIONS WITHIN THE AIR TRAFFIC CONTROL WORK FORCE. FACT SHEET FOR CONGRESSIONAL REQUESTERS
Apr. 1989 131 p
(GAO/RCED-89-113FS; B-222217) Avail: NTIS HC A07/MF A01; also available from GAO, Gaithersburg, MD HC first five copies are free, additional copies $2.00

The complete 1988 questionnaire responses of air traffic controllers, supervisors, and facility managers (the air traffic work force) are compared with those of the air traffic control work force survey done in 1985. The 1985 questions were replicated, and new ones were added. The survey and scope of and methodology are described and the responses to each question are summarized for the air route traffic control centers, which control flights between airports and over oceanic routes; the largest terminals; and the overall combined responses of centers and terminals. The questions and responses address a variety of air traffic issues facing the Federal Aviation Administration (FAA), including, among others, work load, staffing, overtime, training, morale, and system safety. The perceptions of the air traffic work force on these subjects have changed little since the 1985 survey. J.P.S.

N90-25961# Flight Safety Foundation, Inc., Arlington, VA.
SECOND ANNUAL INTERNATIONAL CONFERENCE ON AGING AIRCRAFT
1989 262 p Conference held in Baltimore, MD, 3-5 Oct. 1989 Sponsored by FAA, Atlantic City, NJ
(AD-A222715; DOT/FAA/CT-89/35) Avail: NTIS HC A12/MF A02 CSCL 05/1

This document contains the formal presentations made at the 2nd Annual International Conference on Aging Aircraft. It includes status reports in the areas of transport and commuter aircraft certification, maintenance, research and development, the ATA/AIA airworthiness assurance task force and efforts by NASA. Also included are detailed presentations on the research and development efforts underway and planned in the areas of structural fatigue, loads, corrosion, nondestructive testing/inspection and human factors. GRA

N90-26041# General Accounting Office, Washington, DC. National Security and International Affairs Div.
SPACE TRANSPORTATION: NASA HAS NO FIRM NEED FOR INCREASINGLY COSTLY ORBITAL MANEUVERING VEHICLE
CHARLES REY and JAMES MORRISON Jul. 1990 32 p
(GAO/NSIAD-90-192; B-239570) Avail: NTIS HC A03/MF A01; also available from GAO, Gaithersburg, MD HC first five copies free, additional copies $2.00

The General Accounting Office's (GAO) findings on the Orbital Maneuvering Vehicle (OMV) are described. It was to be a multipurpose space tug used to transport satellites from the space shuttle to other orbits, reboost them when their orbits decayed, retrieve and return them to the shuttle when they malfunctioned, and control their reentry into the atmosphere when their useful lives expired. Subsequent OMV enhancements would enable it to refuel satellites in orbit, perform in-orbit satellite repairs, and rescue

out-of-control satellites. The OMV was to operate initially from the shuttle's cargo bay but would ultimately operate from the Space Station Freedom. OMV was designed to be a free-flying, remotely controlled propulsion stage about 15 feet in diameter and 6 feet thick, that would be carried into orbit inside the shuttle's cargo bay. Once separated from the shuttle, the OMV would be remotely controlled by astronauts working at consoles on earth. GAO found that a firm requirement for the OMV to accomplish the scheduled missions does not exist. Also the estimated cost has greatly increased while the OMV's capabilities have significantly decreased. GAO recommended that the OMV program be terminated, which NASA did following the receipt of GAO's draft report. J.P.S.

N90-26350# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

CHARACTERIZATION OF INSPECTION PERFORMANCE

J. H. HEIDA 7 Nov. 1988 10 p Presented at the 12th World Conference on Non-Destructive Testing, Amsterdam, Netherlands, 23-28 Apr. 1989

(NLR-MP-88068-U; ETN-90-97193; AD-B143051L) Avail: NTIS HC A02/MF A01

For a characterization of inspection performance it is necessary to consider both the Probability Of Detection (POD) of defects in flawed specimens and the Probability Of Recognition (POR) of unflawed specimens. Different aspects of this characterization are discussed. The magnetic inspection results of a test specimen population consisting of about 200 identical aircraft landing gear components are used. It is concluded that for a quantitative characterization of the inspection performance, minimum values for both the POD and POR must be established. A way to visualize the inspection performance is a diagram in which both POD and POR are presented. ESA

N90-26397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

NASA AEROSPACE FLIGHT BATTERY SYSTEMS PROGRAM

MICHELLE A. MANZO and PATRICIA M. ODONNELL 1990 7 p Presented at the 25th Intersociety Energy Conversion Engineering Conference, Reno, NV, 12-17 Aug. 1990; cosponsored by AIChE, ANS, SAE, ACS, AIAA, ASME, and IEEE

(NASA-TM-103237; E-5656; NAS 1.15:103237) Avail: NTIS HC A02/MF A01 CSCL 10/3

The major objective of the NASA Aerospace Flight Battery Systems Program is to provide NASA with the policy and posture to increase and ensure the safety, performance and reliability of batteries for space power systems. The program plan has been modified in the past year to reflect changes in the agency's approach to battery related problems that are affecting flight programs. Primary attention in the Battery Program is being devoted to the development of an advanced nickel-cadmium cell design and the qualification of vendors to produce cells for flight programs. As part of a unified Battery Program, the development of a nickel-hydrogen standard and primary cell issues are also being pursued to provide high performance NASA Standards and space qualified state-of-the-art primary cells. The resolution of issues is being addressed with the full participation of the aerospace battery community. Author

N90-26813# Pratt and Whitney Aircraft, West Palm Beach, FL. Advanced Engineering Operations.

RETIREMENT FOR CAUSE OF THE F100 ENGINE

JOHN A. HARRIS, JR. and M. C. VANWANDERHAM *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference p 515-529 Jun. 1988

Avail: NTIS HC A99/MF E06 CSCL 11/4

Retirement for cause (RFC) is a life cycle management procedure for gas turbine engine components, such as fan, compressor and turbine disks. The procedure enables full use of the safe life inherent in each component, as opposed to arbitrary retirement from service of all components at a calculated low cycle fatigue life. Historically, these components have been retired at the accumulated time (or cycles) where the first fatigue craft in 1000 identical components, all used in an identical manner, could be expected to occur. By definition then, 99.9 percent of these components were being retired prematurely, while they still may have had useful life remaining. The retirement for cause approach is based on fracture mechanics and nondestructive evaluation, and is evaluated economically. The U.S. Air Force recognized the potential of this approach for maintenance life cycle cost savings and began development programs in the late 1970s and early 1980s to reduce the RFC concept to practice. Those programs have been successfully completed. The development and integration of the methodology, its implementation for 23 USAF F100 engine components by the San Antonio Air Logistics Center; and its economic and other benefits are discussed. Author

N90-26843# National Aerospace Lab., Amsterdam (Netherlands).

HIGH PRODUCTIVITY TESTING

J. SMITH, ed., ERICH H. WEDEMEYER, and ANDRE MIGNOSI (Centre d'Etudes et de Recherches, Toulouse, France) *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications p 59-65 Apr. 1990

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Considering investment cost, running cost, operational versatility and flow quality, the present feeling is that a two-dimensional flexible wall test section is a near-optimum solution for production windtunnels, up to high subsonic Mach numbers. For near-sonic test conditions, ventilated walls are still unrivalled. High productivity implies the requirement of continuous testing, i.e., performing measurements while the test conditions are gradually, but continuously, varying in a controlled way. One Step Methods are not by themselves suited for continuous testing. In order to anticipate the ever varying test conditions, the necessary wall adaptation strategy must also to some extent be predictive. Such strategies are presently not well established. Therefore a possible high productivity strategy has been discussed in a somewhat speculative fashion, although supported by a little experimental and numerical evidence. Author

N90-26850# Range Commanders Council, White Sands Missile Range, NM.

SPACE TEST RANGE Special Report

JAMES MEANS Dec. 1989 33 p

(AD-A223259) Avail: NTIS HC A03/MF A01 CSCL 14/2

This briefing reviews the total Space Test Range concept and reminds the Range Commanders that because the Space Test Range is a global concept supported by all three services, they are all involved in it. I was selected to give the briefing because I had initiated the original concept, had the most experience in its evolution, and was currently serving as chairman of the Space Panel of the Multi-service Test Investments Review Committee (MSTIRC). This briefing reviews the need for the Space Test Range, examines the Test Resource Master Plan (TRMP) concepts, investigates the service proposals that were submitted to the Space Panel of the MSTIRC, shows the results of the MSTIRC review, and presents my bottom line concerns. GRA

N90-27671# Federal Aviation Administration, Atlantic City, NJ.

THE MODE S OPERATIONAL TEST AND EVALUATION/INTEGRATION TEST PLAN

EDWARD MANCUS Aug. 1990 223 p

(DOT/FAA/CT-TN89/51) Avail: NTIS HC A10/MF A02

The Mode Select Beacon System (Mode S) Operational and Integration tests that will be conducted at the Federal Aviation Administration (FAA) Technical Center are presented. These tests will be executed following the performance test baseline data collection effort. Each Mode S terminal and en route test configuration is addressed in conjunction with the associated interfaces which will be required to perform the testing in as near an operational environment as possible. The National Airspace System (NAS) requirements and test objectives can be traced to those designated in the Mode S Master Test Plan. In addition to providing requirements traceability, this plan contains a description

of the tests which will be executed, associated success criteria, roles and responsibilities of test personnel, and the overall flow of activities required for a successful test program. Author

N90-27709# Pratt and Whitney Aircraft of Canada Ltd., Longueuil (Quebec). Structures and Dynamics.
LIFE MANAGEMENT PLANNING
K. REZAI and R. N. TADROS *In* AGARD, AGARD/SMP Review Damage Tolerance for Engine Structures. 3: Component Behaviour and Life Management 6 p Jun. 1990
Copyright Avail: NTIS HC A04/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Structural integrity and safe operation of gas turbine engines for commercial aircraft was gained through the application of a life management procedure, which combines state of the art technology from various disciplines of engineering. The core of the process is substantiation of components and their materials for low cycle fatigue/mission life and it is essentially based on Safe Life Approach (SLA) design. Fracture mechanics analyses are also applied in some cases for proper understanding of the behavior of materials susceptible to fatigue crack growth. The life management procedure is discussed. Basic lifing process on the basis of SLA and application of fracture mechanics are also presented. Author

N90-28134# Sandia National Labs., Albuquerque, NM. Photovoltaic Technology Div.
SANDIA'S CONCEPT-90 PHOTOVOLTAIC CONCENTRATOR MODULE
C. J. CHIANG and M. A. QUINTANA 1990 5 p Presented at the 21st IEEE Photovoltaic Specialists Conference, Kissimmee, FL, 21-25 May 1990
(Contract DE-AC04-76DP-00789)
(DE90-012243; SAND-90-1524C; CONF-900542-9) Avail: NTIS HC A01/MF A01

Sandia's CONCEPT-90 module represents a new type of point-focus photovoltaic concentrator module designed for improved safety, reliability, and performance, and for ease of component fabrication and module assembly. These improvements will combine to decrease the cost of electricity produced by this type of concentrator module. Unique features of the CONCEPT-90 module include encapsulated cell assemblies, simple flat components, and integral use of plastics. The first prototype of this module has been made using back-contact silicon concentrator cells and refractive secondary optical elements. This paper describes the approach and the first prototype module, including results from outdoor tests. DOE

N90-28434# General Accounting Office, Washington, DC.
SPACE PROGRAM SAFETY: FUNDING FOR NASA'S SAFETY ORGANIZATIONS SHOULD BE CENTRALIZED
Aug. 1990 16 p
(GAO/NSIAD-90-187; B-239537) Avail: NTIS HC A03/MF A01

The General Accounting Office (GAO) reviewed NASA's safety-related programs to determine whether NASA had established an independent organization with direct authority for these programs throughout the agency, as recommended by the Presidential Commission on the Space Shuttle Challenger Accident. GAO concluded that NASA has implemented the Commission's recommendation to establish separate organizations to oversee Safety, Reliability, Maintainability, and Quality Assurance (SRM and QA) activities. However, because the field center safety organizations are funded primarily by the project offices whose projects they oversee and by headquarters offices that supervise these projects, they do not have the complete independence envisioned by the Commission. GAO did not identify any situations in which the existing funding process had compromised safety programs' effectiveness, but notes that the potential for reduced effectiveness exists, and the safety organizations' oversight functions could be compromised. In addition the safety organizations could be underfunded and their flexibility impaired because they rely on this funding mechanism. GAO recommends that the NASA Administrator modify the processes and procedures for formulating the SRM and QA budget to ensure that SRM and QA activities are funded independently of the programs and activities they are responsible for overseeing, and that the SRM&QA budget be established with the Office of SRM&QA. NASA administrators responded that centralized funding could (1) lead to a lessening of the safety and mission quality responsibilities of the program managers by encouraging them to defer decisions to the Office of SRM and QA; (2) generally diminish the interaction between field center SRM and QA organizations and program offices and affect programs managers' efforts to ensure that the highest priorities are addressed in the budgeting process; and (3) require a significant increase in the SRM and QA staff to properly administer the function. GAO continues to believe that, to ensure independence, funding for these activities should be controlled by the Associate Administrator for SRM and QA and not the project managers. J.P.S.

N90-28700# National Physical Lab., Teddington (England). Div. of Materials Applications.
DEVELOPMENTS IN TEST PROCEDURES FOR HOT-SALT CORROSION OF SUPERALLOYS
S. R. J. SAUNDERS and T. B. GIBBONS *In* AGARD, High Temperature Surface Interactions 8 p Nov. 1989
Copyright Avail: NTIS HC A11/MF A02; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

It is important that the test procedures used to assess the resistance of superalloys to hot salt corrosion should reliably simulate conditions expected in service and the results should be capable of interpretation to provide a prediction of likely long-term behavior. Past experience has shown that the many test methods available have frequently given conflicting measures of alloy performance and intercomparability between test procedures was frequently poor. As a result of extensive research in Europe, much of which was carried out within the COST Project, there is now a better understanding of the critical factors that must be controlled to provide a reliable and reproducible procedure and which gives corrosive attack similar to that encountered in service. In particular, contaminant flux rate was identified as a key parameter. These activities are briefly reviewed and progress towards the definition of a unified test procedure is outlined. Plans for a new international intercomparison, organized under the auspices of VAMAS, to probe the validity of the procedure are described. Author

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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.

A90-12761
THE SPACE FUTURE FORUM - COOPERATION IN SPACE FOR PEACE ON EARTH
Space Science Reviews (ISSN 0038-6308), vol. 50, Aug. 1989, p. 391-522.
Copyright

The texts of the main lectures and discussions at the forum held in Moscow on October 2-4, 1987 are presented, along with summaries of committee reports. The emphasis is on international cooperation and peaceful applications of space technology. Sections are devoted to solar-system studies; space plasma physics; UV, X-ray, and gamma-ray astronomy; cosmology; SN 1987A; the Spectrum-X-Gamma project; radio astronomy from space; space and economics; material science in space; bioastronautics; space and ecology; and space for health. T.K.

A90-17733#
SPACE - TECHNOLOGY, COMMERCE, AND COMMUNICATIONS
JOHN L. MCLUCAS IN: Annual Space: Technology, Commerce and Communications Conference, 2nd, Houston, TX, Nov. 1-4, 1988, Proceedings. Boston, MA, T. F. Associates, Inc., 1988, 30 p.

The factors which contribute to success in commercial space activities are evaluated. Consideration is given to government and private factors, including national policy, the number of users, long-term stability, competition, demand, obsolescence, the number of applications, and cost effectiveness. The conditions which have influence developments in the fields of satellite communications, commercial launch services, remote sensing, and industrial facilities in space are reviewed. R.B.

A90-17811* Resources for the Future, Inc., Washington, DC.
LAUNCH VOUCHERS FOR SPACE SCIENCE RESEARCH
MOLLY K. MACAULEY (Resources for the Future, Inc., Washington, DC) Space Policy (ISSN 0265-9646), vol. 5, Nov. 1989, p. 311-320. Research supported by NASA. refs
Copyright

Consideration is given to the proposed use of space transportation vouchers for space science payloads. The vouchers would be financially backed by the government, and would be issued to researches for redemption on any mode of space transportation. The possible impact of vouchers on the pace of space science and developments in space transportation are examined, focusing on the costs and benefits of vouchers and strategies for designing a voucher program. R.B.

A90-18547
FOR SALE - COMMERCIAL SPACE
JOHN J. EGAN (Egan Group, Washington, DC) Ad Astra (ISSN 1041-102X), vol. 1, Dec. 1989, p. 8-11, 13-15.
Copyright

The current status of commercial space activity is evaluated. Consideration is given to the factors which have influenced the development of commercial space activities. Trends in the communications satellite industry, the launch vehicle industry, remote sensing, and production in microgravity are discussed. The development of a commercial space infrastructure is examined and centers for the commercial development of space are listed. R.B.

A90-18549
SPACE COMMERCE, SOVIET STYLE
JAN GOLDMAN Ad Astra (ISSN 1041-102X), vol. 1, Dec. 1989, p. 24, 25, 27, 28, 30.
Copyright

Soviet commercial space activities are examined. The Glavkosmos agency, which handles commercial launch services and sells and leases Soviet satellites, is described. The commercial applications of crystalline substances grown on the Mir space station are noted. Also, the production of remote sensing imagery and the use of space technology in communications, weather forecasting, and geological surveys are discussed. Consideration is given to economic problems associated with the Buran shuttle program. R.B.

A90-21631
LIABILITY IN AIR AND SPACE LAW
H. A. WASSENBERGH Air Law (ISSN 0165-2079), vol. 14, no. 6, 1989, p. 261-266.
Copyright

Arguments against the introduction of unlimited and absolute liability of air carriers are outlined. It is suggested that an increase in the limits of liability for passengers may be required, but that the higher limit should not be broken unless intent on the part of the carrier to cause damage is proven. R.B.

A90-23646
THE 'OTHER NASAS' - WHERE HAVE THEY GONE?
LORI KEESEY Ad Astra (ISSN 1041-102X), vol. 2, Jan. 1990, p. 14-19.
Copyright

The roles of NASA and the Departments of Commerce and Transportation in space commercialization activities are reviewed, focusing on the relationships between the agencies and the role of the various agencies in determining U.S. space policy. Issues related to governmental vs private development of space activities and issues concerning NASA's program of providing commercial launch services are examined. The Industrial Space Facility, which the Department of Commerce supported as an alternative to the Space Station, is discussed. R.B.

A90-25707#
PUBLIC POLICY MAKING TRENDS IN COMMERCIAL SPACE
STEPHANIE LEE-MILLER (DOT, Office of Commercial Space Transportation, Washington, DC) AIAA, International Communication Satellite Systems Conference and Exhibit, 13th, Los Angeles, CA, Mar. 11-15, 1990. 10 p.
(AIAA PAPER 90-0889)

In the context of current U.S. commercial space policy, the Director of the Department of Transportation's Office of Commercial Space Transportation examines the importance of recognizing that the varied space-related industries in the U.S. are closely interrelated, with important common interests. The paper considers existing government incentives for investment in commercial space, and particularly the commercial launch industry, and discusses the related importance of government incentives to the satellite industry. The value of cooperation between the satellite industry and the launch vehicle industry in capturing future economic opportunities in the U.S. and abroad is emphasized. Author

A90-31775
SPACE DEBRIS: LEGAL AND POLICY IMPLICATIONS
HOWARD A. BAKER (Centre for Research in Air and Space Law, Montreal, Canada) Dordrecht and Boston, MA, Martinus Nijhoff Publishers (Utrecht Studies in Air and Space Law, No. 6), 1989, 186 p. refs
Copyright

A comprehensive study is presented of the technical, statistical, and legal aspects of the problem posed by orbital debris encompassing inactive payloads (20 percent), operational debris (26 percent), fragmentation debris (49 percent), and microparticulate matter (unacertainable, due to the current impossibility of its detection and tracking). If the orbital period of a given object is less than 95 min, natural orbit-decay mechanisms will cause the fragments to decay in a comparatively short time. With longer periods, space debris can constitute an essentially permanent threat to space navigation. Attention is given to jurisdiction and regulatory control over space refuse, as well as to estimates of collision probabilities in LEO, GEO, and geosynchronous transfer orbit. O.C.

A90-38845
NOT-SO-OPEN SKIES
LEONARD S. SPECTOR (Carnegie Endowment for International Peace, Washington, DC) Space Policy (ISSN 0265-9646), vol. 6, Feb. 1990, p. 9-18. refs
Copyright

An evaluation is made of the political consequences of reticence on the part of the French and the Soviets, for reasons of commercial gain and security, respectively, to adhere to the principles of unrestricted access to earth observation satellite imagery from the SPOT and Soyuz spacecraft. This commitment to universal availability of image products has been observed by the U.S.'s Landsat operation from its inception. The ability of Landsat to set the tone on earth observation data-dissemination policies has been undercut by chronic underfunding of the Landsat operator, Eosat, after privatization of this program. While the Eosat and SPOT Image organizations have stated a commitment to unrestricted access, Soyuzcarta refrains from releasing images relating to countries in the 'socialist community', and SPOT Image

has frequently favored large customers over smaller ones in the interest of profit maximization. O.C.

A90-38850
CANADIAN SPACE POLICY
JOHN KIRTON (Toronto, University, Canada) Space Policy (ISSN 0265-9646), vol. 6, Feb. 1990, p. 61-71. refs
Copyright
Canada's geography made it an early leader in the development of space technology, and generated a civilian-oriented, terrestrially focused space program with a strong focus on communications and an increasing emphasis on transferring space technology and activity from the government to the private sector. During the 1980s Canada's space program has strengthened and broadened measurably; it now contains major projects in earth observation and robotics, as well as communications, and has diversified its international partnership from the U.S. to Europe. However, persisting weaknesses in launch capability, space science, and military space programs, and the dependence of all three current major projects (Msat, Radarsat, and the International Space Station's Mobile Servicing System) on the U.S. represent potential vulnerabilities which require national investments and expanded international affiliations if they are to be offset. Author

A90-40522
AIRCRAFT LIENS UNDER ENGLISH LAW
GRAHAM S. MCBAIN Air Law (ISSN 0165-2079), vol. 15, April 1990, p. 79-86. refs
Copyright
The nature and order of priority of liens on aircraft under English common law are reviewed. The evolution of law on liens is briefly characterized, and the nonapplicability of analogies to maritime law is indicated. The order of priority is found to be (1) statutory rights of detention, (2) contractual lien, (3) possessory lien (unless a salvage lien arose prior to possession), (4) salvage lien, (5) registered mortgages (in order of registration), and (6) unregistered mortgages. T.K.

A90-42660
COMMERCIAL UTILIZATION OF SPACE: AN INTERNATIONAL COMPARISON OF FRAMEWORK CONDITIONS
MICHAEL HARR (Battelle Institut, Frankfurt am Main, Federal Republic of Germany) and RAJIV KOHLI (Battelle Memorial Institute, Columbus, OH) Research supported by the Bundesministerium fuer Wirtschaft. Columbus, OH, Battelle Press, 1990, 173 p. refs
Copyright
The regulations governing commercial space activities in the U.S., Japan, France, Italy, the UK, and the FRG are surveyed, along with the applicable ESA regulations, in an updated version of a report submitted to the FRG Minster of Economics in June 1987. The major areas covered are (1) satellite-based terrestrial remote sensing and (2) microgravity applications. Consideration is given to the value and significance of (1) and (2), general requirements for space ventures, economic considerations, legal and political issues, organizational and institutional infrastructures, and specific conditions for (1) and (2) in the countries. Diagrams, graphs, and comparative tables are provided. T.K.

A90-43365
THE MILITARIZATION OF SPACE
JEFF KINGWELL (CSIRO, Office of Space Science and Applications, Dickson, Australia) Space Policy (ISSN 0265-9646), vol. 6, May 1990, p. 107-111. refs
Copyright
The onset of the Space Age had strong military overtones, but these were restrained by international agreement and the creation of civilian-led agencies such as NASA. Currently, however, a number of developments threaten to seriously undermine the concept of peaceful utilization of space, in particular the Strategic Defense Initiative, anti-satellite weapons research, and the routine intentional destruction of military satellites. There are nevertheless several factors mitigating military influence in space: the arrival of 'non-superpowers' as significant space explorers; greater ecological awareness; the virtual end of the Cold War; reaction against the cost and wastefulness of open-ended military expenditure; and the realization of the comparative efficiency of civil as opposed to military space expenditure in stimulating industry. Author

A90-46928#
PRACTICAL ASPECTS OF EUROPEAN COLLABORATION
R. V. SMITH (Westland Helicopters, Ltd., Yeovil, England) IN: Vertical Lift Aircraft Design Conference, San Francisco, CA, Jan. 17-19, 1990, Proceedings. Alexandria, VA, American Helicopter Society, 1990, 12 p.
This paper reviews the practical issues which arise in international collaboration, based upon the experience of Westland Helicopters Limited. The opportunity is taken to indicate the reasons why collaborative procurement is increasingly considered to be necessary. Cost factors which arise in collaboration are discussed, together with the practical implications of collaboration for the Industrial consortium, national procurement agencies, participating companies, and individual participants. Having laid out the challenges to be expected in a collaborative program, the paper presents a check list of factors which are likely to result in a successful collaboration. The most important of these are considered to be the presence of common commercial interests industrially, and the strength of support to the program from the participating governments. The future strength of the helicopter industry will depend upon its ability to recognize and meet the challenges of collaboration. Author

N90-10906# Joint Publications Research Service, Arlington, VA.
SAGDEYEV DISCUSSES SPACE MISSIONS, POLICY, MARS PLANS
ROALD ZINNUROVICH SAGDEYEV *In its* JPRS Report: Science and Technology. USSR: Space p 69-79 28 Jun. 1989 Transl. into ENGLISH from PRIRODA (Moscow, USSR), no. 1, Jan. 1989 p 33-46
Copyright Avail: NTIS HC A06/MF A01
An indepth interview with Roald Zinnurovich Sagdeyev on space research by PRIRODA correspondent N. D. Morozovaya is presented. Sagdeyev, an academician, is a specialist in the field of plasma physics and space research, chairman of the Soviet Scientists' Peace Committee, hero of Socialist Labor, recipient of the Lenin and State prizes, member of the U.S. National Academy of Sciences, the Swedish Royal Academy, the Max Planck Society and a number of other academies. He headed up the USSR Academy of Sciences' Space Research Institute for more than 15 years. He shares his views on Soviet space missions, policies and Mars mission plans. K.C.D.

N90-12636# Commission on Integrated Long-Term Strategy, Washington, DC. Working Group on Technology.
RECOMMENDED CHANGES IN US MILITARY SPACE POLICIES AND PROGRAMS: A PAPER SUBMITTED TO THE COMMISSION ON INTEGRATED LONG-TERM STRATEGY
CHARLES HERZFELD Oct. 1988 15 p Sponsored by DOD, Washington, DC
(PB89-219364) Avail: NTIS HC A03/MF A01 CSCL 22/1
Recommendations by the Commission on Integrated Long Term Strategy's Working Group on Technology are outlined for revisions in the United States' military space policies and programs. Author

N90-14993# Assistant Secretary of Defense (Public Affairs), Washington, DC.
DOD (DEPARTMENT OF DEFENSE) FREEDOM OF INFORMATION ACT PROGRAM (INCORPORATING CHANGES 1 AND 2)
C. TALBOTT Jul. 1989 84 p
(PB90-104753; DOD-5400.7-R) Avail: NTIS HC A05/MF A01 CSCL 05/2
The regulation provides policies and procedures for the DOD implementation of the Freedom of Information Act, as amended by the Freedom of Information Reform Act of 1986. Due to its

size and complexity, there is no central repository for DOD records. Consequently, the military departments and separate defense agencies operate their own Freedom of Information programs under the policy guidance set forth by the Regulation. The addresses of the military departments and separate defense agencies are in Appendix B; requests for their records should be forwarded to the respective department or agency. Author

N90-15966# Congress of the United States, Washington, DC.
ROUND TRIP TO ORBIT. HUMAN SPACEFLIGHT ALTERNATIVES: SPECIAL REPORT
1989 127 p
(OTA-ISC-419; LC-89-600744) Avail: NTIS HC A07/MF A01

Technologies and systems are examined for transporting astronauts and scientists to and from low-earth orbit, and some of the policy choices that Congress faces in this critical aspect of the U.S. Government's space-program are explained. A variety of ways are analyzed to make the Space Shuttle system safer and more reliable. It also explores several proposed systems to replace the Shuttle early in the next century, and examines proposals for a Space Station crew escape system. Finally, the National Aerospace Plane is discussed, and it is compared with other potential future launch systems. Cargo-only launch vehicles are not examined except insofar as their use may affect the need for crew-carrying launchers. Author

N90-22463# Oak Ridge National Lab., TN.
INTERNATIONAL SCIENCE AND TECHNOLOGY POLICIES: TESTIMONY BEFORE THE SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, UNITED STATES HOUSE OF REPRESENTATIVES
ALVIN W. TRIVELPIECE 4 Apr. 1990 13 p
(Contract DE-AC05-84OR-21400)
(DE90-009416; DOE/OR-21400/T418) Avail: NTIS HC A03/MF A01

This paper reflects testimony before a congressional committee on International Science and Technology Policies. DOE

N90-24868*# Fields (James M.), Silver Spring, MD.
SOCIAL SURVEY FINDINGS ON EN ROUTE NOISE ANNOYANCE ISSUES
JAMES M. FIELDS *In* NASA, Langley Research Center, FAA/NASA En Route Noise Symposium p 227-252 Apr. 1990
Avail: NTIS HC A14/MF A02 CSCL 20/1

Most surveys of residents' reactions to aircraft noise were conducted in the vicinity of airports. The findings in those surveys have supported planning and regulatory actions for the airport noise environment. Now, however, aircraft noise planning and regulations are being considered for a new environment, the en route environment. As policy makers search for bases for public policy in these new noise environments, it is appropriate to ask whether the same scientific evidence which supports airport noise policy can also support en route noise policy. Several aspects of that question are considered. An introduction establishes the scope of the present study and examines alternative study methodologies. Next, the selected study methodology is described and important assumptions are listed. The body of the paper then consists of the findings on en route issues. The final section presents findings on relevant research methods and considers priorities for further research. Author

N90-25016# General Accounting Office, Washington, DC. National Security and International Affairs Div.
SPACE SHUTTLE: CHANGES TO THE SOLID ROCKET MOTOR CONTRACT Report to Congressional requesters
Aug. 1988 11 p
(GAO/NSIAD-88-203; B-229005) Avail: NTIS HC A03/MF A01

Changes to the Space Shuttle solid rocket motor (SRM) contract, made after a Presidential Commission concluded that the SRM caused the Challenger accident, are discussed. The amount of work to be done by Morton Thiokol Incorporated increased significantly due to redesigning the motor joints, making other design changes to enhance the motor's safety and reliability, and incorporating the changes into 13 sets of motors of 2 motors each. The estimated contract costs increased substantially and are expected to go still higher after additional contract changes are negotiated. The basis for determining the fee to be paid was changed from specific cost and performance incentives to more subjective evaluations by NASA of Thiokol's performance in areas such as quality assurance, cost control, and project management. J.P.S.

N90-25017# Committee on Appropriations (U.S. Senate).
DEPARTMENTS OF VETERANS AFFAIRS AND HOUSING AND URBAN DEVELOPMENT, AND INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1990, PART 2
GPO 1990 684 p Hearings on H.R. 2916 before the Committee on Appropriations, 101st Congress, 1st Session, 3-4 Apr., 2-3 May, and 15-16 May 1989
(S-HRG-101-345-PT-2; GPO-92-982) Avail: Committee on Appropriations, Senate, Washington, DC 20515 HC free; SOD HC $20.00 as 552-070-07648-4

Hearings before a subcommittee of the Senate Committee on Appropriations are presented. Included are the verbal and written testimony and the budget estimates for the National Aeronautics and Space Administration for fiscal year 1990. The testimony outlines budgetary information and justifications for expenditures, primarily to continue programs previously approved by the Congress.

N90-25018# Committee on Appropriations (U.S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, 2 MAY 1989
In its Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations for Fiscal Year 1990, Part 2 p 261-307 1990
Avail: Committee on Appropriations, Senate, Washington, DC 20515 HC free; SOD HC $20.00 as 552-070-07648-4

Following the opening statements of the Subcommittee members of the Committee on Appropriations, the National Aeronautics and Space Administration presented its fiscal year 1990 budget. Comments on the various budget items included justifications for space flight, Space Station Freedom, university research programs, space commercialization, space operations, employee training, safety programs and devices, and senior executive pay. Budget cuts, should they occur, will probably result in eliminating the space station which is considered to be the cornerstone of the U.S. program. The U.S.S.R.'s and Japan's space research and development programs were also discussed. J.P.S.

N90-25707# General Accounting Office, Washington, DC. Resources, Community, and Economic Development Div.
TECHNOLOGY TRANSFER: IMPLEMENTATION STATUS OF THE FEDERAL TECHNOLOGY TRANSFER ACT OF 1986. REPORT TO CONGRESSIONAL REQUESTERS
May 1989 52 p
(GAO/RCED-89-154) Avail: NTIS HC A04/MF A01

The implementation of the Federal Technology Transfer Act of 1986 is examined. Technology transfer is the movement of federally owned or originated technology from one organization, area, or purpose to another. The act promotes technology transfer from Federal laboratories primarily by permitting Federal agencies to delegate authority to government-operated laboratories to enter into cooperative research and development agreements with entities in both the public and private sector and by providing Federal employees incentives to promote technology transfer. Information was obtained from 12 Federal agencies and 25 of their laboratories. Key aspects examined included the agencies' delegation of authority to laboratories to enter into cooperative research and development agreements, the number of such agreements entered into, incentives provided to government employees to promote technology transfer, and the status of reports mandated by the act. As of February 1989, the agencies contacted had entered into a total of 172 agreements under the 1986 act,

in addition to agreements some agencies continued to enter into under their respective authorizing acts. Each agency either had distributed or planned to distribute to Federal inventors at least 15 percent of royalties collected. One agency had established a new technology transfer cash awards program. The Department of Commerce has drafted its first, mandated, biennial report on the extent to which Federal agencies have implemented the 1986 act. Each agency with government-operated laboratories is in compliance with its required annual reporting to Congress on technology transfer activities conducted under the act. Because technology transfer activities are hard to evaluate when they are defined differently, reporting criteria are being developed. J.P.S.

N90-26169# General Accounting Office, Washington, DC. National Security and International Affairs Div.
NASA PROJECT STATUS REPORTS: CONGRESSIONAL REQUIREMENTS CAN BE MET, BUT RELIABILITY MUST BE ENSURED
FRANK DEGNAN, KAREN L. KEMPER, and AMY L. MANHEIM Jan. 1990 47 p
(GAO/NSIAD-90-40; B-237602) Avail: NTIS HC A03/MF A01; also available from GAO, Gaithersburg, MD HC first five copies free, additional copies $2.00

Congressional decisionmakers rely on reports in making difficult funding allocation choices. New criteria for biannual Project Status Reports are specified for NASA. A project is defined as meeting the NASA Budget Administration Manual's definition of project and estimated to cost $200 million or more to research and develop. Reports are to be prepared according to mutually agreed upon guidelines, and written as of March 15 and July 30. Following a project's new-start approval, the reports will begin the first March after the project's estimate reaches the cost threshold and end with the report following the project's completion. NASA needs to write its guidelines or specifying responsibilities for developing the reports to ensure that the Project Status Reports using the new criteria are reliable for cost, schedule, and performance information. Current guidance is informal and too vague to ensure accurate, timely, and verifiable information. J.P.S.

N90-26715# Academy of Sciences (USSR), Moscow. Inst. of Space Law.
MIR: A SOVIET SPACE STATION. SOME LEGAL ASPECTS OF INTERNATIONAL COOPERATION
V. S. VERESHCHETIN *In* ESA, Manned Space Stations: Legal Aspects p 51-54 Jan. 1990
Copyright Avail: NTIS HC A10/MF A02; also available from EPD, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

The history of the MIR Space Station is reviewed. Various operational aspects and characteristics of the Space Sation are described. The legal regime for foreign or joint experiments in the Space Station are reviewed. Examples of agreements between the USSR and Austria are presented to illustrate the type of intergovernmental cooperation possible. The need for development of a special agreement on manned space flights to supplement provisions within universal international space law is stressed. ESA

N90-26716# Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.).
THE INTERNATIONAL SPACE STATION: THE LEGAL FRAMEWORK
REINHARD LOOSCH *In* ESA, Manned Space Stations: Legal Aspects p 55 -58 Jan. 1990
Copyright Avail: NTIS HC A10/MF A02; also available from EPD, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

The history of the international Space Station negotiations is summarized. The overall setup of the Space Station agreements is presented. The hierarchy among them and in relation to other international instruments is outlined. Key features in the agreements are given special attention. The issue of peaceful purposes versus national security is given particular attention. The European position in the framework of the agreements is discussed. Letters between the German Ministry for Research and Technology and the U.S. Department of State regarding signing of the final agreements are presented. ESA

N90-26717# European Space Agency, Paris (France). Legal Service.
THE PARTNERSHIP CONCEPT AND INTERNATIONAL MANAGEMENT
K. J. MADDERS *In its* Manned Space Stations: Legal Aspects p 59-61 Jan. 1990
Copyright Avail: NTIS HC A10/MF A02; also available from EPD, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

Donations of authority and reservations of autonomy in international partnerships is discussed. The practical deployment of concessions in relation to management is shown to reveal that cooperation is not a one way street. The factor of complementarity is identified as critical to the understanding of a genuine partnership. The use of the space agreements drawn up in Sep. 1988 as a reference point in undertaking future large scale cooperative projects is discussed. Its possible application to better environmental management on Earth is suggested. ESA

N90-26723# Gantt (J. B.), Washington, DC.
SPACE STATION INTELLECTUAL PROPERTY RIGHTS AND US PATENT LAW
J. B. GANTT *In* ESA, Manned Space Stations: Legal Aspects p 107-114 Jan. 1990
Copyright Avail: NTIS HC A10/MF A02; also available from EPD, ESTEC, Noordwijk, Netherlands, 40 Dutch guilders

The principles governing intellectual property rights associated with Space Station activity are investigated. The article 21 of the Intergovernmental Space Station Agreement (IGA) is given particular attention. The separate provisions required to apportion jurisdiction among the European partner states within ESA are discussed. The status of U.S. as it relates to inventions in outer space is examined and the provisions of pending legislation in implementation of the IGA and clarification of U.S. law are analyzed. ESA

N90-27561# Committee on Appropriations (U.S. House).
DEPARTMENTS OF VETERANS AFFAIRS AND HOUSING AND URBAN DEVELOPMENT, AND INDEPENDENT AGENCIES APPROPRIATIONS FOR 1991. PART 4: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GPO 1990 1319 p Hearings before the Committee on Appropriations, 101st Congress, 2nd Session, 20 Mar. 1990
(GPO-30-861) Avail: Subcommittee on VA, HUD, and Independent Agencies, House of Representatives, Washington, DC 20510 HC free; also available SOD HC $31.00 as 552-070-08441-0

Hearings before a subcommittee of the House Committee on Appropriations are presented along with the budget estimates for the National Aeronautics and Space Administration for the fiscal year 1991. All written testimony and submittals for the record are also included. The budget estimates provide a detailed outline of budgetary information and justification for research and development, for construction of facilities, and for research and program management. J.P.S.

N90-28448*# National Aeronautics and Space Administration, Washington, DC.
LEGAL RAMIFICATIONS OF INTELLECTUAL PROPERTY
ROBERT F. KEMPF *In* JAI Press, Inc., Government Information Quarterly. Volume 7, No. 2: National Aeronautics and Space Administration Scientific and Technical Information Programs. Special Issue p 197-209 1990 Previously announced in IAA as A90-34049
Avail: NTIS HC A07/MF A01; also available from JAI Press, Inc., Greenwich, CT at subscription rates CSCL 05/2

Recent government policy changes that have resulted in encouraging or requiring increased intellectual property rights of Federally funded research and development activities are examined. The reasons for these changes are discussed, including

considerations related to technology transfer, patent rights, copyrights, trade secrets, and computer software issues. The effect of these changes on traditional approaches to the dissemination of Federally funded scientific and technical information is considered and predictions concerning future trends in intellectual property rights are given. Author

N90-29259# Syracuse Research Corp., NY. Science and Technology Policy Center.

STATE SCIENCE AND TECHNOLOGY INDICATORS: AN EXPLORATORY PROFILE AND ANALYSIS Final Report

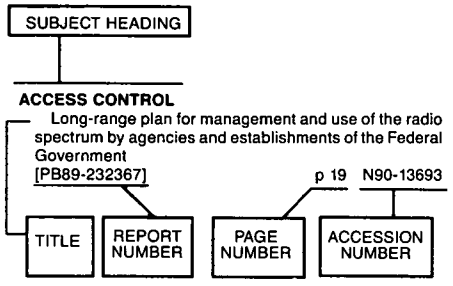
W. HENRY LAMBRIGHT, EVA M. PRICE, and ALBERT H. TEICH (American Association for the Advancement of Science, Washington, DC.) 31 Aug. 1989 148 p

(Contract NSF SRS-87-13477)

(PB90-246711) Avail: NTIS HC A07/MF A01 CSCL 05/1

One of the more significant changes of the 1980s in the relation of government to science and technology (S/T) has been the rise of the states. To better understand the state role, the project has investigated S/T policies in 13 states. The 13 states were selected to include most of the largest states (presumably having much of the country's S/T activity), as well as a few small states, so as to have a more representative sample. The project developed the following indicators of state S/T activity: state-funded research and development, scientific equipment and facilities, technology transfer activities, special science-education initiatives, state competition for national facilities, and S and T-oriented government institutions. Particular attention was given the role of the new S/T agencies and offices. Also examined was the role of more traditional state agencies and organizations in this emerging function of S/T-based economic development. Finally, the project discussed in depth the indicator of state competition for large national facilities, like the Superconducting Super Collider. GRA

Typical Subject Index Listing



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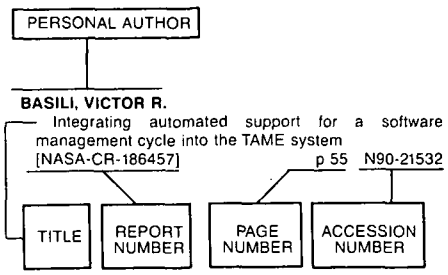

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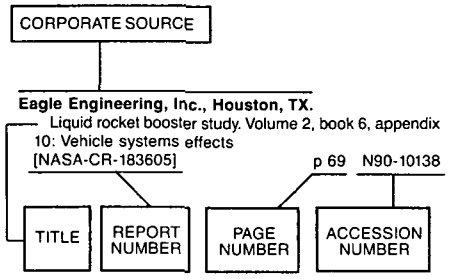

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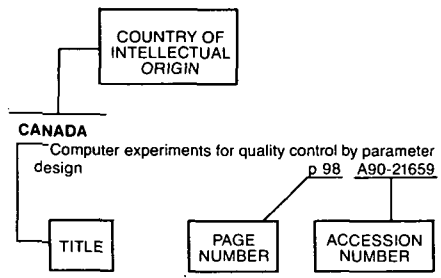

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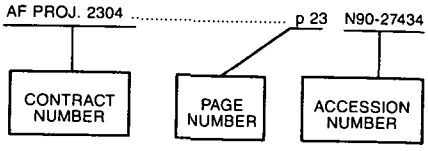

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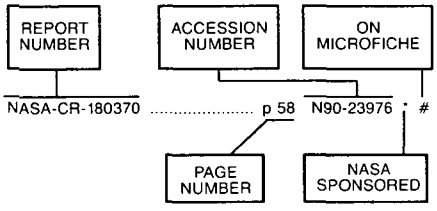

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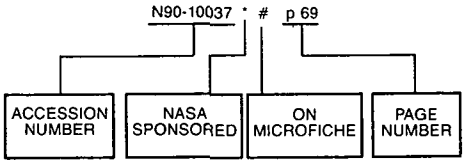

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(313) 833-1409

LIBRARY OF MICHIGAN
Government Documents
P.O. Box 30007
735 E. Michigan Avenue
Lansing, MI 48909
(517) 373-1593

MINNESOTA

UNIVERSITY OF MINNESOTA
Wilson Library
Government Publications
309 Nineteenth Avenue South
Minneapolis, MN 55455
(612) 373-7813

MISSISSIPPI

UNIV. OF MISSISSIPPI LIB.
Government Documents Dept.
106 Old Gym Bldg.
University, MS 38677
(601) 232-5857

MISSOURI

University of Missouri at Columbia Library
Government Documents
Columbia, MO 65201
(314) 882-6733

MONTANA

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA

UNIVERSITY OF NEBRASKA - LINCOLN
Love Memorial Library
Documents Department
Lincoln, NE 68588
(402) 472-2562

NEVADA

UNIV. OF NEVADA-RENO LIB.
Govt. Pub. Department
Reno, NV 89557
(702) 784-6579

NEW JERSEY

NEWARK PUBLIC LIBRARY
U.S. Documents Division
5 Washington Street
P.O. Box 630
Newark, NJ 07101
(201) 733-7812

NEW MEXICO

UNIVERSITY OF NEW MEXICO
General Library
Government Publications/Maps Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
325 Don Gaspar Avenue
Santa Fe, NM 87501
(505) 827-3826

NEW YORK

NEW YORK STATE LIBRARY
Documents Sect. Cultural Educ. Ctr.
Empire State Plaza
Albany, NY 12230
(518) 474-5563

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Davis Library 080A
BA/SS Department Documents
Chapel Hill, NC 27514
(919) 962-1151

NORTH DAKOTA

NORTH DAKOTA STATE UNIVERSITY LIBRARY
Government Documents Dept.
Fargo, ND 58105
(701) 237-8352
In cooperation with Univ. of North Dakota, Chester Fritz Library Grand Forks

OHIO

STATE LIBRARY OF OHIO
Documents Section
65 South Front Street
Columbus, OH 43266
(614) 644-7051

OKLAHOMA

OKLAHOMA DEPT. OF LIBRARIES
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502, ext. 252

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-0489

OREGON

PORTLAND STATE UNIV.
Millar Library
934 SW Harrison - P.O. Box 1151
Portland, OR 97207
(503) 229-3673

PENNSYLVANIA

STATE LIBRARY OF PENN.
Government Publications Section
Box 1601
Walnut St. & Commonwealth Ave.
Harrisburg, PA 17105
(717) 787-3752

SOUTH CAROLINA

CLEMSON UNIV. COOPER LIB.
Documents Department
Clemson, SC 29634
(803) 656-5174
In cooperation with Univ. of South Carolina, Thomas Cooper Library, Columbia

TEXAS

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927 - 1201 Brazos
Austin, TX 78711
(512) 463-5455

TEXAS TECH. UNIV. LIBRARY
Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH

UTAH STATE UNIVERSITY
Merrill Library & Learning Resources Center, UMC-30
Documents Department
Logan, UT 84322
(801) 750-2682

VIRGINIA

UNIVERSITY OF VIRGINIA
Alderman Library
Government Documents
Charlottesville, VA 22903
(804) 924-3133

WASHINGTON

WASHINGTON STATE LIBRARY
Document Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA

WEST VIRGINIA UNIV. LIB.
Government Documents Section
P.O. Box 6069
Morgantown, WV 26506
(304) 293-3640

WISCONSIN

ST. HIST SOC. OF WISCONSIN LIB.
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-2781
In cooperation with Univ. of Wisconsin-Madison, Memorial Library

MILWAUKEE PUBLIC LIBRARY
Documents Division
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3065

WYOMING

WYOMING STATE LIBRARY
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Cheyenne, WY 82002
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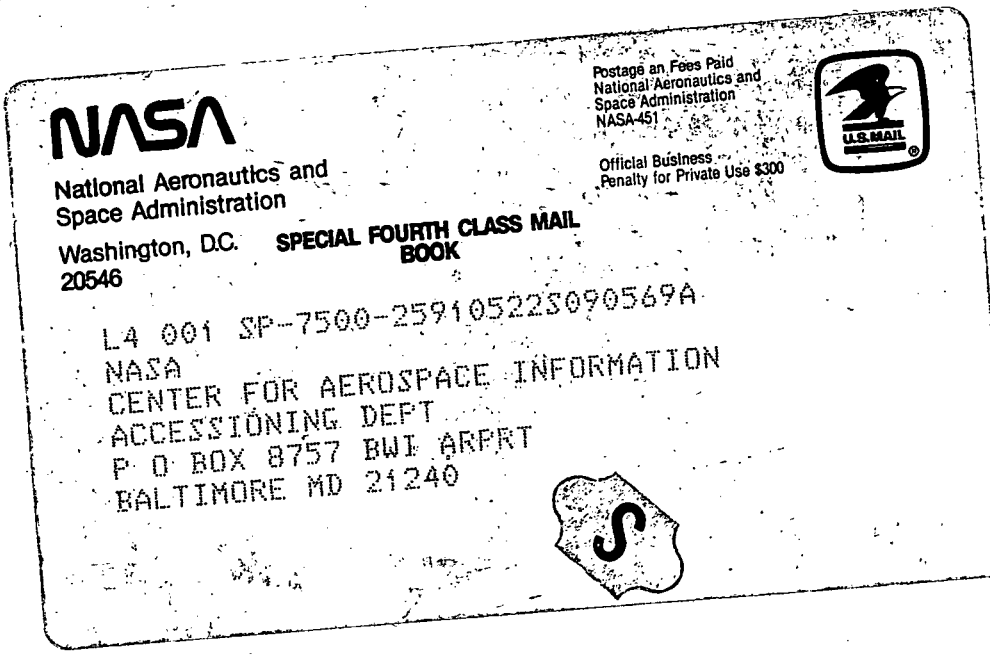

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