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Annual NASA/Contractors Conference on Quality and Productivity (5th). Quality: A Commitment to the Future. Held in Cleveland, Ohio on October 12-13, 1988

(U.S.) National Aeronautics and Space Administration, Cleveland, OH

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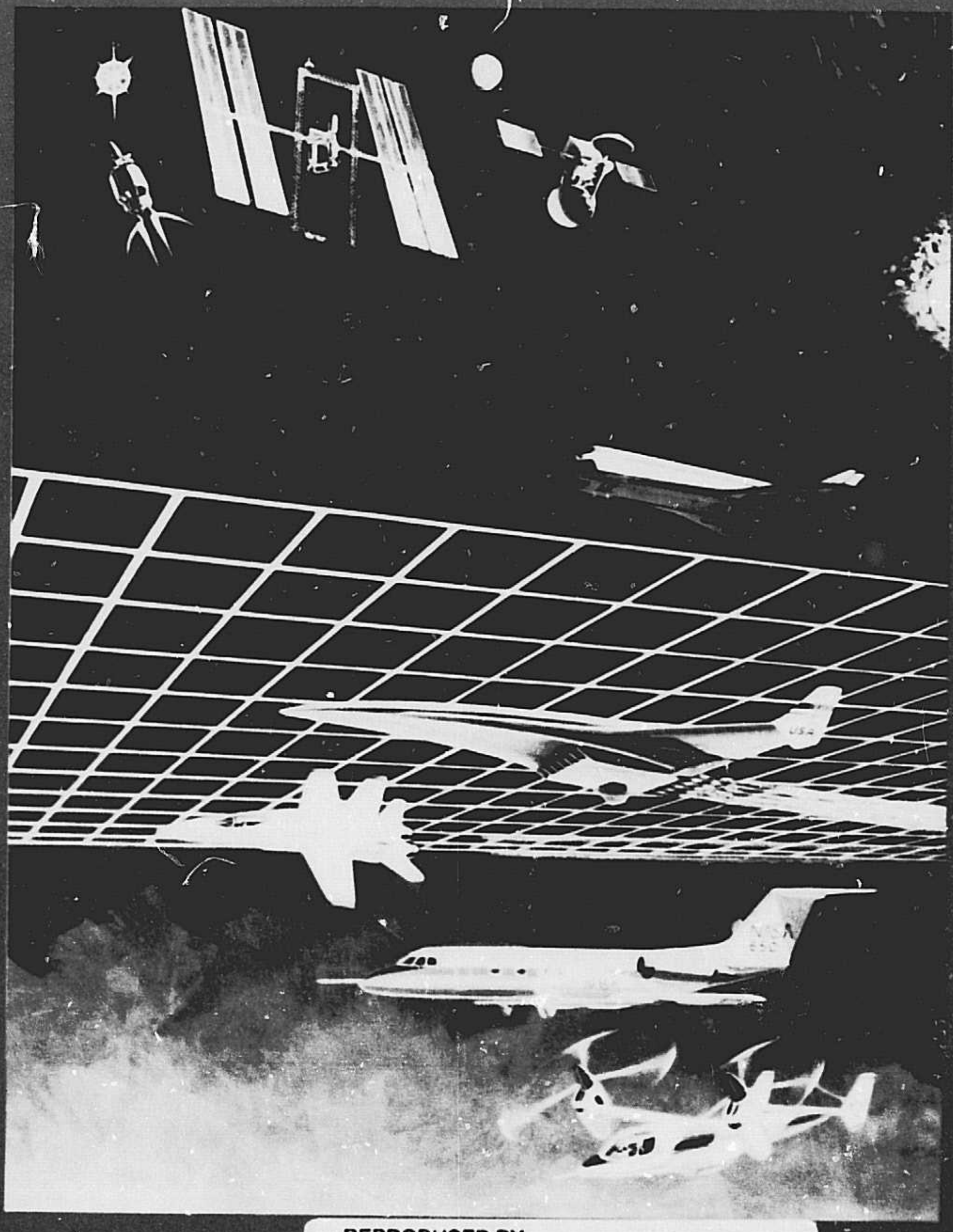
5th Annual NASA/Contractors Conference on Quality and Productivity

"Quality - A Commitment to the Future"

SUMMARY REPORT



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SUMMARY REPORT OF THE FIFTH ANNUAL NASA/CONTRACTORS CONFERENCE ON QUALITY AND PRODUCTIVITY

"QUALITY - A COMMITMENT TO THE FUTURE"

HOSTED BY:

NASA LEWIS RESEARCH CENTER

CLEVELAND, OHIO

OCTOBER 12-13, 1988

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FOREWORD

In the five years since the conception of our first NASA/Contractors Conference, the NASA/contractor team has made major progress toward our common goals. We have awakened a national interest in the importance of high quality and productivity in all aspects of work, and we have emphasized that quality and productivity improvements will drive America's ability to compete successfully in the increasingly competitive world market. To further emphasize quality, we will hold our sixth annual conference during October, which is National Quality Month, and we will announce the recipient or recipients of the NASA Excellence Award for Quality and Productivity at the conference.

The theme of the Fifth Annual NASA/Contractors Conference, "Quality - A Commitment to the Future," echoes an ideal that is shared by NASA and contractors alike. This summary report highlights the key points discussed at the conference. It is our hope that it will be useful to the recipients and serve to strengthen their commitment to quality, productivity, and excellence.

I commend the NASA/contractor team on its diligent efforts toward meeting those goals, for NASA and for America.

James C. Fletcher
Administrator

1.0 NASA's Commitment to Quality

1.1 Introduction

Dale D. Myers, Deputy Administrator, NASA Headquarters

While quality has always been a hallmark of NASA's operation, it assumed new significance after the Challenger accident. Several significant organizational changes were instituted at that point to ensure optimum conditions for all aspects of quality control. At present George Rodney, Associate Administrator for Safety, Reliability, Maintainability and Quality Assurance, reports independently, directly to the Administrator. Increased emphasis is placed on strategic planning, an activity that is led by Richard Reeves, Director of Planning. New technical expertise has been brought into the various NASA centers, and at NASA Headquarters the Management Council is taking a harder look at key issues and costs.

A very beneficial change was made in flight readiness reviews. In the past such reviews were often too remote, not providing direct contact with personnel actually involved in the work. In-person reviews now allow increased communication and a much fuller understanding of pertinent issues. Two other areas of communication are newly stressed: (1) Cross communication between the centers, and (2) communication up and down the organization with civil service and contractors. The following presentations describe in greater detail the key elements of this new emphasis on quality and communication.

1.2 Strategic and Long-Range Planning

Richard A. Reeves, Director of Planning, NASA Headquarters

Strategic and long-range planning are vital to ensuring that NASA maintains its tradition of high-quality products. Such planning is a complex, detailed process that involves input from the entire organization and that must be fully integrated with the Quality and Productivity Improvement Program. Certainly the direction of the agency is much more clearly defined than one would believe from reports carried by the media. A number of very sound plans are in place, they are well documented, and detailed programs are being evolved from them. In many ways the NASA planning activity is a model one, containing a number of unique features and geared to both near-future and far-future goals. There is a growing integration among the various plans, including center plans, which support our technological base and related infrastructure. The intention is to have plans that are elastic enough to allow for necessary near-term adjustments without compromising basic long-term goals.

Although criticisms of NASA planning may be overstated, they indicate that there is still work to be done in the planning area, a large part of which is communication of our vision. In addition to the many established individual plans, we need to develop a comprehensive overall plan, and we need to clearly define the relationships between the plans. Through such a comprehensive approach, our long-term direction can be effectively communicated. In the past, plans have been developed by organizational elements, resulting in many separate plans. These will soon be combined in an Integrated Planning Summary. We have an advantage in that our basic goals and objectives have been in place for some time, they have stood the test of time, and they continue to be valid at this point. Our chief task is now to convey them clearly to the policy makers, the media, and the public.

NASA's most recent planning activities have drawn upon many resources, including Sally Ride's study and the input of some talented new personnel. Newcomers want to be part of the evolving culture, and they are useful for testing the validity of NASA's vision. The planning activity will evolve through consensus, first with NASA management, and then with the Administration. When the comprehensive plan is complete, major themes will be identified and theme targets established to define the best way to achieve an integrated overall approach.

The teaming concept is strong at NASA Headquarters. It is an essential part of strategic and long-term planning, both in terms of drawing upon the resources of the entire work force and of addressing the needs and talents of civil service and contractor employees.

1.3 Quality Commitment

George A. Rodney, Associate Administrator for Safety, Reliability, Maintainability and Quality Assurance, NASA Headquarters

The conference theme, "Quality - A Commitment to the Future," is a challenge both as a matter of personal philosophy and as it translates into leadership. At NASA, quality culture must extend to the full range of operations, including hardware and software development, services, and strategic planning. All phases of the agency's operation must be geared to continuous improvement in light of a single prime consideration, meeting the user's requirements.

This objective is the basis upon which the NASA Office of Safety, Reliability, Maintainability and Quality Assurance (SRM&QA) operates. To achieve it, SRM&QA must have a line of direct access to management, must operate as a tool of a given program (i.e., be useful to the program), and must be supported by adequate resources.

After the Challenger accident, these elements received a great deal of attention. However, now that we have returned successfully to shuttle flight, we can expect a degree of complacency to build up. SRM&QA must guard against such complacency by clearly identifying program risks and making them visible at the appropriate levels of management. Part of doing this involves a long-term build-up of the technical stature of SRM&QA through recruitment of new talent. It is gratifying to see an increasing number of young and senior engineers recognize the tremendous challenges available in SRM&QA because we are very dependent upon a dedicated work force that is fully committed to quality.

Quality assurance of hardware is an area of special concern, particularly in regard to materials certification. These days programs are more sophisticated and we need sophisticated support technology to certify hardware. We know how to assess metallics, but a great deal remains to be learned about non-metallics. Traditionally we have relied upon qualitative assessment, but we now need to develop a method for making a quantitative assessment of risk. In the past we have depended on a multi-series of technical reviews, lessons learned, and engineering judgment. These have served us well, but the projects ahead such as the Space Station, will make new demands on our risk assessment capabilities. In the future we will undoubtedly make greater use of trend analysis, which is a useful tool, although it cannot replace sound engineering judgment. Also, we will need to gear our system so that the right problems are brought to the attention of the right level of management. Great emphasis was placed on this reporting system as we worked to achieve a safe return to shuttle flight; now that has been realized, and we must institute a long-term program that will meet the needs of the many, very expensive, "one-shot" programs scheduled for the near future.

The success of any safety and reliability effort begins with the initial phases of a project, with obtaining the optimum design and engineering. But even in the presence of these elements, we cannot become complacent; and when a failure occurs, the responsibility must always be borne in part by SRM&QA because it shows a deficiency in our process. In SRM&QA we realize many mutual benefits by working closely with contractors. Certainly we depend on industry to make critical upgrades so that together we can realize the ultimate benefit to the work force - the experience of the quality ethic.

Quality and productivity enhancement is not easily prescribed; it is not merely a buzz word or slogan, and it is not realized in a series of uniform systems. It is a perspective that must be flexible and pervasive, continually adjusting to the requirements of a rapidly evolving technology. In order to be first, we must achieve excellence in fact and in perception.

1.4 Risk Management

James R. Thompson, Jr., Director, Marshall Space Flight Center

These are good times at NASA when, after having returned successfully to shuttle flight, we are beginning to make a detailed analysis of the data that were brought back and plan for future flights. It is also a time to reflect over the last $2^1/2$ years and ask ourselves what actions have added value to our programs. Certainly in the future we cannot react as we did to the Challenger accident and continue to maintain the program. The recent downtime was extremely useful for making corrections, but with improved risk management we should not have to experience another such lapse in shuttle flights. Optimum risk management is essential because our missions are very dependent upon how it is handled, especially in the critical area of propulsion in which 90% of the risk exists. Risk can never be eliminated, but we must develop the best possible system to identify it, and we must further formalize the infrastructure of risk management. A number of very effective measures have been instituted over the past 2½ years to maximize our risk management, but we need to continue our efforts to address the evolving technology of the next 20 years of shuttle flights. During this span of time, we will be working with new people and there may be some loss of corporate memory; we need a system of risk management that will enable those of us who are presently involved and those who will be involved in the future to work smarter.

The magnitude of the risk management task can be described in part by projecting the occurrence of top-priority risks, which are referred to as Criticality 1 Risks. Based on our experience to date, we can estimate that in the next 20 years of shuttle flight we will be called upon to address a half million Criticality 1 Risks. Our goal is to achieve 99% reliability in shuttle flights; at present we are at 96% reliability, which is good, but it has to be improved.

In planning ahead for risk management, we must expect that we will be greatly affected by funding constraints. Resources will be increasingly limited, and the loss of a shuttle represents, in addition to the immeasurable loss of human lives, an enormous loss of sophisticated equipment, worth approximately $6 to $7 billion. Hence, the public will rightfully expect that NASA demonstrate excellence in all aspects of risk management. It should be made clear to everyone that risk cannot be eliminated, but that it can be effectively managed.

Special attention should be given to risk management in areas such as those for which there is a history of problems because very few in-flight failures occur without any prior indication of difficulties. Attention must also be given to areas in which nondestructive testing is lacking, some of which will involve the development of new risk assessment technology. Close attention to risk management of the main propulsion system is essential because of its inherent potential hazards. We have the people in place to handle the job, but the process controls and the risk assessment technology must be further developed. Much of this development should not be very costly; but it must occur soon, certainly before the launch of the Hubble Space Telescope. The focus is on the future. This is a time to reexamine our approaches, make appropriate changes, and build upon what we have accomplished so far.

NASA Deputy Administrator Dale D. Myers announces "NASA's Commitment to Quality."

The NASA Panel: (from left to right) Richard A. Reeves, NASA Director of Planning; George A. Rodney, NASA Associate Administrator for Safety, Reliability, Maintainability and Quality Assurance; James R. Thompson, Jr., Director of the Marshall Space Flight Center; Joyce R. Jarrett, Director of NASA's Quality and Productivity Improvement Programs

2.0 Teaming - A Commitment to Quality

2.1 NASA/Contractor Teaming

2.1.1 Managing in Partnership

Richard A. Reeves, Director of Planning, NASA Headquarters

The recent successful shuttle flight is indeed a tribute to the working partnership of NASA and its contractors. In previous NASA/Contractors conferences the importance of this partnership has been discussed, and certainly we have made some good strides in working together. But the time has come to move from partnership rhetoric to partnership reality, a part of which is mutually addressing some of the remaining barriers to teamwork. An example of such a barrier is the archaic civil service/contractor relationship controlled by law and regulation. This is a sensitive issue and not easily resolved; however, I believe there are steps that would facilitate a stronger partnership between the two groups. In the long term, we must seek modifications of the Space Act to eliminate artificial boundaries between civil servants and contractors. In the near-term, we should explore devices such as the Contractor Council that is presently operating at Ames Research Center, which could be used as a model for groups in other areas to foster positive civil service/contractor relationships. Third, a creative brochure should be developed along the lines of one produced by the Ames Research Center to provide a set of practical guidelines and suggestions (do's and don't's) for civil service and contractor personnel.

2.1.2 Productivity Enhancement: A NASA/Contractor Team Effort

Richard R. Holmes, Supervisor, Experimental Manufacturing Techniques, Materials and Processes Laboratory, Marshall Space Flight Center

The Marshall Space Flight Center Productivity Enhancement Facility consists of 21 technology development and process automation cells. The cells were conceived of and equipped by NASA and are staffed by civil service personnel and engineers and technicians representing prime contractors. Most of the productivity enhancement cells are involved with developmental work pertaining to the External Tank, Solid Rocket boosters, and the main engine of the shuttle. The cells are supported by CAD/CAM, kinematic simulation, optical and tactile sensing devices development, advanced robotic processing development, high heat flux testing, hydroproof/hydroburst analysis, and kinematic algorithm down-loading capabilities.

Funding for the effort is not included in the Science and Engineering Directorate budget but is obtained from the Space Shuttle Project Offices on a competitive, return-on-investment basis. For each dollar spent in the facility, 15 dollars are returned from cost savings, cost avoidances, and reduced maintenance costs. An example of the teamwork established in this effort is seen in the development of the backup repair for the shuttle vent valve leak at the PEF, which involved a team of 150 people from NASA, Rocketdyne, Martin Marietta, and USBI.

The facility has resulted in significant technology accomplishments as well as substantial benefits of teamwork and enhanced working relationships.

2.1.3 Building a NASA/Contractor Team for Long Term Mission Support

Michael E. Plett, Program Manager SEAS, System Sciences Division, Computer Sciences Corporation

The recent successful shuttle mission is certainly most gratifying, but a great deal of work remains to build a NASA/contractor team for long-term mission support. We cannot succeed without one another. The problems inherent in building a NASA/contractor team stem from the fact that the relationships tend to be adversarial. Recent increased administrative oversight has resulted in increased overhead costs. Effects of this increased oversight are pervasive; they extend beyond the administrative area and lead to significant barriers in technical interfaces. Another problem exists in the fact that support contracts can be detrimental to productivity. They frequently inhibit innovation by mandating a day-by-day direction that implies lack of trust in the contractor. A part of this results from insufficient long-term planning that clearly identifies what a contractor may and may not do and what is ultimately expected of him. Government and contractor people have equal talent; advantage must be taken of the productive ideas from both groups, or the program will suffer.

Obviously there is a need for mutual trust and respect upon which a team can operate with free exchange of information and a willingness to consider new ideas. Three major areas affect such team building: (1) Personal interactions - contractor management must be encouraged to express their concerns openly; possibly they may be enabled to do so through an award fee based on problem disclosure and resolution; personel interactions might also be enhanced by opportunities for social interaction (e.g., working lunches, NASA-sponsored events); (2) The task order environment - a more direct approach in this area is needed; (3) Changes in the award fee policy - contractors become defensive to protect their fees; if it is perceived that personal service is favored over teamwork, contractors begin to distrust NASA. We all recognize that the administration of award fees is costly, but high awards must be attainable.

In summary, if contractors are willing to be more candid with NASA and if NASA is willing to do less policing of contractors, we will have made a very significant step toward achieving teamwork.

2.2 Contractor/Contractor Teaming

2.2.1 Success in Team Approach

Francis L. Shill, Vice President, Aerospace Division, Pan Am World Services, Inc.

The selection of a compatible teaming partner is vital to the success of a contractor/contractor alliance. Once a workable team is formed, there will be advantages in the proposal preparation as well as in the later stages of contract satisfaction. A good teaming relationship will be at risk if an organization becomes allied with a company with which it is competing elsewhere at the same time. Other impediments to successful teaming are an unsatisfactory interface system and added layers of management with accompanying added costs. A final and overriding prerequisite to teaming is that it must make sense to the customer. The success of a contractor/contractor team basically hinges on a single condition: Unity of purpose.

2.2.2 Space Shuttle - Safe Enough or Too Safe

Allan J. McDonald, Vice President, Engineering, Morton Thiokol

The redesign of the field joint was a team effort in which Marshall Space Flight Center and Morton Thiokol teams worked in parallel with the Marshall team located in Utah. Based on this parallel activity, the best elements of each redesign were adopted. It is interesting to note that the redesign had five to six times more testing than the original design and was accomplished in half the time. Testing took place both at Utah and Huntsville on a test article that was shown to produce the same results as those recorded for the Challenger. Subcontractors were brought in to provide expertise in this effort in which old hardware was modified and new items (such as a joint heater) were added. The J-joint insulation design successfully prevented gas and water from passing through the insulation on STS-26. This redesign has increased the overall reliability of the field joint by a factor of 7000.

In regard to the redesign, an item of interest and possible concern is that the cost of the new O-rings increased by a factor of 10 because of added quality checks (x-rays went from 0 to 100 percent, 1500 laser micrometer measurements as opposed to 15 hand-held micrometer measurements formerly made, and newly instituted resiliency and physical property testing on every O-ring). However, because of the redesign, these new O-rings will probably never come into contact with hot gas. Is this too much safety? At this point the shuttle program must reassess the reliability to determine at what point we are over-inspecting the hardware. The point at which we can back off has yet to be decided. It is clear that concerted teaming efforts can make substantial accomplishments. However, they will reduce the cost competitiveness of the shuttle if we do not eliminate unnecessary reliability. Quality by design is always a better approach than quality by inspection.

2.2.3 Ames Contractor Council - A Success in Contractor Teaming

Libby E. Varty, Site Manager, Bionetics Corporation

For the past 1 $^1/_2$ years the Ames Research Center Contractor Council has brought Ames contractor representatives together to solve common problems and produce mutual benefits. It is geared to excellence in performance and to quality in products and services. It receives strong support from Center management and profits from participation of the Ames Productivity Focal Point who is a member of the group. The group, limited to on-site contractors, represents 55% of all Ames contractor employees, with one vote allowed for each contractor. It meets every other week for 1 $^1/_2$ hours with contractor companies paying for their employees' Council participation. Every six months the Council chairmanship is rotated.

The projects undertaken by the Council include identifying roadblocks to teaming, improving the new employee orientation, developing an Ames services handbook, including contractor yellow pages in the Ames telephone book, and a Productivity Improvement and Quality Enhancement (PIQE) plan geared to contractor employees. The Council's goals for 1989 are to develop a centralized contractor job openings list, an integrated employee suggestion program, and to make the Ames Employee Assistance Program available to contractors. The Ames Contractor Council has been a significant force in the development of team spirit at the Center.

2.3 Space Station Teaming

2.3.1 The Space Station Freedom Associate Contractor Agreement

James M. Sisson, Deputy Director, Space Station Freedom Program

The Space Station Freedom Associate Contractor Agreement structure was initiated to simplify the program integration process. With a multitude of management interfaces between government and contractors, a set of contractor-to-contractor agreements will greatly facilitate communication of information as well as hardware/software deliveries among the development contractors, while maintaining government visibility into this process. These agreements will take the form of negotiated and definitized contract modifications with an appropriate fee structure and performance evaluation criteria. Emphasis will be upon work package commonality, with provision for uniqueness where deemed desirable. The chief benefits are cost avoidance, better use of resources, increased efficiency, and reduced program risks.

2.3.2 Program Support Contract Teaming/Integration

Frederick W. Haise, President, Space Station Program Support Division, Grumman Corporation

The Program Support Contract (PSC) is a team comprised of Grumman Corporation as prime contractor with teammates Ford Aerospace, Booz-Allen and Hamilton, Wyle Laboratories, Inc., Barrios Technology, Inc., and CSAT. The team was formed on the basis of a capabilities review designed to bring together the best match of strengths. Roles and responsibilities were carefully assigned to allow clear accountability, a forum through which each company could express its mission and accomplishments, and elimination of an added overhead burden of tiered-down award fee evaluations. The NASA Award Fee Evaluation is used for all the organizations, and the team has contracted to share a common award fee pool, which enhances teamwork and mutual support.

The team operates as a seamless organization, identified as the Program Support Contractor rather than a group of individual companies. This is exemplified in the fact that a common benefit package was once considered, although it was not enacted because no increase in value would have been realized. All routine functions and meetings involve the entire team, including staff meetings, Horizontal Integration Meetings, Fireside Chats, and an annual picnic. There is one newsletter and a standard PSC viewgraph format and stationery. The telephone directory makes no individual company identification. Award programs are applied to the entire team and all members use the same NASA-PSC badge. The only company-unique function is personnel administration. The teaming effort has resulted in a strong sense of mission, high morale, and performance excellence.

2.3.3 The SSE: Getting a Technological Head Start through Teaming

Richard P. Parten, Executive Vice President, Lockheed Engineering and Sciences Company

The purpose of the Software Support Environment (SSE) program is to provide a single, uniform, flexible software support environment for the Space Station Freedom. Many changes have occurred in this area in recent years. In the early 1970's automated software was not available; implementation of the accelerated technology since then has made teamwork a critical management issue. Software for the Space Station must be flexible enough to meet an expected 30-year lifetime. A key design consideration is to push software development productivity substantially beyond the state of the art. Lockheed's goal of 2,000 developed code lines of software per person per month has proved initially to be somewhat ambitious; however, if half of this amount is realized, it represents a great advance of the state of the art. In fact, the Lockheed system has been so successful that the Department of Defense is looking closely to see what elements of it can be adopted for DOD.

In the overall Space Station effort, five to ten million lines of operation software code will be developed throughout the world. This software must be integrable and testable, and it must meet Freedom's requirements. The SSE must be available early enough to support the work package contractors as they come on board, and an interim system is required 30 days after the contract start. Teamwork from four contractors was required to provide a 75% system at the 30-day time frame. In building this system, both linkage and autonomy were important considerations.

The key element of long-haul teamwork depends on trust relationships rather than legalities. Important elements of building the SSE team were development of an integrated management team, a single badging system, and equal access to equipment and facilities. At Lockheed the performance score flows down to all subcontractors except one. Teaming has made it possible for many companies to be involved in and contribute to NASA activities. It provides a diversified resource base, with long-term benefits to both NASA and its contractors.

2.3.4 Technical and Management Information System (TMIS) Teaming/Integration

R. Peter Dube, Project Manager, Space Station Program's Technical and Management Information System, Boeing Computer Services

The Technical and Management Information System (TMIS) team is a project within the Space Station Program and is composed of personnel from Boeing, the prime contractor, as well as McDonnell Douglas and ORI. The purpose of the TMIS team is to provide an integrated information system with adequate information storage using existing NASA institutional resources. These services are provided to NASA; the work package contractors provide input and output of information. The level of effort goes across task boundaries to maintain team balance; the participating organizations have a shared investment, a common fee pool, and provide copies of their major statements of work to all the other companies. The TMIS contract team is oriented to delivery of services rather than to company affiliations. It has a newsletter, a common employee organization, and is collocated so that it appears to be one company rather than three.

Users are intended to be part of the TMIS team. Information integration planning groups will be established along functional lines composed of Level 1 and

2 management and package personnel, with TMIS team members as non-voting participants. These groups are organized to provide needs and interface requirements to the system. This teaming organization is now in place and functioning well. It exemplifies a unique excellence based upon shared resources and common goals.

Panel A1 - NASA/Contractor Teaming: (from left to right) Michael E. Plett, Computer Sciences Corporation; Richard R. Holmes, Marshall Space Flight Center; Richard A. Reeves, NASA Headquarters; Darrell E. Wilcox, Ames Research Center

Panel A2 - Contractor/Contractor Teaming: (from left to right) Libby E. Varty, The Bionetics Corporation; Allan J. McDonald, Morton Thiokol, Inc.; Francis L. Shill, Pan Am World Services, Inc.; David J. Williams, ColeJon Mechanical Corporation

Panel A3 - Space Station Teaming: (from left to right) R. Peter Dube, Boeing Computer Services; Richard P. Parten, Lockheed Engineering and Sciences Company; Frederick W. Haise, Grumman Corporation; James M. Sisson, NASA Headquarters; Jessie R. Breul, Grumman Corporation

3.0 NASA Excellence Award for Quality and Productivity

3.1 NASA Excellence Award - Hardware

3.1.1 Introduction

Richard M. Davis, Corporate Vice President and President, Manned Space Systems, Martin Marietta Corporation

Less than two weeks ago, America and the world witnessed the most compelling reason to incorporate excellence into every aspect of work at NASA: the launch of the Discovery and America's return to manned space flight. However, this recent success should not dull the realization that without a process or method for reviewing the way we do business, we can invite complacency and the chance for failure.

The NASA Excellence Award provides a process to assess our products and services and an opportunity for improvement, and there is always room for improvement. The companies that have been selected as finalists in this award process are those companies that strive to achieve the goals of excellence, accomplishment, and mission success.

3.1.2 The Total Effort to Achieve Excellence

Richard Schwartz, President, Rocketdyne Division, Rockwell International Corporation

An organization can only achieve excellence in all phases of operation if key management is firmly committed to quality performance and products. At Rocketdyne, vivid demonstrations, such as stopping production lines to check quality, have conveyed this management message to employees. However, communication works both ways. "Speak up; we're listening" is a Rocketdyne forum through which employees can communicate directly with the president of the company. This way everyone shares the responsibility for contributing to productivity improvement.

Rocketdyne has involved its total work force, all levels and all functions, in the commitment to excellence. The program has included a formalized system of goal setting and monitoring for each person on the executive staff, expanded training and recognition programs, PIQE teams that were tasked with implementing change, and a long-term program for automation and computer integration of all functions. Among numerous improvements, the institution of CAD/CAM, robotic welding, and on-machine inspections have been significant in achieving Rocketdyne's quality goals. A Supplier Product Integrity Assessment was introduced as a rigorous review of supplier facilities, as well as a supplier rating system and method of information sharing with suppliers. The review is actually multi-functional, often including Rocketdyne's customers; it is hardware-oriented and is conducted "on the floor." It is gratifying that the program results in higher quality products, reduced costs, enhanced data access and management controls, and improved communication both internally and with outside organizations.

3.1.3 Sustaining Excellence During Reorganization

Peter L. Kujawski, General Manager, Science and Application Programs, General Electric Company

When General Electric and RCA were merged, many challenges were met in combining two different markets and two different work cultures. The resulting reorganization was made along product lines so the functional organizations formed the basis of the merger.

Both GE and RCA had policies that strongly emphasized quality, and the essence of these was retained as a single, simple quality policy. The success of the merger was measured in terms of production (shop defects declined steadily) and interfaces (valuable relationships with suppliers were maintained). A management approach to productivity was developed with a system of establishing goals in view of maintaining a competitive position in the marketplace.

Emphasis was placed upon management training, and quality and productivity was emphasized in material distributed from the division staff. A degree of leverage was achieved by merging corporate resources so that costs to the customer decreased. Attention was given to sustaining programs for employee motivation, a part of which involved having NASA speak directly to the employees on its quality and productivity goals. Noontime briefings by management, provision of fitness facilities, open houses at each site, shuttle buses between locations, and awards programs were all effective in maintaining a high level of employee motivation during the reorganization.

3.1.4 STSD Team Excellence Pays Off

Seymour Z. Rubenstein, President, Space Transportation Systems Division, Rockwell International Corporation

Rockwell International's Space Transportation Systems Division is meeting the challenge of maintaining high quality and reducing costs by involving all personnel in a program geared to team excellence. This program is designed to support the diversity of Rockwell's business activity, and it takes a balanced approach toward excellence, seeking to estabish a center of shared values. It focuses on three basic areas: management involvement, implementation of actions, and acknowledgment of participants. Management takes the lead in initiatives to produce better products and lower costs. Regular reviews are essential in order to measure progress being made in all areas of the organization.

True success of a quality mprovement effort involves participation of the entire organization. At STSD, opportunities are provided for all employees to contribute as individuals or teams in identifying and implementing change to improve operations. Especially effective are the Employee Action Teams, people from a work unit trained in the group problem solving process, who examine their own processes and product for better ways of doing business. These teams have been effectively employed by all division organizations and have demonstrated significant dollar savings.

The challenge of resuming productiion of a Space Shuttle Orbiter after a period of minimum activity has also been addressed by special management actions. Manufacturing/Test Readiness Reviews focus on the preparations in place as specific work milestones are approached. These efforts have prevented problems by assuring that facilities, equipment, work instructions and people fare ready for the work to be done.

An essential part of the process is acknowledgment of accomplishments. Employee recognition takes many forms, from verbal praise and awards to Astronaut presentations and the prestigious Manned Flight Awareness Honoree Award. These provide the positive feedback that encourages continued, increased participation and builds the team spirit that makes the Space Shuttle Orbiter possible.

3.2 NASA Excellence Award - Support Services/Launch Processing

3.2.1 Introduction

I. Jerry Hlass, Director, Stennis Space Center

At Stennis Space Center the pursuit of excellence is a basic theme that underlies the philosophy of building in quality and doing it right the first time. Since Stennis is a Center whose primary product is service, its measure of excellence is in its people. The Quality and Productivity Improvement Program is directed toward technology innovation, management initiatives, and employee motivation and recognition. One important element of the technology innovation effrots at Stennis is development of techniques for monitoring the health of a rocket engine during test firing. Work in this area not only provides increased reliability for shuttle missions, but has resulted in exciting spinoff advances in contaminant detection. Recent management initiatives have included sponsorship of management work retreats, strategic planning, and the inclusion of a quality representative on the Performance Evaluation Board of major contracts. Employee teamwork and motivation are fostered through a variety of interdisciplinary teams. These teams, some of which have a combined government/contractor membership. allow personel with various skills to pool resources in developing a project form concept to the implementation stage. Numerous improvements have been implemented at the Center thorough the teams. Training for performace enhancement has been done utilizing the Investment Excellence Series and has been given to approximately 300 employees. Stennis also has an active recognition program and awards are given to those who make significant contributions in cost savings and improved work processes.

We believe that excellence is possible in support services and that excellence is in the people who perform. It is gratifying to note that five of the eight NASA Excellence Award finalists are support contractors. This is clear evidence that commitment to teamwork results in quality performance.

3.2.2 LSOC Quality and Productivity Through the Use of Advanced Technology

P. Edward Adamek, Lockheed Space Operations Company, Lockheed Corporation

Lockheed Corporation has been involved in a range of initiatives focused on quality and productivity improvement such as laser and voice data tools that measure gap and step dimensions on the orbiter tiles, a low-power laser and scanning device, a voice recognition system, and new applications of video processes. In many cases these new tools have eliminated processes that were cumbersome, time-consuming, and susceptible to human error. In other cases, they greatly extend our capability. This is exemplified in the Cobra borescope, which provides access to many areas of hardware that were once inaccessible. Advanced measurement and analysis techniques afford new degrees of safety and reliability for launches. Lockheed is dedicated to providing the highest quality and greatest value to its customers through increasing quality levels, streamlining work methods, and improving productivity.

3.2.3 LESC's Corporate Culture Empowers Excellence

Robert B. Young, Jr., President, Lockheed Engineering and Sciences Company, Lockheed Corporation

Lockheed Engineering and Science Company is unique in that it is made up of a primarily technical work force, many members of which have advanced degrees. The company's headquarters provides basic policy and oversight, but encourages a large degree of autonomous operation throughout the organization. This type of loose/tight control is based upon a matrix management system with a focus on flexibility to meet the needs of the various customers. Operational autonomy is facilitated by minimizing the number of contracts and work orders.

Three areas of focus are evaluation, compensation, and communication. Preference is given to promotion from within the organization. High levels of training are offered, and there is significant management involvement in the training program. Overall standards for compensation do not exist; these are determined on an individual basis, in consideration with the local environment. The Lockheed culture is a proactive one; there is a great deal of interest in leadership, which at Lockheed is understood to be a particular attitude or method by which one operates. Leadership has no organizational or level limit. It is determined by perspective, language skills (how one relates to the arena of design and structure), and stretch factors (how one makes sense of change and deals with uncertainty). Leaders are people who are able to recognize their risk tolerance and work on the edge of it. Most of our work actions are directed to fulfilling immediate work requirements and, in general, competency is measured by the degree to which these requirements are met. However, excellence is often measured by the amount of action taken on far-sighted, long-range projects.

Team building at Lockheed is accomplished through a combination of NETs and LETs (Lockheed Employee Teams). Many awards are made for team accomplishments through the National Management Association. A sense of team spirit is also fostered through participation in community activities, playing together (including pursuit of well being in company-provided exercise facilities and programs), and periodic social events and celebrations.

The Lockheed program is built on people. Its success is clear evidence of the fact that excellence comes from a commitment to people.

3.2.4 Applying the Q/PIP Process in a Diverse Task Environment

A. B. Gorham, Jr., General Manager, Pan Am World Services, Inc.

The Pan Am World Services effort to build a work ethic into it- organization has been different from that of other companies because of Pan Am's unique environment and its diverse work. Initially, barriers were identified: competition existed between some groups in Pan Am, some groups felt a lack of challenge, and the work force as a whole did not perceive a common mission. In response to the national impetus to increase quality and productivity and the needs of an expanding work force, an incentive fee was added to the contract between Pan Am and NASA.

Three phases of the evolution of the Quality and Productivity Improvement Program (Q/PIP) occurred: (1) pilot period, marked by orientation of management, development of teams, and increasing automation, (2) period of acceptance and refinement, marked by continuous championing of the program, gradual acceptance of Q/PIP principles, and establishment of key relationships, and (3) institutional period marked by expanding self-motivation. In retrospect, it has been noted that three groups of employees were not adequately prepared for conversion to Q/PIP: (1) middle management, which needed more training in Q/PIP principles, (2) supervisors who feared a loss of control, and (3) tenured employees who resisted new patterns. However, as the program got underway, the results in terms of improvement in individual performance were remarkable.

The performance objectives matrix is used very effectively at Pan Am. Currently 40% of the organization is involved in employee teams, with increased incidence of self-managed teams. The program has resulted in significant cost savings as well as immeasurable improvements in employee attitudes. The most valuable assessment of its success is in customer feedback.

3.3 NASA Excellence Award - Mission Services

3.3.1 Introductory Remarks

Dale Compton, Deputy Director, Ames Research Center

Quality evaluation criteria for a research organization such as Ames need to be more clearly understood. Some elements, such as zero defects, may be the same as those applied to a hardware production environment. However, in research it must be acceptable to fail. Hence the quality/productivity improvement effort must be geared to protect the special climate of the research organization.

3.3.2 Managing Quality in a Dynamically Changing Environment

Gerald L. Johnson, Project Manager, Computational Mission Services, Boeing Computer Support Services, Inc.

Boeing Computer Support Services operates at Marshall Space Flight Center to provide computer support for the shuttle missions. This critical activity is affected by a high rate of technological change that makes great demands on the work force. Dealing with change is an ever-present challenge, because as soon as a system is in place, it is not unusual to receive a whole new set of requirements. The key to Boeing's success in this environment is having diverse strategies for attaining quality, all geared to meeting the needs of the customer. Among these strategies are measurement, communication, an integrated decision system, a flexible work force, meaningful recognition systems, and a "total" system view.

The customer-oriented culture is one that seeks continuous improvement (increasing the productivity delivered for the customer's dollar), two-way communication, problem identification (which can save thousands of workhours), delegation down to the lowest possible level, effective teamwork, and involvement of the entire work force. Measurements should be used to track what the customer wants and enable continuous improvement. When uncertainties arise about work processes, the Boeing default option is to measure, which is frequently a very useful way to clarify issues. Requirement definitions developed with great care to maximize full understanding of issues. Problems are fully documented to assure their resolution, and changes in management procedures are made visible to all concerned.

Individual achievement of excellence is linked to involvement of the work force through communication systems, employee development, and recognition initiatives. An executive interview program allows employees to meet annually with the supervisor two levels above to discuss work issues. Daily 15-minute stand-up meetings are held each morning to brief the work force on the status of the program.

This total program of varied elements has enabled Boeing to meet demanding customer requirements and make substantial contract cost savings.

3.3.3 Are You Smarter Today Than Yesterday?

Jerry Barsky, Deputy Program Manager, Network and Mission Operations Support, Bendix Field Engineering Corporation

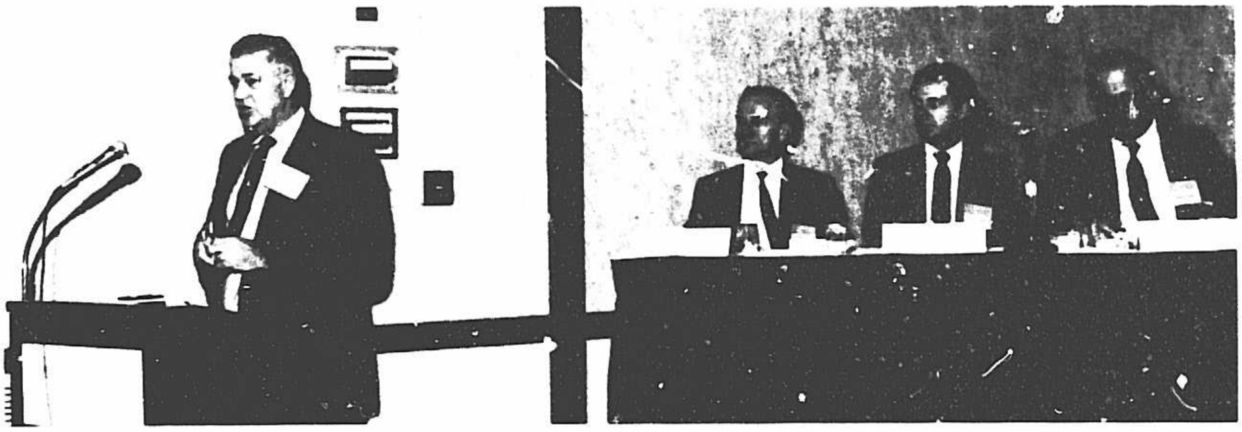
The Bendix Field Engineering Corporation (BFEC) commitment to quality is based on doing things right the first time, the ultimate purpose of which is to provide optimum customer support. "Working Smarter!" is the theme of the Productivity Improvement and Quality Enhancement Program, which is geared to producing a unique system of services with the motto "anytime, anywhere."

The BFEC quality process centers on results through the interaction of all organizational elements. Goals set by management are communicated through the organization and are made more specific at each level. These goals form the basis for the yearly quality and productivity plan, which is designed to make a substantial impact on the department in terms of customer satisfaction, quality improvement, and cost savings.

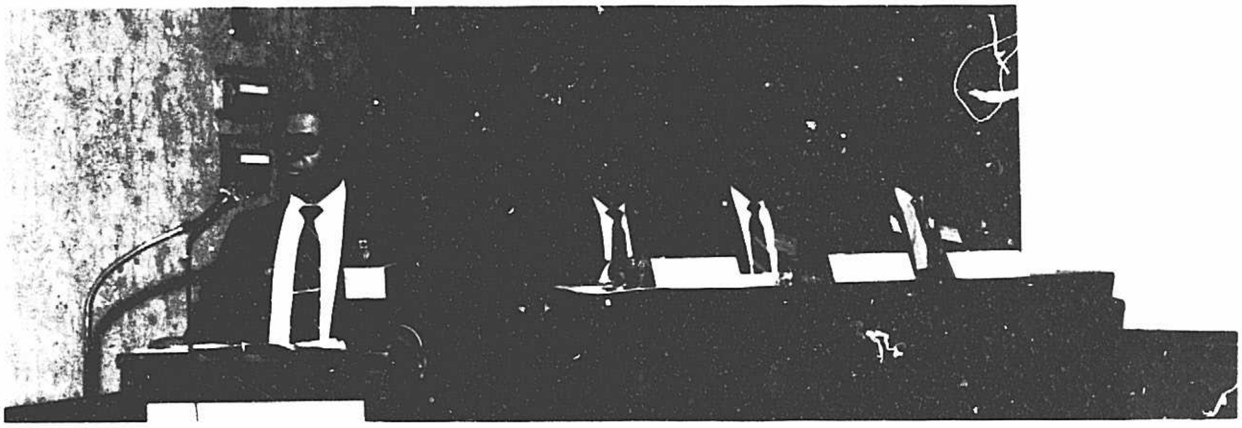
Thorough Productivity Enhancement Teams (PETs), employees prove that "working smarter" is a reality at BFEC facilities around the globe. As PET members, employees voluntarily and actively participate in small groups to identify and solve problems and work on projects that increase quality, productivity, organizational efficiency, and cost effectiveness.

An indication of the success of BFEC's quality and productivity improvement efforts is the awarding of the Network and Mission Operations Support (NMOS) contract at the Goddard Space Flight Center. On NMOS, BFEC and its subcontractor assumed responsibility for the consolidated operations of what had been six distinct contracts. The NMOS challenge involved the blending of an experienced workforce from several other contractors with the BFEC working smarter culture. The transition management process involved educating management; establishing measures, baselines, and goals; communicating goals; involving the workforce; and measuring progress and results.

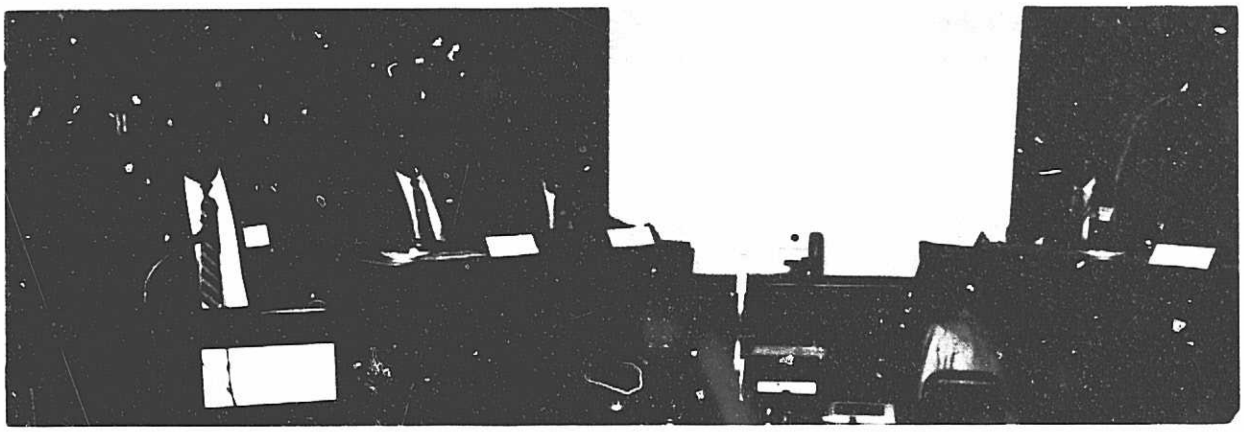
The BFEC commitment to quality has received recognition from the community as well as customers. Besides being a finalist for the 1987 NASA Excellence Award for Quality and Productivity, BFEC was named the recipient of the first Goddard Excellence Award, and was awarded the 1988 U.S. Senate Productivity Award for Maryland.



Panel B1 - NASA Excellence Award-Hardware: (from left to right) Richard M. Davis, Martin Marietta Corporation; Richard Schwartz, Rocketdyne Division, Rockwell International Corporation; Peter L. Kujawski, Astro Space Division, General Electric Company; Seymour Rubenstein, Space Transportation Systems Division, Rockwell International Corporation



Panel B2 - NASA Excellence Award-Support Services/Launch Processing: (from left to right) I. Jerry Hlass, Stennis Space Center; A. B. Gorham, Jr., Pan Am World Services, Inc.; Robert B. Young, Jr., Lockheed Engineering and Sciences Company; P. Edward Adamek, Lockheed Space Operations Company



Panel B3 - NASA Excellence Award - Mission Services: (from left to right) Monte Krauze, Bendix Field Engineering Corporation; Gerald L. Johnson, Boeing Computer Support Services, Inc.; Jerry Barsky, Bendix Field Engineering Corporation; Dale Compton, Ames Research Center

4.0 Quality Measurement

4.1 Overview of Quality Measurement

4.1.1 Making Measurement Work at Douglas Aircraft

David R. Braunstein, Director of Quality and Productivity Improvements, Douglas Aircraft Company

In 1980 McDonnell Douglas Corporation undertook a self-renewal program based on implementation of strategic thinking, employee participation, human resource development, quality and productivity improvement, and ethical decision-making. These elements have since been incorporated into a Significant Business Issue (SBI) project, whereby one area of each component of the corporation is identified for extensive evaluation and improvement.

Douglas Aircraft Company selected "satisfy your customer with first-time quality" as its SBI. This represented a totally different company goal and a new way for employees to approach their jobs. Employee work groups spend approximately six to ten months going through a five-phase quality/productivity improvement process that begins with a two-week training program for approximately 100 people. The process phases are: (1) establish an improvement commitment, (2) specify the process, (3) talk to customers, (4) develop goals/measurements, and (5) reinforce the commitment. By the end of October 1988, 10,000 employees will have gone through this program, which will eventually be extended to the entire work force and the supplier team.

The results of the program exceed initial expectations. Douglas Aircraft has undergone a cultural change. Managers now are working as partners with their employees to achieve quality and productivity improvement goals. The "boss" is now perceived to be the customer.

In effecting this cultural change, Douglas Aircraft avoided the use of slogans; a great many slogans were used in the past, and the work force had become skeptical of them. Care has been taken to avoid an expectation that improvement will be made by great leaps; instead, emphasis is placed upon continuous improvement as an ongoing process.

Measurements should not be viewed as a whip, but they are very effective in attaining desired goals. One tends to get the kind of behavior that is rewarded. Douglas Aircraft views goals in terms of short-term and long-term priorities, taking a decentralized approach that empowers the entire work force. An effective measurement program is dependent upon four elements: (1) a systems approach, (2) adequate skills, (3) positive consequences, and (4) adequate feedback.

4.1.2 Measurement Initiatives at Boeing Computer Services

David L. Nelson, Manager, Statistics for Quality, Boeing Computer Services

Effective measurement is a basis for action to support continuous quality improvement of products, services, and processes. At Boeing Computer Services, we want people to take a look at elements of their work, and then adopt an approach geared to continuous improvement. Measurements are a tool whereby the role of employees, suppliers, and customers may each be addressed in terms of input requirements (what we expect of our suppliers) and output requirements (what our customers expect of us). Measurements are used to ascertain differences between what is expected and what is delivered, and they are made by attaching meters at specific points in the work process. A good understanding of statistics is essential to evaluate measurements. Once the measurements have been evaluated, controls can be applied, and the differences between special causes and common causes can be identified. The goal is a standardized level of excellence; variation is the enemy.

Since Boeing Computer Services has no specific product, its measurements are geared to how well it is achieving a mission. A bottom-line question "why are we here?" leads to responses in terms of "to increase, to decrease, to reduce, to improve, to eliminate, to enhance." Statistical answers may not be entirely valid;

one must not become entirely dependent upon numerical definitions.

Once a mission statement is clear and accurate, various possible measurements become evident. The mission statement itself is subject to measurement. If related activities are underway, their progress can be measured. Both hard measurements (such as customer surveys) and soft measurements (such as assessment of how things are done) are useful. A measurement matrix provides a good overview of the information collected. However, quality must always be measured in the eye of the customer, especially because the customer always knows something that we don't know. You have to keep asking the customer, "How am I doing?" Any negative input that is received can be viewed as useful data. Whatever the defined product, measurements should lead us to achieving more of it at a lower cost. This goal is reached by focusing on elements of the work process rather than the ultimate product.

A cost of quality must be assigned to external failures, prevention of defects, and internal failures. These will vary, but certainly the greatest cost is that associated with the delivery of poor quality to a customer.

Obviously the ways one measures manufacturing are different from how one measures R&D efforts. It is easier to make measurements on the factory floor, but in all cases the key is to keep the mission statement clearly in mind. A great many cost savings can be realized from improvements in administrative areas, all of which will depend on effective measurements. The quality management concept must permeate the white collar segment of the work force. Once management assimilates the quality/productivity improvement process, it will filter down to lower levels. This will involve just-in-time training and a willingness to turn off unusable management systems.

There are questions still to be answered about the purpose of measurements, who will measure what, when, and how; we are still learning about how to construct an ideal measurement report, about which people should receive it, and what they will be able to do with it. We need to strive for (1) simple measurements, (2) ease of data gathering, (3) assurance of data validity, (4) attention to measurement of intermediate steps, (5) use of existing data whenever possible, and (6) selection of measurements that will be worthwhile over a period of time. Implementation of measurement is a continuous learning process that will ultimately be of great benefit to the quality/productivity improvement effort.

4.2 Measurement Techniques and Methodologies

4.2.1 Introduction

R. Ross Bowman, Vice President, Safety, Reliability, and Quality Assurance, Morton Thiokol, Inc.

Measurement is an essential step in achieving quality and productivity improvement. Morton Thiokol set bold goals to reduce flight set non-conformances and, by providing the proper resources and tracking progress with measurements, has allowed employees to succeed in reaching the goals. Measurements make it possible for people to win.

4.2.2 Lessons Learned in Implementing the Objectives Matrix and Using the Data for Corrective Action

Dean R. Lee, Director, Quality/Productivity, Systems Support Group, Unisys Corporation

As part of an overall process aimed at quality improvement at the Unisys Corporation, an objectives matrix is used to measure progress in reaching established goals. This tool assists managers in tracking and reporting improvement initiatives and was introduced as one part of a total effort to make the work force aware of management's commitment to and involvement in quality enhancement.

Pitfalls to the introduction of white collar measurement are characterized in comments to the effect that "you don't understand our work area" and "you can't measure our kind of creativity." Perfect measurements are probably not achieveable, but very good measurements are possible if simplicity and consistency are maintained. The cost of quality improvement may be difficult to establish; however, the Unisys program is dedicated to making improvements even if they don't result in cost savings. The Unisys Quality Council includes one representative from each department and from the administrative area; this group oversees departmental teams that establish measurements and corrective actions. The objectives matrix is formed on the basis of first identifying elements that reflect work quality. Criteria for achieving these elements are then specified, prioritized, and broken down into mini-objectives for which appropriate measurements are determined. Selected objectives are challenging and perhaps optimistic, but potentially obtainable. A numerical system of tracking improvement is applied to the matrix, which provides project management with a standardized method of reviewing and reporting on the status of work activities. Corrective actions are recommended as part of the objectives review process. Success of the objectives matrix at Unisys has depended upon its gradual implementation, beginning with areas which were expected to be most receptive, and a recognition that efforts for improvement should be set aside when an objective has "peaked out." It can be effectively supported by available software, and it is excellent for bringing issues into focus and enabling significant improvements.

4.2.3 Multi-Mission Production Planning System - Lessons Learned

David E. Peterson, Manager, Planning Systems, Rockwell Shuttle Operations Company

The Multi-Mission Production Planning Systems (M^2P^2) is a very useful database tool that integrates and measures project schedules and costs of the complex flight production process. Because the process involves highly detailed planning and preparation for each shuttle flight, numerous organizations and products, frequent schedule and manifest changes, and critical resources, as well as coordination of multiple flight agendas, precise measurements are essential.

The M^2P^2 is used to monitor the overall process and to provide data regarding specific requirements and impacts of individual tasks, including the amount of management visibility, schedule constraints, and future adjustments. Building and implementing the tool were initially expected require about an equal effort; in fact, about 20% of the effort has gone into development, and the greater challenge has been gathering data, designing procedures, and training personnel.

Accurate data are essential for meaningful measurements, but collecting it can be difficult because of managers' rather natural inclination to build buffers into schedules and resource requirements. Human resources was the first area to be put into the system, followed by the financial system, and then the facilities area. The financial system governs the M^2P^2 database effectively, and there is a continuing effort to include greater depth of information detail. The most vital ingredient in the success of M^2P^2 is management's commitment to use it, to expend the energy to measure resource utilization and to act upon the lessons learned.

4.3 Successful Measurement Applications

4.3.1 Measurement at Ford Aerospace & Communications Corporation

David L. Blanchard, Director, Space Systems Engineering Operations, Ford Aerospace & Communications Corporation

The implications measurement became critical to Ford when it was discovered that power transmissions which met all engineering quality design specifications were causing a significant number of problems in actual operation. This was a clear indication that customer needs were not being met and that current measurements were inadequate. In investigating the problem, Ford discovered that the transmissions were acceptable from a component standpoint, but that the system design and manufacturing process was faulty. The problem was satisfactorily resolved, and new insight was gained on the importance of diverse measurement approaches.

4.3.2 Performance Measurement: The Key to Productivity

Robert J. Keymont, Vice President of Production Operations, Missile Systems, Martin Marietta Corporation

In early 1986, the production operations function of Martin Marietta's Missile Systems began implementation of a series of performance measurement techniques and team initiatives to create an environment in which quality was the top priority. A key element of this effort was the establishment of Performance Measurement Teams (PMTs), which were composed of all the hourly workers in each manufacturing work center, the area supervisor who acted as the team leader, and representatives from Manufacturing Engineering, Industrial Engineering, Planning and Control, and Product Quality who were assigned to support the area.

To provide focus for work center involvement in quality performance, a performance measurement system was established which provided weekly performance measurement on shop yield, scrap, performance to schedule, performance to standard, overtime, and lost time at the manufacturing work center level. Goals were established for each measurement and all data was placed on special PMT boards in each work center.

Today, in conference rooms dedicated for PMT use, work center PMTs hold mandatory weekly meetings to review their own performance and resolve issues that impact the work center performance. Issues that are "too big" for the work center teams to resolve are elevated up the existing departmental chain of command for action. The commitment and involvement of mid-level and upper management is key to the success of the process. Outstanding team performance is recognized through Team-of-the-Month and Team-of-the-Year competitions.

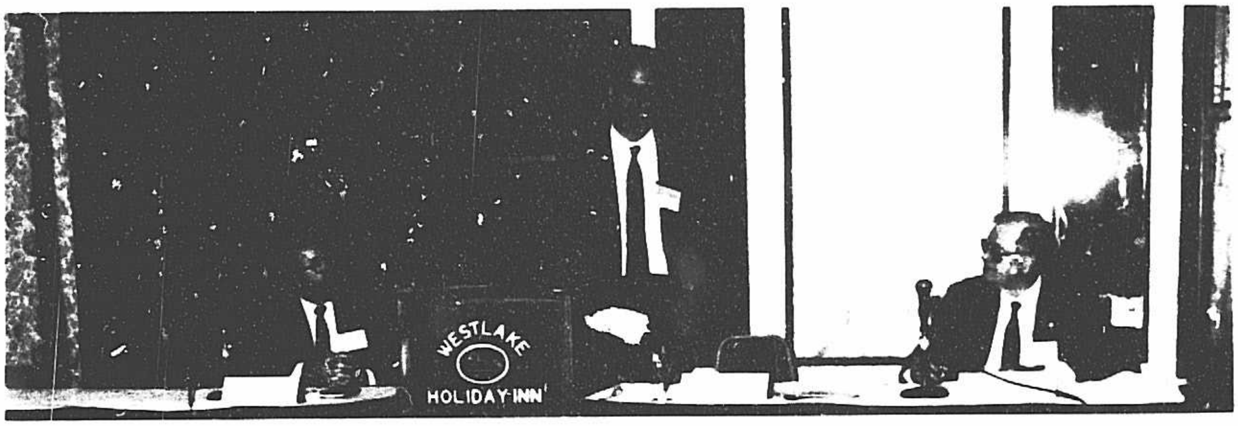
The PMT process has helped the company to meet and surpass customer requirements. The Martin Marietta experience is that, once the quality and productivity improvement process is underway and problems resolved, measurable objectives will be met, exceeded, and new objectives established.

4.3.3 The Importance of Measurements to Support a Total Quality Effort at Florida Power and Light

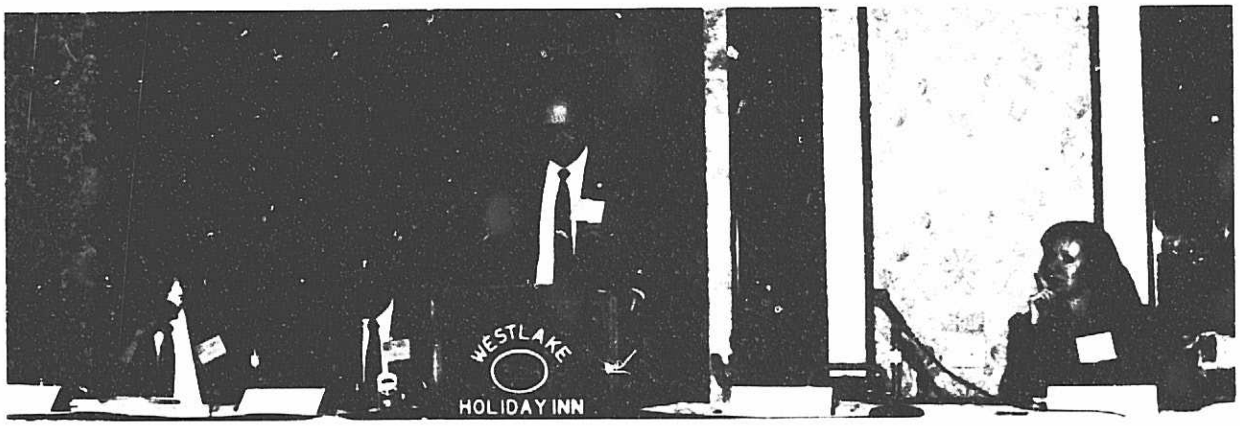
Michael L. Fedotowsky, Laboratory Supervisor, Florida Power and Light Company

A system of total quality control has been successfully implemented at Florida Power and Light Company. The basic measures were derived from strategic goals. The company was a very good provider of service in comparison with other utilities in the United States, but it did not rate well on a world-wide scale. Management realized that a vision to be one of the world's best could only be achieved by setting out very specific quantitative, measurable goals. The company sought to improve the reliability of electric service to customer facilities by avoiding service interruptions, reducing the number of customer complaints and work time lost due to injuries.

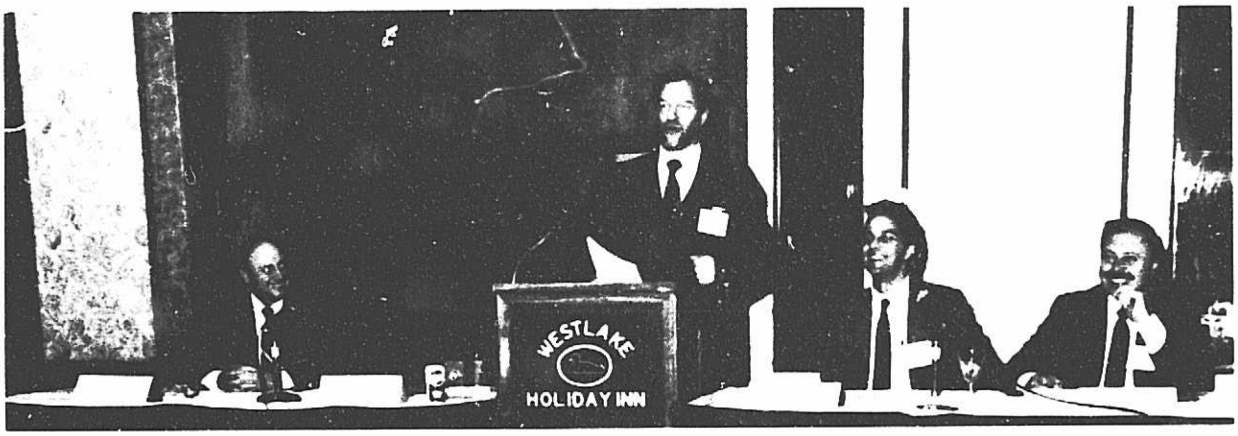
Florida Power and Light's experience is that if a vision is established, if management is totally committed, and if the tools, techniques, and action plans can be implemented, positive results are ensured. The results may not be attained immediately, but with constant visibility and attention to problem areas, they eventually may even exceed the original expectations.



Panel C1 - Overview of Quality Measurement: (from left to right) David L. Nelson, Boeing Computer Services; David R. Braunstein, Douglas Aircraft Company; Robert D. Tolle, Morton Thiokol, Inc.

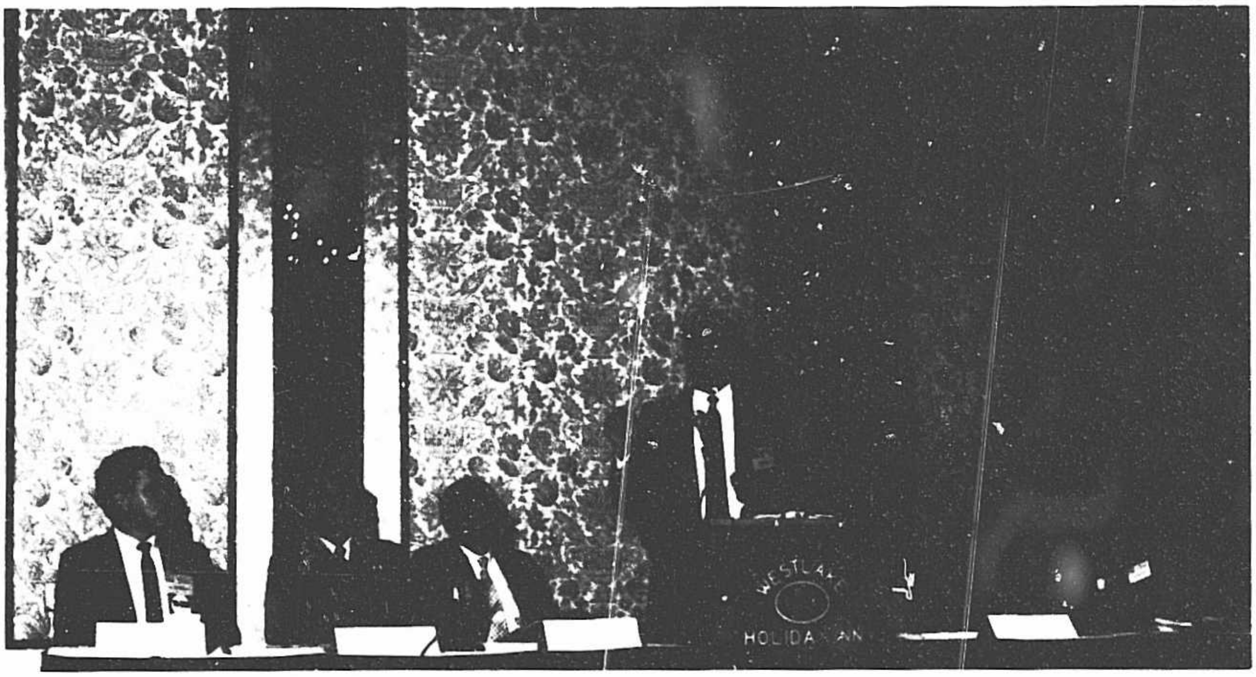


Panel C2 - Measurement Techniques and Methodologies: (from left to right) David E. Peterson, Rockwell Shuttle Operations Company; Dean R. Lee, Unisys Corporation; R. Ross Bowman, Morton Thiokol, Inc.; Karen K. Whitney, Rockwell Shuttle Operations Company



Panel C3 - Successful Measurement Applications: (from left to right) Robert J. Keymont, Martin Marietta Corporation; David L. Blanchard, Ford Aerospace & Communications Corporation; Michael L. Fedotowsky, Florida Power and Light; John F. Loonam, Grumman Data Systems Division

Panel D1 - Strategic Planning - Implications for Quality: (from left to right) Nathaniel B. Cohen, NASA Headquarters; James A. Warren, Rockwell Automotive Operations; Richard F. Stehle, Rockwell International Corporation; Louis B. DeAngelis, NASA Headquarters; Alvin A. Kaplan, Grumman Aerospace Company



Panel D2 - Quality Culture at all Levels: (from left to right) Craig Koontz, Ford Electronics and Refrigeration Plant; LTC James C. Daugherty, U.S. Air Force Systems Command; W. N. Moore, Westinghouse Electric Corporation; Richard Sabo, Lincoln Electric Company; William L. Williams, Langley Research Center

5.0 Creating a Quality Environment

5.1 Strategic Planning - Implications for Quality

5.1.1 Strategic Planning - The Basis for Quality Performance

Louis B. DeAngelis, Director, Human Resources and Organizational Development, NASA Headquarters

Traditionally the driving force in NASA has been the budget process, an activity for which you program rather than plan. Recently NASA has realized that this budget process does not permit a long-term perspective or the integration of programmatic and institutional requirements. It is strategic planning that sets the basis for quality, ensuring that the right things are being done and that resources are allocated to achieve the fundamental purposes of the organization.

Strategic planning provides the context to determine if we are doing the right things, to define quality and productivity, to balance cost and quality, and to identify the things we should elect not to do.

Strategic planning can promote organizational success when used as a tool to establish clear, challenging, and exciting goals and to foster (1) an open, creative environment, (2) teamwork, (3) a strong scientific and technological base, (4) public and Congressional support, (5) a world-class institution, and (6) clear, efficient lines of organizational authority and accountability.

5.1.2 An Approach to Strategic Planning - Reinforcing the Importance of Quality

Richard F. Stehle, Director, Business Planning and Development, Rockwell International Corporation

The Rockwell International strategic planning process involves all organizational levels, including corporate, operations, divisions, and business segments. It begins with corporate visibility, direction, and interaction, and involves each level's (1) management responsibility and authoritative control, (2) optimum use of staff and resources, and (3) knowledge of opportunities and limitations. Since activities are initiated within the business segment of the organization, an early part of strategic planning must be geared to defining business segments, customers, products, competition, and business issues as well as providing for synergistic functional grouping and entrepreneurial management.

Quality is an inherent consideration in each portion of Rockwell's strategic plan because survival and growth of the organization will be determined by the amount of value provided to the customer. Although customer value is determined both in terms of value and cost, one of the most effective ways to achieve step-by-step improvement in corporate performance is to focus on quality. At Rockwell this quality focus is reflected in the Division President's annual Quality and Productivity Review with the Chairman and CEO, the annual All-Division Quality and Productivity Conference, and the Rockwell credo. The credo, "What We Believe," states that (1) maximizing the satisfaction of customers is vital to warranting their continued loyalty, (2) superior value to customers is measured in terms of high technology, fair prices, exceptional service, and (3) organizational success is dependent upon market leadership and the highest standards of ethics and integrity.

5.1.3 Quality - The Business Strategy

James A. Warren, Director of Product Assurance, Rockwell Automotive Operations

Companies these days must move away from platitudes to real, meaningful initiatives with which the work force can identify. This is not an easy transition; the slogan "no pain, no change" would aptly describe it. Quality is a term that we use to refer to the strategy used to improve our product and lower our cost. Planning should be based on what the customer wants, rather than what the engineer wants, and it should work to drive the voice of the customer down through the organization. We need to get away from the viewpoint that "you get what you pay for" and from product redesign late in the process and move forward, increasing customer satisfaction and reducing development time. The added value of the management team is the creation of a culture that affects the work force so as to stimulate discretionary effort.

5.1.4 Establishing an Environment for Quality

Nathaniel B. Cohen, Director, Strategic Planning and Analysis, NASA Headquarters

NASA strategic planning is an effort that has been underway for about three years. It has proven very successful so far, but much work remains to be done. Basically, NASA's strategic planning is geared to establishing an agency mission, setting standards and criteria for quality, and developing a culture with motivation and commitment that will produce excellence at all levels. This planning is based on statutes, policies, and agency themes that promote excellence in programmatic and institutional goals. It is an effort that cascades up and down at all levels, including program offices and NASA field centers. It has brought about improved communication, coordination, and integration.

5.2 Quality Culture at All Levels

5.2.1 Quality Culture at Lincoln Electric Company

Richard S. Sabo, Assistant to the Chief Executive Officer, Lincoln Electric Company

Lincoln Electric is a welding company that meets the exacting standards of its high-technology customers. Attaining quality depends upon the excellence of materials supplied, product design, employee dedication, and customer adherence to prescribed procedures. Lincoln's approach has been to hire the best possible work force, to prepare employees to be fully productive, and to develop latent abilities. The hiring responsibility ultimately is borne by upper management which makes final approval of all new hires. Employees are paid for piece work, and approximately 50% of the pay is in the form of a year-end bonus. Each employee is responsible for his own quality and attendance. These practices reflect the Lincoln belief that hard work is healthy, whereas unemployment or lack of control over one's work is unhealthy. Internal promotions are common, and management maintains an open-door policy. An advisory board composed of factory workers meets every other week with the President and Chairman of the Board. Production quality accounts for 25% of an employee's merit rating, with automatic merit penalties associated with some customer rejections. This emphasis on individual responsibility minimizes the need for direct supervision; Lincoln has one foreman for approximately 100 employees.

Lincoln's program allows employees to work with individual responsibility for quality production and incentives for advancement; it has made the company a leader in its field, both nationally and internationally.

5.2.2 Managing the Change to Total Quality

W. N. Moore, Manager, Corporate Quality Programs, Westinghouse Productivity and Quality Center, Westinghouse Electric Corporation

At one time the products we used were typically made in the United States. However, this period of high inventories and high tolerance of error was destined to end as quality, low-cost Japanese products became increasingly available. We have had to make a radical change in our industrial model. For the Westinghouse Electric Corporation, a large, diverse, decentralized operation, a total quality perspective came to be defined as leadership in meeting customer requirements by doing the right things right the first time.

Since 1981 activities at the Westinghouse Productivity and Quality Center have focused on defining the conditions of total quality, which depend upon four basic areas of focus: (1) customer-oriented philosophy, (2) excellence of human resources, (3) optimum product process, and (4) visibility of management leadership.

Total Quality Fitness Reviews of work areas are held by cognizant management with participation of peer managers from other areas to identify improvement opportunities. Usually the reviews first address management and personnel issues and then deal with product problems. Measurement of improvement is the final step, one that Westinghouse is just now beginning to undertake. The review approach has resulted in cost reduction, improved morale, increased system control, and quality improvements.

5.2.3 Quality and Cost: The Vital Link

Lieutenant Colonel James C. Daugherty, USAF, Chief, Producibility, Quality and Standardization Division, Headquarters, Air Force Systems Command

Quality management practices are essential to the Air Force Systems Command in meeting its responsibility to spend the taxpayers' dollars wisely and to deliver high performance systems to the field. A philosophy of continuous improvement means that merely "doing business as usual" is no longer acceptable. Understanding the role of quality has required serious reevaluation by the Systems Command because participants in a high technology effort tend to think chiefly in terms of functions. Schedules appear to drive operational support and costs, and yet the problem may be with a poor design or poor manufacturing process. Therefore, achieving quality requires consideration of the total production operation.

The Systems Command plan for instituting Total Quality Management is based on steps geared to (1) foster awareness, (2) remove barriers and develop performance incentives, (3) develop tools and techniques, (4) implement programs, and (5) assess results. By the end of this year, all systems managers will have gone through the Deming training. Thus, we know about the tools; it remains to learn what will work in this specific case.

Basically, the Systems Command is working in accordance with a master DOD plan, which calls for a revision of the acquisition process over the next seven years. As part of the revision, consideration is being given to what needs exist and what resources are available that aren't being fully used. Integration and affordability are the principal obstacles. Since an old system has been in effect for a long time, change will require a great deal of effort. The bottom line has to do with adopting an effective mechanism for rewarding contractors for quality performance. Eventually it will be recognized that delivering quality, not meeting schedules, is the most critical element.

Understanding our role is essential in determining what we have to do. As part of the management process to make the most of resources, we must tell the contractors what we as customers need from them. The Systems Command has quality improvement test programs underway; based on experience with them, the effort will be extended into other areas. At this point, it is clear that there is a very positive link between quality and value.

5.2.4 Ford Motor's Quality-1

Craig Koontz, Quality Action Team Facilitator, Ford Electronics and Refrigeration Plant

Quality and productivity improvement initiatives at Ford Motor Company have been instituted through a Quality-1 Program which came into being in part as a result of pressure to compete with the Japanese automobile manufacturers. The quality of a product is determined by the degree to which it satisfies customer needs. The quality improvement process is a fundamental one at Ford. A Ford division may petition management to review it for the Quality-1 award. Receiving the award is both a valued recognition and an assurance that the division will continue its work function. When a plant decides to go for the award, it first undertakes a self-evaluation that includes surveying its customers; it then determines if it meets the criteria, and requests management approval of its candidacy. After this, independent assessments are made, including those of the plant's customers, and management conducts an on-site assessment. If the award is denied, the plant must wait 12 months before competing for it again. The status of Quality-1 plants is reviewed annually and may be rescinded, most notably at a customer's request. Criteria for the award include participative management, employee morale, utilization of new talent, and housekeeping. Employees are fully involved in the application for

Quality-1, and are informed regularly about the status of the evaluation.

In the case of the Ford Electronics and Refrigeration Plant, training was a critical factor in receiving the award. At this site, employees were involved in regular, mandatory business meetings and also took part in task forces that worked overtime on a volunteer basis to study and resolve specific problems. Participative management was also a factor in winning the award; this was facilitated through the communication generated through a newsletter. Union support was also a vital factor. Ford Motor Company's CEO has called for an improved corporate culture, with all areas achieving Quality-1 status by 1990. Beyond Quality-1, Ford's Total Quality Executive Award is given to those who are most excellent among the Quality-1 winners.

5.3 Designing for the Future - Space Station

5.3.1 Introduction

James B. Odom, Associate Administrator for Space Station, NASA Headquarters

The United States has a clearly defined space policy that calls for development of the Space Station as a permanent, manned international effort with flexible capability for the future. Space Station development has been a team effort, and all Space Station managers are aware of their obligation to create an environment that fosters teamwork. The team includes a "silent work force," those who will never make the headlines, but who have contributed in many vital ways.

The Space Station guiding principles are all directed to the top priority, mission success. Quality is planned in, designed in, and built in, not inspected in. Emphasis is upon keeping things simple, and this includes minimizing organizational and hardware interfaces. We seek to maximize clear hardware and software accountability, margins, and redundancy while maintaining full management control. When automation, robotics and A1 capability are not built in, the policy is to accommodate them by hooks and scars.

Levels of management responsibility are clearly defined. Levels 1 and 2 develop and manage the program, and Level 3 and the prime contractors design, develop, and fabricate the Space Station. The Level 3 task includes satisfying and verifying the program plan. Authority is delegated down to the lowest level practical and commensurate with demonstrated, real accountability.

As part of the planning process, the life-cycle cost will always be a key decision driver, starting with development cost. The TMIS will be the basic Space Station management tool, so its development is critical to the overall program. In addition to the teamwork and tools that are so vital to the Space Station, the importance of individual responsibility is continually stressed. We say that every person in the Space Station organization must think and perform as a systems manager, taking the broadest possible view of the program objectives. It is only with this kind of approach that we will achieve our goal of mission success.

5.3.2 Boeing's Design Build Team Approach to WPO1

John B. Winch, Deputy Program Manager, Space Station, Boeing Aerospace Company

Boeing's Design Build Team concept emphasizes doing it right the first time through early, continuing involvement of planning, procurement, manufacturing, safety, reliability, and quality assurance personnel working with systems and design engineers. Each team's responsibility for a specific end item from inception to on-orbit operation is satisfied through continuous technical working level integration and interface. These teams provide the productivity mechanism for translating large organization resources into small organization responsiveness and pride of personal involvement.

Optimum systems engineering at Boeing is based upon use of proven methods, a large engineering master database, automated design capability, consistency with paperless initiatives, functional modeling, and suitability for support analysis. Benefits of such engineering are realized in streamlined interface coordination, common sources for requirements and specifications, available data to support simulations, user access to pictures and data sources, traceability for design compliance verification, and cost avoidance.

5.3.3 Two Space Station Division Approaches to Ensure Quality Designs

Robert F. Thompson, Vice President-General Manager, Space Station Division, McDonnell Douglas Astronautics Company

A commitment to productivity improvement and quality enhancement must originate at the top of an organization. In Space Station development, this top-level commitment is communicated to and implemented within the various distributed systems that address basic flight elements. Three tools have been useful for achieving productivity and quality improvements: (1) electronic data development, which allows expanded versatility in design and elimination of many costly engineering mock-ups, (2) development teams, which ensure that all disciplines are represented and provide input at the design formation stage, and (3) risk management concepts, which establish a method for identifying, assessing, and resolving/statusing risks.

5.3.4 Designing for the Future - The Role of Up-Front Quality

Dominick A. Aievoli, Program Manager, Space Station Program, Astro Space Division, General Electric Company

Space Station development has followed the pattern used for other satellites, with an added new emphasis on servicibility and maintainability. These are characterized by the following eight elements: (1) management commitment to product quality, which is the bottom line, (2) a disciplined, motivated, and trained work force that will maintain high standards, (3) use of proven designs, put through exhaustive reviews and developed by proven practices, (4) controlled production that adheres to training, documentation, process readiness, and revalidation standards, (5) a parts-materials-processes program that follows proven sources with corrective actions taken as needed at every step, (6) manufacturing planning and control monitored through extensive documentation and readiness reviews, (7) use of "tollgaters" and reviews, and (8) product protection ensured by established procedures set for handling materials. To this list is now added the additional requisite of maintainability, which can be enhanced by design criteria that include elements of accessibility, modularity, diagnostics, and standardization.

Quality up-front is the least expensive mode of operation. GE management supports space programs with the resources to yield performance, reliability, maintainability and quality that meets or exceeds customer requirements.

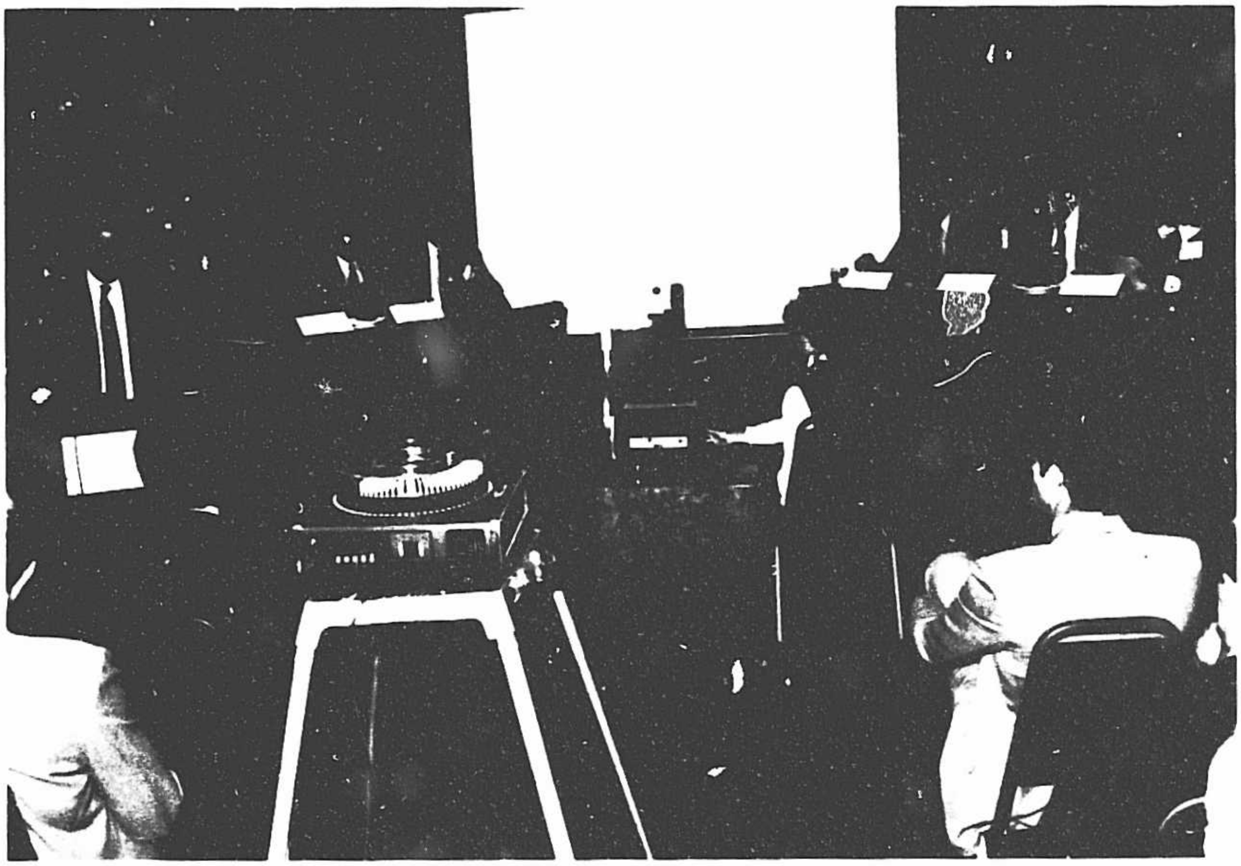
5.3.5 Building a Team Culture at Rocketdyne

George J. Hallinan, Vice President and Program Manager, Space Station Power, Rocketdyne Division, Rockwell International Corporation

At Rocketdyne, team building is a heritage that continues to prove its worth in the area of product assurance. Teams at the Lewis Research Center led by Rocketdyne and composed of five other contractors have successfully achieved planned-in, designed-in, and built-in quality for the Space Station power system. These multifunctional or horizontal teams are collocated, have a shared database, and take an aggressive and coordinated approach to product development. They have met the high expectations of management through improving, correcting, or enabling specific issues as well as affecting positive changes in a number of functions, environments, and projects. Teamwork has brought about a changed philosophy in that functions are now viewed as multifunctional rather than isolated efforts.

Seventy percent of the life-cycle cost of a system is determined in the definition stage; major issues must be addressed early in an effort because the ability to influence quality decreases as the system evolves. An example of such needed foresight is the enormous amount of time spent on development of the Space Station batteries before the power systems contract was in place.

The formal development process must be improved upon daily. Quality assurance during the engineering phase has the greatest potential influence; subsequent quality assurance activities serve to implement and verify established requirements. Effective quality assurance is based upon attitudes, knowledge, program organization, and actions taken. Final responsibility for Rocketdyne quality assurance rests with upper management; it is strongly supported by team action projects, a partial list of which include improvements in parts protection, work instructions, and statistical process control.



Panel D3 - Designing for the Future: Space Station: (from left to right) James B. Odom, NASA Headquarters; John B. Winch, Boeing Aerospace Company; Robert F. Thompson, McDonnell Douglas Astronautics Company; Dominick A. Aievoli, Astro Space Division, General Electric Company; George J. Hallinan, Rocketdyne Division, Rockwell International Corporation; Sally L. Stohler, Rocketdyne Division, Rockwell International Corporation

6.0 Contract Incentives

6.1 NASA's Approach to Contract Incentives

Leroy E. Hopkins, Deputy Assistant Administrator for Procurement, NASA Headquarters

Until recently NASA has not had clear value engineering policies because this area was felt to apply to production engineering rather than R&D efforts. Now, however, the substantial potential benefits of value engineering for both NASA and its contractors are recognized; for example, it resulted in a $9 million savings in a contract with Martin Marietta for the external tank. A major OMB policy change this year requires that value engineering clauses be included in nearly all NASA contracts and that a NASA value engineering department be established. This is a challenging new activity, one that will be demanding in terms of resources and effort, but that will include basic elements of quality and productivity improvement and that should provide us with a useful avenue by which to reach our goals.

6.2 SRM&QA Criteria in Award Fee

Alexander A. McCool, Director, Safety, Reliability, Maintainability and Quality Assurance, Marshall Space Flight Center

After the Challenger accident, safety, reliability, and quality assurance received a great deal of attention, and the role of contractor management was thoroughly assessed. At the Marshall Space Flight Center a system of independent safety reporting, apart from line management, was established with all concerns addressed and NASA Safety, Reliability, Maintainability and Quality Assurance (SRM&QA) management available as needed. We had to get away from the old concept of silent safety and "kill the messenger." To fully effect this change, all major contracts now include an award fee tied into SRM&QA.

NASA intends to keep the award fee flexible and the percentage high enough so that contractors will know that this area is taken seriously. Since the contractor participates in the award fee establishment process, he is kept aware of the determining factors. All contract personnel feed into an SRM&QA monitor who reviews the information, the Performance Evaluation Board recommends a fee amount, and the Deputy Center Director gives final approval.

A number of useful revisions were made in the safety reporting system in areas such as hazard analysis, mishap reporting, modeling analysis, the government/industry data exchange program, discrepancies in materiel review, and defects found in hardware post delivery. These improvements, combined with effectively administered award fees, will help us meet our mission challenges and keep the NASA/contractor work force motivated and committed to performance excellence. Management has to be the leader and share its enthusiasm for potential achievements.

6.3 Task Force Report from the Fourth Annual NASA/Contractors Conference

David J. Steigman, Coordinator, NASA Contract Incentives Review Task Force, Lewis Research Center

A broad-based Task Force was established after the Fourth Annual NASA/Contractors Conference to make recommendations concerning quality and productivity improvement (Q/PI) contract incentives discussed at that conference. The Task Force gave consideration to all proposals and solicited input from contractors, NASA Headquarters, and the NASA centers.

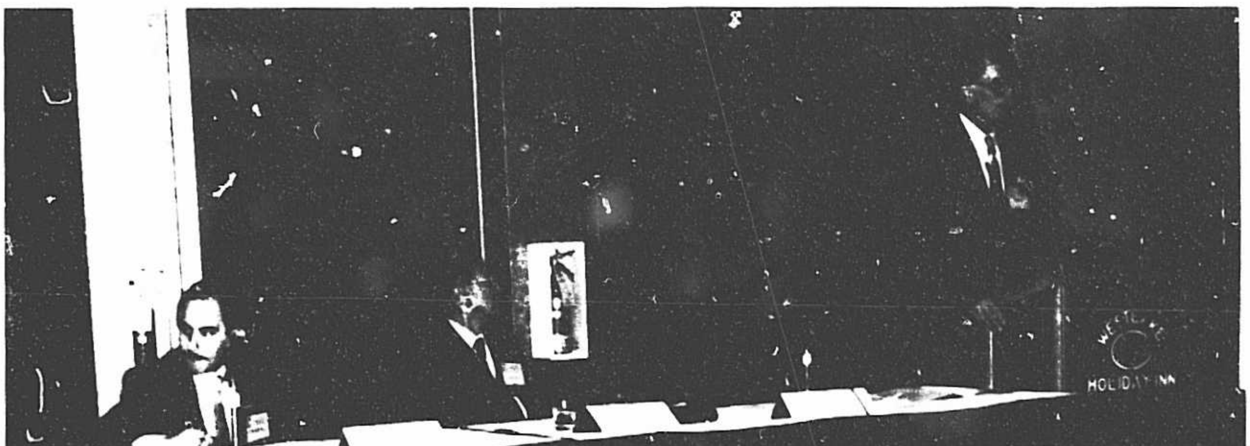
There were several objectives cited for Q/PI incentives. They provide a way to achieve assessable benefits to the government by rewarding contractors for improvements in quality, productivity and/or timeliness above and beyond what would normally be expected under a contract. These incentives should flow down the government's Q/PI objectives throughout the contractor's organization and to subcontractors, and share the benefits of improvements equitably with the contractor. Finally, Q/PI incentives should encourage continuous improvement efforts as well as tangible results.

The keys to success in using Q/PI incentives were deemed to be up-front agreements and understandings about the expectations of all parties involved, and the selection of the proper incentive(s) for the contract. These incentives should be part of contract negotiations. Potential incentives discussed by the team included Award Fee Pools for Q/PI; Gainsharing; Fast Payback; Integrated Suggestion Programs (which allow contractors and civil servants to be rewarded for suggestions made concerning each other's operation); and many others.

Award Fee was the most highly weighted Q/PI incentive, and could involve establishing a separate pool under the Award Fee. Flexibility was considered critical, and the performance evaluation plan should change to reflect prospective changes in emphasis. Government to contractor gainsharing was deemed to have good potential as a flow down mechanism for Q/PI objectives - especially if combined with Award Fee. The Task Force felt that gainsharing should involve investment from both the government and contractor. Fast Payback was discussed as a means to reward contractors for long-range improvements which would require up-front funding. Rewards could be provided either through Award Fee or a shared savings mechanism; Fast Payback improvements would likely require a downward adjustment to contract target cost.

Based on the Task Force recommendations, NASA has agreed to amend the NASA FAR Supplement to consider soliciting and evaluating offerors' Q/PI approaches as part of the source selection process for appropriate contracts. Evaluation criteria could include contract specific criteria as well as generic; potential factors could include projected benefits to the government, management of the Q/PI effort, creating an environment for improved quality and productivity, and active involvement in Q/PI and quality programs of subcontractors. It is hoped that this will help to establish an up-front meeting of the minds, and address the issue of Q/PI objectives "flow-down."

In addition, NASA has agreed to develop training programs for both government and contractor personnel concerning Q/PI criteria; Q/PI contract incentive mechanisms; and incorporation of Q/PI into the Award Fee process. Information concerning sample Q/PI RFP and Award Fee clauses, Integrated Suggestion Programs, and Gainsharing will also be disseminated.



Panel E - Contract Incentives: (from left to right) David J. Steigman, NASA Lewis Research Center; Alexander A. McCool, Marshall Space Flight Center; Leroy E. Hopkins, NASA Headquarters

7.0 Software Quality and Reliability

7.1 Introduction

Marilyn W. Bush, Section Manager, Software Product Assurance, Jet Propulsion Laboratory

With a 10 to 100-fold software quality improvement expected in the next 10 years, development of good software quality plans is essential. Effective software quality planning and management depend upon a strong leadership commitment to make optimum use of available and proven software methodologies and tools.

7.2 Software Quality at IBM Enterprise Systems

Richard B. Butler, Director of System Programming, IBM Enterprise Systems

When implementing a software quality plan, consideration should be given to (1) the nature and criticality of work for which it will be used, (2) quality based on conformance to requirements, (3) early elimination of problems, (4) the need for a rigorous process, (5) the inevitability of human error, and (6) lessons learned from defects encountered. Development of present IBM operating systems has been underway for 25 years; decisions, therefore, have long-term effects, and we must build in quality as a legacy for the future.

IBM software that is being developed for such critical areas as medical analysis and aircraft design must have the highest level of quality and reliability. Since quality means conformance to customer requirements, accurate definition of these requirements is an important initial step. Once the requirements are fully specified, each phase of system development must be carefully analyzed; finding the bugs in a system early on will mean tremendous cost savings. IBM's product development objectives are aimed at zero defects, improved productivity, and a reduced development cycle. Future software environments will demand that we (1) share work products, (2) support basic software engineering principles, (3) define, capture, and measure processes, (4) automate process tasks, and (5) improve process task analysis. Software quality and reliability can't be addressed in a vacuum; they must be designed in to be fully responsive to the needs of the customer.

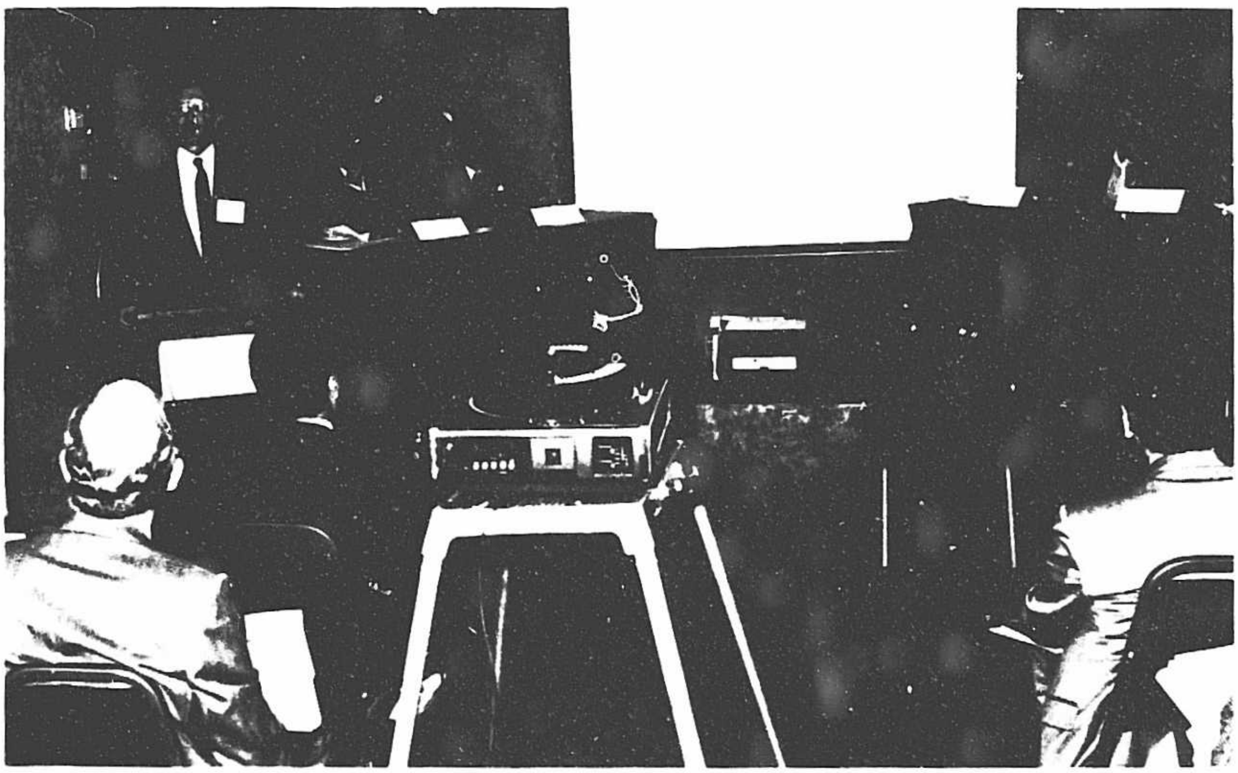
7.3 Improving Software Quality and Reliability in Different Environments

Ilene Birkwood, Vice President, Corporate Quality, Tandem Computers

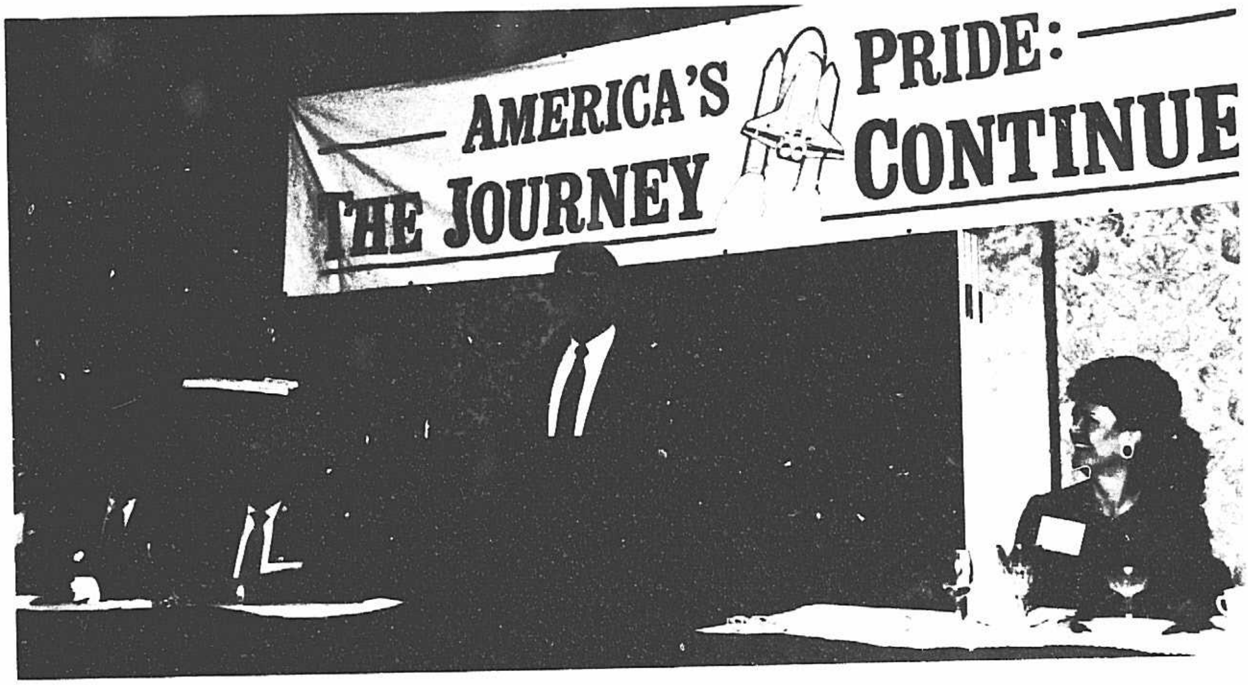
Traditionally, the main elements of software quality have been identified in terms of performance, availability, responsiveness, supportability, and user friendliness. However, we now see that the quality of software can be greatly enhanced by appropriate training and automation, follow-up by consultants, meaningful measurements, and publicized successes.

Automation will not be effective if it is applied to a process that is faulty or to one where there is no control. A program should not be implemented everywhere at once; implementation should start with the people who are most receptive, building on their experience to continue the implementation. Selling people on new methods is the secret to success. Resistance to the introduction of software is resistance to the fact that there are going to be different ways of doing things. Typically people are comfortable with the old methods, which are well understood and do get results; converting to new methods requires a great deal of user education. Training must be carried out by designated individuals; if the trainers can not be readily identified, training probably is not occurring. The opportunities for training in non-threatening environments should not be overlooked. Frequently this is accomplished informally when those more experienced in a particular software function share their experti... ...h novices.

Finally, a variety of measurements should be made. The choice of measurements should be based upon what information would be most useful to know. A good time to measure is when one is at a decision point. Once the measurement information is gathered, it can serve both as a guide to subsequent software implementation and as a record of experience from which to publicize process improvements.



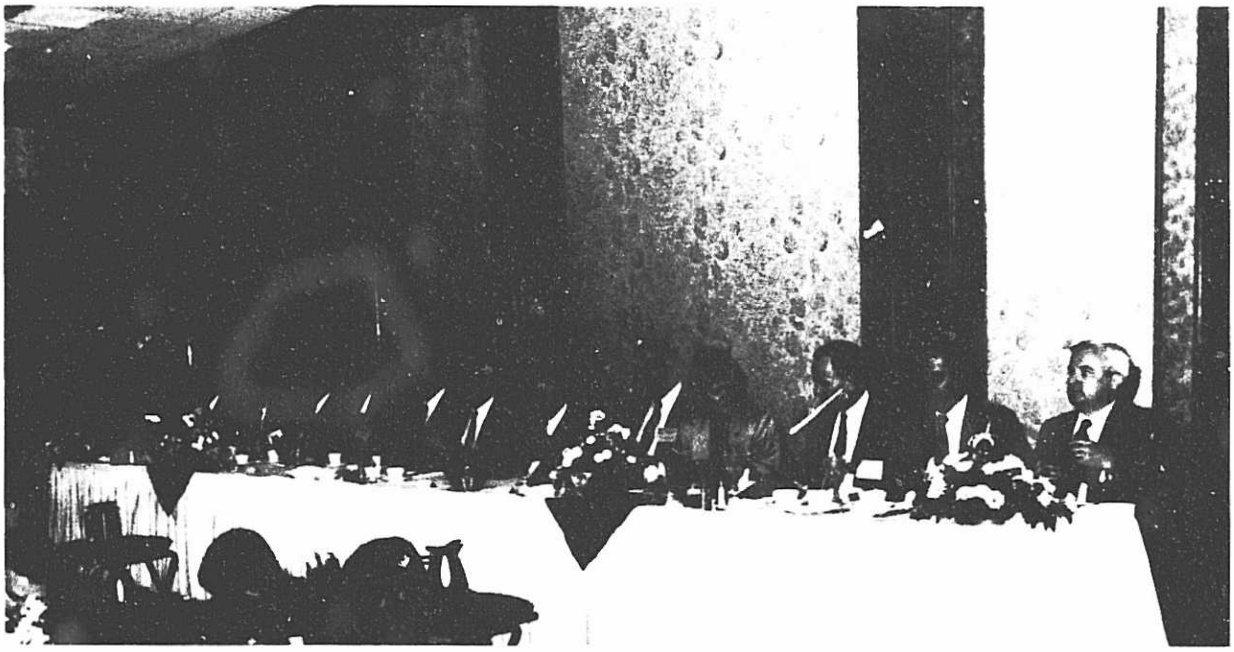
Panel F - Software Qualty and Reliability: (from left to right) Walter P. Baleyko, Kennedy Space Center; Richard Butler, IBM Enterprise Systems; Ilene Birkwood, Tandem Computers; Marilyn W. Bush, Jet Propulsion Laboratory



From left to right: Murray Weingarten, A. B. Gorham, Jr., Charles Bolden, Astronaut, USMC; Joyce Jarrett

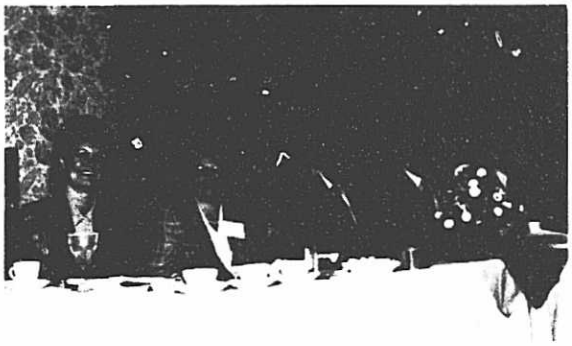
1987 Excellence Award Recipient - The Rocketdyne Team: (from left to right) George Hallinan, Katie Kronmiller, Paul Ross, Melvyn Davis; Sally Stohler, Richard Schwartz, Robert Paster, C. R. Custer, Frank Lary

From left to right: J. R. Thompson, Jr., Richard Davis, George Rodney, Donald Beall, Dale Myers

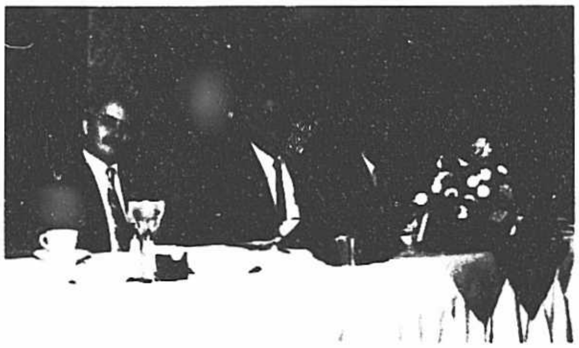


From left to right: Dale Compton, Paul Ross, J. R. Thompson, Richard Davis, George Rodney, Donald Beall, Dale Myers, Seymour Rubinstein, Joyce Jarrett, Richard Schwartz, I. Jerry Hlass, Lawrence Ross

From left to right: Louis DeAngelis, Joyce Jarrett, H. Hollister Cantus, J. R. Thompson, Jr., James Odom, Dale Shanahan, Marilyn Bush, Leroy Hopkins



From left to right: Joyce Jarrett, Katherine Holmes McCabe, Warner Stewart, Lonzo Coleman, John Cachat



From left to right: David Steigman, Charles Gibbons, Leroy Hopkins, Hugh Brown

APPENDIX A - CONFERENCE AGENDA

Fifth Annual NASA/Contractors Conference Program
Lewis Research Center (LeRC)
Cleveland, Ohio
Westlake Holiday Inn
Westlake, Ohio
October 12-13, 1988
(In cooperation with the NASA Headquarters Exchange)
"Quality - A Commitment To The Future"

Tuesday, October 11

5:00 - 8:30 p.m.	Conference registration and no-host social at Westlake Holiday Inn

Wednesday, October 12

6:15 - 7:30 a.m.	Breakfast/Conference Late Registration and Badging
7:30 - 7:45	Board Busses for Lewis Research Center
7:45 - 8:25	Travel from Holiday Inn to Lewis Research Center
8:30 - 8:35	*Welcome* - **Dr. John M. Klineberg**, Director, Lewis Research Center
8:35 - 9:00	*Keynote* - **Dale D. Myers**, NASA Deputy Administrator
9:00 - 9:10	*Conference Overview* - **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvement Programs, Conference General Chairperson
9:10 - 9:30	**Lawrence J. Ross**, Deputy Director, Lewis Research Center "Overview and Commitment to Excellence at Lewis Research Center"
9:30 - 10:00	Break
10:00 - 11:30	*NASA Panel - NASA's Commitment to Quality* - NASA's commitment to quality is indicative of the overall agency desire to improve the total quality of its products and services and the productivity of its work force. NASA's quality objectives range from improving total agency quality through strategic planning and risk management to improving individual quality of work and work life by advocating a team approach and improving quality of relations with contractors.
	Dale D. Myers, Deputy Administrator, NASA Headquarters, Chairman
	Dr. Noel W. Hinners, Associate Deputy Administrator (Institution), NASA Headquarters. "Strategic and Long-Range Planning"
	George A. Rodney, Associate Administrator for Safety, Reliability, Maintainability and Quality Assurance, NASA Headquarters "Quality Commitment"

James R. Thompson, Jr., Director, George C. Marshall Space Flight Center. "Risk Management"

Panel Coordinator: **Joyce R. Jarrett**, NASA Headquarters

11:30 - 12:00 Travel to Westlake Holiday Inn

12:00 - 1:20 p.m. Lunch/Luncheon Keynote Speaker, **Donald R. Beall**, Chairman and Chief Executive Officer, Rockwell International Corporation

PANEL PRESENTATIONS (Concurrent Panels). Generic panels will be presented vertically, one after another, to permit participants to follow a series or attend other panels, if so desired.

Panel A - TEAMING - A COMMITMENT TO QUALITY
Panel Directors: **Larry E. Lechner**, Marshall Space Flight Center, and **Libby E. Varty**, The Bionetics Corporation

Panel B - NASA EXCELLENCE AWARD FOR QUALITY AND PRODUCTIVITY
Panel Directors: **Anthony T. Diamond**, NASA Headquarters, and **James V. Romano**, General Electric Company

Panel C - QUALITY MEASUREMENT
Panel Directors: **Charles E. Herberger**, Jet Propulsion Laboratory, and **Leroy A. Mendenhall**, Boeing Computer Support Services Company

1:30 - 2:45 *PANEL A1 - NASA/Contractor Teaming* - NASA from its inception made the decision to rely on private industry to support a large portion of the agency's mission. Only through this strong mix of civil service and contractor employees can NASA accomplish its objectives and manage the many large and varied programs. This session will discuss the essential alliance between NASA's contractors and civil servants, the framework in which this partnership must work, and examples of this teamwork in action.

Richard A. Reeves, Director of Planning, NASA Headquarters, Chairman. "Managing in Partnership"

Richard R. Holmes, Supervisor, Experimental Manufacturing Techniques, Materials and Processes Laboratory, Marshall Space Flight Center. "Productivity Enhancement: A NASA/Contractor Team Effort"

Dr. Michael E. Plett, Program Manager SEAS, System Sciences Division, Computer Sciences Corporation. "Building a NASA/Contractor Team for Long Term Mission Support"

Panel Coordinator: Darrell E. Wilcox, Ames Research Center

Panel B1 - NASA Excellence Award - Hardware

Richard M. Davis, Corporate Vice President and President, Manned Space Systems, Martin Marietta Corporation, Chairman

Richard Schwartz, President, Rocketdyne, Rockwell International Corporation. "The Total Effort to Achieve Excellence"

Peter L. Kujawski, General Manager, Science & Application Programs, Astro Space Division, General Electric Company. "Sustaining Excellence During Reorganization"

Seymour Rubenstein, President, Space Transportation Systems Division, Rockwell International Corporation. "STSD Team Excellence Pays Off"

Panel Coordinators: **Frank B. Lary**, Rocketdyne Division, Rockwell International Corporation, and **Arthur V. Palmer**, Kennedy Space Center

Panel C1 - Overview of Quality Measurement - This session develops ideas and concepts which highlight or illustrate the importance of "measurement" in environments which seek continuous improvement of products, services, and/or processes. Topics will include: reasons for measuring; measuring the right things; the cost of quality; and measurement differences between engineering and manufacturing environments.

David R. Braunstein, Director of Quality and Productivity Improvements, Douglas Aircraft Company, Chairman. "Making Measurement Work at Douglas Aircraft"

David L. Nelson, Manager, Statistics for Quality, Boeing Computer Services

Panel Coordinator: **Robert D. Tolle**, Morton Thiokol, Inc.

2:45 - 3:00 Break

3:00 - 4:15 *Panel A2 - Contractor/Contractor Teaming* - Within the NASA environment, the continued growth in program complexity and sophistication of systems and procedures gives rise to an ever-increasing need to jointly pursue excellence in performance and quality in products produced or services rendered. The importance of relationships such as contractor to contractor within that environment will provide the catalysts for greater quality, productivity, and profitability.

Francis L. Shill, Vice President, Aerospace Division, Pan Am World Services, Inc., Chairman. "Success in Team Approach"

Allan J. McDonald, Vice President, Engineering, Morton Thiokol, Inc. "Space Shuttle - Safe Enough or Too Safe?"

Libby E. Varty, Site Manager, The Bionetics Corporation. "Ames Contractor Council - A Success in Contractor Teaming"

Panel Coordinator: **David J. Williams**, ColeJon Mechanical Corporation

Panel B2 - NASA Excellence Award - Support Services/Launch Processing

I. Jerry Hlass, Director, John C. Stennis Space Center, Chairman

P. Edward Adamek, Deputy Director, Safety, Reliability, Maintainability and Quality Assurance, Lockheed Space Operations Company, Lockheed Corporation. "LSOC Quality and Productivity Through the Use of Advanced Technology"

Robert B. Young, Jr., President, Lockheed Engineering and Sciences Company, Lockheed Corporation. "LESC's Corporate Culture Empowers Excellence"

A. B. Gorham, Jr., General Manager, Pan Am World Services, Inc. "Applying the Q/PIP Process in a Diverse Task Environment"

Panel Coordinator: **Dr. Marco J. Giardino**, Pan Am World Services, Inc.

Panel C2 - Measurement Techniques & Methodologies - In order to acknowledge or recognize improvement, a baseline and/or measurement system is necessary to record change in the quality of a product or service. An update of the Oregon Productivity Center's Objectives Matrix and application of Rockwell's Multi-Mission Production Planning (M2P2) System will be presented and discussed as measurement methodologies.

R. Ross Bowman, Vice President, Safety, Reliability, and Quality Assurance, Morton Thiokol, Inc. Chairman

Dr. Dean R. Lee, Director, Quality/Productivity, Systems Support Group, Unisys Corporation. "Lessons Learned in Implementing the Objectives Matrix and Using the Data for Corrective Action"

David E. Peterson, Manager, Planning Systems, Rockwell Shuttle Operations Company. "Multi-Mission Production Planning System - Lessons Learned"

Panel Coordinator: **Dr. Karen K. Whitney**, Rockwell Shuttle Operations Company, Rockwell International Corporation

4:15 - 4:30 **Break**

4:30 - 5:45 *Panel A3 - Space Station Teaming* - This panel will discuss the integrative roles of the PSC, TMIS, and SSE contract efforts of the Space Station program. In addition to presenting their company's role in the Space Station program, the speakers will discuss the methods and systems they are employing to facilitate the interaction between the employees, the various companies and countries, and the other components of the Space Station effort in order to develop a unified team.

James M. Sisson, Deputy Director, Space Station Program Office, NASA Headquarters, Chairman

Frederick W. Haise, President, Space Station Program Support Division, Grumman. "PSC Teaming/Integration"

Richard P. Parten, Executive Vice President, Lockheed Engineering and Sciences Company. "The SSE: Getting a Technological Head Start through Teaming"

Dr. R. Peter Dube, Project Manager, Space Station Program's TMIS (Technical & Management Information System), Boeing Computer Services. "TMIS Teaming/Integration"

Panel Coordinators: **Jessie R. Breul**, Grumman Corporation, and **Gene Guerny**, Goddard Space Flight Center

Panel B3 - NASA Excellence Award - Mission Services

Dr. Dale L. Compton, Director, Ames Research Center. Chairman

Jerry Barsky, Deputy Program Manager, Network and Mission Operations Support, Bendix Field Engineering Corporation. "Are You Smarter Today Than Yesterday?"

Gerald L. Johnson, Project Manager, Computational Mission Services, Boeing Computer Support Services. "Managing Quality in a Dynamically Changing Environment"

Panel Coordinator: **Monte Krauze**, Bendix Field Engineering Corporation

Panel C3 - Successful Measurement Applications - Organizations which have successfully employed process improvement methodologies that resulted in a higher quality of service or product will be showcased. How the use of measurement techniques has assisted in meeting the organizational/business objectives of Martin Marietta's Performance Measurement Teams and Florida Power and Light's Total Quality efforts.

Dr. David L. Blanchard, Director, Space Systems Engineering Operations, Ford Aerospace & Communications Corporation. Chairman

Robert J. Keymont, Vice President of Production Operations, Missile Systems, Martin Marietta Corporation "Performance Measurement; The Key to Productivity"

Michael L. Fedotowsky, Laboratory Supervisor, Florida Power and Light Company. "The Importance of Measurements to Support a Total Quality Effort at Florida Power and Light"

Panel Coordinator: **John F. Loonam**, Grumman Data Systems Division

5:45 - 6:30	Free time
6:30 - 7:45	Reception featuring Excellence Award Finalists
8:00 - 9:30	Dinner/Dinner Keynote Speaker, **David Pearce Snyder**, Futurist, "The Imperatives of Excellence on the Frontiers of Human Endeavor," and **Dale D. Myers**, NASA Deputy Administrator/Announcement of the 1987 NASA Excellence Award Recipient(s)

Thursday, October 13

7:30 - 9:00 a.m. Breakfast and video presentation "Return to Flight." Remarks by: **H. Hollister Cantus,** NASA Associate Administrator for External Relations

9:00 - 10:30 **PANEL D - CREATING A QUALITY ENVIRONMENT**

Panel Directors: **Linda A. Marvin,** Lockheed Engineering and Sciences Company, and **Wanda M. Thrower,** Johnson Space Center

Panel D1 - Strategic Planning - Implications for Quality - The ultimate bottom line for any organization is quality output - on time - within cost. This panel will discuss strategic planning at the corporate level and throughout the organization and its implication for achieving the ultimate goal.

Louis B. DeAngelis, Director, Human Resources & Organizational Development, NASA Headquarters, Chairman. "Strategic Planning - The Basis for Quality Performance"

Richard F. Stehle, Director, Business Planning and Development, Rockwell International Corporation. "An Approach to Strategic Planning - Reinforcing the Importance of Quality"

James A. Warren, Director of Product Assurance, Rockwell Automotive Operations. "Quality - The Business Strategy"

Nathaniel B. Cohen, Director, Strategic Planning and Analysis, NASA Headquarters. "Establishing an Environment for Quality"
Panel Coordinator: Alvin A. Kaplan, Grumman Aerospace Company

Panel D2 - Quality Culture At All Levels - This panel will discuss the benefits and key elements needed to develop a total quality environment. Coverage of a broad spectrum of efforts from three very different organizations and their respective programs.

Richard S. Sabo, Assistant to the Chief Executive Officer, Lincoln Electric Company, Chairman.

W. N. (Nate) Moore, Manager, Corporate Quality Programs, Westinghouse Productivity and Quality Center, Westinghouse Electric Corporation. "Managing the Change to Total Quality"

Lieutenant Colonel James C. Daugherty, USAF, Chief, Producibility, Quality and Standardization Division, Headquarters, Air Force Systems Command. "Quality and Cost: The Vital Link"

Craig Koontz, Quality Action Team Facilitator, Ford Electronics and Refrigeration Plant. "Ford Motor's Quality-1"

Panel Coordinators: **William L. Williams,** Langley Research Center, and **Rolf Duerr,** Unisys Shipboard and Ground Systems Group

Panel D3 - Designing for the Future: Space Station - This panel will feature the Associate Administrator for Space Station and the program managers from each work package. The speakers will offer specific examples on incorporating up-front quality designs for NASA's next major manned space program.

James B. Odom, NASA Associate Administrator for Space Station, Chairman

John B. Winch, Deputy Program Manager, Space Station, Boeing Aerospace Company. "Boeing's Design Build Team Appoach to WPO1"

Robert F. Thompson, Vice President - General Manager, Space Station Division, McDonnell Douglas Astronautics Company. "Two Space Station Division Approaches to Ensure Quality Designs"

Dominick A. Aievoli, Program Manager, Space Station Program, Astro Space Division, General Electric Company. "Designing for the Future - The Role of Up-Front Quality"

George J. Hallinan, Vice President and Program Manager, Space Station Power, Rocketdyne Division, Rockwell International Corporation. "Building a Team Culture at Rocketdyne"

Panel Coordinator: **Sally L. Stohler**, Rocketdyne Division, Rockwell International Corporation

10:30 - 10:50 Break

10:50 - 12:00 **CONCURRENT PANEL PRESENTATIONS**

PANEL E - Contract Incentives - An update on Contract Incentives for Quality and Productivity. Issues to be addressed:

a. Office of Management and Budget Directive on Value Engineering.
b. Quality as an Evaluation Factor under Award Fee.
c. Report from the Special Task Force Assigned to Study the Contract Incentives Issue at the Fourth Annual NASA/Contractors Conference.

Leroy E. Hopkins, Deputy Assistant Administrator for Procurement, Chairman

Alexander A. McCool, Director, Safety, Reliability, Maintainability and Quality Assurance (SRM&QA), Marshall Space Flight Center. "SRM&QA Criteria in Award Fee"

David J. Steigman, Coordinator, NASA Contract Incentives Review Task Force, Lewis Research Center. "Task Force Report from the Fourth Annual NASA/Contractors Conference"

Panel Coordinator: **David J. Steigman**, Lewis Research Center

PANEL F - Software Quality and Reliability - Software is a major part of all NASA systems, and systems reliability is heavily dependent on software quality. Achieving excellent software requires a quality improvement program to plan, manage and measure quality. This panel will describe the key parts of a software quality plan, and experiences in implementing such plans.

Marilyn W. Bush, Section Manager, Software Product Assurance, NASA - Jet Propulsion Laboratory, Chairperson

Ilene Birkwood, Vice President, Corporate Quality, Tandem Computers. "Improving Software Quality and Productivity in Different Development Environments"

Richard B. Butler, DSD Divisional Director for Programming Systems, IBM Corporation

Panel Coordinators: Walter P. Baleyko, Kennedy Space Center, and Gene Guerny, Goddard Space Flight Center

12:15 - 1:30	Lunch/Luncheon Speaker, Katherine Holmes McCabe, Ph.D., President, Winnlow Manufacturing Company, Inc. "Is Corporate America Missing the Point on Productivity?"
1:30 - 1:45	Closing Remarks and Adjourn - Joyce R. Jarrett, Director, NASA Quality and Productivity Improvement Programs, NASA Headquarters, Conference General Chairperson
1:45 - 2:00	Board Busses for Tour of Lewis Research Center
2:00 - 2:30	Travel to Lewis Research Center
2:30 - 4:00	VIP Tour of Lewis Research Center
4:00 - 4:30	Travel to Holiday Inn

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