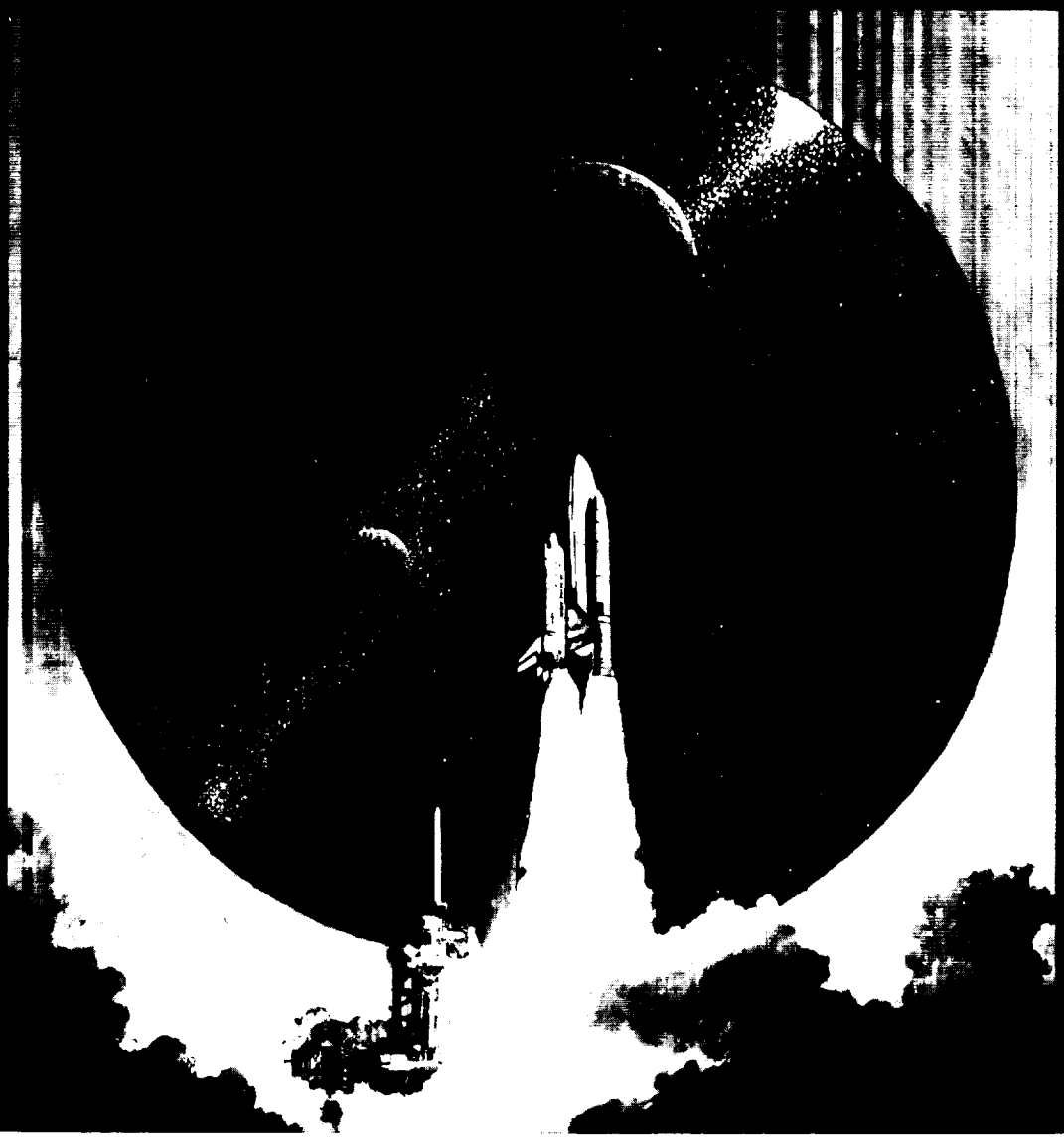
ISSN 1049-667X

7th Annual NASA/Contractors Conference on Quality and Productivity

"Total Quality Leadership"

SUMMARY REPORT



NASA

APRIL 1991

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

"TOTAL QUALITY LEADERSHIP"

HOSTED BY:
NASA JOHN F. KENNEDY SPACE CENTER
GRENELEFE, FLORIDA
OCTOBER 24-25, 1990

Table of Contents

THE WHITE HOUSE

WASHINGTON

September 28, 1990

I am delighted to send warm greetings to Admiral Truly and to all those gathered in Grenelefe for the Seventh Annual NASA/Contractors Conference. My congratulations to the nine finalists for this year's NASA Excellence Award.

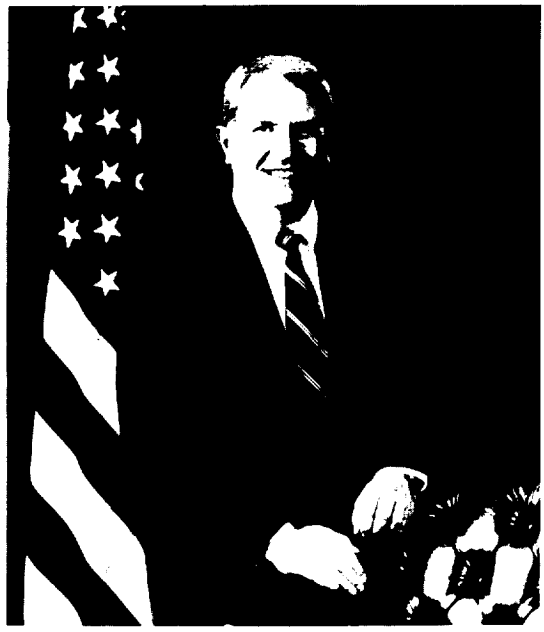
Being first in space is not just America's dream: it is our destiny. In order to ensure our leadership position, we need strategies that will produce timely, cost-effective, quality products and services for our space program. That's why cooperative efforts among NASA, universities, and private industry are so important.

Our goal, to explore Mars and beyond, can only become a reality through innovative teamwork. I have every confidence that your dedication and commitment to excellence will guide our Nation to a golden age of technological achievement.

Barbara joins me in sending you our best wishes for a productive and informative conference. God bless you.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

FOREWORD



President Bush has defined our destiny: to be first in space, to explore Mars and beyond, and to guide America in becoming a leader in the global marketplace. We are entering a new age of space exploration where we will find countless doors of opportunity. Continuous improvement strategies and techniques, implemented through cooperative efforts of NASA, industry, and academia, will allow us to take advantage of these opportunities and ensure America's leadership in space exploration. Furthermore, these strategies, coupled with innovative teamwork, produce positive changes that benefit employees, organizations, customers, and the nation. Leadership, quality, and excellence will be the keys to this new age. The strategies, techniques, and accomplishments presented at the Seventh Annual NASA/Contractors Conference provide a basis for making the improvements necessary to excel in the 21st Century and beyond.

At this conference, I announced the renaming of the NASA Excellence Award for Quality and Productivity. The George M. Low Trophy: NASA's Quality and Excellence Award, honors a man who represented quality and excellence in all he did, and who implemented the principles of total quality management long before TQM became the benchmark for American management. George Low served as manager of the Apollo Spacecraft Program Office, Deputy Administrator, and Acting Administrator. He was directly involved in nearly every success America's space program saw during the 1960's and 1970's, and he inspired a generation to reach for the stars.

Total quality management demands the personal dedication of America's top leaders to continuous quality and performance improvement. You have my unyielding support in this quest for excellence.

Richard H. Truly
Administrator

BLACK AND WHITE PHOTOGRAPH

INTRODUCTION

More than 750 NASA, government, contractor, and academic representatives attended the Seventh Annual NASA/Contractors Conference on Quality and Productivity on October 12-13, 1990, in Grenelefe, Florida. The panel presentations and keynote speeches revolving around the theme of "Total Quality Leadership" provided a solid base of understanding of the importance, benefits, and principles of total quality management. The implementation of these strategies is critical if we are to effectively pursue our mission of continuous quality improvement and reliability in our products, processess, and services. The annual NASA/contractors conferences serve as catalysts for achieving success in this mission.

The conference was highlighted by the announcement of the first recipients of the George M. Low Trophy: NASA's Quality and Excellence Award. My congratulations go out to all nine finalist organizations and to the two recipients of this prestigious honor: Rockwell Space Systems Division and Marotta Scientific Controls, Inc. (the first small business to achieve this honor). These organizations have demonstrated a commitment to quality that is unsurpassed in the aerospace industry.

This report summarizes the presentations and is not intended to be a verbatim proceedings document. You are encouraged to contact the speakers with any requests for further information.

George A. Rodney
Associate Administrator for
Safety and Mission Quality

Opening Address--
"Excellence, How to Strive For It and How to Gain It."

Admiral Richard H. Truly
Administrator
National Aeronautics and Space Administration

Admiral Richard H. Truly

We're here to discuss excellence in America's space program. This conference will provide a forum for the exchange of ideas that work and do not work in the pursuit of quality and excellence. When I think of excellence, in NASA and in the American space program, one name repeatedly comes to my mind.

I would like to reflect briefly about a man that I associate most with quality and excellence in the space program. His name is George Low. In 1938, George Michael Low immigrated to the United States and studied aeronautical engineering at Rensselar Polytechnic Institute. After earning his Bachelor and Master degrees at RPI, he joined the National Advisory Committee for Aeronautics. He was a research scientist in the flight propulsion laboratory at the Lewis Research Center in Cleveland. Thus began an NACA and NASA association with aeronautics research and space flight that would last for nearly three decades.

During those years of service, George Low was involved in every success the American space program had. He helped to organize NASA, and worked on the Mercury and the Gemini programs. George was then named manager of the Apollo Spacecraft Program Office, and saw eight of the successful Apollo flights to the moon. His personal commitment to quality and to excellence was the driving force behind the historic lunar landing just 27 months after the fire aboard Apollo 204. Later, as acting NASA administrator at headquarters, he laid the foundation for the Apollo-Soyeuz flight in 1975.

When George Low roamed the halls and the centers of NASA, his favorite saying was, "Without risks, there are no gains." He practiced TQM long before it became the management buzzword. If NASA is synonymous with excellence, George Low is synonymous with NASA.

Our charter for the next two days is to discuss ways to build upon the legacy that George Low left us. We are entering a new age of space exploration, where we will find countless doors of opportunity to learn more about this precious planet that we live on, about our neighboring planets, and about what lies beyond our solar system. The President's Space Exploration Initiative is a dramatic and ambitious undertaking. Whether or not America actually chooses to pursue this effort will depend, in part, on the people in this room.

We, as individuals, will have to be leaders in our own right, in order to assure that we retain our aerospace leadership in the world. As leaders in these efforts, and as leaders within your own organizations, you are in a position to ensure the success of America's future in space. Space is a harsh, unforgiving expanse that will not tolerate error. Our vehicles, our equipment, our processes must be as perfect as humanly possible. Anything less is simply unacceptable.

Since 1958, our contractors have been partners as an integral part of NASA and our stunning successes. No nation has ever before recorded such a level of success in such daring ventures. But with that pride must come a commitment to continued excellence in the great challenges that lay ahead. We must remember and build upon the commitment to excellence that George Low brought to this team. If we mutually commit to continue Total Quality excellence as a management philosophy, as a way of doing our daily business, there will be no limit to our achievements.

We must share our best ideas and our worst mistakes, and acknowledge our errors, not just today, but everyday. Space Station Freedom - Mission to Planet Earth - Lunar Outpost - Mars exploration. These are heady ideas. They excite us and they dare us, much as President Kennedy did when he challenged us to place a man on the moon and return him safely to earth, and as President Bush has again. If we are to realize these goals, we must demand the best from ourselves and those in our charge. Every member of our team must demand excellence, must be personally committed to it, and must get it.

Tonight, J.R. Thompson will announce the 1990 recipients. This year, in recognition of the tremendous contributions made by smaller businesses, I established a Small Business Category for the Award. My message is simple: large or small, customer satisfaction is met through quality products and services.

Also, in recognition of the commitment to quality and excellence demonstrated by George Low, I have directed that this prestigious award be renamed in his honor. This year's recipients will be awarded the George M. Low Trophy: NASA's Quality and Excellence Award. I hope that the memory of George Low will inspire all of you as it does me. Let me take this opportunity to thank you for your continued efforts in this daring and wonderful business that is ours together. I wish you the best success in your future endeavors, and commit to you my unwavering support for teamwork, for quality, for excellence. And remember, "Without risks, there are no gains."

Conference Overview--

Joyce R. Jarrett
Director, NASA Quality and Productivity Improvement Programs
Conference General Chairperson

Joyce R. Jarrett

Despite the current budget situation, we have over 800 attendees with us today and 220 organizations represented. This gathering is the culmination of the efforts of many people, many teams of individuals both from industry, academia and NASA, and I would like to thank all of you who have participated in making this conference possible.

The planning of this conference has taken place over many months, and the theme—Total Quality Leadership—is certainly appropriate, as we enter the decade of the 90's. It is a decade that promises to be one of the most challenging of our time—one where strong team work and leadership are crucial. As you heard from President Bush's letter this morning, it is efforts such as these—represented by all of you in this room—that foster the action we need to take in order to succeed, to strengthen our organizations and our nation's future performance. In putting this conference together, the conference director and the planning team worked to orchestrate presentations that would best communicate the urgency and vitality of effective leadership, and how to integrate total quality management principals which cultivate organizational excellence.

In looking at this year's agenda, you will see that the next two days offer us many opportunities to share ideas and new information from a wide range of top leaders in government, industry, and education regarding the critical role of leadership in shaping this nation's future. We are now in the new decade of the 90's; for many years, many of you/us have been preparing to meet the challenges of this decade. We are looking forward to broadening our foundation of resources to include our global neighbors. Our national priorities are becoming inclusive of these neighbors, in order to meet our mutual goals.

As we look to the international symposium in 1993, we realize how far we have come since 1982, when NASA first launched its quality and productivity efforts. Total quality was not

the vision then that it is today. Continuous improvement and world class excellence is now a vision that we all share and work together to achieve.

During our NASA awards sessions later this morning, you will hear from the nine companies that are finalists for the newly-named 1990 George M. Low Trophy: NASA's Quality and Excellence Award. These companies are the leading edge of what we all strive to be. The leadership and teamwork in these organizations have brought them to high and sustained levels of excellence to become leaders in their industries. We can learn much from their methodologies and cultures. As you attend these sessions, you will learn first hand how they have used the George M. Low Trophy criteria as a stimulant and a standard.

Our luncheon speaker today is Edwin Garrison, President and Chief Executive Officer of the Thiokol Corporation, who has made much progress using the principles of TQM. On hand this evening to narrate the latest film on space is astronaut William Sheppard. Tonight we will hear the announcement of the best of the best—the recipient or recipients of this year's award. For the next year, this company or companies will share their lessons learned, as have prior recipients. You will hear shortly from Robert Young, Jr., President and CEO of Lockheed Sciences and Engineering, last year's recipient and first Service Support Organization to win a major award of this type. Bob has personally given over 200 presentations, both nationally and internationally, since receiving the award.

Along with the George M. Low Trophy presentations, you will have the opportunity today and tomorrow to attend panels built on total quality management tenets, on strategic planning, on employee development and empowerment, teamwork, quality assurance, measurement and customer satisfaction. These are the topics your representatives wanted us to address at this Conference.

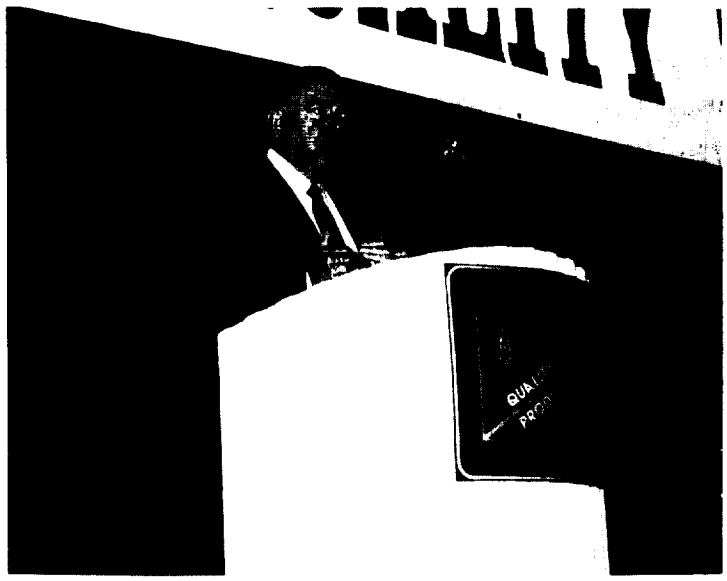
Regardless of which presentations you attend, we hope you will find them informative, and that you're able to take ideas back to your own organizations and apply them. You will find survey forms to assess what you've heard, and I encourage you to fill these out. You will also find a post-conference TQM assessment. All of these are important to us, in helping us plan for future conferences.

Finally, I would like to thank all of you for returning your TQM assessment prior to this conference. We received 519 responses, and an early analysis indicates that the highest mean was customer satisfaction, at about 3; the lowest was employee empowerment and teamwork at 2. As you will recall, we were scoring on a scale of 1 to 5, so that should tell us that we do have a lot of room for improvement. I think it's exciting that you have taken the time to complete the assessment. I hope that over the next two days, we share ideas that will help us improve.

Before we begin our first conference panel, I would like to acknowledge those in this room who attended the first conference in 1984. Welcome back. To those who have attended all the conferences—you deserve a hand. And finally, a special welcome to all the first time attendees.

Keynote Address--
Profile of a Quality Organization -- "Building the Foundation for a Total Quality Culture"

Robert B. Young
President and CEO
Lockheed Engineering and Sciences Company



Robert B. Young, Jr.

This is a very special time for us at the Lockheed Engineering and Sciences Company. It completes the year when we've had the opportunity to tell the firsthand story of what our people have accomplished.

We were a finalist three times before we were selected to win the NASA Excellence Award. It's been important to us to be a finalist, because it recognized our people. However, it's been even more important to be a participant, because participating in the Excellence Award process has increased our focus on quality and productivity, and led us to develop, to grow, and to find out what we can really accomplish. A major contribution to our success was the support and encouragement we received from NASA at all levels.

One of the things that has made us an Excellence Award winner, is that we've made a paradigm shift from control to empowerment of our people. We paid attention to control and empowerment before, and we pay attention to it now; but we used to work to empower people in a context of controlling them, and now we work to control people in a context of empowering them. We've made a basic change in our values. Making empowerment the senior concern has altered the decisions we make. It has altered the relationships between our management, our employees, and our customers.

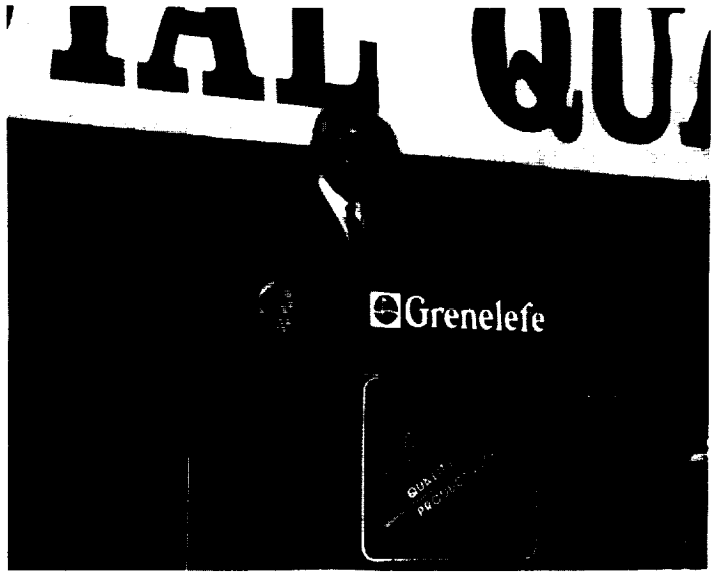
The commitment and performance that our people have shown has gone far beyond anything we expected. We've made the commitment to bet on people instead of on systems. Anyone in our organization can make improvements in our systems by simply being able to show that they add value to the process and value to our customers. We made a leap of

faith that this would actually lead to some kind of improvement in how we operate in our processes, and to an improvement in customer satisfaction.

It's been our privilege to carry the banner for the NASA Excellence Award for the past year, and I wish the finalists this year the best of luck. It was tremendously valuable for us to participate in the award process. Thank you very much. I've enjoyed the opportunity to be here.

Keynote Address--
"Total Quality Leadership--The Foundation for Our Future"

U. Edwin Garrison
President and CEO
Thiokol Corporation



U. Edwin Garrison

Last year Thiokol spun off the non-aerospace side of the business, while retaining our traditional space DOD activity. The split made Thiokol a pure aerospace company, which allowed us to better serve our customers, while challenging our ability to lead the company through this transition.

In our first year of business, we met or exceeded every objective we set for ourselves, with an emphasis on safety, quality, and productivity. We are confident about the future, because we take our business very seriously, and know that it all depends on our people. Understanding and practicing Total Quality leadership has become an essential part of our day-to-day business. We're also confident because our employees and suppliers have responded to our new commitment in a very positive manner.

Since our return to flight, the improvement in our rocket motor quality performance has been tremendous. We have seen a 70% reduction in workmanship non-conformance, and a 93% reduction in problem reports written on our motors. As our quality goes up, our cost goes down. Our scrap rework and repair cost per motor have been reduced by 49%. Our

overtime has been reduced to less than 8%. It's performance like this that is enabling us to receive awards and recognition from our customers.

My emphasis today is on three points: NASA's role, Thiokol's role, and our people's response to this renewed process. We've been a charter member of the NASA contractor team since its inception. Thiokol has participated in every manned space flight program. From day one, NASA has demonstrated its leadership and longstanding commitment to the pursuit of quality and productivity. Today's environment can be put in perspective by looking back about 30 years, when programs were developed on a "test it and fix it approach". Costs were comparatively low, and the vehicles were unmanned. The transition to manned flight vehicles, billion dollar payloads, and national pride has driven our requirements to the point of being "unforgiving".

We have benefited greatly throughout this evolution. The most recent element of NASA's leadership has been the creation of the George M. Low Trophy: NASA's Quality and Excellence Award. When we baseline our performance to the criteria of the Award, good things start to happen. Then, when we compare and measure our performance to standards we know are achievable, the rate of progress increases. Our awareness of supplier and customer problems and needs has been strengthened because of our participation in the Excellence Award process.

I would like to take a minute and talk about the leadership changes we've been making and how it's involved our employees. When we split off the non-aerospace side of the business, we became more focused and better able to respond to our customers. Instead of one large organization, we are now decentralized into four smaller autonomous business units. These operating level changes are allowing our employees to assume more active roles in solving problems and making decisions that affect our commitments to the customer. I personally hold each vice-president responsible for assuring that safety, quality, and productivity are an integral part of each organization's objectives.

Because of the Challenger experience, Thiokol understands better than most the importance and significance of safety in the quality of our products. We've initiated an effort to enhance our total operations in parallel with the redesign program. The plan gives our first-line employees the resources they need to achieve higher levels of quality and productivity. NASA teams from Marshall participated in the development and approval of this plan. With their help and input, we developed a quality improvement program that will generate greater solid rocket motor reliability, and a safer, more productive manufacturing environment.

As part of this plan, our employees are now working in five unique manufacturing work centers. All technical and support disciplines for a specific manufacturing process are co-located within each work center. A work center Director runs each one as a small business within our space operations. And we have a central production control that integrates the planning and schedule of the total operation. After 15 months of operations, our employees have responded to this new way of doing business in an extremely positive manner. They have taken on a much stronger ownership for planning and completing their work. They are

taking the initiative for making needed changes. They know what to do and when to ask questions.

One of the more challenging aspects of the plan is the computer integration of the manufacturing operation. This network will enable people to improve quality and reliability through statistical process control right at the shop floor level. These changes are improving the ability and willingness of our employees to get involved and achieve successes where they work. Thiokol employees company-wide are responsible for maintaining a safety management system which is based on three premises: 1) operating safety is the highest priority of our business; 2) working safely is the responsibility of each employee; 3) implementing and maintaining safe operating practices is an integral part of our management responsibilities.

Our 460 suppliers have recently received a new "suppliers guide", which helps them understand our quality requirements. Regular symposiums, workshops, and other awareness events provide leadership and motivation to our suppliers. These and other initiatives have resulted in an 80% reduction in supplier non-conformances per motor in the last three years.

I'm convinced that the whole spirit of continuous improvement is teaching us that ownership and accountability grow as employees are allowed to genuinely think and contribute to the company goals. We're seeing tremendous participation, with improvements in all areas of the operation. We are realizing capabilities that we had never seen before.

Let me emphasize again: there's no doubt in my mind that all these successes have come about because of our uncompromising commitment to quality and productivity. Total Quality must begin with each of us; it is truly the foundation for our future.

Keynote Address--
"Total Quality in Maryland Education"

Dr. Joseph L. Shilling
State Superintendent of Schools
Maryland State Department of Education

Dr. Joseph L. Shilling

In Maryland, we have only 24 school systems in the whole state. So, in one sense, if we want to change something, we have a tremendous advantage, because we only have 24 school systems to change. The difficulty is that 5 of the 15 largest school systems in the United States are located in Maryland.

If you look at our standardized achievement test scores at the third grade, we rank about three to five months ahead of the national norm; at the fifth grade, we are about six to nine months ahead of the national norm; at the eighth grade level, we are about one and a half years ahead of the national norm group. In SAT scores, we ranked third in the country two years ago; this year, we rank second in the country. So, if you use the things people traditionally use to judge the worth of a school system, ours is pretty good.

Our question is not "Do we stay good, and make 'good' a little better?" The question for us, as for all of American education is: "How do we strive for a level of excellence in public education that we had previously not even thought about in this country?"

We've adopted a very simple mission for public education in Maryland—to have Maryland in a national and international leadership position in public education. We adopted very straight-forward goals. They are very atypical for educators, because we made them quantifiable, so we would know if we were achieving them.

Goal #1: That 95% of our students be ready to learn when they enter first grade. Twenty percent of our first graders aren't ready to learn, because of nutritional problems, health problems, learning disabilities, or poverty.

Goal #2: That Maryland rank in the top five states in the nation on measures of student achievement and other student outcomes. We don't know where we stand in this respect. SAT scores tell us very little about our student population; they reflect only 59% of our students, because they are the only ones who take the SAT's. We don't have a good base in how we compare nationally and internationally. We are looking at the National Assessment of Educational Progress and its international counterpart to give us that baseline data and enable us to track ourselves as we move toward that goal.

Goal #3: That 100% of our students be functionally literate. When I say functionally literate, I'm not talking about a very high level of achievement. We have four tests in Maryland, one in reading, one in mathematics, one in writing, and one in language arts. 67% of our ninth graders can pass the functional mathematics test, 82% can pass our functional writing test, and 73% can pass our functional citizen test. So, just at the functional level for our ninth graders, we are not nearly as successful as we need to be.

Goal #4: That 95% of our students achieve at a satisfactory level on our state measures for student achievement in mathematics, science, reading, social studies, and writing and language arts. That "satisfactory" level is considerably above a functional level; it means that students are able to enter our college and university system, and perform well. We have a crisis in Maryland and, I suspect, across this country. Of all the kids we graduate from our schools (about 48,000 from our public school system) who go on to Maryland's college and university system, 1% are majoring in mathematics, and 4% are majoring in all the sciences combined.

Goal #5: That 95% of our students graduate from high school and be prepared for post-secondary education, meaningful employment, or both. Currently, only 75% of our kids graduate from high school, which is about average for the nation. About 22% of our kids are not preparing to go on to post-secondary education, and are not in a vocational educational program preparing for meaningful employment. They cannot get into our colleges and universities; they are not prepared for any job that demands any kind of technical skill. Industry looks back at us and says, "What in the world are you producing? These people are not prepared to go to work."

Goal #6: That Maryland schools be free of drugs and alcohol, and provide a safe environment conducive to learning. Some people say we can't do that. My response to that is very simple: "Yes, we can, because if we cannot achieve that goal, we can't achieve *any* of the goals that we have established for ourselves." About 27% of our high school seniors report a serious involvement with drugs or alcohol some time during their school experience. Our suspensions, expulsions, and referrals for medical treatment for drugs and alcohol would astound you. They astound me, and I'm talking about 12 and 13 year old middle school kids.

How are we going to achieve these goals?

We've laid out 15 strategies. They are not designed to tell people how they are going to teach in the classroom; rather, they are designed to make us look at ourselves differently, from a structural perspective. We established a set of state-level standards. As a state, and in each school system and school, we hold ourselves accountable for reaching these

standards. We are developing a School Improvement Challenge Grant Program for schools that are not meeting the standards. An individual school will have three years to make significant progress toward meeting the standards, or funding will be terminated and the school system will be called in.

Coupled with this, is a strong emphasis on quality teaching and school-based leadership. Although we currently allow people to enter the teaching profession based on paper credentials, we are moving toward a performance assessment process in conjunction with the paper credentials. A second perspective is the need for a strong educational training program at the local level. This will be accomplished through both Total Quality Management and site-based management.

Next, we are proposing a comprehensive early childhood intervention program for children up to age 3, to prepare them to enter school. We are proposing that every disadvantaged kid will attend a pre-kindergarten program for 4-year-olds. We are suggesting that kindergarten be mandatory for all our students.

We are in the process of revising our high school graduation requirements. To graduate, a student has either met the core credits required by our college and university system, or has come through an approved vocational educational program. There will be no more general curriculum programs for graduation.

We are proposing raising the compulsory attendance age from 16 to 18. Here, I'm getting a lot of flack, because people are saying, "You need to develop alternative programs that will make those kids want to stay in school." I am convinced the only way develop the programs we need is to say to teachers, principals and superintendents that the kids are going to be there. Period. Once we do that, I feel we will develop alternative evening programs for those kids who can't be in school during the day, and will devise work-study programs with business and industry to get those kids into a meaningful learning environment.

We are also proposing extending the school year from 180 days to 200 days. In Japan, Germany, Korea, and all the industrialized nations of the world who are taking over our share of the marketplace, they go about the business of schooling much differently than we do. They value education much more highly than we do, and their kids spend a lot more time in school than ours do. A Japanese student, from kindergarten to grade 12, spends 4 1/4 more years in school than his counterpart in the United States.

Although we are learning a lot about how we can enhance the education, we haven't even begun to approach how to use technology in our schools. We are proposing that we have one computer available for every 10 students in the state.

Our teachers are not prepared, particularly in our elementary and middle schools. We are asking teachers in the elementary school to begin to teach algebraic and geometric concepts, and they are scared to death. They don't even know what we are talking about. So, we have set up what we call the Governor 's Academy in Mathematics, Science, and Technology,

and are going about a very intensive retraining program for our elementary, middle, and high school teachers.

Finally, we have a tremendous disparity in terms of how we fund education in Maryland. We have to come to grips with this disparity, because the places where we spend the least are the places where we have the greatest number of disadvantaged kids in trouble.

That's what we want to do, and where we want to go. But, we need a management process which gives those goals and strategies a soul, a reason for being. We have begun to focus on Total Quality as the driving force for the State Department of Education. We have entered a partnership with Westinghouse Corporation through which they have dedicated tremendous resources and time to come in and work with us to help us develop a Total Quality culture within our organization. We want to have one central theme as we look at this management process, and the theme is very simple: Meeting customer requirements by doing the right things right the first time. But, truthfully, we don't even know who the customer is. People in education think that the customer is the student. The customer is *not* the student. The student is the product that we are attempting to produce. We've got to figure out who our customers are and how to meet their expectations.

We are looking at the degree to which our employees participate in establishing and achieving our Total Quality improvement goals. We are looking at our products and services to see if they are appropriately innovative, and if there is a process of verification and a control mechanism that allow us to know whether or not we are meeting our customer requirements. We're in the process of removing the rules and regulations, so that we're not left in a position of either having services to sell or going out of business. That's a very new concept for our people, because they are used to rules and regulations selling their services for them.

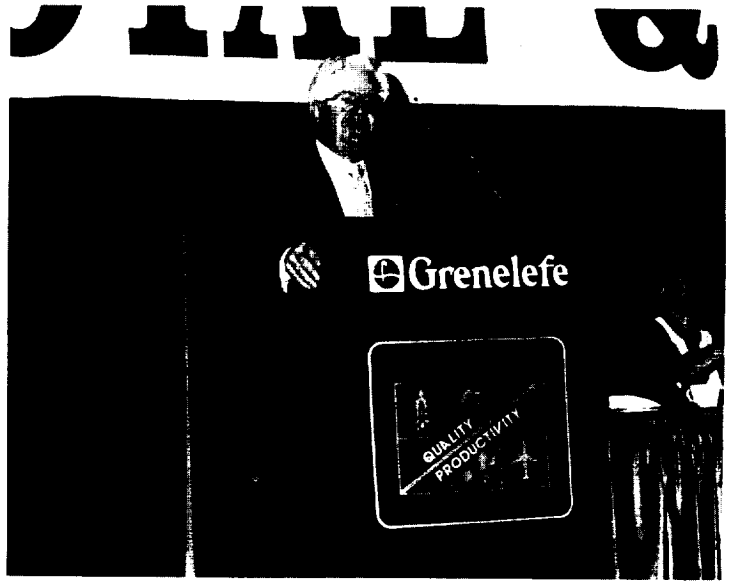
We are looking at our suppliers as partners in the process. Conversely, we are determining if the same suppliers, textbook companies, equipment companies, are producing what we need. We are putting accountability measures in place for ourselves, because we can't hold school systems accountable unless we're willing to hold ourselves accountable.

But, we are fortunate. We have an extremely well-educated, well-informed group of employees. We have a real opportunity to build a Total Quality culture in the Maryland State Department of Education.

I want you to remember just one thing. We're your farm system. You're the major leagues. We want to prepare a product that can make it in your work force. We've got our mission. We've got our goal which is success for all of our students. We've got our process: Total Quality. I would remind you that I have 49 counterparts across this country. They need your help. So I encourage you not to be reticent about walking in and volunteering to be a part of that effort. We need your experience, we need your expertise. We used to talk about needing your money. That's the last thing we need. We need more resources, but we need your experience and expertise much more.

Keynote Address--
"Answering Industry's Question: How Can I Help?"

Elmer B. Kaelin
Retired President
Potomac Edison Company



Elmer B. Kaelin

Assume that you have just joined a new organization with overall responsibility for manufacturing and quality control. This organization has plants throughout the United States and you produce millions of complex parts per year. This is a finishing operation. The parts are produced elsewhere by many small suppliers. Many plants do not have incoming material specifications for the parts entering the plant. But it doesn't matter, because all incoming parts are accepted anyway. All plants process in small batches of 20 to 30, and there are 13 major steps in the process. The process itself is 150 years old and is obsolete. In fact, your process is so inflexible that at every one of the 13 steps you give each part the same finishing treatment, ignoring both the incoming characteristics of the part, and the external specifications that the part is capable of achieving. Overall process yields are between 65 and 75 percent. All parts coming out of step 13 are shipped. You can do this because you are a monopoly and you don't have in-house government inspectors. Your customers are screaming about the quality of your parts. They have told you that only about 5% of your parts are equal in quality to those produced in every other industrialized nation in the world.

After several weeks on the job, you have reached two conclusions. First, you have stumbled into the worst mess you've ever seen. Second, you can make no significant improvement in the end product until you have a modern, flexible process that can apply a finishing treatment to each individual part that best matches the characteristics of the incoming material. Unfortunately, as you look around, you find there is no such process. Every plant in every country in the world processes these parts in batches. Then a staggering thought hits you, just as it hit the inventors of continuous casting steel many years ago. You realize

that if you could develop a process and make it work, your organization could leapfrog every nation on earth in the quality of its output.

I am talking about K through 12 education in the United States, a catastrophic failure that has put our nation at risk. How do we change this? We have a national blueprint for making the transition from the obsolete blackboard classroom to the sophisticated computer classroom, where every child is individually tutored using the feedback from continuous monitoring. The name of this blueprint is *Transforming American Education: Reducing the Risk to the Nation*. My message is a call to action--a call to carry out the mission and vision set forth in this report, to implement the recommendations, to reach our national goal of making a total transition by the year 2001. Unfortunately, the task force report which I refer to has been largely ignored by both educators and the press--despite the fact that it was the follow up to the *Nation at Risk* study, which awakened all of us to the plight of K through 12 education in this country.

As an example, several months ago I sat at the same table for dinner with the Undersecretary of Education, and I asked his opinion of *Transforming American Education*. He could not recall ever having read it. Yet this document has provided the insight into what we must do as a nation to meet the challenges of today's global society. The path to excellence requires that we replace our obsolete tools with new ones based upon technology. New tools that will recreate, rekindle, and renew the kind of thinking necessary to produce the quantity and quality of students this nation will need to succeed in today's competitive world. Reforms predicated on more time in the classroom, revised course content, and stricter discipline will not by themselves produce the desired results, unless we give the teachers the tools to assist each student to reach his or her full potential.

The success of an individually tutored classroom depends on good hardware and software, a well-trained teacher and strong support from principals and superintendents. The classroom is configured with the teacher behind the students, with a one-to-one teacher to student ratio. The computer is the instructor. In these classrooms, students move at their own pace. In a given 4th grade math class, for example, students are scattered from grade 3 to grade 7 or 8. Students do not have to skip grades or be held back if they are weak or strong in just one subject. They can stay with their peers in these classrooms.

Who is tutoring these students? The finest teachers in America, who have developed curriculum in software form. Why do we want teachers to write our software? Because the concepts of teaching and learning don't change significantly from the blackboard to the computer classroom. The only thing that changes is the delivery system. Teachers have noted significant changes in their students in the computer classroom. They say that students concentrate harder, complete more work, have a greater attention span, are better behaved, have a better attitude toward school, and improve their attendance, compared to the blackboard classroom.

Cooperative learning is another dynamic of the computer classroom. Teachers report that when students get stuck, they first try to solve the problem by themselves. If that fails, they turn to the student on their right, then to the student on the left. If all else fails, they ask the teacher for help. Cooperative learning has several benefits. It fosters problem solving

skills. It creates the environment of group problem solving that the student will eventually meet in industry. The teacher now has more free time, because he or she is not delivering the lesson. S/he can give more time to the students who need it most.

In this Network Classroom, the teacher is able to generate a management report monitoring each student's progress status. Every response that a student makes on a computer is recorded by the management system that resides on the network. This enables the teacher to create and adjust individual learning plans for each student on a daily or weekly basis. But, we are already going beyond this. We are developing software that will respond automatically and make the adjustments so that the teacher doesn't have to intervene. It will use criteria that the teacher can enter easily into the software.

How did Potomac Edison get started in this? A resolution was adopted by the Virginia General Assembly in April 1986, giving the State Department of Education 200 days to develop a plan for financing and installing technology in the public schools. The Virginia Resolution and a copy of *Transforming American Education* crossed my desk within a week of each other. They both had noble goals. We saw an extraordinary opportunity to speed up the process. We immediately begin donating computers by the thousands to the schools in our service territory. We were able to quickly form a partnership with the Virginia Department of Education, and we established similar partnerships in our Maryland and West Virginia territories.

Over the past four years, Potomac Edison has spent $7 million to place technology-based classrooms in the 23 school districts that we serve. Our partners provided an additional $6 million. Today, we have approximately 6,400 computers installed in 250 locations. Every school in our service territory has at least one classroom.

In the first year, a sixth grade mathematics class in Rapahannock County was taught by computers. There was a dramatic improvement over the average of the previous five years.

	5 Year Average Score -- Traditional	1st Year Computer	Percent
Mathematics Concepts	56.4	73	29.4%
Mathematics Computation	57	65	14 %
Mathematics Problem Solving	53.4	74	38.5%
Mathematics Total	56.4	72	27.6%

Results like these are representative of what we are now seeing in elementary school mathematics, where the teachers use the management system and permit the students to progress at their own pace. This result in no way represents the end of the story. We are only in the beginning stages of an evolutionary process that will continually improve our ability to use technology as a teaching tool, to raise our standards from functional or satisfactory in order to achieve academic excellence.

We at Potomac Edison are particularly concerned about the teaching of science. *Transforming American Education* recommends that research partnerships be formed with colleges and universities. We chose as our research partner Western Maryland College, a small rural college in Westminster, Maryland. We placed $300,000 worth of very sophisticated computer equipment in that school three years ago and asked them to find a better way to teach science. Today, embryology is taught in a computerized classroom at Western Maryland College. Potomac Edison has adopted this classroom for teaching high school science. This year, we have installed six of these classrooms on a test basis in six high schools in Washington County, Maryland. These classrooms are built around enormous data bases containing thousands of digitized pictures, birds, fossils, mammals, anatomy, etc., anything relating to science. Many of these techniques have unlimited potential for easy application to the industrial process.

The Network Classroom is a revolutionary new process. Educators are just beginning to see the enormous potential of this product. But, because education is a monopoly, with a culture highly resistant to change, getting where we need to be will take pressure from groups outside education. Pressure must come from legislators, from governors, from business leaders, and from parents. Business people should get involved in any innovative way they can think of. Don't throw your obsolete computers away. Give them to your local school district if they can function on the network. At Potomac Edison we funded our program for about 1/2% of retail revenues, which cost the average residential customer less than a penny a day.

There is one more element that is critical to this program, and that's teacher training. Training funds should be distributed through the State Department of Education, and designated for the sole purpose of training teachers. At Potomac Edison, we went a step further. We built a training center at our corporate headquarters in Hagerstown, Maryland. The center has tested every major piece of computer equipment in the computer network. It contains thousands of pieces of educational software. Formal training has been conducted for several thousand teachers in our three state area. But, we found that this is not enough, so we've equipped a mobile van with a 30 station computer classroom that can be set up in minutes, for PTA meetings, for training, for demonstration purposes, for introducing technology, even for country music festivals. Slowly, as more and more people see computers, the pressure develops that is necessary for change. In my opinion, very few of the superintendents wanted the first classrooms we donated, thinking it was just another industry gimmick. But, public pressure grew to a point where they had to accept them, and people started to use them. To support this effort, we also hired a full time educator in each state, to travel to the schools and provide instant support when a teacher needed it.

America now has before it an historic opportunity to leapfrog the world in educational quality. Because of the widespread penetration of computers in our society, we are the only nation with the capability to quickly make the transition from group teaching to individualized tutoring. If we don't seize this opportunity, it will be gone forever.

1.0 Top Leadership Panel

Government and industry top leadership discuss the importance of commitment and leadership in implementing Total Quality.

1.1 Introduction

Admiral Richard H. Truly, Administrator, National Aeronautics and Space Administration, Chairman

We've been up here at the front table talking about the U.S. space program, and the international program. It has been a very interesting education for me, during the last few months, as I've traveled to Japan and also to the Soviet Union to take another look at the Soviet program.

It's a privilege to have two distinguished gentlemen like Tom Murrin and Dan Tellep join me this morning. So—since you've already heard from me—without any further adieu, I'm going to let them make a few comments, and then we'll join you in a round table discussion.

1.2 Panel Presentation

The Honorable Thomas J. Murrin, Deputy Secretary, U.S. Department of Commerce

As a team, the coalition of government and industry has created a truly elite organization. Together, government and industry have accomplished several of the most extraordinary feats in the history of the world.

Recently, however, you, in industry, have suffered some conspicuous setbacks. Your costly programs are constrained by federal budget limitations and you are often confronted with attitudes ranging from indifferent to critical.

Happily, we no longer consider quality and productivity to be competing concepts. Rather, quality improvement—properly defined and implemented—can be the single most effective means for productivity improvement. An excellent definition, in my view, is "doing the right things right the first time." Although it sounds simple, this definition—at least in the organization I was involved with for many years—took quite a few years to develop. We started with the commitment to doing things right, which we saw as a pretty major undertaking, in itself.

After awhile, largely inspired by the Japanese and certain studies we'd been making there, we added the first *time* requirement, which—if you really think it through in a quantitative way—adds a major challenge.

Next, we asked a small group of our brightest and best to spend some time seeing if our initial concept should be refined; that's when they added that "the right things be done right *the first time.*" What strikes me as significant about this is that though it can be applied to everyone in an organization, it is particularly challenging to those in senior positions. The implications of doing the right thing right the first time, present a challenge that we have not always fully undertaken before and have not always been fully committed to.

After 36 years in American industry, I've concluded that quality improvement is the *only* business activity that simultaneously satisfies customers, motivates employees, comforts investors, teams suppliers and wins media and public approval. That's quite a sweeping assertion. So I ask you to think about it. Think about what you can do with joint ventures and de-acquisitions and cost reductions and more R&D and the myriad of other things that you get involved in. Then ask, "What *other* effort might simultaneously gain the same results?"

After my recent months in government, I believe that similar judgments are appropriate for this key segment of our society. Your numerous customers —among them the Congress, the citizenry and numerous other countries—are like industrial customers: increasingly demanding higher quality and greater reliability in the goods and services that they support or procure. Answering their demands can only be beneficial.

Congress and the general public can be considered your investors. Increasingly, they're coming to realize that poor quality and non-conformance are enormously expensive. As Fred Smith, the Chairman of Federal Express, the first winner of a Baldrige Award in the service category, recently observed, "At least 15 percent of the cost of any product or service is spent on rework or repair." So quality improvement is a comfort to your investors.

As to establishing a team-like relationship between government and industry, you've done this wonderfully well on many programs. Increased emphasis on quality improvement can only enhance this relationship and serve to more effectively team NASA and its contractors.

Finally, effective quality improvement should win media and public approval in a unique, world-wide way. Therefore, your future performance can help enhance the prestige and influence of the United States in the world community.

In industry, like it or not, one of the most powerful factors forcing executives to become world class practitioners of quality improvement is foreign competition from the Japanese and others. I think this will continue for some time. During the past year, I have spent much effort attempting to monitor and interpret technology changes. I am really startled by the many competitive advances that have surfaced.

For example, Japan and Western Europe are now equal to or are gaining on the United States in several major technology sectors, such as advanced materials, semi-conductors, opto-electronics, aircraft and space and advanced manufacturing. Western European gains are strong in aerospace-related technologies, and Western Europe has technology parity with the United States in most civil aircraft technologies. The Europeans have caught up in aerodynamics and structures and are slightly ahead of the United States in a few advanced materials applications. Europe is also at parity in propulsion and only slightly behind in avionics.

The U.S. maintains an overall lead in space technology, primarily because of our manned space program. However, if we include the U.S.S.R. in our comparisons, we find that they are ahead of us in some important aspects of space. Both Europe and Japan will also soon achieve parity with the United States in expendable launch vehicle technology unless new, significant U.S. developments appear.

Japan's growing capabilities are most evident in electronics. Japan is the world leader in semi-conductor memory technology, non-silicone material and devices, and semi-conductor manufacturing of all kinds. The Japanese supplier base for semi-conductor materials, manufacturing equipment, and related technologies is rapidly improving. Japanese strength in semi-conductor manufacturing equipment, particularly in lithography, means that U.S. semi-conductor production capabilities will be determined, at least in part, by the quality and the timeliness of materials and production equipment exported by Japan. The Japanese are using their superiority in semi-conductor components to help them pull even in computer hardware. Their next generation of super computers will probably have performance levels close to those of the best U.S. machines, and they are using their access to U.S. technology to overcome deficiencies in software and microprocessors.

Another worrisome competitive factor is the superior capability—particularly of the Japanese —in such significant techniques as design-for-manufacture, concurrent engineering, just-in-time production and continuous quality improvement. One is struck by such specific examples as the ECC's successful entry into the commercial rocket launch business, and the prospective entry—via Cape York, Australia—of the U.S.S.R. into this sophisticated marketplace. Another, is the proposed joint venture of one of our aerospace companies with the Soviets to rapidly develop a supersonic executive jet, with considerable know-how coming from the Soviet side.

It has been suggested that the four factors that will most determine the overall outcome of such competitions among nations are: national will, available capital, leading technology and world class education. In all four areas, we appear to be wanting and, if we compare ourselves with our leading competitors—particularly Japan and Germany—one has to conclude that the competitive challenges we face will definitely increase.

In order to meet such increased challenges, we must make quality improvement a top priority goal. There are no great mysteries about quality improvements. The so-called "secrets to success" have been captured in the Malcolm Baldrige National Quality Awards process which is coordinated by the Department of Commerce, and consists of seven criteria.

The first criterion is executive leadership, i.e., senior executive success in creating and sustaining a quality culture. Others include strategic quality planning and human resource utilization. The seventh criterion, and the most important, is the effectiveness of company systems in determining customer requirements and demonstrating success in achieving customer satisfaction.

All of this is described in a booklet, "The 1990 National Quality Award Guidelines". You can contact the National Institute of Standards and Technology in Gaithersburg, Maryland for a copy.

Two years ago, Commerce received requests for about 12,000 of these guidelines. Last year this increased to 65,000. So far this year, we've had requests for about 175,000 copies. We're quite certain that organizations are not just asking for copies for copies' sake, but are really getting involved in the process.

Nine National Quality Award winners, along with our folks at Commerce, are anxious to help you with your commitment to achieving world class quality. For example, Motorola, who was selected in the first round of these awards in 1988, is often asked what they believe to be key ingredients for an organization to renew itself, to change or refine its culture, to strive to be best in the world and to truly approach the goal of total customer satisfaction. Their reply is that the basic ingredients are six in number: Top-down commitment and involvement, a comprehensive, quantitative measurement system to track progress, tough goal setting, providing the required education, spreading the success stories, and sharing financial improvement gains with those who contribute to them.

To date, of the nine Malcolm Baldrige National Quality Award winners, no aerospace or defense contractor has won. This seems like a surprising and somewhat worrisome situation for such a crucially important segment of our society. Hopefully, you'll change this and commit fully to the Baldrige process and apply at the appropriate time for the award.

1.3 Panel Presentation

Daniel M. Tellep, Chairman of the Board and Chief Executive Officer, Lockheed Corporation

Over the past year I've learned that not all quality efforts are created equal. At Lockheed we have some marvelous efforts going on in "Continuous Quality Improvement" or CQI. Yet there remain a few spots where the message hasn't quite got across in its entirety.

For example, I asked a supervisor at one of our companies: "Do you have CQI here?" "Sure I do", he said. I asked him to tell me about it. He said, "It's over there", and pointed to the suggestion box. I asked him if he got many suggestions. "No", he said. "That shows what a good program I've got." We need to improve the process for CQI.

I confess that when I heard about CQI, I was skeptical. It was my experience that effective management practice had led to some outstanding missile and space products whose inherent objective had always been high quality and high reliability.

Yet, at the same time, I also had to recognize some very critical differences in the CQI program: the idea of empowerment of a work force, of cross-functional teams, metrics, and a new view of what is meant by "the customer".

On the strength of these fresh distinctions, we decided that we would initiate Continuous Quality Improvement, but in a way that was consistent with our decentralized operating style. I also made it my personal business to squelch anything that would cast the CQI initiative as merely buzz words or sloganeering. I am absolutely committed to making the CQI philosophy integral to everything we do, not superimposing it on a pattern of "business as usual".

Good Managment Practice (GMP) gave us top quality product, but at a premium in time and cost. With CQI's focus on process, we can eliminate that premium. With GMP, if we had trouble with a product, we formed tiger teams. With CQI we can minimize trouble from the outset by establishing cross-functional teams to simplify processes and head off problems. With GMP we understood the imperative of customer satisfaction and service *externally*. But with CQI, we clearly understand that we must apply this imperative *internally* throughout our organization and among our suppliers.

We have had continuous improvement in the past, but, in many ways, it was technology driven. We've exploited technology to improve processes, productivity and quality. Although CQI retains this technology driven component, its emphasis on people and their empowerment adds powerful leverage and is a powerful amplifier to the system of continuous improvement.

The way by which CQI makes its way into any large multi-operational, rules-and-procedures encrusted organization, which is resistant to change, is through a process of personal conversion. It is usually the best managers—those who have the least to lose—who are in the forefront of continuous improvement. They make themselves agents of change. We find that our best-managed organizations are taking a leading role in becoming better managed and retaining their edge. The critical role of management in facilitating CQI is to become personally involved and to personally create the climate that permits CQI to take root and to flourish across all functions and across all disciplines. The true power of CQI is its ability to

transform people's work and, thereby, the fortunes of whole enterprises.

When Bob Young took over at Lockheed a decade ago, he began to change the culture of the company. The odyssey culminated in his winning the NASA Excellence Award last year. It is an odyssey that will continue. Bob learned that successful organizations recognize the inevitability of change in markets, technology, and people. He also learned to deal with the continuous process of change by training and empowering every one of his people to recognize and capitalize on the opportunities which change presents. He was willing to bet on his people and take the necessary leap of faith that, given the opportunity, his people would do not just good, but consistently excellent work.

What I have learned over this past year, is that this leap of faith is the fundamental act of commitment and leadership in implementing Total Quality.

Top Leadership Panel (seated from left to right): Admiral Richard H. Truly, NASA Administrator/Panel Chairman; Honorable Thomas J. Murrin, Deputy Secretary, U.S. Department of Commerce; Daniel M. Tellep, Chairman of the Board and Chief Executive Officer, Lockheed Corporation; Joyce R. Jarrett, Director, NASA Quality and Productivity Improvement Programs Division, NASA Headquarters

2.0 George M. Low Trophy: NASA's Quality and Excellence Award Session - Total Quality Leadership

Highlighting the George M. Low Trophy Criteria, these panels of 1990 finalists discuss the necessity for top management commitment and leadership methods to achieve performance excellence.

2.1 1990 George M. Low Trophy Finalists (Small Business/ Subcontractor)

2.1.1 Introduction

Robert D. Paster, President, Rocketdyne Division, Rockwell International Corporation, Chairman

The one constant in successful world-class companies is the recognition that total customer satisfaction—both internal and external—is the key to success. This is best accomplished through an absolute emphasis on and delivery of the highest quality product or service. The emphasis must come from the top, from the company leadership.

This morning we have three individuals who, through their leadership and emphasis on quality, have seen their companies nominated for the prestigious George M. Low Trophy. All three emphasize the need for top management commitment and total employee involvement.

2.1.2 Commitment to Quality

Wiley E. Williams, President, Grumman Technical Services Division

At Grumman, we've been involved in TQM for two years. The first year it wasn't altogether clear whether we were making progress. We lacked a set of measurements by which to gauge improvements. By the second year, we've defined weaknesses, incorporated improvements, and are seeing a very clear trend in the right direction.

Total Quality Management has two basic differences from what we've had in the past. First, it provides a focus for continued improvement. Second—unlike quality circles—it's not limited to the average working-level person; in fact, it starts with the management.

Our employees are motivated, and our management is motivated to provide an environment in which the employees can participate in an atmosphere that is open and dedicated to process improvement. Since communication is so important to this process, we've established two techniques that have been very effective in communicating with our workforce, both vertically and horizontally. One, we call "dialogue"; the other, "job shadowing."

With "dialogue", senior management, at the director or manager level, goes down into the work place, has meetings with small groups, and listens to their problems. With "job shadowing", a director goes into the workplace each month and works four hours along side his employees, doing what they are doing. This achieves two things. It creates another form of communication, and it enables the director to understand the work that's actually being done and the environment in which it's being done.

Employee recognition is also vital. It isn't enough to pay people, or give them bonuses or raises. You also need other forms of recognition. We have a very visible recognition program, for both individuals and teams. We give recognition for outstanding accomplishments, sustained superior results, and even more mundane things, like perfect attendance—not taking a sick day in two or three years. Community service is recognized. We even let our employees recognize their peers. And certainly, we recognize outstanding contributions to the Grumman quality process.

As we had hoped, training each employee in the Total Quality process has resulted in team thinking throughout the organization. Secondly, we firmly believe that quality is self-perpetuating. Once you get it started, once you get enough people believing it, it's contagious. Effective improvements in the workplace result in a dedicated workforce that wants to do the "right thing right the first time".

Let me say a few words about small business and subcontractors. Quality initiatives need to be instituted by small businesses and subcontractors that are involved in the program, to insure that we complement the efforts of the primes and NASA. Subcontractors and small businesses have a very important role to play in ensuring the success of the NASA programs. It is true that small businesses and subcontractors will find it more difficult to achieve the level of savings that primes do, principally because we don't control the entire process. But, I firmly believe that there are many opportunities for subcontractors and small businesses to improve the part of the process which they do own.

Grumman participates in the George M. Low Trophy process not to win a plaque and not to be chosen the recipient, even though we're very pleased to be one of the finalists and would be even more pleased to receive the award. We're involved because it gives us an objective analysis of our performance against a set of criteria, a standard. We're not competing with other companies, we're being measured against a set of standards.

In addition, we get independent feedback, an appraisal of how we're doing measured against that set of standards. If you are a participant, you get a debriefing at the end of the award process. In this way, you learn what your strengths and weaknesses are. You can then sustain the strengths and improve the weaknesses.

2.1.3 Building in Quality and Performance

H. Ray Barrett, Chairman of the Board and Chief Executive Officer, Barrios Technology, Inc.

At Barrios, the thing we all have to ask ourselves when starting a program is, "What is quality?" There are two aspects to quality. The first is a measurable aspect. You need a reference number that you can quantitatively identify. The second—which is the most important—is the attitude and morale of your people. There are all kinds of abstract words for quality, but real quality comes down to something very basic—your people. If you can achieve that—the positive attitude and the good morale—the other is an add-on. But to have a thorough program, you can't have one without the other.

At Barrios we've given them a title. We call them the "Building Blocks to Quality and Performance". We believe that the first thing that you ought to do when you start a program of building quality and performance into your organization, is to start at the beginning, with the employee when he walks through the door of your operation the first day. If you don't start him off on the right track—by instilling quality philosophy, performance, goals, objectives, involvement—right up front—then you'll have to catch up with him later and try it then.

One of the things that you won't hear me say during this session is communication. I don't even know what communication means. To me, communication is understanding. If you can't get understanding, you haven't communicated. The employee's understanding of his place in the organization and what you're trying to achieve becomes vitally important; it has become one of our building blocks.

The second building block is sustainability. You can't achieve anything unless you can sustain a process over time. And there's only one way to truly sustain a group of objectives: let them become the employees' objectives.

Another other major building block is training. What do you expect from your people? Where do you want the corporation to go and what are the strategies to get there. You have to build training programs into your organization that are geared toward certain objectives. The objectives fall into three categories:

- Quality improvement. You don't know what this means unless you find ways to measure. And, by creating measurements, you build morale.

- Recruiting. When you have an empty void or you have to go after a new contract, don't fill it with bodies. Fill it with skills. Recruit for strength, and recruit for morale and attitude.

- Commitment. You can't have successful programs unless there is a true commitment from the top to the bottom and the bottom to the top. It's got to go both ways. You can't force feed. There must be an appetite, if you are going to be able to achieve what you're after.

We established a system after the first year and put it on the computer. The computer program allows any employee to program their activities into the system and measure themselves at any point in time. In addition, we designed a computerized reporting system, so every employee can be recognized for the programs that he participates in.

We also established a number of "steering circles"—committees which get together to stress the following: Where are we weak? What do we need to be doing? What do we need to do to help our customer? What other programs need to be implemented? Then the committees come to management and say, "Here's what we think." We react to it; and we go together as a group to get it accomplished.

As a small business, we feel very strongly that we are part of the customer that we contract to. We want to be involved in its quality program. We request that we be on its panels. We want to make certain we integrate thoroughly into every objective our customer is after. And we bring this back home and make sure all our people are aware of the program and want to participate in it.

At Barrios, we don't believe that a TQM program is dependent on cost. Rather, a Total Quality Management program is the result of how well you motivate your people toward a common objective.

2.1.4 Planning for Continuous Improvement

Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc.

Marotta Scientific Controls was started by my father in his garage 47 years ago. As the business grew, he moved the operations into an old abandoned school house. This was in January of 1944. From these modest beginnings until today, our growth has been directly related to technological advances and to meeting new requirements in state-of-the-art liquid or gas valves and systems.

Our quality culture was established in the earliest days of the U.S. rocket programs in the early 1950's. In the late 1960's, Marotta played a major role in supplying over 150 custom control valves on each Saturn, Apollo and Lunar mission. For the past ten years, Marotta has made major investments in its people and facilities in order to be competitive and successful in this decade. While we have made great progress, we still have a long way to go.

In order for U.S. manufacturing companies to compete on a global basis in the 90's, we must achieve better quality, higher productivity and faster response to customer needs. To make significant advances in these areas top management must continually demonstrate its commitment to performance excellence.

Teaching our employees Statistical Process Control and getting them to fully utilize this tool in accomplishing their jobs are two totally different things. Encouraging our employees to properly implement and utilize SPC is a continuous challenge. Top management must be 100% committed to building quality into the product, along with the people who design, build, assemble, test and service the product. By giving our employees the tools for measuring self-improvement in each process, we give them the ability and responsibility of performing quality work.

We send the wrong message to our employees when we try to inspect quality into the product. Third party corrective action programs never built a product right the first time. Top management must take a leadership position in getting our customers and vendors to buy into our statistical quality program, and our employees must clearly understand that top management will not waiver when cost and delivery schedules conflict with meeting performance and reliability requirements.

All levels of management must continuously measure performance against previously established

goals. Since markets change and competitors improve, a philosophy of total continuous improvement is necessary if Marotta is to compete in tomorrow's marketplace.

Marotta's continuous improvement efforts have also been directed towards total integration of all company functions. Integration at Marotta means that we have a common database. We do not have to regenerate information among various departments. All tooling information concerning geometry comes directly from engineering. What used to take days now takes hours or just minutes. The machinist on the shop floor now has the ability, training and information to make decisions to produce a part to the right specifications the first time.

The next steps include further advances in computer-aided engineering and computer-aided process planning. The efficient production of the highest quality products will necessitate the effective use of computers to eliminate paper on the shop floor and in all of the manufacturing processes. Top management at Marotta believes that, by the end of this decade, we can establish global quality leadership on the strength of a truly integrated manufacturing organization focused on the high pressure custom hydraulic and pneumatic controls marketplace. Computer Integrated Manufacturing (CIM) and other advanced technologies enhance the capabilities of the empowered employee to help us achieve global quality leadership.

Human resources are the greatest asset top management can develop. Our employees have the control—as well as the responsibility and pride of ownership—of the manufacture of each part or each process. This is the essence of the term "employee empowerment".

Investment in education and training, motivating and challenging our people precedes everything else. At Marotta, we foster individual innovation and creativity. To accomplish this, we work in small teams on most of our development programs. The teams usually include one representative from marketing, engineering, manufacturing and each test areas. These small groups are empowered by top management to apply the sum total of their creative energies to each project, while making sure the development of the product or system stays on course and in line with our customer's needs.

Successful aerospace programs have an incredibly long life. Products we designed and qualified 25 years ago are still being used to launch and fly successful missions today. I fully expect that the products we are designing today will be around for the next 25 years.

***Panel 1 - 1990 NASA Excellence Award Finalists** (Small Business/Subcontractor) (from left to right): Robert D. Paster, President, Rocketdyne Division, Rockwell International Corporation; Wiley E. Williams, President, Grumman Technical Services Division; Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc.; H. Ray Barrett, Chairman of the Board and Chief Executive Officer, Barrios Technology, Inc.; Imants (Monte) Krauze, Director, Quality and Productivity, Bendix Field Engineering Corporation.*

2.2 1990 George M. Low Trophy: NASA's Quality and Excellence Award Finalists (Hardware/Mission Support Contractors)

2.2.1 Introduction

Arnold D. Aldrich, Associate Administrator for Aeronautics, Exploration and Technology, NASA Headquarters, Chairman

I strongly believe that the Total Quality Management process is essential to the success of our future programs and mission. As you know, this is one of three concurrent panels to talk about the 1990 George M. Low Trophy. This panel will discuss the necessity for top management commitment and will share experiences in leadership methods in achieving performance and excellence.

2.2.2 Continuous Total Performance Improvement at Rockwell/Space Systems Division

Robert G. Minor, President, Space Systems Division, Rockwell International Corporation

There is no question that the leadership in your organization has to be focused on continuous total performance management. First, by providing a vision, direction and guidance for the organization. Second, by creating an atmosphere that creates and encourages team building, and by simultaneously stimulating a process-improvement situation.

It should be clear to everyone that this has to be a top-down, bottom-up type process. We have more than 160 formal teams at our division and over 2,000 plus people are involved. Most of those teams are cross-functional. One of the purposes is to make sure that there is a continuous exchange of ideas at the improvement councils, at our employee action circles, and our individual employee suggestion programs.

We use computer tracking. We think it helps us eliminate errors, and simplify the way we do business. It also helps us make sure we keep records, so that we can recognize the appropriate people that have been involved in these programs. And it also gives us statistics on how well we're doing, and on the level of participation throughout the division.

Communication--honest, open, two-way communication—started this program. We let our people know that we were very much interested in improving their overall working conditions. We also made it very clear to them that there was an element called "competitive positioning," that says that you cannot stand on your laurels in this business; that you have to continue to improve, or someone is going to take it away from you. Finally, we described our business pursuits—our targets, the specific programs we're implementing, and the specific markets we're going after.

Periodically, we have employee surveys. The surveys are strictly voluntary, but participation is quite high—generally in the 80%+ range. In addition, employee groups talk about our strengths and weaknesses. From our employees, we learned that we needed to simplify our overall processes and ways of doing business. We needed to eliminate steps and paper, and streamline our organization. We found that every additional level of management made it more difficult to communicate to the troops on the line.

If you're going to ask your people to change, you owe them a very comprehensive training program. You can't ask them to do business a different way without showing them how.

We have "design for competitiveness" workshops. One example involves the system that is being designed to allow the orbiter and the Space Station to dock with one another. Specifically, we looked at the docking mechanism capture latch. We involved 30 teams and 5 working groups in the study. The results were astounding. They came up with 20 separate ideas that reduced the part count and overall processes by 50%, and increased the reliability of the system. We then implemented this technique throughout all of our docking system studies.

We created something called "Centers of Excellence." We found that we were duplicating services and capabilities, and that meant a higher cost to the government. Now, as an example, our Rockwell Operational Software Engineering System, or ROSES, does software for some of our other divisions.

We try to make sure that our suppliers and subcontractors are an integral part of our activity. Sometimes, we tend to focus too much on what we're doing in-house, but, in reality, nearly 50% of our hardware work is done with our subcontractors.

We believe our program supports the Rockwell Corporation objectives. We think it strengthens our competitive position. It certainly helps harness our

total force capabilities, and goes a long way in assuring that we're meeting our present and future customer expectations.

2.2.3 Total Quality Leadership: Top Management's Role

Carl L. Vignali, Vice President and Group Executive, Honeywell Space Systems Group

The first requirement in bringing about a Total Quality initiative culture is defining the vision. To lead an organization toward a goal, you've got to explain what the goal is. We developed a TQM vision. What the specific vision *is*, is not as important as that it be developed by the people who will lead the way toward the vision.

We came up with a set of vision statements that are meaningful to our people. These statements were developed by the management staff after a lot of discussion. I think the way you get ownership is to have debate about the right thing to say and the right thing to do; then you arrive at an answer. Next, you make the decision to *do it*. You've got to have an agreement among management that this is something that they really want to do. That's not always easy to obtain. People have differing viewpoints; but, it's important to reach consensus. It's not always possible to define and identify what the benefits are going to be. You do it because you believe it's the right thing, and that it's going to pay off.

Our goal was two-fold. First, to produce a clear picture for everyone in the organization. We were striving for mastery in every category. Second, once we had the matrix developed, we used it as a measurement tool to find out where we were along the road; where were we falling down, and where were we doing well.

We had a lot of problems describing the process to our employees. After we told them what we wanted to do, they said, "Fine, but what do you want *us* to do?" When you've got 3,000 people, and they all have different jobs, you can't sit down with each one and say, "This is what this specifically means to you." Being an engineering organization, we came up with an engineering solution. We created a flowchart. Now, when people say, "What do you want me to do?", we can refer to the chart. We created one of these for the organization, and one for individuals.

Once we had all of the tools in place, we again needed to demonstrate the top management team's commitment to Total Quality. The executives serve on TQM teams. I'm on two teams. Every one of the top managers is on one or more teams. We talk about TQM; it gets infused into everything we do. You can't paint TQM onto your organization and expect to have it stick. You have to weave it into the fabric of the organization.

We've embedded this continual improvement into people's individual goals and objectives, and into departmental goals and objectives, so that is a part of everybody's job. I think a lot of managers felt that just turning out the product was their job. What we're trying to convince them is that the manager's job is *improving the process* by which the work is done.

It's important to continually monitor results. Either I or one of my direct reports has a sensing session with a group of managers to find out what the obstacles are to getting this culture embedded. And, *that* gets reported back to the staff, so that we can keep the loop closed, and don't let process wander off.

The final thing, of course, is to keep the momentum going. My staff and I meet bi-weekly as the TQM executive council, to look at where the process is, and what we have to do to keep it going. On a quarterly basis, we get together with the management team and talk about what's happening on Total Quality, what progress we've made, and what the priorities are going to be for the next quarter. We have a continual series of articles in our in-house newspaper to keep the work force informed on what's happening.

2.2.4 Quality Leadership— Vision for Excellence

H. Joseph Engle, Chairman of the Board and President, Bendix Field Engineering Corporation

Quality is the key to corporate survivability. This means ensuring that we have leadership commitment, sense of direction, and the resources and processes to achieve customer satisfaction.
Quality is the key to expanded corporate opportunities. This means ensuring that strategic goals are achieved in response to our plans, changing economic opportunities or customer requirements.

Quality is the key to growth and achievement potential for our employees. We ensure that our employees remain committed to BFEC, by creating an environment which permits personal and professional growth.

Quality is the key to achieving end-to-end excellence. We constantly get a report card from our customers on how well we're doing, and how well we meet their requirements. This means that we must be willing to set the standards for others to follow. We developed a support structure that maintains and refines our internal measurement system and regularly monitors our quality status.

Our PIQE (Productivity Improvement and Quality Enhancement) program got started back in 1984. It is now evolving into SPQ: Service-Performance-Quality. SPQ is our definition of Total Quality Management, as it applies to the service industry, and our growth and experience in continuous improvement methods. But, TQM is not a dogma. Management is responsible for finding the right TQM fit for its respective needs and its customers. Furthermore, we assist our subcontractors in embracing a quality-oriented philosophy.

Management of our SPQ process is done through an executive committee composed of a senior manager, two senior vice-presidents, and myself. The BFEC quality assurance department and quality enhancement process is administered and directed by the senior manager, assisted by several key managers who are a part of what we call "The SPQ Council."

Key points that this team was asked to consider, include:

- What events must occur for BFEC to move toward a participative management style of decision making and problem solving?
- How do leaders re-educate middle managers to foster teamwork at all levels?
- What action needs to occur for us to wipe out "turf barriers" among departments and individuals?

In addition, I chartered another team to recommend methods for increasing the effectiveness of communications at all levels throughout the organization. This communications team is composed of senior management and technical communications experts. The team was asked to consider the following:

- How can we develop effective communications among employees, internal customers, and contractors?
- What method or vehicles of communication are we presently using? What methods of communication should we consider adding to those now in use, or what vehicles should be discontinued?

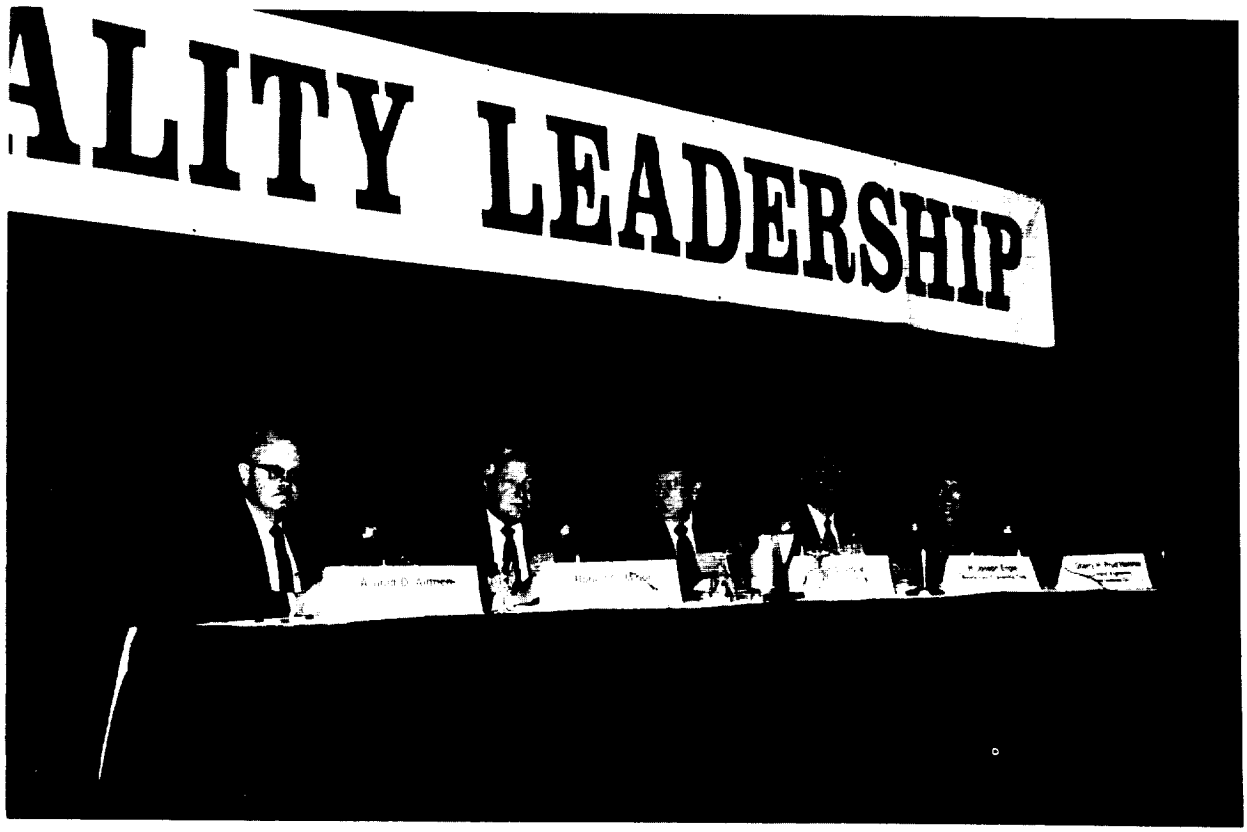
We reorganized the company to provide short, direct lines of communications with our customers and our employees. We developed a flat organization that reduces unnecessary management review, and provides an effective management span of control. We established a decentralized management authority and accountability approach to business. We have positioned our organization to be very flexible, adaptive and totally responsive to our customer's needs.

We recognize that leaders need to re-educate the middle manager and foster teamwork at all levels. This commitment to teamwork and customer satisfaction needs constant nurturing and attention and support by management until it becomes a way of life in the organization.

To give our PIQE program a little more impetus, we implemented a Chuck Rounds Award. The Rounds Award is the highest honor given for accomplishments made under the BFEC PIQE program. It's presented annually to the deserving individual, group or department that produces measurable and verifiable results in the achievement of excellence in quality and productivity.

BFEC exudes a management philosophy that places major emphasis on striving for customer satisfaction, by tailoring our services to our customer's needs, putting high value on our employees, fostering individual innovation, and establishing teamwork approaches to assure quality performance at competitive prices. BFEC does not merely speak or write about quality and performance improvement, we take action, commit resources to achieve end-to-end excellence, and are committed to continuous process improvement.

Somebody once said to me, "What's the difference between involvement and commitment?" And I said, "Well, I guess the best way I can answer that is, it's like a plate of ham and eggs: the chicken was involved—the pig was committed."



Panel 2 - 1990 NASA Excellence Award Finalists *(Hardware/Mission Support Contractors) (from left to right): Arnold D. Aldrich, Associate Administrator for Aeronautics, Exploration and Technology, NASA Headquarters; Robert G. Minor, President, Space Systems Division, Rockwell International Corporation; Carl L. Vignali, Vice President and Group Executive, Honeywell Space Systems Group; H. Joseph Engle, Chairman of the Board and President, Bendix Field Engineering Corporation; Sherry H. Prud'homme, Manager, Total Quality Management, Lockheed Engineering and Sciences Company.*

2.3 1990 George M. Low Trophy: NASA Quality and Excellence Award Finalists (Service Support/ Mission Support Contractors)

2.3.1 Achieving Excellence in a Diverse Organization

James R. Dubay, President and General Manager, EG&G Florida, Inc.

Excellence is not a goal on a milestone chart, and it's not a finite objective in time. Excellence is a culture, a quality of being, a value, a virtue. It is an inherent part of the individual. You're not excellent at work, and something else at home. You're excellent because it is part of the fabric of your being.

The base operations work at Kennedy provided a particular challenge for us. We were the first contractor after the consolidation of 14 contractors. We were given very little time to start up, and we had virtually no identity. We had less than three months to get started and to hire close to 2,000 employees. How does one do that? First of all, you establish an identity. You tell other people who you are, where you've been, and what you believe. Then you establish credibility. You tell them about your corporate history. You tell them that you've been in the business and that you know something about it. Then you set a vision of what you really believe; you affirm that the importance of that vision is that it include everybody.

The employee, after all, is the only asset in a service company. I don't have to tell you where we have drifted over the last 40 years in terms of labor and management. The "we" and the "they", the "us" and the "them" have probably cost more in terms of national asset and national progress than anything else. It's not "we" and "they", it's "*us*", and when we finally realize what the proper equation is in terms of teamwork, we'll be on the right track. Pay attention, if you will, to what GM is doing in their new Saturn plant. Innovations in labor were absolutely unheard of in the automotive industry. And innovations similar to that are going on in industries where the union and management essentially have been unable to talk for years.

The equilibrium between labor and management does, in fact, involve a culture shift. Top-down management is absolutely a thing of the past. In the past, you had the employee taking direction—regardless of his position in the company, or his expertise—from a management which, by no stretch of the imagination, was qualified to do the work. The management training that all of us had undergone for the last four decades taught us "control, and control, and more control," usually for the sake of control itself, or for the sake of a bottom-line. We lost sight of the fact that the people who cause these bottom-lines to happen, are the only asset we've got. You must protect, advance, and nurture them, if they're going to continue to perform.

So, our mission at Kennedy has been simply to set a vision in which people are the asset, people do count, in which we are going to listen, and then listen some more. And, before we take any overt action, we're going to go back and ask questions, to make sure we understood what we thought we heard. The people know what to do. When *we* are challenged by opportunity, we are challenged because we are insatiable in our desire to improve and progress in what we do and what we know. The employee is no different. The employee responds spontaneously to these opportunities.

In any change situation, the biggest problem you're going to have is with your managers. Letting go of control is difficult. We just recently did an employee opinion survey. What got our attention was that, while we're doing a lot of good things, the one shortfall was management. Management was having a really difficult time letting go. So, what we're going to do is dramatically increase our internal educational training to really get the team coalesced.

Are we there? Certainly not, but we're well on our way. And, since excellence is a process, I submit that you never get there. It's a day-to-day thing, because it's a people equation. We know the vagaries of ourselves, and we know the tendencies we have to forget, if we're not focused. But we've learned to play together. We've learned to work together. We've learned to support the community together. We've learned to share. The empowerment of people is an awesome dynamic—and, it's your only option.

2.3.2 Success Through Partnerships

Paul J. Holyoak, Program Manager, Integrated Information Services, Boeing Computer Support Services

The key to our success are two specific partnerships. When we began the PSC contract in 1985, the spirit of partnership was established between NASA and Boeing. We shared a common goal: to implement a nationwide world class telecommunications network in one year. This professional partnership with NASA has continued, and has provided an environment which has allowed us to develop the second partnership. That partnership is the internal partnership between leaders, between leaders and their people, and among all the people.

During the implementation of the Program Support Communications network, the goal was clear. Completing the detailed network implementation plan provided the incentive that people needed, to work 60 to 80 hours a week in pursuit of that goal. During this period, everyone expected that, once the network was implemented, we'd have a lull period in which to refocus our efforts for sustaining operations. No one projected that user acceptance of PSC services would be so great that the requirements would literally double by the time the network was operational. It was critical that we establish new visions and new goals. We had to tap the ideas and knowledge of everyone in the organization. We had to create an environment where everyone could contribute, not just a key 15 or 20 people, as it was during implementation.

We began that change with education. The team was composed a lot of different people from very diverse backgrounds, and we needed to establish a common base. We developed that base through two types of training: quality basics, and leadership development. We chose the idea of CQI: "Continuous Quality Improvement."

The next step was developing the leadership team. With more effective leadership, communication with all of our people was developed, partnerships were formed, and the sense of trust was expanded.

Once we had the basics of leadership and quality training, we began the strategic planning process. We established a vision of missions and goals, and a partnership and trust among the key leaders. Then we cascaded this trust and understanding and goals throughout the entire organization. We printed a card with the vision, mission, goals, and objectives on it, so that everyone in the organization could always have a reminder with them. We established the target symbol as a constant reminder to our commitment to quality that exceeds customer expectation. In addition, we linked every PSC person's job goals to a higher goal: that of NASA's major goal of launching the Space Shuttle. For example, a finance clerk, who might not think he was associated with the mission, was taught that even a mistake on payroll or benefits of someone who was in direct mission support, could impair that person's ability to work and thus impact the mission. Through a series of meetings and rallies, we gave all the employees an emotional investment in the program. We showed them that success would come through partnership. The promotion of the target and the return to flight poster and astronaut visits got everyone emotionally involved.

Because of the people's ownership in all these processes, *they* began to drive the continuous quality improvement. Without realizing it, we had created a new culture within our organization. We moved from controlling and directing from the top, to a culture of participative leadership and involvement of every member of the team. This creates an excitement in people about their task, and their investment in the goals. Our people began to see and understand how their daily tasks supported the entire mission. Through understanding comes commitment. Through commitment comes quality.

Leadership is partnership. The success of PSC is a result of clearly defined goals, and the establishment of an environment where everyone could make a maximum contribution. Then, once the momentum was established, the wisdom of the leaders was to step back and get out of the way, and let people be successful.

2.3.3 The Quest for Excellence

John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems

I'd like to focus on just three points, that are the key elements in this whole quality process: management commitment, employee involvement, and metrics and measurement. I grew up in a culture where management commitment was what you got from the boss when he didn't give you money or people to do a job. That's changing now. Without the leadership involvement and the commitment, a quality program will fail. If you don't know where you're going, any direction is OK.

The leader must have the vision. He must be able to relate that vision to others and inspire others. He's the one that sets the goal, the objective. The manager must demonstrate commitment through his actions. I like the expression, "Walk like you talk." Involvement by the leader and the manager is what proves his commitment to the program. We had an extensive quality education program, and I personally started and finished each one of those 20-hour sessions, so I could tell the people what I felt the vision was, and discuss with them what happened after the program.

It took us a year to come to an agreement about the goals for our policy development. We decided that our policy had to be clear, concise, and actionable; it had to be understandable by our people. Our policy says that *our goal is error free products and services.* We're going to accomplish this by: 1) understanding the requirements before we start the work; 2) having documented procedures and processes to do our production or manufacturing activities; 3) when we get done, testing again to the original requirements; 4) using the corrective action review process to continuously improve the program we have in process.

The toughest sell in this whole process is the first level managers. Quality is a little ambiguous; but, they eventually begin to get the word that quality is first, and cost and schedule come second, in order to achieve quality.

The second element in the quality process is employee involvement. The quality program can't simply be a management program. It's got to have ownership by the employees; you do this by creating teams. The employees have to be responsible for their own work processes, and they have to have the authority and responsibility to change them. They develop charts and metrics to track the program. We have quantitative tracking—things like number of errors per month, or the number of days to fix something. We have analytic tracking: why did the errors occur, what systems generated the errors? And we record improvement in the various teams.

Lord Kelvin said there's no science without measurement. Measurement is the key element in being able to track success. The essential steps include evaluating where you are today, deciding where you want to go, implementing a plan of action, and measuring your progress toward meeting that plan. You've got to identify your trends and the risks; and, in our case, we chart our progress. Our goal is to create, track, and plan significant improvements in quality and productivity.

Panel 3 - 1990 NASA Excellence Award Finalists *(Service Support/Mission Support Contractors) (from left to right): Jeffrey M. Corbin, Manager, Total Quality Management, Martin Marietta Manned Space Systems; John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems; Paul J. Holyoak, Program Manager, Integrated Information Services, Boeing Computer Support Services; James R. Dubay, President and General Manager, EG&G Florida, Inc.; Richard M. Davis, President, Martin Marietta Manned Space Systems.*

3.0 Building on Strategic Planning to Advance TQM

A focus on strategic planning as the foundation for tactical implementation of continuous improvement throughout the organization. How do we integrate the strategic business plan and the quality strategic plan?

3.1 Creating the Vision

Understanding the process that an organization must undergo to develop its vision statement: what it is, what it wants to be, and what it can be. How the vision integrates the continuous improvement process throughout the operating levels, including labor/management relations.

3.1.1 Introduction

Dr. Harriett G. Jenkins, Assistant Administrator for Equal Opportunity Programs, NASA Headquarters, Chairman

I'm sure that most of you are already aware of what has been said and written on the topic of strategic planning for excellence and continuing quality. You are also very much aware of the usual steps that are identified, or the processes that are talked about. These include creating a vision, determining one's customers or stakeholders, and determining the environment in which you've got to work. This afternoon we're going to be concentrating, in particular, on the importance of the first step—creating the vision—but you're going to hear more than just a theoretical presentation. You're going to hear what it's like to work with these ideas in two very real, and significant firms.

3.1.2 Boeing Commercial Airplane, Continuous Quality Improvement (CQI)—Vision to Reality

James A. Blue, Vice President/General Manager, Materiel Division, Boeing Commercial Airplane Group

We've always prided ourselves on designing technically excellent products, and delivering quality products on time to our customers. But, about five years ago, the lights suddenly came on, and we realized that we had to really concentrate on continuously improving quality and productivity to satisfy our customers and remain competitive.

The business environment has changed, and the key to the whole thing is "satisfy your customer." You can get all the awards in the world but they don't mean a thing unless your customer is satisfied with the product that you're delivering to them. Our airline customers no longer have a brand preference. They're looking for the best deal for the money.

I had the responsibility of bringing CQI to the forefront of everybody's thinking in the Boeing Commercial Company in early 1985. At that time, I was chagrined to hear Dr. Deming and Bill Conway say, "If you're going to really change the management culture in your organization, it's going to take you eight to ten years."

When we started looking into how we were going to change the way we operated and get everybody thinking about everything they do every day, it began

to look like an almost impossible task. We started educating our top management in January of 1986. We used all the gurus we could get our hands on through there. We ran over 4,500 managers through two and three day seminars. We got into statistical process control in 1988, and we started incorporating the CQI principals into our mission. When we started this process, we were only averaging about five hours per employee per year for this type of training. Last year we averaged 50 hours per employee, and it will be over 60 this year.

To ensure success, everyone has to be involved in the CQI process. Our goals support the corporate objectives of delivering defect free products and services to our customers on schedule and at competitive prices; reducing waste; developing a motivated and skilled work force; and incorporating the principles of continuous improvement into our relationship with our supplier.

One of the things we have done is to go from an adversarial relationship with our suppliers to a partnering technique. We want to work *with* suppliers to help them with the implementation of continuous productivity and quality improvement. Our goal is to not have to reinspect anything when it comes into Boeing. We know that each of us as individuals is important; we also know that each one of the people that work for our suppliers is important. And we've found that if we treat each other as we like to be treated, we get fantastic results.

An important factor in being successful in CQI is communication. In addition to the various papers and newsletters and annual performance objective reports, we have executive meetings, division quality meetings, quality teams and circles, all-employee meetings and rap sessions, and supplier symposiums. But, the key is the daily interface with all the people. The essential tools for CQI education are planning and reporting. Communication is at the top of the list in importance.

We hadn't done a very good job training our managers. We made them managers, then left them to sink or swim. So Performance Management was implemented. It's a tool for increasing individual and organizational effectiveness. It's absolutely the best tool I've seen implemented in the 40 years I've worked for the company.

At Boeing, we've implemented CQI, and we're seeing results. We've been working very diligently for over five years. Our people are excited. *They* know that *we* know that they're the experts. They know that we're giving them the credit for the input we get from them. It ain't easy folks, but the rewards are there. We've had all our suppliers in, on at least three occasions. We're bringing them back again. They're with the program. Productivity is improving.

But remember, CQI requires a clear vision, and it must be integrated throughout all operating levels. It needs to be started and supported from the top, but it has to go all the way down to the person on the floor. The idea of improvement doesn't have to be gigantic. Fantastic improvement can be just little bits and pieces, but that's the way you get to there from here. All of this takes time, education, good communication, teamwork, and perseverance.

3.1.3 From Breakdown to Breakthrough—Role of Vision as a Catalyst for Total Quality

David Clark, President and Chief Executive Officer, Campbell Soup Company, Ltd.

Like many organizations, we have been through a round of downsizing. In the 7 1/2 years I've been involved, we've cut back from 11 plants and 4 farms to a core of three plants. In the period from '84 til '90 inclusive, we have been relatively successful at turning the business around.

The real trigger to it all occurred in January, 1989, and the period leading up to it, when the Canada-U.S. Free Trade Act was passed. We woke up one morning and found that all of a sudden we no longer lived in a Canadian environment. We were now in a North American environment, and our plants were at a 37% cost disadvantage, on average, in relation to the best U.S. plants. There was an alliance among my management group, myself, and our employees to keep plants in Canada. Employees cared, because of the jobs involved, and from a management perspective, we wanted to be something more than warehouse managers or distribution experts.

I'd like to make a distinction between what I'm going to call "normal incremental" management and "breakthrough" management. They both start from an assessment of a problem, from an opportunity, from a threat. You do a feasibility assessment. You say, "OK, we know what the objective is. Do we know how to do it? Is it possible?" That feasibility assessment, naturally, is based on your history. It's based on what you know, and on the facts as you see them.

If the answer to that question is, "Yes, we can do it," you move into the "normal incremental improvement" mode, which is very simple. You have objectives; you have methods of attacking those

objectives; you line up resources; and so forth. When it works, you are have an outcome which I would certainly characterize as improvement.

However, what do you do if, through force of circumstance or by force of your own will, you find yourself in a situation where you are driven to do something, but you don't know how to do it. You are driven toward an objective or a goal which appears impossible at the time. That's the situation that drives to breakthrough, or transformation, as we call it. The process of managing breakthrough in a systematic way, so that it can be replicated any time you need it, and wherever you need it, is what my organization has been engaged in for the last year and a half.

The first step in managing breakthrough is to enroll yourself and some people in the "possibility". Now, "possibility" is nothing more than an opening for future action or a future outcome that may not appear. In fact, you do not know how to achieve it right now, but you are willing to commit yourself to make it happen. It's an image in your mind of what *could* be. It's the leap of faith.

That brings me to the second step—commitment. Getting commitment to a possibility is very tough, both within yourself and within your organization. Often you have to be cornered. You have to be in a situation which is so distasteful and inevitable that you simply must create your way out of it. Or you may be enrolled in this possibility by colleagues, or by a leader, or by a group within the organization. That is somebody else's commitment that has become contagious. And, indeed, a strong, supportive team is immense leverage to have going for you because, somehow, it doesn't feel quite so lonely to be taking that first gut-wrenching step toward something that you don't know how to do. The key here is to focus in on uncharacteristic action or extraordinary action that will dramatically change the rules of the game, not only for yourself, but ultimately for your competitors. That focus on the extraordinary is consistent with possibility.

Let's talk about what actually happened at Campbell-Canada. First, we settled on the "possibility" that we're committed to being the best food company in North America; to providing products of superior value and quality, through implementation of the "fastest gate-to-plate" strategy. The thing about that vision is that it's probably never achievable. We'll never get there, because, no sooner will we have achieved it in some dimension, than someone will come along and challenge us in another dimension. But, that's the beauty of it. It's infinitely expandible.

We have three strategic areas that we are focusing on right now. The first is superior brand powering. Our objective here is to dominate every category; we want to have three times the share of the nearest competitor. It's as simple as that.

Our second strategic area is embodied in the phrase, "fastest gate-to-plate". That refers to competing in time—from the farmer's gate to the consumer's plate. The total food chain becomes our playground. We are accountable for only several links, but we are inextricably tied to both ends.

The last part is the "turned on" organization, where the empowerment of individuals and teams comes in. Because the magnitude of our stated vision, "the best food company", is beyond our grasp, the thing that will power us through this is what we call "breakthrough power", or "business as unusual".

These are some of the results: the frozen food plant was restructured into self-managed work teams, which eliminated three levels of management within six months. Our soup plant reduced "held" product--that's any product that needs reworking—from 120,000 cases to 20,000 cases within five months. These results were achieved by people who, on their own time and over an extended period of time, have taken extra instruction in the technique of breakthrough management, until they are now trained coaches who themselves coach the breakthrough teams. This also allows us to phase out most of the consultants. As a result, it looks like we are going to achieve our objective of remaining an independent, integrated, fully sustainable company in Canada.

QUALITY LEADERS

Panel A1 -- Creating the Vision (from left to right): Dr. Harriett G. Jenkins, Assistant Administrator for Equal Opportunity Programs, NASA Headquarters; David Clark, President and Chief Executive Officer, Campbell Soup Company; James A. Blue, Vice President/General Manager, Materiel Division, Boeing Commercial Airplane Group; Michael W. Foster, Chief Financial Officer, Unitech Composites, Inc.

3.2 Organization for Planning and Implementation

Exploration of how different organizations function within the operating unit and how the perceived barriers are overcome. Defining the goals of TQM with emphasis on the required mindset within the organization. Identifying the availability of existing tools and techniques for implementing TQM.

3.2.1 Panel Introduction--Implementing the Goals of TQM

Gordon P. Carlson, President, GS Aerospace Technology, Inc., Chairman

Our subject today is broken down into five major points: 1) we want to determine how different organizations function within the operating unit; 2) we would like to determine how real or perceived barriers are overcome; 3) we would like to define the infrastructure to implement the goals of TQM; 4) we would like to define the required mind set of the organization; 5) we would like to identify available or existing tools and techniques for implementing TQM.

3.2.2 From the Ground up-- A BAMSI Perspective

Hugh M. Brown, President and CEO, Brown and Associates Management Services, Inc.

During my tenure with ITT and with several other organizations, it became clear to me that there was a void regarding the services being received and the industry. The customers insisted that they didn't know what the contractor was doing. There was no effective communication; no coordination existed relating to effective services and team play.

In studying our potential to start a company, I decided to add to our basic company philosophy what I knew could make us a successful company, and that is the following: the customer is the number one priority of our company's pursuit. We recognize that without the customer, we will not exist as an organization. Second, employees must provide the necessary services to that customer. In order for the employees to meet 100% of the mission requirements, it's extremely important that they be fully aware of what their mission requirements are, and that they are totally responsive to the needs of the customer. Those employees are the most valuable asset that our company has. And lastly: profit. As a company, we are a profit-making organization, but our company is not profit driven.

As leader and CEO of the company, I consider it my responsibility to ensure that every individual is aware of the mission of our company and the mission of the contract. Many times employees—at every level—tend to feel that they can never get to someone at the top. Many employees have never seen the CEO of a company—they don't know who he is. I can assure you, I have met every employee across the country. I know who they are, and they know who I am.

As a company, we have to place certain emphasis on our customer. It is extremely important that our customer understands that we want to understand him at every level. We must talk with the customer, not only to communicate the goals and objectives of the mission, but to ensure that we are on the proper wavelength to execute the mission. Without that understanding, the degree of success is going to waiver from day to day.

Next, we try to establish a comfort level. If we do what we say we are going to do all of the time, that begins to get attention. For every conversation that is had between the parties, there should be follow up. It's our practice that each manager, each employee, understands the importance of follow up for every direction.

It is totally impossible to operate without being accessible to your customer. The customer is getting smarter; he is looking for the very same things that we should be looking for in a Total Quality environment. We have to be in agreement with the customer on a course of action. Sometimes we tend to think that our course of action is better than what the customer wants or requires. That is the first way to achieve negative results. You must totally align yourself with the customer, understand the course of action that you want to take, and make sure he is in agreement with it.

We've reduced the time in which a viable decision is forthcoming to a customer. At some companies, it takes two or three weeks to get a decision, because you have to go up through many levels of management to get someone to make a decision. At our company, if you call me today and you want a decision today, you get it today.

We have to constantly measure performance. However our mission has been defined, and whatever course of action we have outlined, we must make sure we are measuring performance at any point in time. That ensures that the customer and the company and all its employees are totally aligned with the mission.

The last item in our management philosophy is our emphasis on profit. We maintain a competitive posture. We also want to achieve a reasonable fee for our services or product provided. We have a free strategy for the long term instead of trying to get something in the very short term, and we want to remain attractive to our customer. That's the basis on which we operate.

3.2.3 TQM—An Implementation Approach

Joseph A. Frankovsky, Staff Vice President for Total Quality Management, General Dynamics Corporation

A fundamental paradigm, something we all learned when we were children, is: "Ready, Aim, Fire". When a lot of organizations began to implement TQM in the early 1980's, they were ready to implement the philosophy in order to get the cultural change. The paradigm was: "Ready, Ready, Ready". They didn't get many results. There were other people who wanted to get to where they were working the process and trying to demonstrate results, and the paradigm was: "Ready, Fire, Fire". But they were doing things without a plan. I think the paradigm we are talking about today is: "Ready, Aim, Aim, Fire". Let's make sure that we have a plan, that we can focus on the change, and that all the necessary steps are in place.

In our own corporations, most of us are working with processes that are rather old. We need to bring those processes up to date. The advice we have received from Motorola and Westinghouse is that if you just try to improve quality without improving the processes, you are only going to take the variability out of a bad process. If you want to accelerate, first get yourself a good process. Then you can improve the variability.

A focal point in terms of bench marks is the time it takes to accomplish the entire development cycle. In most companies, that means reducing the cycle time by 50%, and proceeding from there. Two changes should occur as the result. You deliver the first product through process improvement, and, more importantly, you put in place a set of documented, proven processes, through which you then make further improvements. Three things are necessary for understanding process changes: processes must be identifiable, repeatable, and predictable.

How do you take the current process and rapidly move to the strategic concept? By combining, restructuring, and eliminating unnecessary steps. But also, by spending time to design the process. If you use the slow approach, it's akin to improving business on a farm by paving the cowpaths. What you are trying to do is come up with a streamlined highway through which to run the business.

We looked at the cycle time for manufacturing, which initially was 538 days. We thought we could reduce it to 1/3 of that time. Again, we thought it through: "Ready, Aim, Aim, Fire". We put together teams that were cross-functional. We wanted to prove that we could manage cycle time; we wanted to make sure that we could manage multi-functional teams together. The individual teams formed their own sub-process activities to fix their own areas. We had 89 difficult-to-make parts at the beginning of this operation. One of those sub-process teams determined, not how to make one part at a time, but how to make all the parts easier. We improved the design for manufacturability. We improved by getting teams to focus on what the problems were from a design standpoint, from a process standpoint.

In the assembly processes, there are several benchmarks. There is the stand-time benchmark, which measures hours in terms of labor hours and costs. We thought we could gain an advantage in this area in 9 to 18 months. One of our teams already has close to a 50% reduction in the stand time, and they have done it in less than 5 months. We used process improvement to train people on TQM. We loaded the gun with real bullets; they saw we were serious, and they brought up more ideas to work on.

TQM is relevant. But significant results just can't be, "Gather the low-hanging fruit, declare victory, and pass on TQM." The long-term bench mark establishes the fact that TQM must be a long-term journey, and we must be able to demonstrate a need for further TQM investment. TQM has to earn its way.

3.2.4 Translating Vision into Action

Daniel A. Nebrig, Associate Director, Lyndon B. Johnson Space Center

Today's challenge is the changing nature of manned space flight. What that means to us is that, heretofore, we have been working with one large program at a time; we have progressed from program to program to program. Today we are operating continuing programs that are not going out of existence. For instance, the Shuttle program is ongoing, while we are attempting to design and implement a Space Station program. And the Space Station program is ongoing while we are looking at a design for Mars landing initiatives. We are having to keep abreast of rapidly changing technology, maintain a high performance organization, and overcome all of these with limited resources.

One of the things we established in 1984 was a Team Excellence Forum made up of the 50 largest contractors we had at the Johnson Space Center. The Forum gathered to share ideas, to talk about mutual goals, to exchange things that work, and to avoid things that didn't work. It has a steering committee chaired by both government and contractor personnel, and five working groups chaired by contractor personnel. An example of what we have done in the training group is to take all of the non-proprietary courses that we have, put them in a catalog in our library, and offer them to companies that do not have, or are not large enough to have their own training program.

We are trying to go into TQM in such a way that we learn and benefit from those that have been there before us. Many contractors are well ahead of us in implementing the principles of TQM. One of the things we learned is that we were working too close to the fulcrum. We are not a production organization, but we were working in a production process design area, and we quickly realized that we had to get out on the other end of the pole where the real leverages are, and start to affect the product design.

We need to raise our expectations. Successful companies exhibit very common beliefs and behaviors--that is, high management expectations. They are quality driven, and they achieve higher quality at lower cost. That's an important lesson to learn. Good quality does not necessarily have to cost more. We need to focus on a robust design, improve our work processes, and base these on extensive management and employee involvement.

Today, in our search for what works, we have had people focus on tools, techniques, and concepts. We are looking at benchmarking and tools for improving our processes. We decided that we needed to employ TQM from the top down, and infuse it into our organization. We had been burned with "zero-based budget", "zero defects", and a lot of other buzz words. We knew that if we were going to do something as pervasive as TQM, we would have one shot at it with managers who could be very cynical and critical, when it comes to things that they believe might waste their time. So we plan to educate our senior staff, and then have them train their people in TQM. We have adopted the goal of a ten-fold increase in our product services and processes by the year 1995.

We believe that we must do today's job to the very best of our ability. Tomorrow's jobs we must do even better. There's a consensus building among our managers and contractors that a Total Quality approach will offer a solution to at least some of our concerns. We know from the past that we can achieve challenging goals if we set them.

Panel A2 - Organization for Planning and Implementation *(from left to right). Gordon P. Carlson, President, GS Aerospace Technology, Inc.; Hugh M. Brown, President and Chief Executive Officer, Brown and Associates Management Services, Inc.; Joseph A. Frankovsky, Staff Vice President for Total Quality Management, General Dynamics Corporation; Daniel A. Nebrig, Associate Director, Lyndon B. Johnson Space Center; Joe E. Alcala, Division Director, Productivity and Competition Advocate, Space Systems Division, General Dynamics Corporation.*

3.3 Winning Strategies For Total Quality

Planning strategies of organizations successfully implementing Total Quality Programs, including pitfalls encountered and benefits derived.

3.3.1 Introduction

Roy S. Estess, Director, John C. Stennis Space Center, Chairman

Today I've had my batteries recharged. I've got a renewed commitment and that's a part of what being here is all about. It's a very broad and interesting topic that we have: Winning Strategies for Total Quality. "Strategies" implies that there's some planning involved. "Total Quality" certainly suggests the utmost in customer satisfaction, and "Winning" obviously denotes success. So I'm looking forward to hearing from our panelists, about what they've done in their organizations.

3.3.2 TQM: The Promise Is Real

Ronald G. Robinson, TQM/People Coordinator, Electronic Systems Sector, Harris Corporation

Total Quality is not free; our experience is that it costs. It costs you some of your basic beliefs about the way things have to be done, and your basic thinking about people. We found that, first and foremost, Total Quality has to do with the management philosophy. Embodied in that management philosophy are some basic values, some basic principals regarding continuous improvement and people—customers, suppliers, workers, even managers. We call our Total Quality process PEOPLE. It's an acronym for "Performance Excellence: Our People Lead the Effort".

We've pulled together—from many external sources, from our own experience, and things like the Malcolm Baldrige criteria— what we call "standards of excellence." These encompass management leadership, employee involvement, customer focus, quality technology. In each of these areas, we look for continuous improvement. It starts with the issue of top management leadership and how essential that is. This is not something that management can delegate and say, "Yes I support you. Go forth and do good." You have to get intimately involved in the process. Another basic tenet is that managers don't know everything. There is no way, in the complex world that we deal in today, that I, as a manager, can know everything that's going on in my organization. It's OK for me to admit that I don't know everything, and especially admit it to the people that work for me.

The next principal that we had to consider was that people want to do a good job. Our belief is that 100% of the people at Harris, and I would venture to say in all of your organizations, come in every day highly motivated to do a good job. Now, that's at eight o'clock. But, by nine o'clock they're so frustrated by all the problems in the system that they *become* unmotivated.

The last basic tenet that we had to change—and this again was a hard one for us super-high-tech folks to accept—was that the customer is really king. What that means is that the customer is smart. As we started making this change in our thinking, we got feedback from our customers that we were finally listening.

When we started out in 1985, even though we called it the PEOPLE process, 99% of all the improvement activity was happening in manufacturing, because we couldn't measure what engineers do, and they had all the excuses. But, very quickly, we realized that most of our cost-of-doing-business was in non-manufacturing areas. To date, of all of the improvement activities going on at Harris, over 80% are in non-manufacturing areas. And, out of all those improvement efforts, we have consistently seen a 5-to-1 return on our investment in terms of the time that it takes to train people, and the cost of implementing their recommendations.

We have to reshape the employee's question from, "What is my function, and what department am I in?" to, "What is my process, and what team am I on?" We have to start answering the question, "Who is my customer, both internal and external?" versus "Who is my boss?" We have to give them the information they need in order to make decisions on their own, rather than giving them detailed procedures to follow. And finally, we must inform them about the overall business direction, so that they can make those decisions more effectively.

All of this takes a lot of time on the part of manager leaders—in our experience at Harris, at least 50% of our time. But, what are we there for? Our primary function should be to provide the leadership that is addressing strategic and improvement issues. The day-to-day should be the responsibility of the people who are doing the work.

This is a never ending journey. As David Kearns at Xerox puts it: it's a race without a finish line. We're always going to be running to keep up and to keep ahead.

3.3.3 Change Strategy to Become a World Class Industry

Andrew J. Stofan, Vice President, Technology, Martin Marietta Astronautics Group

Change consists of two elements, one sociological, the other, technical. If you don't make the sociological change first, then the technical part of it, or the training, will not have any effect at all. The sociological part means education. You have to remove ignorance from the minds of the people. Removing that ignorance is a big job, and it's far more difficult to educate the top leaders than the rest of the organization. The education starts with the top team. The best way to educate them is to have the leader of the organization and his direct reports take every single one of the education courses before anyone else in the organization does. Then, when the rest of the people start talking and questioning, the top team will know how to respond to the questions. Demonstrate constant support and total encouragement. Once you start down the path, do not change, keep on going and keep the top management leading the change. Continuous talking is absolutely necessary, so the people understand what the goals and objectives are. But, the top leader must also go out and "do". The employees must see him performing in the new environment. They must see participative management, consensus decision making, team support, and the reward to people who work well with other people.

You start by changing the paradigm, from control to commitment, from autocratic management to a situation where people are committed to the organization. They come to work because they enjoy it; they're having fun and they're part of the process. It's people empowerment—releasing the creativity of all the people.

Look at everything as a process. If something is going wrong on the line, it is not the fault of the people. You do not continuously improve the people, you continuously improve the process. The people are highly motivated and want to do a good job. They don't need to be improved, the process does.

It is essential to develop measurement systems. If you can't measure it, you probably shouldn't be doing it. You have to know when the process is not working, and you have to be able to measure to see that it is improving. Again, I know a lot of people are struggling in the engineering field, but I think it's an absolute necessity that we develop metrics in that arena.

Involve the suppliers. If we just fix our in-house problems, that's not enough. We make our suppliers a part of the team that's developing the product. We bring them in, they spend time with us, they go through the training with us, they understand what we want. We go back and help them in their shops and plants, help them set up this process.

"Quality Functional Deployment" is a formal technique for capturing the users' requirements, mapping them into product and process parameters that consist of techniques for creating and completing a series of matrices showing the association between specific features of a product and statements representing the voice of the customer. It is a tool that forces you to follow a methodical process up front, before you start doing anything else. You may spend more money up front, but you only need to do it once.

"Design of Experiments" is a method for systemically planning and performing engineering studies, so that the factors that may influence process performance are actively manipulated, resulting in fewer experiments in shorter time, and more concise results. Again, this is a tool that is used up front. You think before you start doing. We were taking about 30 hours to run a certain computer program, and weeks to run different parameters and study it. We got down to where we could do this study in four hours, and we found out what was really important.

"Statistical Process Control" is the application of statistical methods to analyze data produced from in-process monitoring, and then using these data to make observations and improvements on the process. We applied statistical process control, along with design of experiments, to a wave-soldering process we were doing on boards. The design of experiments identified the driving factors, trends, and improved overall process understanding.

Then we looked at what the variables were and the reduction opportunity in areas that require improvement and maybe improved training for the operators. This sets the stage for continuous process improvement. Thus, you are doing more than solving a problem, you're going to make a process better forever.

"High Performance Work Teams" is a tool for empowering people, that facilitates concurrent engineering. This tool breaks down the barriers between levels of employees. It solidifies a group of people who have never worked together, and gives them the means to analyze a problem.

Organize a steering committee immediately. You need to keep the pulse, to look at the metrics, to guide, facilitate, coach, and help. There has to be a place where these teams can turn and say, "Hey, we're in trouble, we need help." Initiate development of measurement and scoring systems to determine the process. Again, you must measure to see if you're making progress.

Carefully consider the psychology of these changes. What are you doing to your work force? What are you doing to your first, second, third line level of supervision when you do this? What are their roles? When the employees come in to work every day, it's going to be different. Understand that, because then you'll be able to deal with the problems that arise.

When you sit and talk with one of these high performance work teams and listen to the enthusiasm, the experience is just mind boggling. You have really freed these people. You have freed their minds, their productivity goes up, they come to work everyday, and they enjoy it.

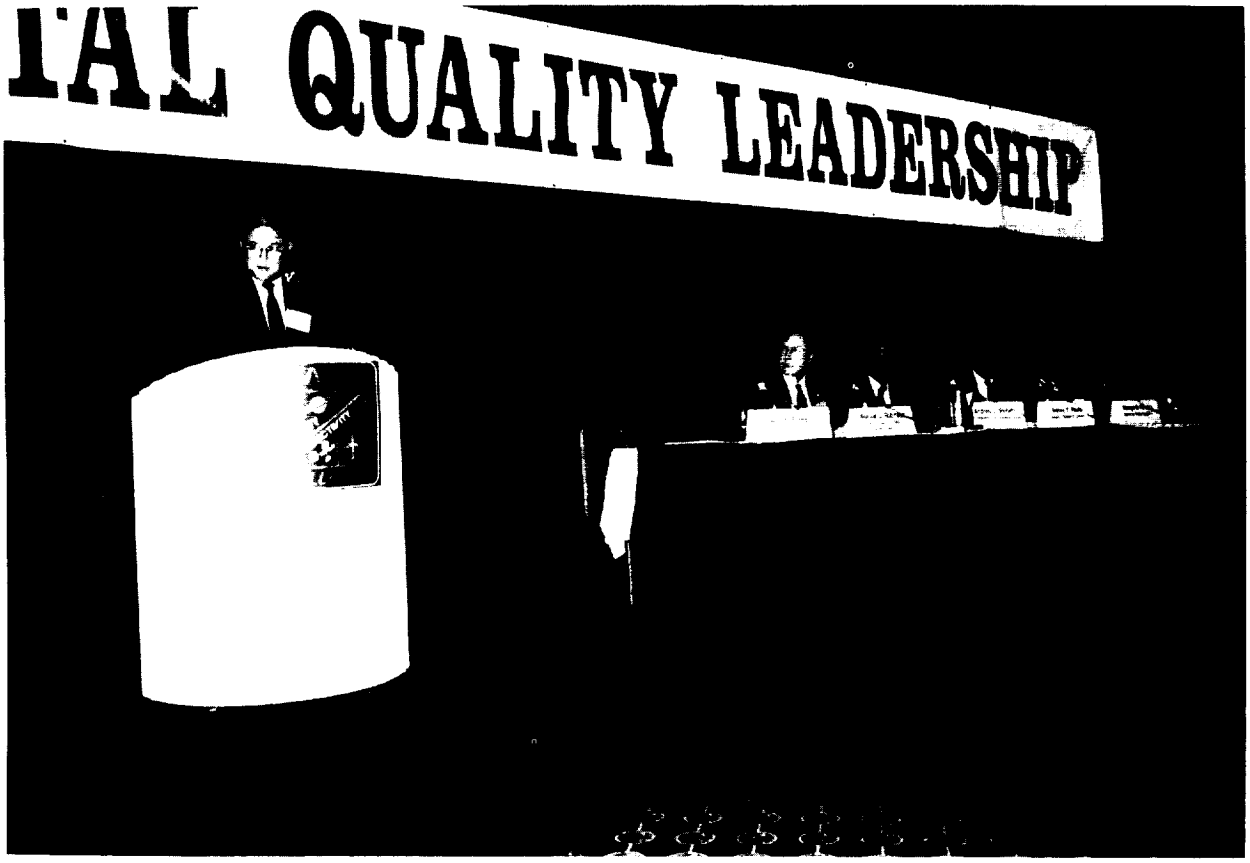
3.3.4 Strategic Planning in a Research Environment

Sidney F. Pauls, Associate Director, Langley Research Center

As a result of a NASA-wide survey, we learned that we weren't doing very well in the area of awards and recognition. So, we put together some of our employees to take a look at it. Here are some things that they came back and told us. They said, "You guys are picking managers because they're good engineers, and not necessarily good people managers." And you know, they were right. Not only that, but we were promoting managers without giving them sufficient training to make them good managers. And then they said, "There's no employee rating or evaluation of the managers." They recommended that we put together some management training that's available to *all* the employees. Give people a chance to see what it's like managing people, before they decide it's something they want to try. Put together a curriculum, emphasize the human resources, management skills and the selection criteria.

The strategic planning process that we go through is very disciplined. The third Wednesday of every month, the senior staff meets for a full day to deal with strategic issues. We have a "no substitute" rule for that day, which means that, when we say we're going to meet, the right people are there and they try not to stay away. In the summertime, we go offsite and review our strategic plan as it regards our people, our facilities, and our human resources issues. That's important, because the emphasis at our center is process—a strategic planning process. Having that process in place enabled us to react to those indications that we were creating problems for our people. We were also able to utilize the strategic planning process to correct the situation. The response that we agreed to give them is either, "Yes we will do it," or, "No, we won't do it, and here's why." An acceptable response was *not*, "We'll study it and come back and let you know."

We have impressed our guests with our ability to respond to some fairly significant issues that require culture change at the Center, and we think it's because we have an active strategic planning process. It's the key to our going further in the TQM environment.



Panel A3 - Winning Strategies for Total Quality-Planning *(from left to right). Roy S. Estess, Director, John C. Stennis Space Center; Ronald B. Robinson, TQM/People Coordinator, Electronic Systems Sector, Harris Corporation; Andrew J. Stofan, Vice President, Technology, Martin Marietta Astronautics Group; Sidney F. Pauls, Associate Director, Langley Research Center; George B. Nelson, Productivity Manager, Stennis Space Center Group, Sverdrup Technology, Inc.*

4.0 Continuous Employee Development for Total Quality

Highlights the vital role training and recognition play in developing a Total Quality work force. The importance of assessing training readiness as well as design and implementation tools and techniques is discussed. The power behind employee recognition and its value to the organization is also covered.

4.1 Are You Ready?

A focus on the role of training in a "Total Quality Culture," from needs definition through evaluation. The speakers discuss the range of activities needed for effective and continuous employee development, from senior executives through the entire work force. The primary focus is training as a vital "Total Quality" element.

4.1.1 Introduction

Jerry J. Fitts, Deputy Associate Administrator, Office of Space Operations, NASA Headquarters, Chairman

In all of the presentations that have been made, the importance of Total Quality Management has come through loud and clear, in terms of it being a critical element to our future.

From a corporate standpoint, it is imperative for survival in the marketplace. From NASA's standpoint, it is imperative in serving its customers, namely the American public and, certainly, the folks on "the Hill." From an even broader perspective, it is imperative for maintaining U.S. leadership in areas in which we currently enjoy leadership. More importantly, the Total Quality Management approach is absolutely necessary in order to regain the leadership in those areas where we have lost ground.

4.1.2 Panel Presentation

Charles Zimmerman, Director, Education and Training Services, Electronic Systems Group, Westinghouse Electric Corporation

The Productivity and Quality Center at Westinghouse is a collection of about 125 people. Our mission is to be a change agent, to try to seek a Total Quality culture throughout the Westinghouse Electric Corporation. Those of you who know anything about Westinghouse are surely aware that we're extremely diverse. So, when I talk about a culture, I'm talking about bringing many diverse cultures together within some sort of flagship initiative.

Let me start first by explaining what we mean when we talk about Total Quality. I think it is quite important that you get it in our context. First of all, we have what we call a "model for management." It's not something that we try to layer over everything else that we do. It's our intention to adopt that model as the principal strategy for conducting our business worldwide. It's requirements represent the four constituencies that we feel it's necessary to deal with:

- The customers who need to be satisfied. In our world that means both the internal and the external customers.
- The stockholders - the people who invest their capital in the corporation, and who need to be satisfied that the corporation is delivering a reasonable return on that capital.

- The employees who need to be satisfied. It's our goal that all our employees feel that what they are doing is their very best employment opportunity, that it fits, that their goals are harmonized with those of the corporation, that they have a sense of value and a feeling of creativity about what they do.

- The public. Westinghouse has been in the nuclear business ever since it started in this country, and we're a perfect example of what can happen to a business when the public decides it doesn't approve of what's going on.

If you're going to pursue Total Quality, you measure in terms of three things: 1) What are the ratios that exist between the customer value that we deliver and the price that we charge for delivery? 2) What are the ratios between the total cost associated with delivering those same customer values to the customer? 3) How often do we get those things right?

The implication is that if you're focused on customer value, you can feel reasonably confident that you're working on the right things. The four bullets in the imperative grouping, really represent the things that we *decided* we must do. As we pursue the Total Quality journey, we ask ourselves continuously, "Are we working on things that are oriented to customers?" "Are we creating value through human resource excellence and product process leadership?" and, "Is the management leading this process with all that leadership implies?" That's our architecture, if you will, for Total Quality as a "model for management" of the business.

Process is ongoing; it never ends; it's self renewing. This is a very important concept to us, because we are so used to thinking in terms of finite goals. Continuous improvement means that you expect your organization to have the capability to change. It is not only willing to accommodate change, but eventually, to thrive on it. That's one of the most severe implications of the continuous improvement and continuous process mentality.

People. The implication is that people are truly strategic. But we have trouble with this. We're just like many other corporations in the world. Our culture allows us to say lots of very satisfying things about how "people are our most important resource." But, the truth is, we have trouble behaving that way. We very rarely treat investments in people with anything like the same respect that we treat investments in technology products and processes. But we're trying.

Something interesting has happened to us over the past few years. We've been pursuing Total Quality for about ten years, and about three years ago, we stopped expressing our goals in terms of "this year's numbers," or whatever. While we recognize that the driving forces in our corporation are, in fact, things like revenue growth, operating profit improvement, asset turnover, and return to shareholders, we are much less focused today on absolute numbers than we are on rates of change. There are changes in place that are going to increasingly reward people on the basis of the rate at which those changes are occurring, rather than what they achieve in any particular time period. Again, the emphasis is on continuous improvement.

Now, whenever you implement a process, you need a plan for doing it. We find we have two very demanding tasks on our hands. One is to communicate. We find that we don't know what communications really are. I do know that we're not very good at it. I do know that we tend to satisfy ourselves with saying things, and writing things, and publicizing things. We spend precious little time thinking about how much of what we said or did is understood, truly relevant, or has added value. Communications is much like Total Quality itself. It's not something that you delegate to communicators. Communications is a basic part of every manager's job. How many of us take for granted that the things we need to do our jobs are understood by the people who provide the input? Communicate to your internal suppliers, as well as to your external customers and suppliers.

Let me take you quickly through a few things that we have learned about change. We came to these conclusions after studying what was going on in over 100 companies worldwide, which had attempted to change substantially and quickly. There are seven elements that we noticed in this change process that were key to successful change, which were absent in situations where successful change was not realized:

- The vision needs to come from the top. People have to understand it at every level. It has to be a stretch goal, so that people will feel challenged, but not intimidated. It has to be measurable. Typically, we find that visions that are expressed in numbers don't work. Over and over, we find that some people don't feel as if numbers are part of their lives. But, they can relate to being the best at something, or the most powerful at something, or to receiving recognition in the marketplace.

- The key element we find in successful change leadership has to do with consistency. We have lots of people who understand Total Quality, but who, in their daily actions, do not demonstrate and model Total Quality. For instance, a demonstration of consistency is having a product that is ready to be shipped at a certain time, but you don't ship it, because it isn't quite right. No matter how pressing the financial goals are, you don't send it out the door.

- The people who have been successful change leaders tell us that one of the most important characteristics they have is stamina. It takes a while to accomplish this kind of change.

- Change won't stick unless you have participation. The people who are going to be affected by the change have to have a role both designing and implementing it. People need to understand the change, and the way people understand best, is to get involved in planning.

- Communications. Here it is again. Continuous, consistent, omnidirectional. When you have it, it's very noticeable. When you *don't* have it, it's very noticeable.

- Training and education. I'm talking about training people to learn what a change process means, both to themselves and to their environment. We are specifically training our management team, plus others whom we hope will become change leaders, in the dynamics of change.

- Reinforcement has to be present. We get so caught up in striving for greatness, that we fail to recognize the tremendous value that's being contributed at every level of the organization. Place charts and posters at the work stations. Have people track their own performance and discuss the progress with them. Recognition may include pay, where it makes sense. We find that even minor kinds of recognition are tremendous motivators.

4.1.3 Panel Presentation

Charles M. Ericson, Manager Product/ Process Technology, Westinghouse Productivity and Quality Center, Westinghouse Electric Corporation

Every manager has to be a teacher. As you get into Total Quality, take a look at your training needs across the board. Certainly, people must be aware of your Total Quality architecture. Certainly, they must be aware of what Total Quality means. But, this should be integrated into what they need to know to survive in the work place, what they need to know to be mobile. You don't have to hire a big training department to do this. We run our own evening college, because of the high number of technical people we have. We use our own scientists to teach in that program. We use our engineering managers and other
technical people to run the school. We have one professional employee who - part time - actually manages the college. We have hundreds of people involved, who all contribute their time. People are very pleased to have that kind of an opportunity.

You've got to find different methods and techniques for developing people. I've found that we have to start looking at a curriculum framework from a comprehensive standpoint. We have several thousand software engineers who are writing software for advanced radar systems that will go into the next tactical fighter. Some of them don't even know what radar is. So, when I run technical programs based on our products, guess who come to those programs? Those software engineers, who are desperately trying to learn what our products are all about. We've got to share the knowledge. We have people in our organization who have never seen an end product. We've got to get people to relate to our business, to our processes, to our products. And, one way of doing that is by offering the right kinds of developmental programs for people night and day, on their time, on our time.

We've been a stable employer in the Maryland area for many, many years, but in these tight times, we've removed all the contract engineers from our facilities. We're taking nearly 100 people from product areas that are no longer viable, and retraining them for the clerical positions we need. We're putting them into jobs that will grow, and people are glad for the opportunity. We're starting to retrain other engineers from different programs to

fill a very large need we have in software engineering. The more flexible you are, and the more skills your people have, the more dynamic the process becomes, and the easier it is for you to respond to your challenges.

Panel B1 -- Are You Ready? (from left to right): Jerry J. Fitts, Deputy Associate Administrator, Office of Space Flight, NASA Headquarters; Charles M. Ericson, Manager, Product/Process Technology, Westinghouse Productivity and Quality Center; Charles Zimmerman, Director, Education and Training Services, Electronic Systems Group, Westinghouse Electric Corporation.

4.2 Tools and Techniques for Total Quality Training

A discussion of the use of large scale systems change techniques as a methodology to position the organization for culture change and prepare it for specific training interventions that promote continuous improvement. The use of a simulated production environment to teach the application of continuous improvement concepts is modeled.

4.2.1 Introduction

Joseph A. (Woody) Bethay, Associate Director, George C. Marshall Space Flight Center, Chairman

All of us know that there are profound changes occurring in the nation's workforce. All of our organizations are hiring more women employees, more minorities, more young people, and that makes a significant impact on our organizations. But, at the same time, we're seeing a change in what's expected of our organizations, and how they are expected to operate. We're moving into a team environment. In that environment, we have to draw from each employee the very best that he or she has to offer, and be sure that they accept the responsibilities that go along with this new approach. We expect employees to have the vision of the organization, and to help in achieving that vision. How do we control and direct those changes; how do we go into the new era of Total Quality Management?

4.2.2 Errant Arrows and Maggie's Drawers

C.W. (Pat) Duffy, Director, Continuous Quality Improvement, Boeing Defense and Space Group, Aerospace and Electronics Division

Sometimes I think this quality improvement movement is a lot like an experience with Maggie's Drawers. If you're on a pistol firing range, you have a pit man down in the pit who runs the target up and down on a set of rails. After you've fired your specified number of shots, he lowers the target, makes the count and gives you a signal. Now, if you happen to miss the target, there are no bullet holes. The pit man runs the target back up, along with a big long stick with a pair of red drawers on it. It's waved back and forth in front of the target. There isn't a soul on the line that doesn't know what happened.

Just a year ago, we decided to merge the Aerospace Division, and the Electronics Division. What happened was that our management arrows, as they related to CQI, were going in every direction. On the Aerospace side, we did not have strong leadership; we had lots of activity, but it was not well coordinated. Over on the Electronics side, they had benefited from some very strong management direction from the top down. Those arrows were very vertical and very aligned with their mission, goals, and objectives. But the problem was, it hadn't been in place very long. So, when we put the two organizations together, we were facing one heck of a job.

The first thing that we did was to take our quality council off-site for two days and hammer out a 37-word mission statement. We started listening to one another, and found that it was a lot tougher then we expected. We took into account our stakeholders, our chairmen, our corporate people, our sister divisions, our suppliers, and our customers. The first question we asked was: "What business are we in?"

Out of this came the strategic goals. We had to pay attention to the business issues, the competitors, and our own organizational capabilities. Here, we identified the thrust, the strategic directions, the long range.

Next came the development of our objectives. Our experience is that one ought not to have more than three to six objectives. They're measurable, they're achievable, they're easily understood. This is where you start making your action plans. This is the who, what, when, and how, at *every* level of the organization.

At this point, you start listening to the most important people of all – the ones doing the business. Here, we incorporated "Performance Management." It's here that the individual gets tied into the alignment of the goals and the objectives of the organization. Alignment, in our case, simply refers to making our organization more responsive to customer requirements. The organization then measures its progress against keeping the customer satisfied.

There is no change without pressure to change. When I say pressure, I don't necessarily mean from outside the company. I mean wherever it may come from, and most of that change comes from within the company. To get change, you've got to have dissatisfaction with the status quo, a vision of where you're going, and you've got to take some first steps. The product of those three elements must exceed the resistance to change. If any one of those elements are zero, then there will be no change.

To get commitment, we developed what we call our "large scale systems change". "Large scale" means taking about 250 of our managers offsite for three days. It took 11 of those events to get through our 2100 managers, but we did it. It's important to build a common database, so that everybody is singing from the same sheet of music when you start into the change process.

Next, we start on our mission goals and objectives, and we get feedback. We developed a number of goals and objectives, and then submitted them to the next group of 160 managers, and asked for their reaction, feedback, and suggestions. We were totally unprepared for the help we got. The managers were surprised that we had listened. We were surprised at their reaction. The net result was that we got a marvelous set of missions, goals, and objectives. But, most importantly, we got buy-in from that group of 160. *They* were the ones who had to make the idea happen, who had to carry it on down.

On day number three, we talk about QC and review the quality council responses. Then, we work on the preferred future. In the 11 events that we've had, we've had over 1800 commitments from our management staff to make change, ranging from, "I'm going to start talking to some of my customers", to, "We're going to cut the first cycle flow in manufacturing by 50% in 36 months." That is very, very powerful. It brought together our management structure; our two organizations came together.

Having gone through this, our organization was now postured for learning. We still have a lot of people who don't understand clearly that quality improvement is their job. It's not something you do after hours, or on the weekend, or at a three day get-together.

We've learned a lot out of all this. The leader's got to be a role model, and that doesn't have anything to do with making speeches. We've learned that marvelous things happen when people start talking to one another. It's just that simple. We've learned that, when we put design teams together in parallel, and not in series, we get a much better product. Our engineering organization is learning that their customer is manufacturing. Amazing, isn't it? I think most folks think that their customer is somebody outside the company. But, that's not true, and our people are learning that.

So, what we have just considered are the three change models that we use. We've been at it a little over a year, and we're seeing some marvelous results. The people in middle management *are* getting a little paranoid in terms of what their role is, but these are symptoms that I hear from many other organizations. We're striving to form partnerships with our suppliers, to quit beating up on them. A good example is the job we've done in getting that particular issue squared away in the work we're doing on the Space Station.

4.2.3 CPI Boot Camp

Phillip R. (Bob) Elder, Director of Total Quality Management, Rocketdyne Division, Rockwell International Corporation

When I joined Rocketdyne almost two years ago, we had just been introduced to the idea of Total Quality Management. Rocketdyne enjoyed a good deal of success, no small part of which was a George M. Low Trophy. But, there lies one of the problems. How do you convince people in an organization that has just achieved this Award, that there is something more to do. I was launched on a mission to try to find a practical technique to introduce TQM to Rocketdyne, and I believe we found a pretty good device.

The device is very, very practical. It gets down, gets dirty, it gets personal with individuals in dealing with problems. The challenge: how do you shake paradigms, how do you convince people that there is a different way, a better way, than what they've done in the past? How do you mobilize all levels of management from the top all the way down to your first line managers and how do you mobilize the workforce to get them to buy in, after many years of being jaded by the buzzwords "satellite quality", "quality circles", and so on? And, how do you provide them with the tools for change that they will need to achieve improvement? A proper solution should be one that allows a student to experience the change process himself, and enjoy the benefits of working in a process that has been changed. The device is the CPI "boot camp."

CPI is our vernacular for "Continuous Process Improvement". The boot camp is a two-day education process. It has application at all levels, from presidents to janitors. CPI focuses on the

interim steps of understanding, documenting, characterizing, and simplifying your current processes. The enemy is the process that we're buried in, the systems that our organizations have developed over the years to get work done and to protect themselves. The tactics are very common: reduce process variability, reduce cycle time and remit time, and remove non-value added steps. Boot camp uses a simple manufacturing process that is replete with real challenges and real systems defects. You actually make something, and you deliver it to a customer. The training takes place in a real factory building.

The students experience this process three different times. They role-play everything: suppliers, vendors, management, operators, quality inspectors. They actually touch, feel, and smell on three separate occasions, so that they internalize what's going on. The scenario each time is exactly the same. You deliver the product (which does not change) to the customer on time, with acceptable quality. In the process, you have to deal with engineering changes, both customer-driven and self-imposed. You have to deal with the systems that are built into the process; you have to deal with the management; and, you have to deal with the inventory.

The first time you run it, it looks a whole lot like my factory and your factory. The first time, needless to say, you don't make your deliveries on time, and quality is lousy. Quality stands out as being the biggest problem, so you use a Continuous Process Improvement model to improve your processes. With a little luck, you eliminate the quality defects in the factory. Then, feeling robust and well, you go back and run it again, and, lo and behold, it's not the quality problems that get you, it's your systems: the change systems, the procurement systems, the way you manage the systems. You have much better quality, but you just can't get it out of the factory in time. So, you go back and do some more CPI, and introduce some notions about how to do change management, how to manage better, how to deal with vendors better. When you run it the last time, you have the opportunity to experience a factory that really does work well with some of these new ideas in place. Flexibility, the response to change, what is externally driven, or internally driven—all of these are emphasized in the process.

The employees learn a lot in the boot camp, they learn a lot in class. But, management must support it. Management must be knowledgeable of the techniques. If the team goes to a manager and tells him about something that they've done, or tells him about a problem they've got, and the manager looks like he doesn't understand what they just said - he doesn't understand their new vernacular, their new buzzwords - then *they* understand that they don't have his commitment. If you've got winners, slap them on the back and make sure other folks see you. Be very patient. Results take time. This is not a process that solves your problems by tomorrow afternoon.

Panel B2 -- Tools and Techniques for Total Quality Training (from left to right): Joseph A. Bethey, Associate Director, George C. Marshall Space Flight Center; C. W. (Pat) Duffy, Director, Continuous Quality Improvement, Boeing Defense and Space Group, Aerospace and Electronics Division; Phillip R. (Bob) Elder, Director of Total Quality Management, Rocketdyne Division, Rockwell International Corporation.

4.3 Recognition Adds Value

The importance of recognition in improving quality and productivity. Speakers emphasize the importance of recognizing each individual at every level in the organization.

4.3.1 Introduction

Peter M. Alex, President, The Osterland Company. Chairman

A successful TQM program must address what motivates people, and causes them to be committed to the success of their efforts for a significant period of time. This is far more difficult than getting them interested and committed to TQM at the beginning. There is a continuous debate rages on this subject. At the heart of people motivation lies the central issue of recognition. Why do we recognize people? What does the employer get in return for recognizing employees? Can this return to the employer be measured? How do you most effectively recognize people? How frequently do you recognize employees? Does recognition mean a monetary award? Does recognition need a predetermined ceremonial occasion, or can it be spontaneous? Does recognition truly add value?

4.3.2 Lewis Means Teamwork

Lawrence J. Ross, Director, Lewis Research Center

In 1982, we were faced with the prospect of closing our doors. Whether or not that was imminent or even true was not terribly relevant. We thought it was true at the time. So, we began a process of looking into ourselves, and doing strategic planning. We needed to make a fundamental change in how the Center was managed.

The objective of our awareness program was to figure out ways to build an emphasis that underscores the importance of team concept, team spirit, and the pride of the individuals who make up the team. We do that with four major activities:

- We recognize our people, not as individuals, but as members of a team.
- We arrange display and publicity promotions, as awards to changes in rank or pay.
- We focus specifically on improving the quality and frequency of communications, both horizontally and vertically.
- We alert employees to additional information, through a wider range of communications from outside the company.

Inasmuch as we believe in participative management, whose core idea is that all the players in an enterprise participate in the design, planning, and execution of the enterprise, we must buy into the notion that there has to be very effective, very frequent, and very high quality communications. You can't expect participation without communications.

The interesting thing about the program is that, with minor exceptions, it is entirely volunteer. The program activities are very widespread and quite demanding in terms of time, planning, and execution. But, it's served almost entirely by volunteers throughout the Center. People are interested and eager to be part of this, and it is their active involvement that makes this program work.

In the case of recognition, the primary activity is a "Level One" award, where we select a number of teams each year, bring them together for a ceremony, and present them with a personalized folder and a letter signed by the Center Director. The award is a key event, and it's highly sought after. Level Two is a little less formal, and consists of a letter of appreciation for the efforts of an individual team member from the Center Director.

"Promotions" is a billboard type activity intended to support and reinforce the team concept throughout the laboratory. We take out a four-page insert in the local newspaper, run a story in our Lewis newspaper, and exhibit a display around the Center at various times.

We foster communications through a series of events called "Issues and Answers," that occur about 15 to 20 times a year. Each event involves from 300 to 400 staff, including people who work at the Center, and those who work for contractors. It's about a two or three hour event, and is a period of time when the Center Director can describe how things are going in the outside world. In addition, each of the participants gets an opportunity to suggest a topic, question, issue or concern that he would like to hear elaborated. Our policy is to

address and answer every question during the course of the meeting.

There is a type of communications activity called simply, "A Talk." It's a way of getting special topics out in front of everybody, to talk about and comment on. It may be procurement one day, engineering processes another day, or personnel issues a third day. Experts come in, we open the doors to the entire Center, and then just sit and chat about what the problems are, and how we see the future.

The "Alert" program expands communications outside the company. Among other things, we bring in nationally prominent speakers about 6 times a year, to share their expertise with our staff. All of these have turned out to be extraordinarily powerful ways to bind the Center together, to lay the foundation for effective participative management, and build teamwork. Our logo is L-A, Lewis Awareness. The awareness staff, the Director, Deputy Director, and the management staff interact with the Center employees, the program managers, and the large number of dedicated volunteers. Together, they make the expression "Lewis Means Teamwork" something real for us.

4.3.3 Almost Everything We Do is a Form of Recognition

John G. Johnson, Vice President, Manufacturing, Electronic Systems Sector, Harris Corporation

Our Total Quality leadership program is called the PEOPLE program, which stands for "Performance Excellence: Our People Lead the Effort." The name of our program will suggest to you that we are focused on the social, as well as the technical, aspect of TQM. I'm going to discuss the philosophical underpinnings of a reward and recognition program.

In our program, we define leadership as "inspiring people to voluntarily pursue a worthy set of mutually held values." The key words in that phrase are "inspiring," "voluntarily," and "values." Those three terms are not in the vocabulary of the traditional manager, because they have very little to do with the traditional management skills, i.e., planning, directing, and controlling. Those terms take the manager into a new domain, that he must understand, before he can properly reward and recognize.

Here's another definition we made up. We define rewards and recognition as, "that set of interactions between people, that provide reinforcement of behaviors which advance commonly held values." You'll notice that the term, "values" again. You'll also find that there isn't much said in here about money. At this point the key words are "interactions," and, "behaviors," as well as values.

Let's consider some of the values that world class companies claim that they have:

- Customer satisfaction is essential to enterprise success.
- People want to do a good job.
- Teams can frequently accomplish more collectively, than the individuals on them.
- Everyone has unique knowledge that can add value.
- We are proud to be associated with each other.
- We can and must continuously improve.
- Excellent performance will be noticed, and will be rewarded.

Even the best companies, on occasion, are capable of communicating another set of values that tend to contradict the first ones:

- Quality is somebody else's job.
- Performance improvement is something extra, and not part of your job.
- Longevity is more important than performance.
- Rewards go to the managers, not to the workers.
- Record keeping is the first law of survival.
- We pay people to conform, not to think.

We've discovered that the first set of values are values that we all say we believe in. They have a lot to do with things that we say in meetings like this, and things that we write about. But the second set of values are frequently communicated by the things that we do, by the priorities that we set, by our daily behavior. These are what our feet say when our voices are saying something else; and our employees respond more to our feet than they do to our mouths. Another thing that we've discovered is that there are systems in place that reward and recognize

all by themselves, without any human intervention, and without respect to what our articulated values really are. These systems have their own set of built-in values; they criticize, punish, and reward independently of anything that we have decided:

- Human resource systems are typical cases in point. I'll bet yours communicate a different set of values than you would like to believe. A lot of them communicate the value that, "if you stick around long enough, it will no longer make any difference how well you perform." In other words, HR systems are capable of advancing the value that longevity is more important than performance.

- Look at policies and procedures. When do you come to work? Who gets to park where? How big is your office? That communicates a value system too. It communicates the value that, maybe some people are more important than other people—which may not be consistent with your spoken values at all.

Rewards and recognition are not just about money. In fact, our experience has shown that, money is not the most important aspect of reward and recognition, providing you distribute your money fairly. We have found that people tend to feel more rewarded by our behavior toward them, than by either our speeches or our money.

There were two inviolable rules that we set for ourselves in establishing monetary reward systems:

- There must be a universal perception of fairness, and the one who we want to judge the fairness is the one who *does not* get the award.

- Whatever you do must reinforce the value system that you say you're signed up to. In fact *everything* else you do needs to reinforce that value system.

There is far more risk involved in handling financial rewards. We like to work in teams, but teamwork only works up to a point. People take their paycheck home one at a time, and they use it to feed their family. So, if you handle a financial reward system incorrectly, you can destroy teamwork, because you'll break the teams down into individuals who are pursuing their own financial best interest.

Here are some examples of non-monetary rewards. Please note that the highest paid scientist or engineer on the staff is motivated by the same things as the assembly people on the floor and the guy that cuts the grass in front of the building.

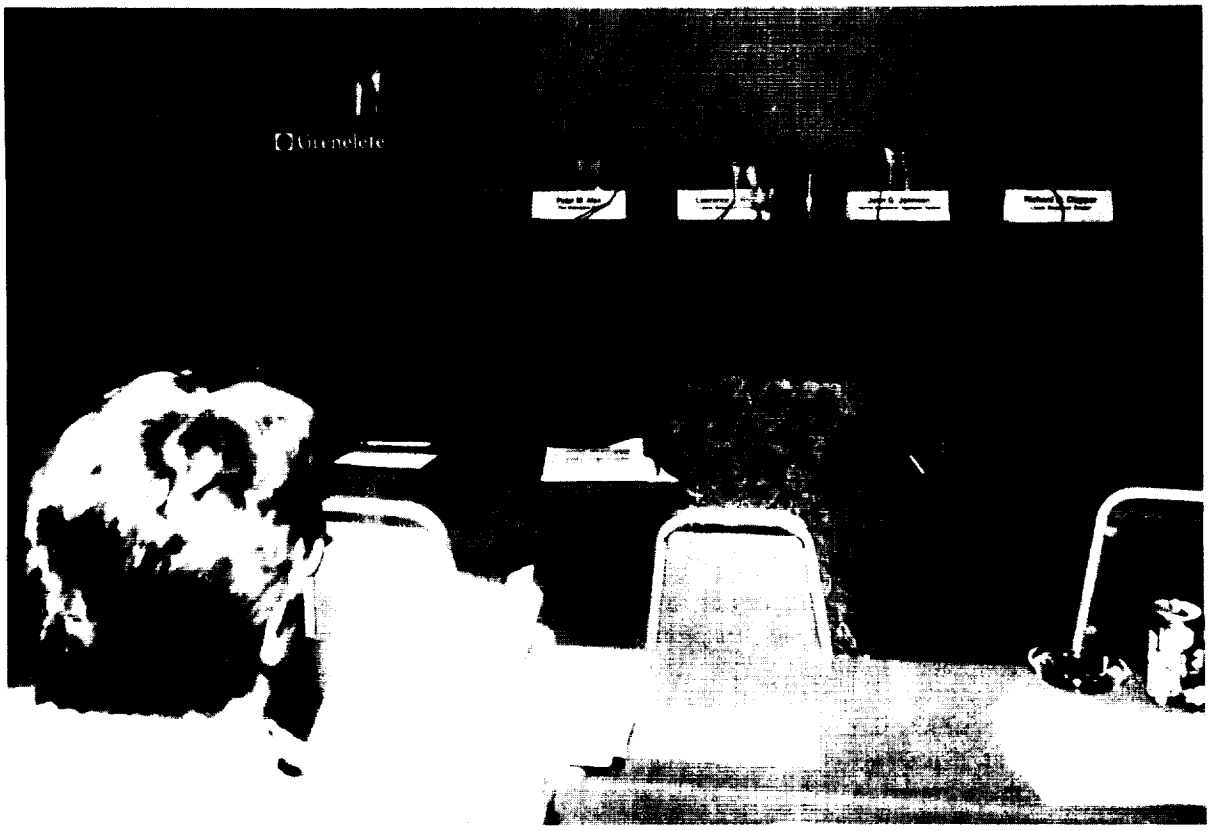
- Symbols. One is our lapel pin. What makes this important to the people working for me is that, in six years, they have never seen me without the pin in my lapel. They know that the pin is very important to me, and that gives it importance for them. So, when they get one of these pins, I never see *them* without it either.

- Things people can use. There are things that are both symbolic and functional, such as the "Employee of the Month" parking space. An employee is selected by other employees to park for a month in a preferred parking space. That means something, and it's useful as well.

- Experiences. We have recreational events for our teams. We send teams on trips. We have working level people speaking at conferences just like this, in Cincinnati, New Orleans, and other places, telling people about their experience. What a reward that is!

There are articles covering team results. Employees design and build displays to put in the lobby, or they put their team plaques and charts in prominent places, and show them to customers as they come through. We have celebrations. One of the things that the government does really well is sending letters of thanks and praise. I don't know anything that motivates stronger than a letter from a customer that says, "Please convey my thanks to so-and-so for what they did on my program."

This is the kind of message that we want to send throughout all of our systems: our HR systems, our accounting systems, our behavior, our words, everything. We're trying to communicate three very simple messages: I admire what you're doing, I want you to keep on doing it, and I consider it a privilege to be associated with you.



***Panel B3** (from left to right): Richard D. Clapper, Chief, Office of Human Resources Development, Lewis Research Center; Peter M. Alex, President, The Osterland Company; Mr. Lawrence J. Ross, Director, Lewis Research Center; John G. Johnson, Vice President, Manufacturing, Electronic Systems Sector, Harris Corporation.*

5.0 Employee Empowerment and Teamwork

Total Quality leadership requires the development of each individual in the organization. Employee empowerment and teamwork are strategies for tapping the potential of each employee. This panel addresses the issues of employee empowerment and teamwork by discussing the organizational prerequisites for empowerment, the implementation of teamwork, and the changing role of management as organizations implement TQM.

5.1 Prerequisites For Empowering Employees

TQM demands empowerment of employees to be successful. Empowerment involves several critical elements—role clarification, supportive organizational policies and procedures, and external customer involvement. It is a process. Empowerment provides an opportunity for the employee to make changes in their work processes which may result in continuous improvement.

5.1.1 Introduction

George W. Davis, Director, Engineering and Space Operations, Boeing Aerospace Operations Inc.

In the area of leadership, empowerment of the workforce is not optional, it's mandatory. There is a group of employees called managers, and they often get forgotten; they're considered a separate group, but in the context of Total Quality leadership, what better process for them to work on than TQM?

Effective leadership in TQM is also found in the workforce. It's amazing how many people you will find who are not managers, but who could be real movers and shakers, and get your program going. Until you get out and work with these people, you'll never find them.

5.1.2 Setting the Stage for People Involvement

Dr. Marco J. Giardino, Center Education Program Officer, John C. Stennis Space Center

In discussing TQM, three main points stick out for me. One is, obviously, the customer—satisfying him or her or them the first time, every time. Whenever we make this presentation to work groups, there's always a great moaning and groaning: "You can't be perfect every time. Perfection is an ideal that you cannot reach." An example we always use to illustrate the ability to reach perfection the first time, every time, is the payroll department. Payroll departments usually know who their customers are. If they mess up, they hear about it every time. So, there are some existing models that do work on that premise. Understanding who the customer is, what they want, and what they need, is essential to being able to deliver a quality product in the first place.

The second thing that comes across to me in terms of TQM is a paradigm shift—a shift from a mechanical way of looking at organizations. When we look at the processes and the process improvements that are required in TQM, management needs to start to look at the organization as a system. Looking at an organization as a system, changes your problem solving approach.

In a mechanistic model, if you have a problem, the first question usually is, "Who did it? Who is the source of the problem?" In other words, which cog broke? We replace the cog and, hopefully, the machine will run right. When you take a systems approach, the first question should be, "What happened?" And then, through your process

improvement/system improvement efforts, you solve the root causes of the problem. It's not just a conceptual nicety. It's really a very practical shift in thinking.

The last point is that it's absolutely essential to have employees involved, and you get employees involved by empowering them. There is a lot of work to be done—in terms of management values and beliefs—in order to understand what kind of control is required in an empowered organization. A lot of managers have the opinion that by empowering employees they lose control. Yet, we've started to learn that, by empowering employees and treating them like adults, you actually gain control.

Why do TQM? First and foremost, when you do continuous improvement forever, that translates into good business. Deming teaches us that 30% of an organization's resources are taken up by the "hidden factory": the rework, the retype, the redo, the redundant. When your organization adopts a continuous improvement forever attitude, people start to tackle things like: "How do we eliminate rework? Is this job really adding value? Would the customer pay for the activity that's going on in my organization today?"

The second reason to practice TQM is because the business environment continues to change. I have met people who have managed to send five kids through college on basically poverty wages, have never defaulted on a car loan, have never defaulted on a house, and have maintained their family intact in the face of social pressures. Yet, when we talk about self-managing teams, we'll say, "Oh no, we need special people for that. We don't have those kind of people." *You have them. We have them.* They're all in the organization today!

Deming used to rail against posters and slogans, and I always wondered why, since I was part of the department that ordered those great looking posters and slogans and buttons. But, what these posters are telling the welders, the machinists, and the custodians is: "If only you worked harder, if only you worked safer, if only you weren't the problem, this organization would be great." And, the posters go up in all the work areas, but not in the CEO's office. Management creates, owns, and controls the systems; we then try to motivate the very people who are least empowered to fix the systems, to fix the problems. Management needs to believe that it can make that cultural change. You need to assess the beliefs and values you have about work, about workers, about variety in your organization, about continuous improvement. A homogeneous board room means that there are very few minorities, there are very few gender differences, there are very few intellectual, conceptual, or cultural differences. Management needs to be aware that when they sit down and define reality for themselves, they might be looking at a limited part of the picture.

TQM is often a problem, because people expect quick results. Culture change is so difficult that quick results, without a long term process, are nearly impossible. So, I propose cultural engineering. There should be an initial understanding of what culture is, and what culture does: symbols, heroes, myths, roles and status. Leadership and trained facilitators are essential. The process of getting there, is to assess where you are, based on your new value inventory; to imagine where you're going; and to strategize to close the gap.

5.1.3 Employee Involvement: Getting Everybody On-Board

Theresa A. Brelsford, Assistant Commissioner for Administration, U.S. Patent and Trademark Office, U.S. Department of Commerce

You can do a lot, if you are a manager with a small unit, regardless of what the head of your organization does. What I want to stress is the importance of preparing mid-level managers—those people between the top and the employees who might be empowered or involved. Often, those managers are the ones left out. They're the ones who may feel threatened, because their authority might be eroded.

In preparing managers, in preparing the unions, and in preparing the employees, you go through the same process. You *focus*, *educate*, and *involve*. With managers, the question you need to deal with is, "Why change?" People don't understand why, all of a sudden, things have to be different. Unfreeze the organization from what it's been doing, by making a case for why you want to do it differently.

Once you've decided and focused on "Why change?", you have to focus on where you're going to go. You want to do things differently, but what's the vision for where you want to go, and what is the strategy for getting there.

What were our reasons for wanting to change? First, we had an increased work load. The increase in patent applications being filed is skyrocketing. The ultimate quality of the product is good, but what it takes to get there has been costly. We have customer complaints. We have high

employee turnover rates, which causes real problems with training. We have also experienced a lot of union grievances that are filed by employees. We have a lot of adverse actions taken by managers, disciplinary actions against employees—a very unhealthy kind of environment.

Once we knew we wanted to change, we established a vision—to consistently achieve customer satisfaction. Now, a lot of our customers are internal customers. We're working to get the point across that everybody has a customer.

The strategy for achieving customer satisfaction is made up of two things—a structure and a change of behavior. There are a lot of different ways to structure and organize, in terms of councils and committees to make things happen, but it is very difficult to change behavior. My message is: just start doing something and learn as you go along; because, if you believe in the principal of quality, in doing it right the first time, in getting employees involved, you'll find the best way as you go along.

We have tried to move from assuming we know the customer requirements, to listening to the customers determine their requirements. We had a lot of people working in our organization who didn't know they had any customers. What they realized was that the customer is the person or group that gets the product next in the processing line, who may also have some other internal customer, or who has an external customer.

So, now the managers know the vision; they know why they're changing; and they know how they're going to get there. Now you need some real education—on how to build a team and how to work together with a team. Our first teams were just managers and supervisors, and it was a totally different role for them. We didn't know how bad we were, until we started doing things differently. Once we started working as a team, things began to happen. We realized you've got to train people, orient people in terms of what teamwork means, and put them through it. Don't expect managers to have effective teams if they don't even know what that experience is.

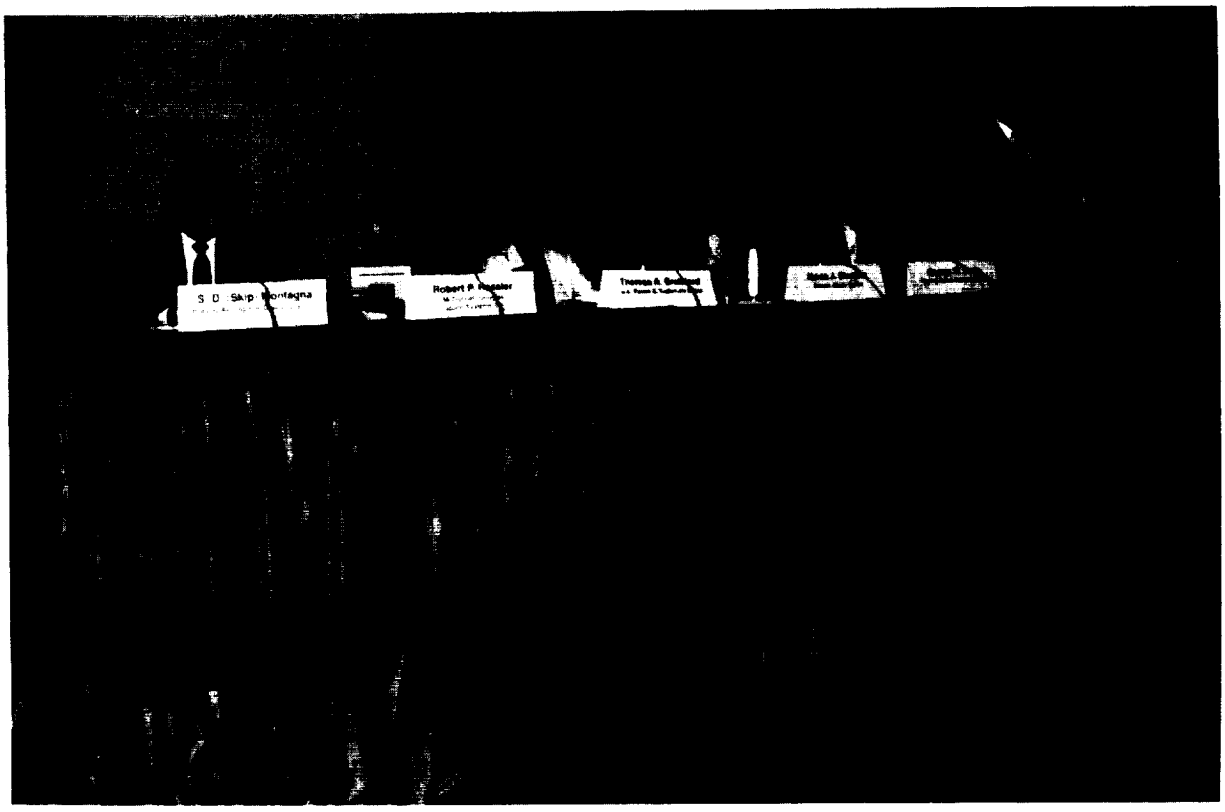
You may have unions that represent your workforce. Go through the same thing with them in terms of the focus. Go through the same thing with the employees, so they know why. Employees really have to know what's in it for them.

I think it's important is to start small. We started with three teams. Because you learn so much, you can do better each time. Calling for volunteers for the first teams was important too; if people feel like they *have* to do it, they aren't very enthusiastic.

Good communications are a must. The teams shouldn't be coming up with recommendations that are a shock to the supervisor. They should be in communication all along. Fast consideration of the recommendations, and prompt recognition are all important things.

Measurement systems. This was another pitfall for us. We did not do a good job of making sure all the teams had a base measure of the way things were, before they implemented any change. Everybody had this feeling that things had improved, but there were no measurements.

It takes a very long time to really change an organizational culture, but there are so many short term payoffs, that you stop worrying about it. If you like the way things are, and you do things the way you've always done, then you'll get what you've always gotten. It's only if you don't like the way things are, and you really want things to be different, that you take the risk and try to change your organizational culture.



Panel C1 - Prerequisites for Empowering Employees *(from left to right): S.D. (Skip) Montagna, Director, Quality Assurance/Quality Improvement, Boeing Aerospace Operations, Inc.; Theresa A. Brelsford, Assistant Commissioner for Administration, U.S. Patent and Trademark Office, U.S. Department of Commerce; Dr. Marco J. Giardino, Center Education Program Officer, John C. Stennis Space Center; George W. Davis, Director, Engineering and Space Operations, Boeing Aerospace Operations, Inc.; Robert P. Hessler, Manager, Communications, McDonnell Douglas Space Systems Company, Kennedy Space Center Division.*

5.2 The Changing Role of Management

Employee empowerment may be threatening to traditional managers whose experience is based in traditional organizational structures. This subpanel addresses changes in the role of management, the relationship between authority, responsibility, and accountability, and what organizations must do to prepare management for its new role, and to support the development of effective relationships between non-management employees, managers, and teams.

5.2.1 Introduction

George R. Faenza, Vice President/General Manager, McDonnell Douglas Space Systems Company, Kennedy Space Center Division, Chairman

Within our topic, The Changing Role of Management, the empowerment of our people is the biggest challenge we face. Having grown up in a traditional manner within the aerospace industry, it has been disturbing to watch the struggle—both within government and industry—to address our shortcomings in producing quality products. However, it has also been very gratifying to see the results of the actions that we've taken to remedy the situation. A significant part of our nation's resurgence in producing quality products is the result of the change in attitude of our workforce.

5.2.2 TQM Strategy for Complex Systems: Management's Role in Empowering Employees

Paul L. Kruelle, Vice President, Systems and Technology, Unisys Defense Systems

What really inhibits performance excellence in complex system development is traditional top-down management. Top-down management *has* produced results in the past (we've all had our share of successes); but, in the end, it really limits achieving excellence in programs. Top-down management is primarily a requirements-driven approach, in which we take a statement of work, and specifications, and pass them down into our organizations. In a project with 26,000 pages of requirements, can I be assured of dealing with *everything* that the customer needs? What about unidentified issues? How do I, from a top-down management point of view, really deal with many of the problems that are going to occur on the program—for example, cross organizational issues, such as the classic problem of engineering throwing designs "over the wall." What about the issue of improvement? How do I really direct improvement with a top-down management structure? Fundamentally, I believe the jobs are too complex for all the answers and solutions to come from above. And, frankly, this creates a reactive culture.

We must move beyond requirements management to what I call process management, and to what we all call, Total Quality Management. From my perspective, there are three ingredients to TQM:

- Participative management. In addition to determining requirements, we must create an environment in which employees participate in management through program objectives.
- Employee responsibility. Employees take ownership for the processes that they're engaged in, and actively participate in improving these processes.
- Teamwork. Organizations, subcontractors, suppliers are brought together to mutually address program objectives.

These efforts produce a proactive culture in which employees and teams are focused on group improvement.

In this system, we still retain the requirements allocation to organizations, but, have empowered employee teams to take a proactive approach by focusing on the processes underlying the job. In many respects, we retain top-down management, since we still need to pass requirements down and allocate to other organizations. But from the bottom side, we empower our employees to really deal with the requirements, and to begin to work with other organizations to solve the problems which are beyond a top-down management approach.

The toughest part is creating the atmosphere for change. This involves changing management/ style, and requires the commitment of the leader of the organization. Change will occur only when that individual steps forth, practices communication, and encourages employee involvement. The second step is allocating resources to train your managers, to

train your people in teamwork and in Total Quality Management tools. The third step is the need to establish accountability or program goals at the employee level. The last step is acknowledgement; we need to recognize and reward real accomplishment.

Total Quality organizations must make a major commitment to process management and recognize that the payback is performance excellence, customer recognition, and competitive advantage. It is at the level of accomplishments that all the elements come together. This is how we measure empowerment and whether we are, in fact, being successful.

5.2.3 Excellence Through Quality

Dean G. Cassell, Vice President of Product Integrity, Grumman Corporation

What is quality? Quality is your link to your customer, and customers are why you exist. I'm talking about both internal and external customers. At Grumman, we've had some difficulty dealing with this concept. As a high-tech house, we sometimes found ourselves telling the customer what he wanted and not listening to what he was asking for. Try looking at your company through the eyes of your customer; it is quite sobering.

Why quality? It's a survival issue. Businesses have become much too bureaucratic. The traditional way of doing things is inefficient and costly, particularly at a time when there is increased competition for fewer dollars.

Let's make some comparisons between management and leadership. The comparisons I have chosen are the basic ingredients which corporations use to operate their businesses:

- Management is planning and budgeting, establishing detailed steps and timetables to achieve the needed results, then allocating the resources necessary to make the results happen.

- Leadership is establishing a direction, developing a vision of the future—often, the distant future. Leadership is developing strategies for producing the changes that are needed to achieve that vision.

Leaders lead people. Managers manage systems.

The leader should be in the business of motivating and inspiring people. He should energize people to overcome major political, bureaucratic, and resource barriers—those barriers which make it impossible for you to hire someone because you have to go through the personnel office first, or those barriers which prevent you from spending money on a piece of equipment you need because you have to get approval from someone else.

Is leadership what we need by itself? No. We need leadership *and* management. Leadership provides vision. Management provides structure. Until now, we've had a bit too much management and too little leadership. We need a proper blend of both leadership and management in this day and age to do—as Tom Murrin said—"Right things right the first time."

People tend to think of a business as a collection of departments in a reporting hierarchy. However, business is really providing processes and services to customers on time and at an affordable price; none of this is visible on an organization chart. Thus, processes tend to be undermanaged because they are invisible. No one has the authority, responsibility, or accountability for the processes. With Total Quality Management systems, you to attack the process, you don't fight the fires.

The 90's are certainly going to require fewer management layers. We have process management teams now, which we call quality action teams, that are empowered to improve the processes, and then formulate measurements. You certainly can't change, if you can't measure. We have leaders who now have broader responsibilities and increased authority and control. And we give them the tools they need to do the job.

5.2.4 Employee Involvement Through Performance Measurement Teams

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

In 1986, Martin Marietta Missile Systems began using Performance Measurement Teams. Our approach was to form the teams into individual companies. Every company owns all of its data, all of the measures, whatever they build, whatever it costs to build it, their quality, their scrap, their rework, everything. Participation and quality are mandatory. There is a designated team leader, who leads the "company." Within the companies, proactive management is practiced at all times. There's a formal meeting structure; measurements, goals, objectives are set up even before the team is formed.

We found that when the teams were set up, it was very hard to get someone to fix something, because they were in another building or unavailable. So, we moved the support people—the industrial engineers, quality engineers, facilities engineers, production engineers—and relocated them with the teams on a full time basis. They became part of that company, and that was a key ingredient.

PMT meetings take place once a week for one hour in designated conference rooms. That is *their* meeting place, *their* time, and they have top priority. They have the data to tell them what's going on on a daily basis. As their process improves, they know at the end of the day what their performance is. We want them to identify problems and show areas which inhibit performance. They are not to work on items that they cannot fix. They can identify problems and the companies, or fix the problem themselves.

Every one of these little companies has its own management control board. They establish their own goals. There is commitment from everyone—from the operators, from the support people, from the leaders.

The team is composed of cross-functional membership, selected with reference to the nature of the specific job. Everyone has the same amount of training. Once the solution is reached, the team that was assembled to work on the specific problem is disbanded. All kinds of measurement takes place. They may measure computer usage, utilities cost, stockroom accuracy, telephones, anything in the company that costs money. The measurement is done and the team decides what improvements need to be made. The team negotiates goals with management. The measurements often change as the team evolves. After 52 months, we found that 90% of all the issues they bring up they resolve.

Recognition is important. Some people used to say the only time you'd ever see anybody on the floor was when something was really screwed up. No one ever came out to tell them about a good job. But with the PMT process, there is recognition, with the teams competing every month. We take certain teams to our customers each month to present what they've accomplished. We have a program where the customers come and visit. We have a recognition breakfast every month.

The bottom line is that if you do these things, and do them from one end of the company to the other, with total management support, your costs go down, your quality stays up, and your culture changes.

***Panel C2 - The Changing Role of Management** (from left to right): Dr. Dean R. Lee, Director, Quality/Productivity, Systems Services Group, Unisys Defense Systems; Robert J. Keymont, Vice President, Production Operations, Martin Marietta Missile Systems; Dean G. Cassell, Vice President of Product Integrity, Grumman Corporation; George R. Faenza, Vice President/General Manager, McDonnell Douglas Space Systems Company, Kennedy Space Center Division; Paul L. Kruelle, Vice President Systems and Technology, Unisys Defense Systems.*

5.3 Making Teams Work

Teamwork is essential to improving quality and increasing productivity. The panel addresses methods for making teams effective in achieving TQM goals, and dealing with teamwork difficulties. Teamwork, today and in the future, must adjust to an ever increasing, culturally diverse work force. Teamwork methods will have to address this cultural diversity and find more effective ways to reward team excellence.

5.3.1 Introduction

David J. Posek, Division Vice President, Government Services, General Electric Company, Chairman

The subject of the panel is teamwork. Improving quality and increasing productivity cannot be achieved without teamwork. This is the key difference between successful and unsuccessful TQM programs. Our goal for this panel is for you to take away some examples from what we are going to talk about, and also, to learn from some of the problems and difficulties that our team members and panel members have encountered.

5.3.2 Performance Excellence: Our People Lead the Effort

Cindy S. Kane, Supervisor of Facilitation, Harris Corporation

At Harris, we feel that our biggest asset is our people; for that reason we named our process the "People Program." The goal of our program is to increase the value to the customer by solving problems. We do this by involving our total workforce in developing a customer orientation, and a relentless day-to-day pursuit of quality and productivity. I will define some key words in that definition. A problem is anything that distracts us from performance, as defined by our customer. Our customer is the direct recipient of the product, and is the sole definer of quality. Quality is the degree of fulfillment of the customer's expectations of the products provided.

While our People Program encompasses ten key elements, today, I will touch on the employee involvement process, and our teams. We have three types of teams, which enable us to involve our total work force.

The first is the EIT, or Employee Involvement Team. This is like a traditional team formed around work areas. The team is responsible for the throughput, quality, and productivity of what we call a cottage industry or a work cell. They also collaborate with their management to set goals. The EIT system involves everyone from our sector president—who leads the staff through problem solving—to our many assembly teams. These teams provide their management with weekly status reports, and are assigned advisors who eventually move into the facilitation or coaching of the teams.

The second type of team is the System Improvement Project. These are like the old tiger teams. These teams are created from recommendations from management, or from the employee involvement team. These teams disband upon completion, and, as we grow in our program, we find that we have fewer and fewer SIP's starting up. We have more and more EIT's, because we've expanded our EIT program to include our business area teams, program management teams, and also our cross functional teams.

The third type of team was created to support our supplier partnership program. These teams are made up of procurement experts, quality engineers, field engineers, and our component engineers. They are responsible for forming mutually beneficial relationships with their suppliers. These teams are a link between our internal and external processes.

The managers have a significant role in the People Program. Their first role is one of a steering committee, which guides the development of policies, procedures, training, and a reporting system. They also have to work on improving their processes, and they must establish the same type measurements as EIT's. But, most importantly, they act as our change masters, because the rest of the organization watches their feet more than their words.

We also administer an in-depth award and recognition program. We look for every opportunity we can to celebrate. Every year we have an awards night for members and guests, and the awards system was developed by a team in our EIT program. Our employees at all levels go out and spread the word for us.

The leaders' role is to provide structure for the team, they keep the meetings focused on the goal, and they make sure every member is heard from. They insure actions are taken and completed, and they meet with the facilitator regularly. They receive 25 hours of training, and their goal is to have their team self-facilitating.

The members' role is to participate by attending meetings and to identify, analyze, and solve problems. Their motto is, "There is no 'I' in the word Team."

When companies get into hard times, it seems that training is the first thing to go. I can't emphasize how important education and training is for everybody. We have spent over 125,000 hours in the classroom on TQM, and had over 9,000 attendees, and we continue to add to our training.

We invite you to come and visit us for our monthly TQM day, the first Thursday of every month, because, the *most* interesting thing we found out about our People Program, is that it is good management.

5.3.3 Managing a Culturally Diverse Work Force

Dr. Thomas M. Steinfatt, School of Communications, University of Miami

Whenever any human being meets someone from another culture, it's fairly likely that the behavior from the one culture will not be perceived in the same way by the other culture. I was with a University of Miami group in Bangkok, and we were attempting to cross the street. The street traffic there flows without regard to lines and rules. If you are a pedestrian attempting to cross the street, the traffic simply moves around you, as you cross. Some in our group condemned this behavior and said, "Their behavior is rude and impolite," Someone else in our group said, "No, they just don't know any better." A third person said, "These people are crazy!"

"Rude and impolite" assumes that the other person knows the appropriate standards for behavior, but is not willing to adhere to them; so, who knows what else they might not accept and what other anti-social values they might hold. We get very suspicious of the other person. "They don't know any better", implies that the person does not know the appropriate standard for behavior, was not brought up properly, and had lower class parents. "That person is crazy," states that the person is mentally imbalanced, that we have no way of predicting their behavior, and therefore, they are dangerous.

No matter how strange a behavior is, you need to think about it in terms of the norms of the particular culture that it comes from. Specific behaviors do not necessarily imply that a person shares norms of anti-social behavior.

In managing, one of the most common errors is simply assuming that the invisible features of communication are the same across cultures. Invisible features are the markers we use in communication that have very important meaning for the interpretation of a message, but we don't even recognize that they exist.

For example, how long do you give someone to give a response in a conversation on the telephone? A non-verbal norm in our culture is to reply in a specified amount of time, and we might become nervous if we receive a long silence on the other end of the line. You might start inventing things in your mind, that might explain this behavior. After an inappropriately long pause, which is probably only three seconds, the other person says, "Well, yes." And you think, "Why did that take so long? What is this person trying to tell me?" In another culture, there may be some very different norms for when a response is appropriate and inappropriate. In some cultures, "yes" can sometimes mean "yes", and sometimes mean "no". Another thing that differs across cultures is the need for task information, versus relationship information. There are some cultures in which task information is very highly valued, but the people will never ask for it; it is expected that you will offer it. There are other cultures in which they do not want task information, they do not want to be told how to do something, but it is polite to ask for the task information. It seems that you're in trouble either way. You can't assume that because someone asks for task information, that they want it, or that, if they don't ask for it, they don't want it. You have to interact a little with the culture and understand what the norms are.

The same thing goes for relationship information: "Hey, you're doing a hell of a job, Charlie!" Well, maybe he's doing a hell of a job and maybe he's not; and maybe that's not a polite thing to say in that culture. Maybe a generalized compliment like that, without knowing specifically whether the person is doing a good job or not, is very inappropriate in that culture. And yet, another culture says you should compliment Charlie a lot, whether or not he's doing a good job.

Whenever you get behavior that you can't explain, from someone who is not from the same culture, you must make an effort to learn that culture.

One thing that helps is what I call, the IRS principle: Importance, Respect, and Status. If a manager remembers that every person is important and that every job makes a difference; if every manager respects every person as an individual and respects a job well done; and, if every person regards every employee as having status, and as belonging to the group—then you will overcome the initial barriers in managing intercultural workers.

5.3.4 Rewarding Team Excellence

Dr. Maurice M. Miller, Vice President and Engineering and Science Program Manager, Lockheed Engineering and Sciences Company

Our reward and recognition program is a broad-based program, but this does not mean that we grant awards on a willy-nilly basis. An award is given for something that is real, for something that a person has contributed that has really helped our service to our customer.

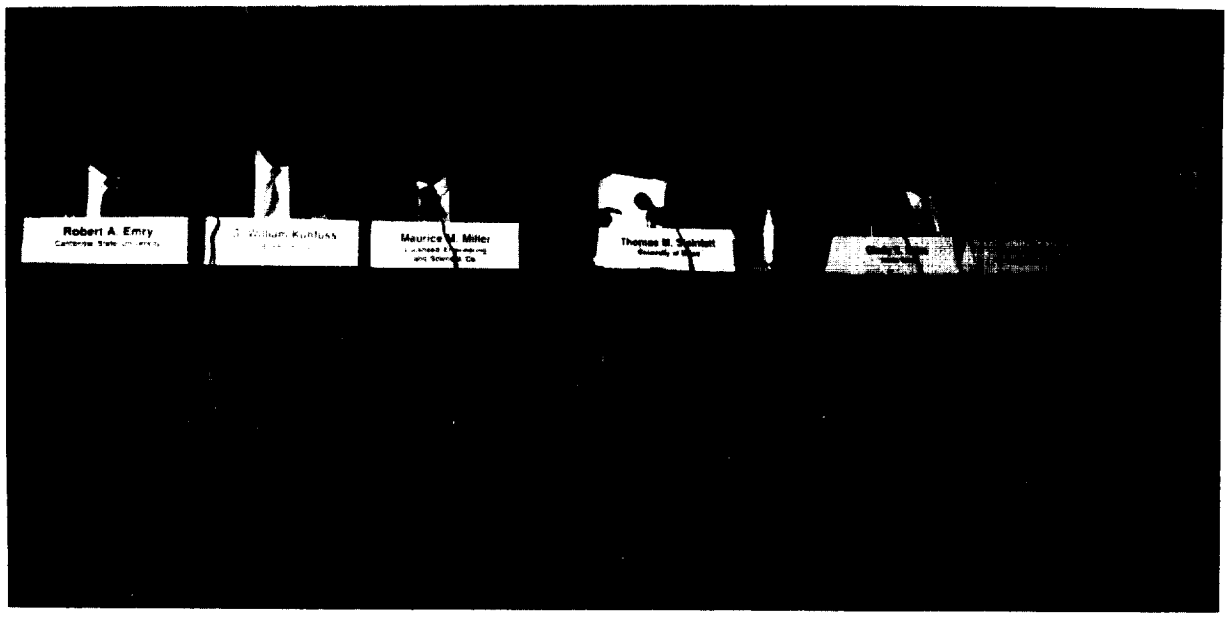
Awards are given for cost reductions and new technology, and for publication of technical papers. Awards take the form of customer commendation letters, the Silver Snoopy, and the Manned Flight Awareness Award.

The Technical Publication Awards generally involve money, but the recipients are happy, because they are acknowledged by their program manager or director and by their peers, and, in many cases, even by their customer. Awards have been won by the Cost Reduction Committee. This is a cross-functional group, a very active sample of how people can get together from different technologies and disciplines, and work to reduce cost to the government.

Another award is the Silver Snoopy award, given by the Astronaut Corps. JSC issues letters of commendation and group achievement awards. In conjunction with the Silver Snoopy, an astronaut and I have, on occasion, gone to the winner's place of business.

Lockheed's first Chairman of the Board, Robert Gross, set up a special award in his name, for technical excellence. Non-managerial engineers or scientists are rewarded through a weekend meeting with the Chairman of the Board; they have been extremely happy with that kind of recognition.

As part of the Manned Flight Awareness Award, we arrange for the winner and his/her spouse to attend launches and landings. It is a very significant pat on the back; recognition for outstanding work.



***Panel C3 - Making Teams Work** (from left to right): Dr. Robert A. Emry, Associate Dean, School of Communications, California State University at Fullerton; G. William Kuhfuss, Product Assurance Manager, General Electric Aerospace; Dr. Maurice M. Miller, Vice President and Engineering and Science Program Manager, Lockheed Engineering and Sciences Company; Dr. Thomas M. Stenfatt, School of Communications, University of Miami; Cindy S. Kane, Supervisor of Facilitation, Harris Corporation; David J. Posek, Division Vice President, Government Services, General Electric Corporation.*

6.0 Quality Assurance's Role in Total Quality Management

Exploring the transition of traditional organizational roles and quality assurance standards in a Total Quality Management environment.

6.1 The Changing Role of Quality Assurance in a TQM Environment

This panel explores and defines the changing role of a traditional quality assurance organization, and how it relates to TQM implementation.

6.1.1 Introduction

Donald O. Atkins, Director,
Quality Assurance ILC Space Systems,
ILC Dover Inc.

We are going to focus on the changing role of quality assurance in a TQM environment. We'll talk about where TQM has been—which is basically that of a cop enforcing standards—and where it is now. The standards are becoming more flexible, but they're still pretty formal, and they still define the classic QA system as part of a business's technical environment. We will learn how the role of QA is becoming that of a verifier, an auditor for the new cultural change. We will then talk about quality as an integral part of the business and technical system, as it takes on an advisory role. Finally, we will talk about improvisation, with TQM assuming the role of quality in the functional line.

6.1.2 The Evolution of a QA Function within a TQM Environment

Ron O. Roberts, Director of Quality Assurance, Space Systems Division, General Dynamics Corporation

I'm going to talk about the future, and where we expect the Space Systems Division quality assurance role to go. We see four objectives:

- That the quality assurance organization must enhance the competitive position. If we don't compete, we won't gain that advantage position and we won't survive.
- Establish and support TQM as a basic foundation for the achievement of continued process improvement.
- Facilitating the implementation of TQM throughout all the major processes, and into our supplier base.
- Quality assurance as a function that supports the major processes through highly qualified people, to serve as a resource to major process owners.

In order for any of these objectives to be met, a paradigm shift must occur. The process owners must benchmark the process and establish verification systems, so that we can establish milestones for the shifts to occur, and for the process of improvement to start.

In Phase 1 the controls of the process and the matrix will allow us to determine if the process is stable and under control. At that point, we will transition from in-line detection to sampling. Here, we have the partial disengagement by the quality

assurance organization, away from the normal role, into that of an oversight capacity.

Phase 2 says that once the process comes under control—as far as variation is concerned—we can move from sampling to monitoring the process. That means we come around and look at the matrix, maybe every day, maybe every week, maybe every two weeks.

Phase 3 says that when the process reaches a point where variation reduction is starting to occur, and is continuing, we will move from monitoring on a daily/weekly basis, to auditing the process every month of two, depending on what the process is. Meanwhile, we'll come around to make sure variation reduction is still continuing to reduce.

In Phase 4 we have continuous variation reduction of the process and matrix to show that's happening. The paradigm shift has occurred. We now transfer the responsibility for audits and surveys over to the process owner. At that point our transition from detection to prevention will be complete, which means we are totally disengaged.

Thus, quality assurance becomes process assurance. We become a resource for the process owners. Highly trained individuals in TQM methodologies may be assigned to the staffs of process owners, such as production procurement. Their job will be to assure continuous improvement for that particular individual's organization. Once the paradigm shift is fully implemented, and the process variability has been reduced to the point where we feel comfortable, we will completely transfer oversight—everything—to that process professional. At that time, we become purely a resource to that individual.

6.1.3 Quality Assurance as a Part of the Continuous Improvement System

Thomas Curry, Corporate Quality Director, Electronic Data Systems Corporation

Today I want to talk about what I believe to be the changing role of quality assurance, and how that role is integral to a company's continuous improvement system. In many companies, the role of quality assurance has tended to be one of a formal overseer or that of cop.

Work that's done inside a company is really part of a process, or of a larger system within that company. Everyone in the company needs to have the same aim, and that's to make the company successful. Everyone has to be working toward that goal, while understanding his or her role in working toward it. The greater the inter-dependence between components, the greater the need for communication and cooperation between them.

The traditional, hierarchical organization chart that we're all familiar with seems to be less important, as we take a look at organizations from a systematic approach. We see that having a separate group that somehow assures the quality, doesn't really fit in with the aim of where the organization is going. We must be sure that people understand that crossing traditional organizational boundaries is OK.

William Shirkembaugh of General Motors talks about, "Listening to the voice of the customers." Listening to the voice of the customers is not just going out and asking the customers what they want, it's understanding the customers' competitive position, understanding their pressures, understanding what it is *they* need in order to achieve success. As with any other process, the voice of the customer has variations; what makes one customer happy, won't necessarily make another customer happy. In a traditional role, the quality assurance group might interpret the voice of the customer one way, and set up specifications, or requirement limits. If something ended up outside the limits, we would set up a defect detection group, or a cost analysis group. What we discovered is that this approach led to things like acceptable quality limits, and acceptance sampling. This, in turn, led to high cost; and customers were not, necessarily, satisfied.

Mr. Shirkembaugh also talks about something he calls the "voice of the process." For the sake of definition he defines process as, "a blending of people, environment, methods and systems, material and equipment, and the output of that blending becomes the voice of the process." As with the voice of the customer, the voice of the process has variation. What we want to focus on is reducing the variation of that process in order to provide our customers with more consistent products and services. With both the voice of the customer and the voice of the process in mind, we begin developing ways to close the gap between the two.

An example of how we're beginning to make that change at EDS is demonstrated by our systems life cycle method. We had a fairly traditional quality assurance approach—such as testing after each phase, walk throughs, and customer acceptance testing. We're beginning to take that data and make sure that we use it to improve the process itself, so that we continually improve the system's life cycle.

We've gotten away from reinventing the wheel every time we've used the system's life cycle.

We use a measurement and feedback system to constantly monitor, and we use criteria like the George M. Low Trophy, or Malcolm Baldrige Award to assess how we're doing in terms of the voice of the customer and the voice of the process.

6.1.4 The Necessity for Improvisation in TQM

Ernest Roberts, Jr., Project Manager, Lewis Information Management System, Lewis Research Center

I'm going to tell a different kind of a fairy tale, so we're going to begin with the ending right now. The moral of this presentation is: "Nothing ever works the way it was planned."

Let's take a look at what I will call the traditional project planning process. Traditionally, project planning starts as a top-down process. You start at the very highest levels of management, where you establish enterprise-wide objectives; from these you develop long-term strategic goals, followed by specific missions. Each mission is finally associated with a budgetary goal, a schedule, and, eventually, a project plan. Next, tradeoffs and compromises are accepted by all the parties involved. A consensus is reached. A project plan is developed, and it's cast in concrete. That's the first mistake.

We then come to the second mistake. At the very beginning, projects are never given adequate resources. In addition, policy always changes, no matter who makes the policy, no matter what the policy is. Profit pictures change. Government policies change. The senior management turns over. If you're working with the Department of Defense, the military project manager is rotated.And then, the customer requirements may change as a result of a design review, or an intermediate test on a particular component or prototype. Finally, the objectives—which appeared to be technologically obtainable at the beginning—prove not to be obtainable at all.

Yet here you are, stuck with a project plan that's cast in concrete. The project manager is forced to adjust the manner in which the project is conducted. The first question that you have to answer is, "What is affected when the concrete breaks?" Is it the schedule? Is it the budget? Almost always, it's quality, because that's the safest thing that you can take a risk on.

The nice thing about it is that the hidden costs of skipping quality don't appear right away. As a matter fact, by the time those hidden costs become evident, the project has been declared to be a success, the project team is scattered, the project manager has been reassigned, and the program manager and the senior staff have all been promoted.

Then, the hidden costs begin to emerge: excessive maintenance costs, excessive training costs, the cost of user support—all of the things that weren't accounted for at the time the original project plan was cast in concrete.

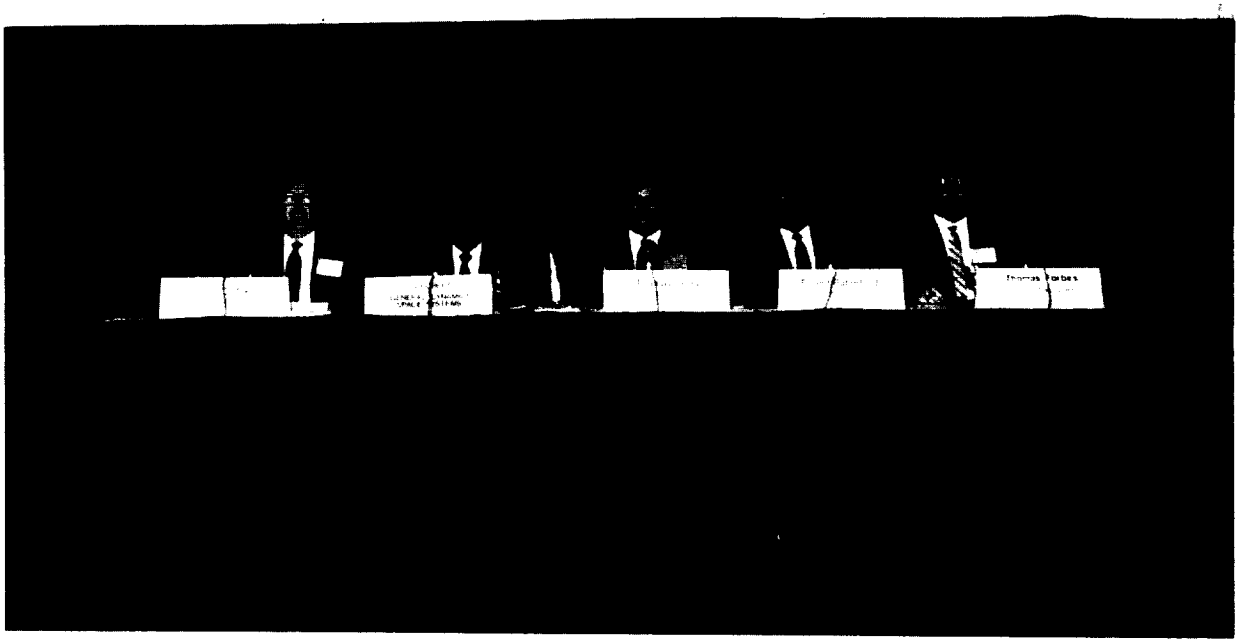
What I'm proposing is a methodology which accommodates the inevitability of change, and which tends to preserve quality. I've chosen to term this, "improvisation." I want to draw an analogy between improvisation in the performance of jazz music, and improvisation in the performance of a project. When jazz musicians come to the stage, they expect to improvise. The performance occurs as an interaction. But the intriguing thing about it is, you listen to the music, and you say, "How can those people be improvising, because it sounds so great." The reason is that their improvisation occurs within the established conventions of a jazz culture.

The execution of a project occurs as an interaction among many things, and the original project plan is only one of the elements of that interaction. It's a continuous, always changing, process. But you can remember certain established conventions, and you can accommodate those changes. You can expect those changes and you can react to those changes in an orderly manner.

By my definition, improvisation and Total Quality Management are a structure, and that structure offers a controlled response to continuously changing environments and events that refuse to correspond to a project plan. What do you, as the project manager, have to do? You have to sit down, and you have to recognize that something is going to go wrong. What's going to go wrong? Everything. Everything is going to change. You have the obligation to sit down in advance, and write out a response to each and every problem that you can visualize. Of course, no matter how good a job you do, something's going to happen that you didn't foresee. But it doesn't really matter, because you recognized the project plan as a continuously changing event. As a matter of fact, you should look forward to it. You should enjoy it. You should thrive on it.

The main thing to keep in mind is that the element of greatest risk is quality, and you must resolve to maintain quality when you are responding to the changes in your project.

QUALITY LEADERSHII



Panel D1 - The Changing Role of Quality Assurance in a TQM Environment *(from left to right): Donald O. Atkins, Director, Quality Assurance ILC Space Systems, ILC Dover, Inc.; R. O. Roberts, General Dynamics Space Systems; Thomas Curry, Corporate Quality Director, Electronic Data Systems Corporation; Ernest Roberts, Jr., Project Manager, Lewis Information Management System, Lewis Research Center; Thomas Forbes, Electronic Data Systems.*

6.2 Quality Assurance Standards versus TQM

This panel explores the primary differences/conflicts between traditional quality assurance standards and TQM and provides potential solutions to these conflicts.

6.2.1 Introduction

Larry Parker, President and Chief Executive Officer, Leach Corporation, Chairman

To survive and compete successfully, we must examine and change traditional methods and practices. This is most evident in the way we define quality, and practice the management of quality. I think the principals and beliefs of Total Quality Management are clear. They're well known. They have been ably demonstrated by Japan over the last four decades, and recently, across America.

To address the challenge, our industry developed and published DOD Standard 5000: Total Quality Management. As we attempt to apply this standard across the industry, it is crystal clear that we must break the inertia and the barriers inherent in decades of traditional quality standards and practices. That's the subject of our panel today: quality standards versus TQM.

6.2.2 Including TQM in Government Quality Standards - We Can't Afford to Wait!

William Mike Cooney, Vice President, Quality and Reliability Assurance, Texas Instruments Inc.

We've built a quality strategy around four cornerstones of policy deployment, training, teamwork, and measurement. We keep things simple, so that they can be grasped by, and integrated throughout, all of the 20,000 people that we have in our workforce. Our objective necessitates training. Not just training in the tools that we need to execute our jobs, but training in the communication of that policy, and its deployment.

Specifications and standards are needed. Yes, there are too many. Yes, there are many that are obsolete. Yes, they conflict with some of the things we're trying to do. But, I think the key is that they are in the spirit of TQM. A lot of initiatives have been set up in the last few years. I'm a little disappointed that some of them aren't moving as fast as they should. But, we need to work together, and not just say, "Kill all specs."

Specifications and requirements are inherently good, if we go back to the cornerstone of TQM, to the policy and policy deployment and what we are trying to accomplish. Our customers must have some way of establishing and communicating their requirements. I think that we in the contracting industry should roll up our sleeves and work with our customers on solving that problem.

So, if it isn't specifications that are the barrier to implementing TQM, what *is* the key barrier? I think one of the tall poles in the tent is *us*—on both the contracting side and the government side—and our ability to accept change. We don't have to go into all the changes that are going on, but the quality assurance discipline affords a tremendous opportunity to be a key element in that change. All of us understand what our requirements are, and how we can execute TQM. We don't need another spec on TQM. Yes, there are guidelines, but we don't need to sit around and wait for the government to tell us how to implement TQM. It is up to us to execute that responsibility throughout our organizations. We can't afford to wait. We need to get on with it.

6.2.3 TQM Implementation - A Success Story

Earl G. Mills, Director, Quality Assurance, Electronics and Missiles Group, Martin Marietta Corporation

TQM will work for you, if you let it. And, by the way, it becomes fun. But, TQM is not going to be an easy fix. You have to be patient, and you may have to spend a little money up front. If you're not willing to persevere, then you probably should go do something else, because you're wasting your time, and probably, the time of others.

The reason we're serious about this, is that everything that we produce is in the Desert Shield theater today. I know one thing for sure: if a Patriot or a Hellfire or a Lantern, or anything else we produce, is used over there, since I've got to make sure it's right. I've got to know myself, I'm doing away with inspections. What's the government going to say about that? I'm going to give them an alternative. I'm going to do something better than

inspecting. If an inspector looks at something, he only catches 80% of it. Over half of the inspection points that are put on in a plant are put there by engineering and manufacturing. Why? Because, they don't trust the design. We have got to put the process back where the responsibility belongs: with the person who produces the product. Then, we've got to support that person, help that person, encourage that person, and coach that person. People have to be the key to what we do.

Our Chief Operating Officer says that, if you put quality first, schedule and cost will follow. I can remember many PMs laughing at him about that. But, it works. If you put quality first, you don't have to build something two and three times. You'll watch your rework go down. You'll watch your scrap go down. You won't have to work 30% overtime, in order to try to meet the schedule.

It's the CEO's job, the president's job, the worker on the floor's job, everybody's job, to make sure that you have zero findings. Today's performance is tomorrow's challenge.When I came on board, people were buying boats and cars on overtime. I said, "No more overtime in my organization." People said, "I'm going to lose my boat and car." Sorry, I can't help it. We can't do business this way any longer. We aren't competitive. Overtime, scrap, rework, and so forth, all those things are non-value added.

You need to ask yourself if you are focusing on the wrong thing? You have 77 inspectors down on the floor of a $2.4 billion organization. You're focusing on the wrong thing. You've missed the boat. You better start concentrating on white collar. That's us. Don't concentrate on the quality director and inspection. I'm telling you right now, we're getting rid of inspections.

Process simplification says that you look at every organization, everything that you do, and ask simple questions. First, you flow out the process, as is. In 1987, we discovered that we did 26,850 unnecessary tests on one of our programs. Why? Because the guy over here didn't talk to the person over there. Just that simple. If you flow it out, you'll see it.

Total Quality Management is not about management of quality. We are talking about the quality of management. I asked a lawyer the other day what he did. Well, he waved his arms and said, "I do this for the president and I give him advice." I said, "How good is the advice?" He said, "Well, I don't know, he never tells me."

6.2.4 Resolving the Conflict

Spencer Hutchens Jr., Senior Vice President, Intertek Services Corporation

The government specified quality programs can be fairly described as somewhat controversial in the contracting community. There is a sense that the program is based on outdated principals, such as inspection and sampling. The requirements are sometimes perceived to be in conflict with Total Quality, and yet, I don't think any of us would say that the government deliberately set out to impose requirements that would prevent us from achieving Total Quality.

What we might call the traditional way of thinking about quality was, essentially, negative. We accepted defects as inevitable. In fact, it seemed that the best way to achieve quality, was to inspect our work and try to sort out bad from good, or in some cases, bad from less bad. We found that inspection was costly, so we adopted sampling plans; and we didn't have to inspect as many pieces. Of course, we knew that some defective products were getting through, but that didn't matter, as long as we hit our acceptable quality levels—the old AQL, you recall. Obviously, the reason we had defects is that workers didn't do their job. Defects, in fact, were the reason we had something called the quality department. It was their job to make sure that not too many defects got through. It was also their job not to make too many waves when we had an order to ship. Not making waves is what we often meant by the word "teamwork" in those days.

By contrast, the new view of quality, which we call Total Quality Management, is a powerful vision that has not yet been completely translated into reality. Perhaps the biggest change in the new definition of quality is: "conformance to specifications that will satisfy the customer's needs." The corollary of that definition is that acceptable quality levels are no longer acceptable. We must always improve, if we are to stay one step ahead of constantly rising expectations; that means we must prevent defects by improving product design and controlling processes.

I don't think any of us would dispute the benefits of Total Quality Management, but I might get an argument, if I suggest that the same benefits can be achieved by organizations that are required to follow the government specified quality program. So, the question is this: Are these two approaches, Total Quality Management and the quality program

mandated by the government, in conflict, or in harmony with each other?

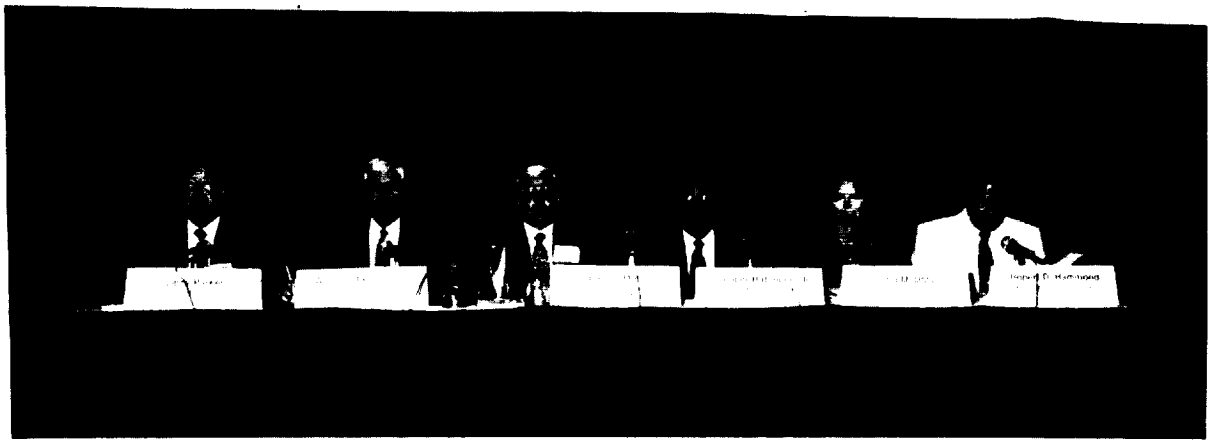
If we look carefully at requirements of the government quality program, we will see that they really support the objectives of Total Quality Management. Let me read one short statement from one of the government requirements: "The program is intended to ensure adequate quality throughout all areas of contract performance, for example, design, development, fabrication, processing, assembly, inspection, tests, maintenance, packaging, shipping, storage, and site installation." Even though the words "company-wide quality control" are not used, certainly the intent is to get the entire company involved in the quality effort.

Let's look at another area where the government may seem in conflict with the philosophy of Total Quality. That area has to do with responsibility for the quality effort. The government specifications require that those responsible for the design, production, testing, and inspection of quality be clearly identified. This requirement might seem to imply that the quality department is solely responsible for quality. A quality effort that does not improve and involve the entire organization cannot succeed. The role of the quality department has changed. The quality department is responsible for more specialized or technical aspects of quality, such as quality planning, or for advanced tools, such as design and experiments. But, the entire company must work together to achieve quality.

How did people get the idea that there is a conflict between the government specified quality program and Total Quality Management? Perhaps one reason for the image problem, is the age of the specifications. NASA quality requirements have as their source, a document that was last revised 25 years ago. How, we may ask ourselves, could any set of specifications with roots in that era reflect today's philosophy? Well, the ideas of Total Quality Management are not new. They just haven't been used and practiced.

The George M. Low Trophy is a good example of what needs to be done. The award has been a milestone in the agency's ongoing work of improving quality within its own contracting community. The NASA awards helped pave the way for the Malcolm Baldrige National Quality Award. The criteria represent a floor to be built upon, not a ceiling to limit efforts. The same is true of the government quality program requirements. Those requirements are a means to an end, not an end in themselves.

QUALITY LEADERSHII



Panel D2 - Quality Assurance Standards versus TQM (from left to right): Larry Parker, President and Chief Executive Officer, Leach Corporation; William Mike Cooney, Vice President, Quality and Reliability Assurance, Texas Instruments, Inc.; Earl G. Mills, Director, Quality Assurance, Electronics and Missiles Group, Martin Marietta Corporation; Spencer Hutchens, Jr., Senior Vice President, Intertek Services Corporation; Tina M. Doty, Group Director, Quality Assurance, Relay Division, Leach Corporation; Robert D. Hammond, Director, Business Pursuits and Special Projects, Space Systems Division, Rockwell International Corporation

7.0 No Measurement--No Progress

The purpose of this panel is to: a) generate interest in measurement, showing utility, rewards, and payback; b) discuss techniques and applications; and c) demonstrate successful application through a case study.

7.1 Measuring TQM in the Real World

Members of this panel offer ideas and discuss issues in the "real time" application of TQM measurement in two diverse environments--hardware and software.

7.1.1 Introduction

James (Gene) A. Thomas, Deputy Director, John F. Kennedy Space Center

Recently, I had a reason to cross the river to the Cape Canaveral side, and, as I approached the gate from the Kennedy Space Center, I saw a large, distinctive billboard that really caught my attention. It brought home the ease with which measurement can be done. In bold letters, on the sign, were these words: "On 9/24/90, we presented 31 traffic citations for seat belt violations in a 75 minute period." That was all that was on the sign. Why did that sign catch my attention? Well, two things came to mind. First, the Cape's security policemen had devised an ingenious way to get the attention of seat belt violators. Secondly, they had come across a real simple method of measuring success. Four to six weeks later, they can come back, and, for 75 minutes, they can stop people to check for seat belts, and see how well they're doing. It became an easy way to measure the success of that safety initiative.

I think as managers and engineers, or whatever your job is, you often, subconsciously, put into a process or system, a way of making a measurement. It just seems to fall into place. But, I think it's very important that it be a *conscious* effort in everything we do.

7.1.2 TQM Measurement: Breakthrough or Bureaucracy

Max E. Zent, Executive Director Quality and Productivity, Tenneco Inc.

I want to make three points this morning:

- Measurement has to be integrated with the overall Total Quality Management system. It can't be an independent event.
- There must be relevant measures at every single level.
- The whole objective of having measurements is to support and reinforce continuous improvement and breakthrough.

What is the role of measurement in the quality revolution? And, more fundamentally, how does one really manage a revolution? Take yourself out of your present profession, and think about becoming a revolutionary--the kind of revolutionary who might help overthrow the government of a small island, for example.

Now, why would we want to have a revolution in the first place? From our perspective, there is something wrong with the government of that island. The economic system, the political system, the social system—all the systems are in shambles. But, what's required in a revolution? Well, there may be some violence involved. Let me tell you, there has been a lot of violence in one of our companies. Of the top 300 positions, over 50% have been turned over in the last three years. That's violence. But, behind the violence in a revolution, there are the

people who have to think what it is they're trying to achieve. They're the people who have to have the zeal to try to do something about the existing conditions. They have developed a new political platform, a new economic platform, a new social platform. It's futuristic. It's saying that we're going to make things better around here. We're not satisfied with the old.

For the revolutionaries to really get control, they're going to have to capture the banks and control the distribution of wealth. They're going to have to manage and control what is taught in the schools. Since their revolutionary platform has to be reinforced, they've got to take over the media. Finally, they've got to put new leaders in place, to run the new government.

Now, let's transfer that lesson to our own islands and our own cultures, where we're trying to manage a quality revolution. We'll call the revolutionaries a transition team or a quality council. We depend upon those people to write a new platform. It's our mission, our vision, our strategies. It's our new standards of expectation, and, generally, it's our direction. The banks become analogous to our measurement, reward, and recognition system. Schools are analogous to our training and education system. The media are internal news publications. Our leaders must be role models for the new platform.

My second point—that you have to have relevant measures at all levels—brings me to the following measurements:

- Self-assessment. I'm talking about comparing yourself against some national standards, such as the George M. Low Trophy, or the Baldrige criteria. Companies that are really into TQM are doing this, and they're re-measuring themselves against a national standard every year, and re-identifying any gaps.

- Survey. Here, I'm talking about the kinds of surveys that examine *all* the stakeholders, not only the employees and their attitudes and perceptions, but also our customers and our suppliers.

- Benchmarking. Here, we're saying a company gets out in the world, and compares itself to the world's best. Pick the world's best, irrespective of the industry, and compare yourself against it.

- Measurement by the quality council, or by the steering group. It's calling "time out" periodically, and asking ourselves, "Do we have all of our arrows aligned in the same direction?" For example, are we measuring and rewarding the right things? Are we moving in the direction we said we wanted to move?

- Leadership behavior. Xerox has done the best job I've seen. Managers, at all levels of Xerox, are appraised against the expectations of how to behave. They're appraised by their superiors, they're appraised by their subordinates. The top 200 people cannot be promoted, until they have been appraised to be role model leaders. And, the people below that top 200 cannot be promoted, until they have almost reached the status of role model leader.

Measurement can support continuous improvement, if we just tend to a few necessary criteria. Let's look at the intent of measurement:

- Measurement should support internal assessment, rather than external control. That means that people need to be involved in developing measures that support their needs, not somebody else imposing it on them.

- The whole intent of TQM is to satisfy customers. Therefore, we have to measure those things that are relevant to customer satisfaction.

- If our measures don't provide a focus for what we ought to do next, we probably don't have a good set of measures.

- Measures tell us when to applaud, and when to celebrate. We're not used to thinking of measures from a behavioral standpoint. We're used to thinking of measures from a control standpoint, so it's a different paradigm.

7.1.3 Using Metrics Feedback to Improve Life-Critical Software

Ted W. Keller, Manager, OBS Project Coordination and Configuration Management, Federal Sector Division, IBM Corporation

You're in a hurry to get to work. You run out of your house, you get in your van, start up, back out of the driveway, and you run over and crush a tricycle. Does it matter whether there was a child on that tricycle or not? Well, to the child, I'm sure it does. To the child's parents, I'm sure it matters. And, even to you, I'm sure it makes a difference. But, from the standpoint of evaluating what you did wrong, and how you need to change that process that you just went through, it really doesn't matter whether there was a child on that tricycle or not. The key here is to analyze that process, the procedure you went through, the thought process and the physical steps you went through, and to recognize and analyze the defects in your process, so that you won't ever make that mistake again.

That's the attitude we're taking toward the on-board Shuttle software. The Shuttle software, the primary avionics software system, is the heart of the Space Shuttle, as far as command and control. Whether it's a manual input by the crewman, or an internally calculated command by the data processing system, virtually all the switches, commands, inputs and outputs of the Shuttle, go through the data processing system. It's essential that there be no errors in that flight software. We have to treat any error that we find in the flight software just the same as any other error, regardless of how insignificant it might be, because we have to treat that problem as a tricycle.

How do you know when your product is of a quality that will allow you to stand up and say, "Yes, you may go and commit human life to my system?" That's where measurements come into our world. We have to be able to evaluate how good the quality of our product is. We also use measurements to evaluate how well we're doing along the process.

We have a requirements definition phase, which is a process by which we go in and analyze exactly what NASA wants us to put in the software. We're constantly evaluating and evolving the capabilities. As a result, new requirements are continually coming into our process; and we have to be able to understand those requirements well enough to implement them. One of the things that we learned to do, is keep statistics. You must evaluate which parameters you need to retain. We document a lot of other information, so that we can go back, years later, and do trend analyses and studies, and look for common elements in the problems.

Once we've developed the base design, we have an inspection phase and a testing phase. We integrate that element of change in with all the other changes, in order to put together a new release of the software. Then, we turn the software over to an independent verification group within our own organization. That independent verification group starts from scratch, and retests, as if the software had never been tested.

We also have to measure the effectiveness of those groups. We have to know whether the development group is finding all the mistakes, so there's nothing for the verification group to find, or are they are missing their mistakes, which are being found by the verification group.

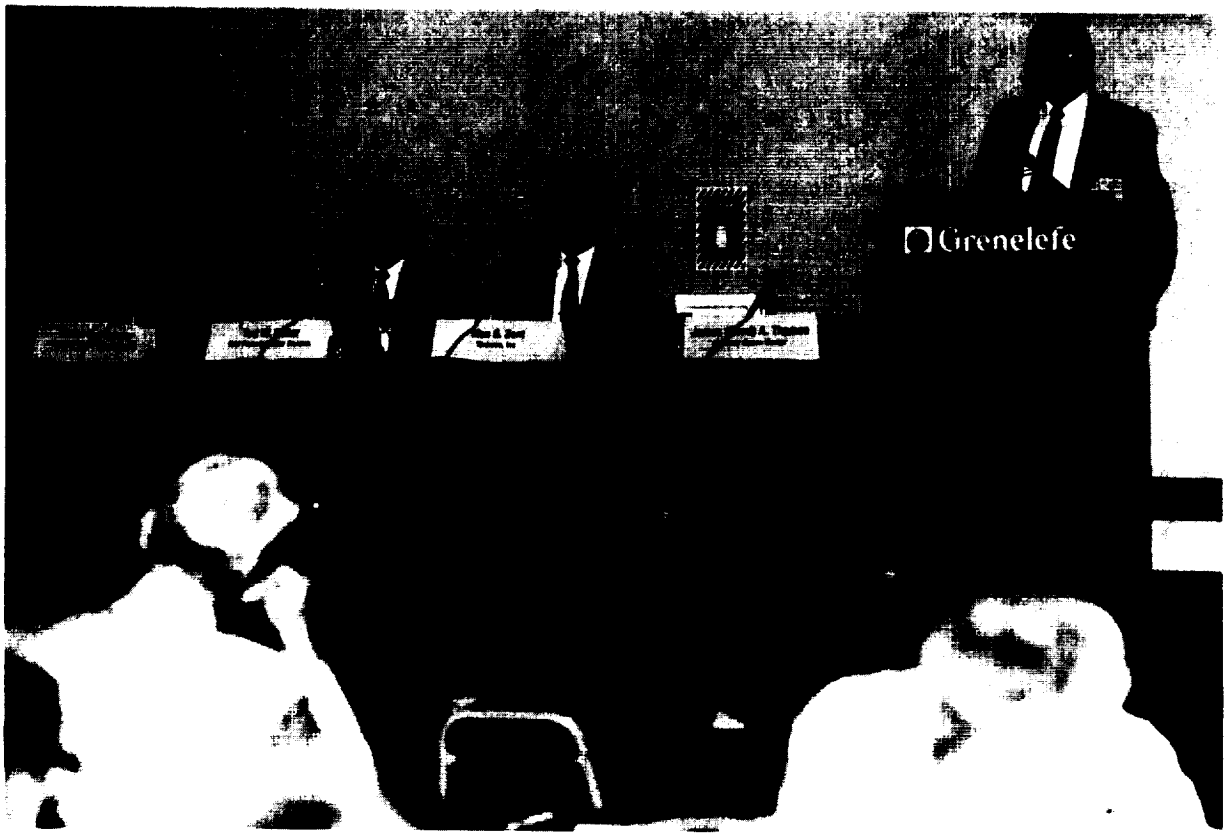
When we deliver that software to NASA, it's not yet ready to fly. It still has to be reconfigured with the parametric data that defines the particular mission that it's going to be flown with. Then, we have to test that again, to make sure that the quality of the system has not been affected by application of all that data. Only when that is complete, do we stand up and certify that the software is ready for flight.

This is not something that you add to the process at the end. Quality is built in on the front end. We've learned that testing doesn't add the quality in the software. All testing is supposed to do is ensure that the quality is already in the software. Quality is not a goal. Quality is a prerequisite. The goal is how high a level of quality you can demonstrate, and that's what the testing will show.

We want to satisfy our customer. That's really our definition of true quality. I mean, it may be enough to say, "Well we never really had any serious errors in the Shuttle flights." But, the customer—NASA—has to train the astronauts. They have to prepare the vehicle, they have to test the vehicle, and in every one of those activities, they have to use our software. And if, in using our software, they're always being set back, or having irritating problems, because it doesn't have the quality that it needs to have, then we're not satisfying the customer. So, in order to measure the customer's true satisfaction with our product, we define a measurement that says, "Of all the software we give to the customer, how many mistakes are present in that software?" Even though we may get them all out by the time we're ready to fly the Shuttle, how many mistakes are in there? Because that number should be zero.

If our process is as good as it should be, there should be no errors.

But that's not the end, it's only the beginning. Once you reach that point, you realize how much farther you have to go. And the process, no matter how good it is, and the TQM approach, no matter how good it is, are based on some mandatory attitudes. Management and employees have to be obsessed with quality in the product. Through this obsession with quality, they will want to measure and evaluate how well they're doing, because they won't be satisfied until they can see that they're achieving what they're striving to achieve. The perfection expectation has to be a self-concept, held by every individual involved, so that each individual will independently take ownership of, and measure, his piece of the process.



Panel E1 - Measuring TQM in the Real World (from left to right): Dr. Karen K. Whitney, Manager, Productivity, Rockwell Space Operations Company; Ted W. Keller, Manager, OBS Project Coordination and Configuration Management, Federal Sector Division, IBM Corporation; Max E. Zent, Executive Director, Quality and Productivity, Tenneco, Inc.; James (Gene) A. Thomas, Deputy Director, John F. Kennedy Space Center.

7.2 Case Study: Measurements In Action

This session demonstrates successful applications of measurement in achieving Total Quality process improvement.

7.2.1 Pursuit of Excellence

Christopher J. Holloway, Pursuit of Excellence Director, Interior Furnishings and LaGrange Industrial Division, Milliken & Company

I want to step back to about 1979, and give you a feel for the type of company that we used to be. Milliken & Company was a very autocratically managed company. We were the epitome of how to professionally run a company. We had been very successful for over 110 years. We had the understanding that most of the knowledge was encapsulated between the ears of the people that wore suits and ties. You might say it was sort of a "my way, or the highway" type of management system. We didn't believe our workers were the key to problem solving. We thought the managers were the ones that had all the knowledge; they were the ones that took care of everything. It was not uncommon for us to outfit an entire manufacturing plant with new machinery all at one time. Now, to pay for this machinery, to get our money back, we knew that we had to run that equipment all the time. In other words, we had a very volume-oriented mentality. "Don't let the machines stop, run them all the time. Search for those great big orders."

So it was: "Big orders, run full." Those big orders and running full meant long lead times. And, the longer the lead times for our company, the better, because that told us that our machines were going to be running full for three, six, eight months out. That was good. We told our customers when they would get product; it was *our* schedule. We told them how much they had to order, for us to run it. We told our workers: "Bring your hands and your back, we'll tell you what to do."

And, did we ever know how to take care of suppliers! Put them in a little room, and say, "OK, Mister or Miss Supplier, the person with the lowest price wins." That was Milliken & Company in the early 80's. That was the company that we are changing from, even today.

With every big change there's always a catalyst; there's always a reason for change. Our competitors were causing us a lot of problems. The imports that were coming in from the Far East, were cheaper. We could accept that. Imports are always cheaper. But, the real kicker was that they were also better. Better quality. And our response to that has been to change.

The entire industry has changed, but not without pain. Our pain has been plant closings. We are still affected by imports, and that catalyst has not gone away. It is forcing us to continue to change.

In 1980, our chairman, Roger Milliken, went on vacation, and carried with him a copy of Philip Crosby's book, *Quality Is Free.* He then sent the book out to 300 of the top leaders in our company, and he said, "Folks, please read this book. It's going to change the way we do business." He arranged to have a 4-day meeting, and Philip Crosby came, and explained his 14 steps, and explained "cost of quality" to us. Well, this "cost of quality" thing, that was kind of strange. We knew what quality was: quality was good, and luxurious, and kind of that touchy-feely, warm-fuzzy stuff.

For the first time in Roger Milliken's dealings with the company, he did not tell us to immediately implement the new steps. This time he said, "I need to get a little bit of consensus here. Is this what we need to do?" So, he sent 200 of his top leaders to Philip Crosby's quality school. They came back and decided that, "Yes, this is what we needed to do"—the very first team decision in our company. He became a leader that led by example, and expected us to follow, but didn't tell us when to do it. And, our quality process centers around that idea. It is happening at the rate at which it should happen within our company, and that's why I say, ten years after the start, we still have a long way to go.

"Pursuit of Excellence," is the term that we use to describe our quality process. Pursuit of excellence —we'll never get there, but, we're going to strive for it, constantly. At one of our annual meetings, Roger Milliken got up on one of his bank chairs, told everybody to raise their right hand, and repeat after him. What he said was, "I will listen. I will not shoot the messenger." And, then, he said, "I'll recognize that management is the problem." Everybody had to repeat that, too.

Well, all this "management is the problem" stuff started a lot of culture changes. We learned that there is no desired future state that you can attain. There is constant movement, in the transition state. That was the biggest culture change of all—the realization that we were going to constantly change

from then on. Never again would the status quo be appropriate.

One of these changes was to search for leaders, instead of managers. We want leaders to lead their teams, their groups, their businesses, into new areas where they would never have gone without that leadership. But, the best solutions come from the teams and the teams' experience.

We've worked hard on changing our environment, and that environment includes vocabulary. In the old days, a "spare hand" was somebody who knew all the jobs in the plant. A hand knew all the jobs, but they didn't really have a job. They were there in case you had a lot of problems, or in case somebody was laid up at work. If one of those two things happened, they could work that day. If not, then the spare hand was sent home without pay. That's unbelievable! Today, they're the most valuable associate that we have.

So, we started out with "hands" a long time ago. By the 70's, we graduated to "employees," but this is still a barrier: "We're the employers, you're the employees. Park your brain at the gate, bring your hands and your back, and we'll tell you what to do." Now, we use the word "associates."

In 1981, Tom Mulone, now our company president, was a division president, and he had a nice office up in the top center of the building. He said, "I need to move out. I need to lead by example." And, he invited all of his director force to move out, too. The last one moved out in 1987, six years later. That's very symbolic of our process. That's how it works in our company. It's not a forced march. But by moving out, the leaders made sure they could be accessible to people.

The old way of paying textile workers, was through an incentive pay rate—the more product you made, the more money you made. And, until 1982, our associates could not turn machinery off without the permission of management. So, we empowered our associates to do that, saying, "If there is a quality or stage problem, shut it off. We expect you to; we want you to." But, we were paying them *not* to shut off the machinery! If they shut the machinery off, it cut their paycheck. It took us until two years ago to realize that something was wrong. Now, every production associate in our company is paid on a straight, hourly basis. Our sales force is not a commission sales force, they're a salaried sales force.

We cannot separate measurement from our quality process. Without a scoreboard, you're just practicing —you're not in the game, and the game is deadly serious. We need scoreboards, and we utilize them in every aspect of our company. We don't have a group of management associates, or management people, or support people walking around updating charts. The charts and the scoreboards and the measurement devices are updated by the teams that do the work. Our quality process is handled the same way. We don't have a group of quality cops in our company. We have line responsibilities—the plant leaders, the business leaders, the department leaders, the process improvement leaders, those are the people that are responsible for quality.

Back in the early 80's, we thought education happened when you changed jobs. That's not true anymore. We believe that education's purpose is to prepare our teams, so that we don't send in plays the teams can't run. Last year we spent over $28 million in education. We're working with some of our associates, to get them up to a 12th grade literacy and numeracy level; and by 1996, we hope to have every single person in our company at a minimum 12th grade level.

When we started our quality process, we faced three big hurdles. The first one was upper management; the second biggest hurdle we had was middle management; and the third biggest was front-line supervision. So, we worked for three years to get to the point where we could share the quality message with the rest of our company. If we had tried to share it in 1981, we'd have fallen flat on our faces, because we didn't believe in it. Now, we have a vehicle in our company which is the primary involvement tool for getting everybody into this quality process. We call it OFI: "Opportunities for Improvement." It's an idea process, not a suggestion process, that allows everyone in the company to participate in improving their job, their environment, and their company. It is an actual process that forces us—the problem—to react to things that people have been telling us for years. Last year, we received 262,000 suggestions. That averaged a little over 19 ideas per person, which is pretty good for an American company.

If we look at OFIs as the gas for the vehicle of quality progress, recognition is the accelerator that makes things really go; here again, you have to have measurement. You've got to have scoreboards. It might be a banner, that congratulates a customer service team for shipping 2.1 billion yards eight years without an error. The only people who have reserved parking places in our company, are "associates of the period." Tom Mulone, Roger Milliken—none of us has a reserved parking place. A great tool for recognition is simply saying, "Thank you." We have sharing rallies, quarterly events that are held in New York, Spartanburg, and LaGrange,

Georgia, where everybody is invited to share with their peers and with the leadership, what they and their team have done—through skits, or whatever the team wants to show.

The whole idea of recognition is to find people doing the job right; and you find them by using measurement. Then, you make heroes out of those people, out of those teams, and hold them up on a pedestal before everyone else to show them that, "This is how it works."

Panel E2 - Case Study: Measurements in Action *(from left to right): R. Ross Bowman, Vice President, Safety, Reliability and Quality Assurance, Space Operations, Thiokol Corporation; Christopher J. Holloway, Pursuit of Excellence Director, Interior Furnishings and LaGrange Industrial Division, Milliken & Company.*

8.0 Customer Focus--Practice or Preach

8.1 Customer's Expectations--Everybody's Business

This panel examines some "common sense" approaches to discovering the real expectations behind customer requirements, and successful programs involving all levels of the work force.

8.1.1 Introduction

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

To be completely successful, we must go beyond merely meeting the customer's needs. We must meet their expectations and address their perceptions. Customer satisfaction is the key to long term profitability, and keeping the customer happy is everybody's business. The way to achieve true quality is by striving to deliver value to the customer. What's at issue here is perspective. The customer is the final arbiter when it comes to quality. The customer's perspective is necessarily different from the supplier's perspective. Customers form impressions surrounding every aspect of doing business, not just about the products and services, but about the total transaction.

8.1.2 Defining Customer Expectations —Back to the Basics

Robert M. Little, Vice President, Information Services, Boeing Computer Services

I've become concerned that, as we become enraptured with cultural change, with the concepts and methodologies of the moment, we're addressing more form than substance. I think it's healthy to reflect on the basic principals of achieving customer expectations:

- Know who the customer is.
- Know what the customer wants.
- Know how to provide it.
- Do it.
- Be sure you've done it.
- Do it better the next time.

Know who the customer is. We're never quite sure whether we should focus on the official customer —a company or agency, or the real customer—the person with whom we transact the business. We have to get up close and personal. We have to decide, at any given moment, who our customer is, and then focus on that customer. Certainly, we have to be guided by the official customer, but on a day-to-day basis, a minute-to-minute basis, I think the customer is the "real person" customer.

Know what the customer wants. This one also is sometimes elusive, but it's also a solution to the dilemma of knowing who the customer is, and the solution to ensuring that you are addressing the customer's needs. In my business, the programs where we have the most trouble, where we are the furthest behind schedule, and where we are the most over cost, are programs where we started off without knowing what it was the customer wanted.

Know how to provide it. By this I mean, *really* know how to provide it. For the most part, the programs that are the most successful are the ones similar to those we have done before. We've designed and built airplanes, space systems, missiles. We've designed and installed telecommunications and computing systems. We have done those things before, and we have been very successful. There's a temptation to say that the Boeing Company can do anything. We can't do anything, and there are lots of things we've proven we can't do well.

Do it. This is the essence of achieving customer expectations. This is where commitment comes in. This is where integrity comes in. It requires

discipline. It requires understanding your risks and managing those risks. It requires sweat. It requires work. It requires doing it on schedule, and doing it at the cost you said you would do it for. When was the last time that you were involved with a major program that achieved all of its objectives on schedule and on budget?

Be sure you've done it. This is where quality considerations come in. Quality assurance, testing, customer satisfaction surveys. Be sure you've done it. Essential ingredients, but, I believe, only one of the basic principals.

Do it better the next time. That's kind of where we are today, with the focus on Continuous Quality Improvement, Total Quality Management, measurements, metrics, cultural change. Within BCS, we've decided to focus on two aspects of measuring our improvement and performance. We've taken some lessons from Motorola and others, and we've decided that we want to focus on measuring defects, and eliminating defects. We want to focus on reducing cycle times, in a similar way.

As I said, I sometimes become concerned that when we march off, we become more concerned with form than with substance. We become more concerned with putting our metrics on the wall, and being sure that our crinolines are down. We need to continue to focus on the six basic principals, that I've outlined for you this morning.

8.1.3 Meeting Requirements Through Customer Partnerships

Robert A. Wolfe, Executive Vice President, Space Propulsion and Systems, Pratt & Whitney, United Technologies Corporation

I'd like to talk to you about what we have done with our process improvement program—in other words, joint partnerships with our customers: involving the customer in the process, actually bringing them on board, and letting them work with us. Many people feel that that's risky business, letting your customer—whether the government or a commercial customer—actually look at your processes, and help work on them. We found that the benefits far outweigh the risks, and we're going to continue to do it.

We started our TQM process about five years ago. We called it Quality Plus. Q-Plus. In 1984, we lost 75% of our large fighter engine market to a competitor, primarily because we didn't listen to the customer. We were very arrogant; we had the situation controlled; we had the market controlled; and we quit listening to the customer. We learned a hard lesson.

We had to put a cultural change in place, and we did. We've spent over $25 million on Q-Plus training, and that included training at the very top. We've structured our entire 35,000 work force with awareness education; and we started with the executives at the top and the middle managers. We've instructed over 15,000 people in basic problem solving and team building. These are the groups that are carrying the ball today, as facilitators in our process.

Our program says that we do not hit any home runs. We discourage home runs; we look for singles. All of the process improvements or product improvements that we go for are very small, and we try to build those up to the equivalent number of the runs that we need. We've seen some results. We've cut our manufacturing overhead by 50%. We reduced our scrap rework and repair to 4%. We've also eliminated 80% of our inspection costs.

We found that the primary benchmark of anything successfully done in the TQM process remains very simple: are you meeting the requirements of your customer to their satisfaction? And the customer, in this case, is either internal or external, or certainly both. Very often, to effectively meet these requirements, it requires a process change—not only in ourselves or our contractor—but in the customer, as well.

We believe that the customer's expectations are everyone's business. A joint customer/supplier partnership is an excellent way to meet the expectations and maximize your TQM process.

Over the last 25 years, NASA has purchased 174 engines. During that period of time, the RL10 has had a perfect quality record. It's never had a misfiring. It's had over 178 firings in space, over 20 hours of operation in space without a mishap. It's a perfect record engine. So why would we change this? (If it ain't broke, why fix it?) The answer is very simple. A new customer has new requirements. The new customer, General Dynamics, has ordered 154 engines. We've certainly got to step up the production effort, meet a new schedule, make a lower cost product—and, by the way, not screw up the quality.

We looked at the various things that caused high cost and long schedule delays with the RL10, and found that one of the major tie-ups was the delivery and acceptance process. We found that the current delivery and acceptance was averaging 65 days, with some taking as long as 110 days per engine. The joint team's goal was to reduce the 65 day average to 20 days. Just constructing the process flow chart was

a monumental task; but, the data now indicates that we will achieve the 20-day average, and reduce the time, cost and manpower for the delivery of the final product. Again, looking at singles and not home runs, we reduced the engine log book from 50 pages to 11 pages, reduced the acceptance team, from 8 to 2 members, eliminated a preliminary review of the data package, and reduced the transportation time of the engine.

The intangible thing is that everyone—from contractor to customer—now has a clear understanding of each other's roles. Morale was improved significantly. Before, we had a typical contractor/customer checker, and we were worried about what they were going to find. Now, the local General Dynamics person at our plant feels very comfortable about the amount of authority he has. He can walk in and discuss any problem or issue with his counterparts. We've certainly increased teamwork.

The key is to involve your customer, even if the customer is a competitor. We have people who cringe at the fact that we would have Rocketdyne involved in our detailed workings, in order to make something work a little better. You must walk-the-talk; you must do what you say you're going to do. You must be willing to take that customer, arm-in-arm, and march out and solve the problems together.

We found that this walk is not easy. It requires a lot of change by a lot of our people. It's a journey, and one that never ends. However, we've also found that when you make customer expectations everyone's business, and establish cooperative team efforts with the customer, your TQM will be a success for the long term.

***Panel F1 - Customer Expectations—Everybody's Business** (from left to right): John S. Welzyn, Chief, Administrative Operations Office, Safety, Reliability, Maintainability and Quality Assurance Office, George C. Marshall Space Flight Center; Dr. Dale L. Compton, Director, Ames Research Center; Robert A. Wolfe, Executive Vice President, Space Propulsion and Systems, Pratt & Whitney, United Technologies Corporation; Robert M. Little, Vice President, Information Services, Boeing Computer Services.*

8.2 Will The Real Customer Please Stand Up?

Individuals have a tendency to function within an envelope which, while protecting and preserving their autonomy, limits the awareness of internal customer needs. Internal organizational structure must allow and encourage involvement, inter-change, and feedback to foster problem resolution and enhancement of customer expectation.

8.2.1 Introduction

Thomas W. Herrala, Vice President and General Manager, Space and Sea Systems, Hamilton Standard, United Technologies Corporation

There are three sets of customers. First, there are the customers who pay us the money for the goods and services that we provide to them. Second, there are the customers who are our shareholders. They provide us with the assets and the money that's necessary to run our companies. Third, there are the customers who are our employees. Those are the people who do the work, and those are the customers that we really have to think about.

We often find ourselves in an either/or situation. We either have to achieve better financial results, or we have to satisfy our external customer, or we have to do something for our employees. We have to balance the needs and demands of all of our customers and satisfy them all. Today, we're going to spend some time talking about internal customers.

8.2.2 Bound by the Chain of Command

Ronald R. McCann, President, McCannics Air Conditioning and Heating

For years, our energy and focus was on capital resources, equipment, tools, and machinery. Now, we see a new possibility in investing in developing our human resources. The common conversation that management, staff, vendors, and customers all can share is service. Through service to one another, we can produce results, and experience a kind of joy from our contribution. It's time for employees and managers to view customers-including our fellow employees—from the viewpoint of how we can serve them and how we can help them, rather than trying to prove how much we know. One attitude comes from domination; the other comes from service. The joy that is available in the work place comes only from selfless service, and not from a will to dominate. The work we do may produce results; it may get the machine fixed; it may get the rocket to fire—but excellent service only occurs when people feel taken care of in the process. That's what service is. It's not just satisfying the customer. It's that special grace of providing service and being served.

How do we determine who the customer is? First, you have to ask another question: who benefits directly from the work that you do? In the more traditional chain of command structure, most of the employees in the organization are trying to please the boss, instead of the people that they serve. Technicians or front line people, when asked to do something special or something extra, say things like, "I'll have to check with my boss first," or, "I don't know, they didn't tell me to do that." Where's the accountability for the job that they're doing?

In organizations of the 90's, we want people to be accountable for the jobs that they do. It seems that we want them to do their jobs like their life depended on it. But there is a real dilemma in creating a customer-driven organization that serves both the internal and external customer. I say, "We are to the customer, as we are to one another in the organization."

You may be familiar with the inverted pyramid organizational chart of management. At the top of the chart is the paying customer, or the using customer—the person who is the final customer in your chain of customers. The front line server would be the next person in that inverted pyramid. That would be the person that takes care of the "using" customer directly, i.e., a repairman, or a customer service rep. Next, comes the rest of the organization—the technical supervisor, whose customer is the repairmen, and the sales rep, whose customer is the customer service rep. Next, below them, is the service manager or the supervisors or the foreman and their customers. Their customer would be the dispatcher, and the staff people. And, at the bottom of the chart is the president of our organization, the CEO. His customer is everyone else.

Another way of looking at this is that the person at the bottom goes for a "thank you" from the person just above them on the chart. If you are a front line server, you want a "thank you" from the

paying customer. If your job is dispatcher for the repairmen, you want to go for a "thank you" from repairmen for a job well done. One of the things that may be missing in our structures today, is that organizations don't set up structures that facilitate staff members getting authentic acknowledgements. We can do things like creating customer satisfaction cards from paying customers, so that they can get information back to the front line server. Also, organizations need to set up systems whereby staff members provide feedback for jobs well done by the managers. Is it any wonder that managers get burned out so easily, when they never get an authentic "thank you."

People need to experience the joy that's available in the work place, and that joy comes from relationships with customers. It's not in having some mission, or vision statement, that you're doing a noble job in the organization. If only 20% of our employees actually work directly with external customers, what are we going to do about the others in the work place? We have to design it, so that people know that they have customers inside the organization that they can take care of. It's a cultural change, but now's the time. It's time for us to begin to look at how we can shift the culture in organizations.

Managers need to let the employees be the heroes. We win when they win. When they thank us for letting them win, that's when we have taken care of our customer—the employee. Managers are not responsible for the work people do. Managers are responsible for the people who do the work. It's silly for us to think that we can be responsible for mistakes. But, we can be responsible for having the kind of employee that regularly makes mistakes. We're responsible if they're not trained, or if they're not developed, or if they don't have the tools that they need to get the job done.

It's important for us to realize that, service occurs when we provide quality, and when the customer feels taken care of in the process.

8.2.3 The Results of Knowing Your Internal Customer

S.C. (Carl) Stimson, Vice President, Quality Services, Qualtec Incorporated

At Florida Power & Light Company, our quality principals are: customer satisfaction; Plan-Do-Check-Act; management by fact; and respect for people. Approximately 80% of our employees never interface with the external rate-paying customer. So who is our customer? It's the next person in the process, in the next department. How well are you meeting their needs and expectations? Years ago, when I designed layouts for condominiums and subdivisions, I would stop by the line crew that was building the facilities that I designed, push down the power window in my air conditioned car, and yell out to the line crew down in the ditch, "How's it going?" They'd look up at me, and answer, "If you want to get out of that car and come down here, we will tell you how it's going." Ladies and gentlemen, all of a sudden I had somewhere else I needed to be. I never thought of that line crew as my customer.

Plan-Do-Check-Act. We were very good at the first two steps: planning and doing. The check and act phases, we needed to improve on. So, a lot of processes need to be looked at first. It's a constantly changing environment, and we need to be receptive to change.

Management by fact. We're using facts and data to change our organization—going back to that internal customer, and gathering facts and data on how well you're doing with them. "Well I don't hear from them, we must be doing a good job." What does that really tell you? Maybe they just got tired of telling you things, and just put up with what you're giving them.

Respect for people. I remember distinctly, back in 1968, as a meter reader going to night school that management's opinion was: "Do it that way, because I said to do it that way." We needed greater respect for our employees, regardless of their educational background, regardless of their position or job title in the company. They have a lot of value, skills and abilities to share with the company, and we need to have that resource. We used to practice MOP: Management On Patrol. "Here comes the boss, I will keep my head down. Maybe they will walk on. They aren't, they are staying here." And, ladies and gentlemen, the only time we saw management was when things were not right. We needed to change that. We need to get our management out there, catching people *doing things right,* and complimenting them sincerely for that.

Our definition of quality is meeting the desires, needs, and expectations of the customer, internal or external. We accomplish this through three elements. First, we start off with teams. We give our employees training, statistical training, and training management, for their role and responsibility in supporting a Total Quality Management system. We use a QI story, or quality improvement story—an analytical process for solving problems:

- Who is the customer? Also, facts and data about the product or service that you want to improve.

- Setting a target. Negotiating with a customer. Then, setting a target from that data.

- Analysis. Looking at the root cause or causes of problems.

- Counter measures. Looking at significantly reducing, or eliminating, the root cause or causes of the problems. Coming up with action plans to implement those countermeasures.

- Looking at results. Do we have the facts and data to prove that the solution is what we anticipated?

- Standardize that process. How do we replicate, or duplicate, or standardize that improvement throughout the company?

- Future plans. Looking at how do we do as a team. Did we identify something we need to work on in the future?

Second, policy deployment is really where we want to stratify a few priority items, and put a lot of resources into improving those items. In 1985, we started using the JUSE (Japanese Union of Scientists and Engineers) organization to consult and audit what we had put in place at Florida Power & Light. When they started coaching us in establishing policies the first year, we had 12 five to seven year plans. Their comment was, "You're chasing too many rabbits. You're never going to catch any of them." Now, with policy deployment, we focus on customer needs. We focus on results, but also on the processes we put in place to get there.

The third element turns the focus inside each department. Our customers' needs were cross-functional, but the way we were managing our company was functional. Engineering said, " We did our part—we're through—it's yours now." We implemented a new suggestion program. In our old suggestion program, if you got a response from corporate in six months to a year, you were doing good; and generally it was a form letter that said, "Thanks, we're looking at it, we'll let you know." Now, there's about a three week turnaround time, and the response is from a first line supervisor. We got more suggestions from our employees in a year and a half—over 25,000 suggestions—than we did the previous 60 years of our history.

Quality, in daily work, is where our employees take the process and look at what their top priority job is, what the objectives of that job are, and then, at who their customer is, whether internal or external. We identify targets for improvement, put control systems in and implement them, check the results, and continuously improve. If a hurricane hits the state of Florida, our ultimate goal is to get to our external customers in a timely, responsive manner. But, we also look at how well we provide food, lodging, material, and equipment to our line crews, our internal customers.

Panel F2 - Will the Real Customer Please Stand Up? *(from left to right): Bradley A. Johnson, Director, Space Systems Division, CTA, Inc.; Thomas W. Herrala, Vice President and General Manager, Space and Sea Systems, Hamilton Standard, United Technologies Corporation; Ronald R. McCann, President, McCannics Air Conditioning and Heating; S. C. (Carl) Stimson, Vice President, Quality Services, Qualtec Incorporated.*

9.0 George M. Low Trophy: NASA's Quality and Excellence Award Banquet

This session recognizes the 1989-90 George M. Low Trophy finalists and announces the recipients of the 1989-90 George M. Low Trophy: NASA's Quality and Excellence Award

9.1 Presentation

William Shepherd, Captain, U.S. Navy, NASA Astronaut

Quality is an elusive word. It can't be added on or applied externally. It is integral to anything you are working with, and it has to be everywhere. It is like a piece of finished cabinetry. We all know it took a lot of quality to make, but wasn't some of that quality there to start with? Wasn't there some in the wood, in the planes and chisels, and even in the training of the craftsman who built it? The elements of quality are as much in the toolbox as in the technicians who work on the Shuttle in the hanger, as it is in the components that go into the main engines. Quality is a lot more than we perceive. You can't separate the cabinet from the man, or the man from his tools. Quality is a part of all of it.

To me, the parallel with the space program is clear. All of us at NASA set a date 12 months ago; and, just over two weeks ago, we launched Ulysses on the second day of the window. We processed Discovery for STS-41, went to the pad, and lifted off with virtually everything up and running. If it wasn't for a small rain shower over the end of the runway, we wouldn't even have been 10 minutes late.

Discovery deployed an important scientific spacecraft, Ulysses, and we were on time and on target. Once the business of the first day in space was over, I had the chance to look out the rear cockpit windows into the payload bay, and I spent an hour watching the world go by underneath the tail. I looked at the payload bay, and I was trying to visualize—beneath all of the thermal blankets—the piping and the valves and the APU's, and the engines that made it all possible. Then I thought of the people who had built that hardware, who installed it, checked it out and made sure it was ready to go. Although I was taken with the view of the earth, and the spectacle of being 160 miles into space, what really struck me was: I was looking at quality.

9.2 Introduction

George A. Rodney, Associate Administrator for Safety and Mission Quality, NASA Headquarters

I would like to take this opportunity to say that I am equally proud of each one of you finalists. I am also just as proud of all the individuals and organizational entities that are represented. Your presence says that you are interested in improving quality, and that we are well on our way to achieving the mission success that all of us need in this business.

9.3 Announcement of the 1989-90 George M. Low Trophy: NASA's Quality and Excellence Award Recipients

James R. Thompson, Jr., Deputy Administrator, NASA

It is an honor for me to be here tonight to recognize the 1989-90 Quality and Excellence Award finalists, and, in addition, to announce the recipients of the 1990 George M. Low Trophy. The achievements, over this past year, of all our honored guests here tonight have been outstanding. Tonight is what it's all about. Some call it the "Oscar," the "Super Bowl," the "World Series", but I think that, collectively, you are the keepers of NASA's unwritten contract. I know that if Dick Truly were

here tonight, he would be equally honored, and join me in saying a special "thanks" to all of our industry partners. For without the strong commitment and the dedication to excellence that these companies stand for, the aerospace industry today would not be the banner of pride that we can all wave in an expanding global market. In these changing times, you folks lead the way. You are, indeed, the leaders of the future.

Our finalists have earned the right to show the pride of leaders and innovators in industry today; to be proud of the painstaking attention to excellence, which is what this nation needs for a strong tomorrow. You are the very heart and soul of NASA. Collectively, we salute you. For leadership is something these finalist companies have demonstrated with their initiative, their innovation, and the well-documented results of their continuous improvement activities. They serve as examples of Total Quality organizations that have displayed outstanding leadership characteristics, from the top of management down to each of the employees.
The immense and thorough critique that each company went through in this very rigorous evaluation process, was a test in itself. Through pages of documented process improvements and achievements, presentations to the validation team members who visited their sites, and the interviews that were conducted with their employees, they have demonstrated the standards by which they operate—standards that we should all strive to make a competitive force throughout the world economy in the future. These companies have succeeded in supporting the nation's space program with high-quality products and services, while saving NASA and the American people millions of dollars through the success of their process improvements.

I know I speak for all of NASA when I say "thanks" for your continuing efforts to meet the highest levels of excellence in all that you do for America's space program. As you know, space flight ain't easy. It's hard, if you do it right—and you folks do it right. There are no short cuts. You have reached deep into your organizations, applied the resources, and made the commitment top to bottom, in order to seek better ways to do business. For this, you stand as beacons of excellence, that we all can look to for improving ourselves and our practices. In fact, the close examination that the excellence award process forces us to make, makes winners of us all. We in NASA receive numerous gains in the continuous improvements to our missions. All of industry benefits for what each of you has learned and will pass on, and the nation's citizens have been given a space program in which they can derive the ultimate pride as Americans.

NASA has added something extra this year to the award process: the Small Business Category. This enables more of our U.S. firms to participate in this challenging process. This category means that a larger part of the backbone of the American industry can learn from the examination, and can also reap the rewards of recognition.

Total Quality leadership is indeed a vision for the future—something we can strive for, while seeing it as vital to our future mutual success. In order to lead the world's advancement in space exploration and technology expansion, we must be leaders in our own endeavors, day-to-day, month after month; we must take the initiative, and continuously improve our processes.

Our finalists are models for both small and large companies. They have all asked themselves the toughest questions that any of us can ask: "Are we meeting the customer expectations? Are we applying Total Quality principles and tools in and throughout our operations? Are we measuring our processes and improving them? Are we documenting the results of these efforts so we know where we are? What kind of savings are we realizing?"

After this very extensive evaluation process, all of these companies have demonstrated a high level of excellence. Some have reached the highest level against the established standards. They are the best of the very best in NASA.

It's my pleasure to name the following companies recipients of NASA's most prestigious award, the George M. Low Trophy, standing for NASA's Quality and Excellence Award.

In the Small Business Category, the first recipient of this award in the category, is Marotta Scientific Controls Inc. To receive the award is Tom Marotta, the Chairman of the Board and President. Marotta provides critical valves and systems for flight vehicles, launch pads, and engine test facilities, in support of contractors working with Langley, Johnson, Marshall, Stennis, Kennedy, and Goddard. They're also major suppliers of valves throughout the federal government.

In the Large Business Category, the award goes to Rockwell International Space Systems Division, represented by Bob Minor, the president. Rockwell provides a very diverse base of products and services, ranging from the production of the fifth Shuttle orbiter, to existing orbiter refurbishment, to a variety of specialized studies in support of space operations at Johnson and Kennedy Centers, as well as Langley,

Ames, and Lewis and the Marshall Space Flight Center.

9.4 Marotta Scientific Controls, Inc.—The 1989-90 Small Business George M. Low Trophy: NASA's Quality and Excellence Award Recipient

Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc.

On behalf of all the employees of Marotta, I want to thank NASA. It was the process that we went through that made the company better and stronger. This was not a competition with other companies, it was a competition with ourselves, to improve ourselves. We're very proud to be here, to have won this first award, and we're certainly in the company of the finest people and the finest companies in the United States. This is certainly a tremendous award.

9.5 Rockwell International Space Systems Division--The 1989-90 Large Business George M. Low Trophy: NASA's Quality and Excellence Award Recipient

Robert G. Minor, President, Space Systems Division, Rockwell International Corporation

I want to give special thanks to our employees: those in southern California and Huntsville and Houston and here in Florida at the Cape, and also in Washington, D.C. It would be shortsighted of me if I didn't also thank the many subcontractors and vendors, many of whom are represented here tonight. They are an integral part of our success. We have been a finalist four times, so this is particularly sweet for us and for me personally. This being the first year of the George Low Trophy, makes it very special for me. He was a very special man.

I would also like to give special thanks to Chuck Baker and Bob Hammond, who have worked so hard to make this happen. And I would like to leave you with a solemn promise that Space Systems Division will not rest on its laurels. We will continue to strive to improve in everything we do.

***General Category Award Receipient** - from left to right: James R. Thompson, Jr., NASA Deputy Administrator; Robert G. Minor, President, Space Systems Division, Rockwell International Corporation*

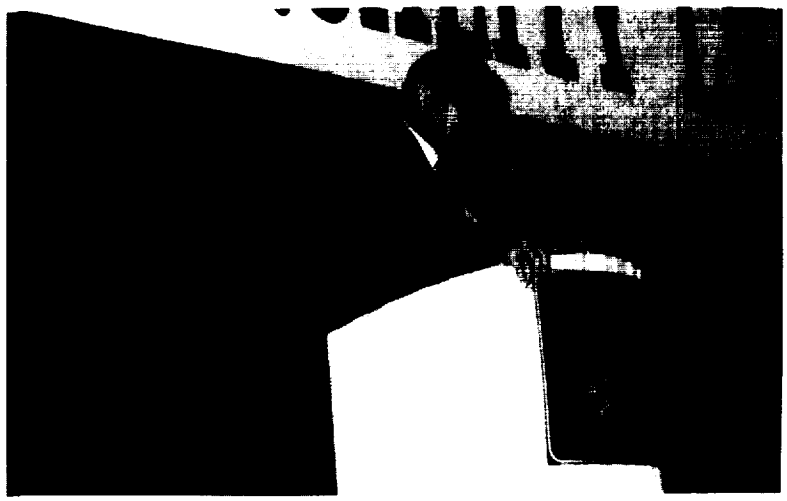
From left: Captain William M. Shepherd, USN, NASA Astronaut; Robert G. Minor, Rockwell Space Systems Division; Thomas S. Marotta, Marotta Scientific Controls, Inc.; John R. Thompson, Jr., NASA Deputy Administrator

From left: James R. Thompson, Jr., NASA Deputy Administrator; Thomas S. Marotta, Marotta Scientific Controls, Inc.

(Small Business Category Award Recipient)

George R. Rodney, Associate Administrator for Safety and Mission Quality

***1990 George M. Low Trophy: NASA's Quality and Excellence Award Finalists stand to be recognized** (from left to right): H. Ray Barrett, Chairman of the Board and Chief Executive Officer, Barrios Technology, Inc.; H. Joseph Engle, Chairman of the Board and President, Bendix Field Engineering Corporation; Paul J. Holyoak, Program Manager, Integrated Information Services, Boeing Computer Support Services; James R. Dubay, President and General Manager, EG&G Florida, Inc.; Wiley E. Williams, President, Grumman Technical Services Division; Carl L. Vignali, Vice President and Group Executive, Honeywell Space Systems Group; Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc.; Mr. Robert G. Minor, President, Space Systems Division, Rockwell International Corporation; John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems.*



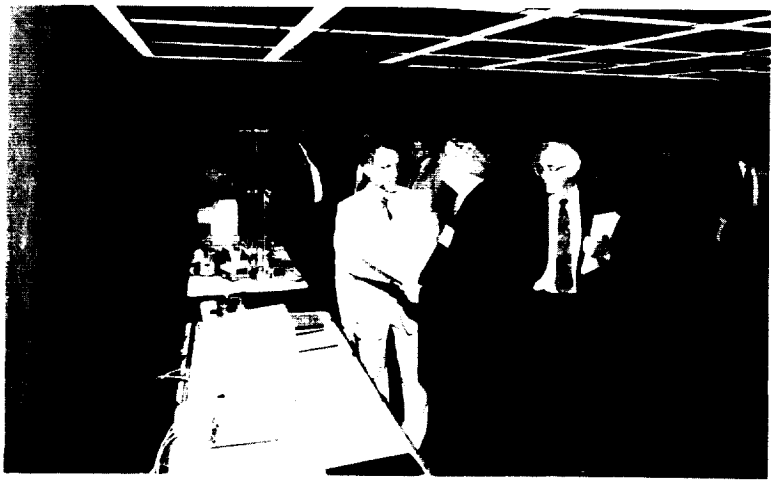
James (Gene) A. Thomas, Deputy Director, NASA, Kennedy Space Center Welcomes Conference Attendees

Seventh Annual NASA/Contractors Conference Planning Committee

From left: Admiral Richard H. Truly, NASA Administrator; Lawrence J. Ross, Director, Lewis Research Center; Arnold D. Aldrich, Associate Administrator for Aeronautics, Exploration, and Technology; Andrew J. Stofan, Martin Marietta Astronautics Group

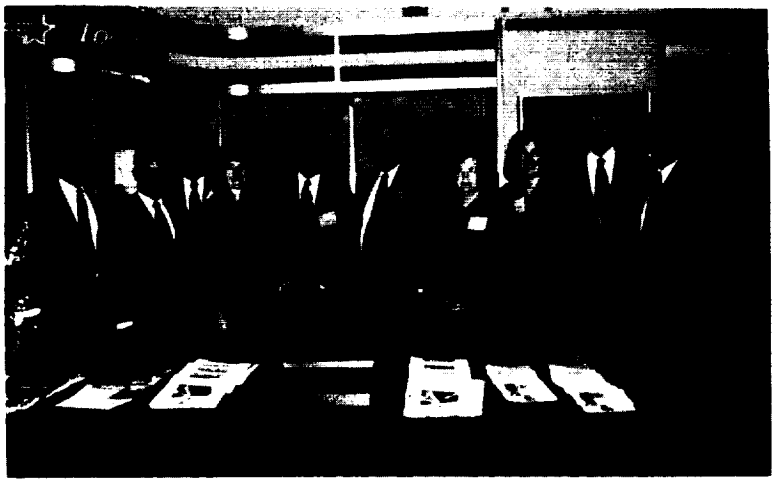
Several of the more than 800 representatives from government, industry, and education

Potomac Edison Computer Interactive Learning Display



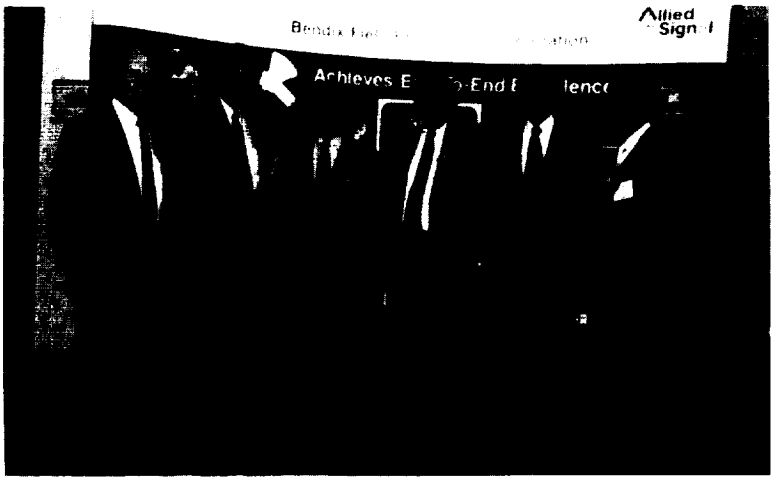
Potomac Edison Computer Interactive Learning Demonstration

Potomac Edison Computer Interactive Learning Demonstration



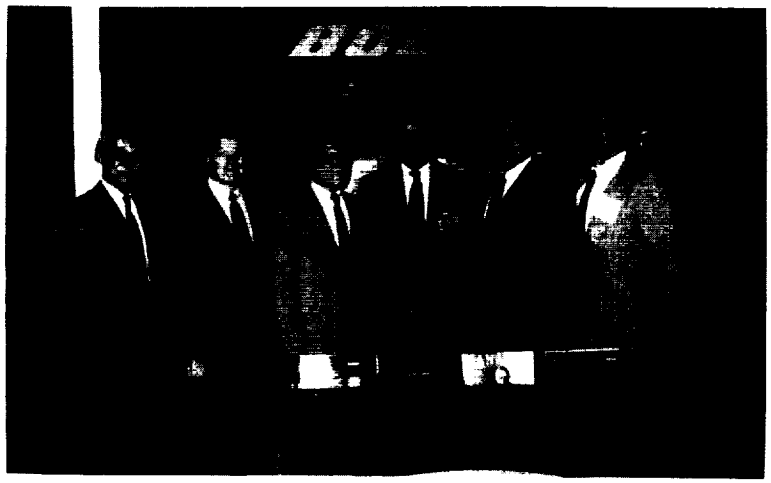
Last Year's Recipient – Lockheed Engineering and Sciences Company

Barrios Technology, Inc.



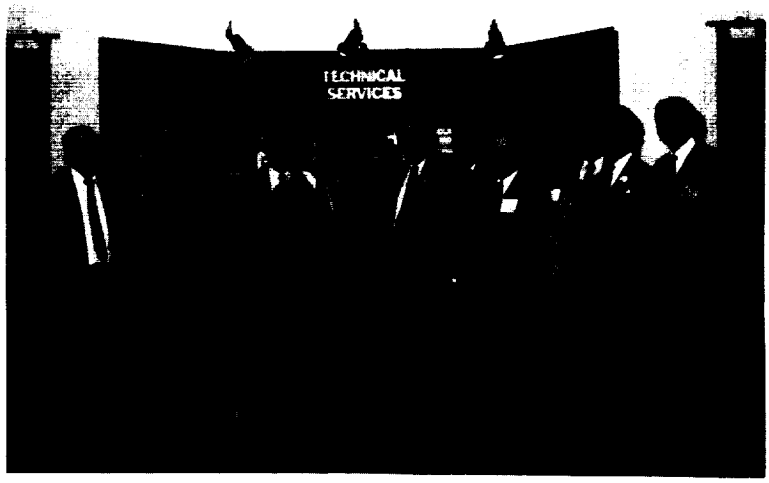
Bendix Field Engineering Corporation

Boeing Computer Support Services

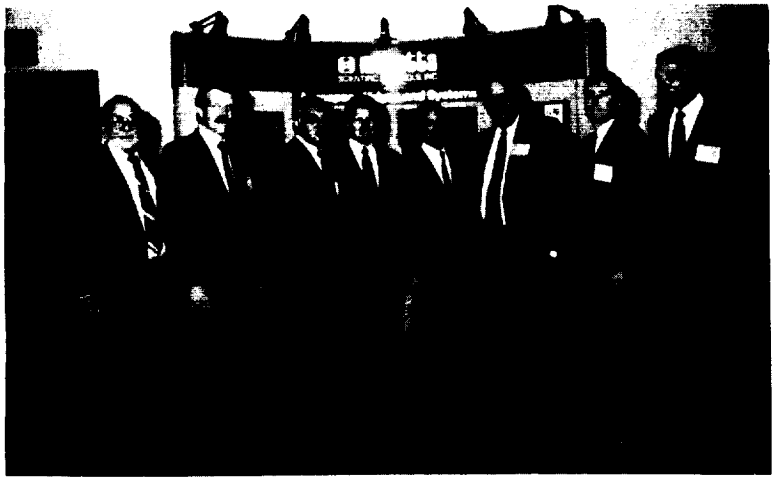


EG&G Florida, Inc.

Grumman Technical Services Division



Honeywell Space Systems Group

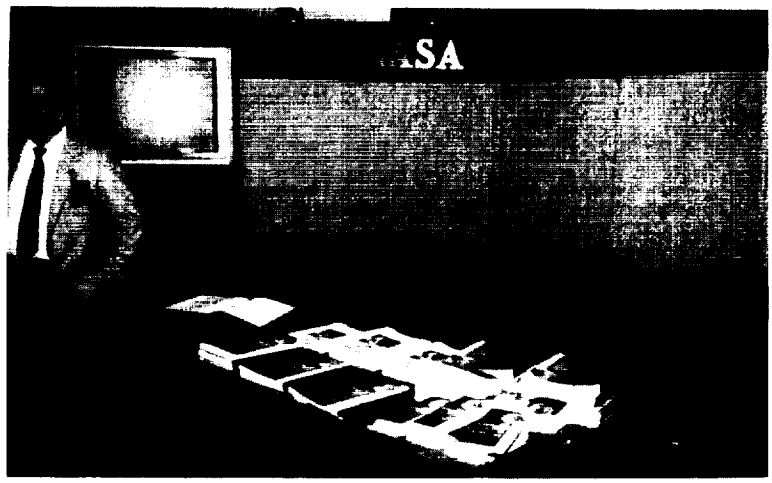


Marotta Scientific Controls, Inc.

Rockwell International Corporation
-Space Systems Division

Unisys Defense Systems

George M. Low Trophy: NASA Quality and Excellence Award Booth



Manned Flight Awareness Booth

Appendix A - Conference Agenda

Seventh Annual NASA/Contractors Conference On Quality and Productivity

Hosted by the John F. Kennedy Space Center

Grenelefe Resort and Conference Center

Grenelefe, Florida

October 24-25, 1990

"Total Quality Leadership"

Tuesday, October 23

5:00 - 8:30 p.m.	Pre-registration, Grenelefe Resort and Conference Center.

Wednesday, October 24

7:00 - 7:50 a.m.	Buffet Breakfast and Registration at the Grenelefe Conference Center
8:00 - 8:10	Welcome - **James A. (Gene) Thomas,** Deputy Director, John F. Kennedy Space Center
8:10 - 8:15	Welcome and introduction of Keynote Speaker, **George A. Rodney**, Associate Administrator for Safety and Mission Quality, NASA Headquarters
8:15 - 8:35	Keynote - **Admiral Richard H. Truly**, Administrator, National Aeronautics and Space Administration
8:35 - 8:45	Conference Overview - **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvements Program, NASA Headquarters, Conference General Chairperson
8:45 - 9:10	Break

9:10 - 10:30	**TOP LEADERSHIP PANEL** - Government and industry top leadership will discuss the importance of commitment and leadership in implementing total quality. (Question and answer session will follow.) **Admiral Richard H. Truly**, Administrator, National Aeronautics and Space Administration, **Chairman** **Honorable Thomas J. Murrin**, Deputy Secretary, U.S. Department of Commerce **Daniel M. Tellep**, Chairman of the Board and Chief Executive Officer, Lockheed Corporation Manager: **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvements Program, NASA Headquarters
10:30 - 10:50	**Profile of a Quality Organization** (1989 NASA Excellence Award Recipient) - **Robert B. Young, Jr.**, President and Chief Executive Officer, Lockheed Engineering and Sciences Company, "**Building the Foundation for a Total Quality Culture.**" Introduction by **George A. Rodney**, Associate Administrator for Safety and Mission Quality, NASA Headquarters.
10:50 - 11:00	Break
11:00 - 12:00	Three Concurrent Panel Presentations **NASA EXCELLENCE AWARD SESSION - TOTAL QUALITY LEADERSHIP** - Highlighting the NASA Excellence Award criteria, these panels of 1990 award finalists will discuss the necessity for top management commitment and leadership methods to achieve performance excellence. Panel Director: **Geoffrey B. Templeton**, NASA Excellence Award Program Manager, NASA Headquarters Panel 1: 1990 NASA Excellence Award Finalists (Small Business/Subcontractor) **Robert D. Paster**, President, Rocketdyne Division, Rockwell International Corporation, **Chairman**

Wiley E. Williams, President, Grumman Technical Services Division, **"Commitment to Quality"**

Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc., **"Planning for Continuous Improvement"**

H. Ray Barrett, Chairman of the Board and Chief Executive Officer, Barrios Technology, Inc., **"Building In Quality and Performance"**

Manager: **Imants (Monte) Krauze**, Director, Quality and Productivity, Bendix Field Engineering Corporation

Panel 2 - 1990 NASA Excellence Award Finalists (Hardware/Mission Support Contractors)

Arnold D. Aldrich, Associate Administrator for Aeronautics, Exploration and Technology, NASA Headquarters, **Chairman**

Robert G. Minor, President, Space Systems Division, Rockwell International Corporation, **"Continuous Total Performance Improvement at Rockwell/Space Systems Division"**

Carl L. Vignali, Vice President and Group Executive, Honeywell Space Systems Group, **"Total Quality Leadership: Top Management's Role"**

H. Joseph Engle, Chairman of the Board and President, Bendix Field Engineering Corporation, **"Quality Leadership - Vision for Excellence"**

Manager: **Sherry H. Prud'homme**, Manager, Total Quality Management, Lockheed Engineering and Sciences Company

Panel 3 - 1990 NASA Excellence Award Finalists (Service Support/Mission Support Contractors)

Richard M. Davis, President, Martin Marietta Manned Space Systems, **Chairman**

James R. Dubay, President and General Manager, EG&G Florida, Inc., "**Achieving Excellence in a Diverse Organization**"

Paul J. Holyoak, Program Manager, Integrated Information Services, Boeing Computer Support Services, "**Success Through Partnerships**"

John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems, "**The Quest for Excellence**"

Manager: **Jeffrey M. Corbin**, Manager, Total Quality Management, Martin Marietta Manned Space Systems

12:00 - 1:30 p.m. Lunch/Luncheon Keynote Speaker, U. Edwin Garrison, President and Chief Executive Officer, Thiokol Corporation, "**Total Quality Leadership-The Foundation for our Future**"

1:30 - 5:30 **CONCURRENT PANELS**. Generic panels will be presented vertically, one after the other, to permit participants to follow a series or attend other panels, if so desired.

PANEL A - BUILDING ON STRATEGIC PLANNING TO ADVANCE TQM - A focus on strategic planning as the foundation for tactical implementation of continuous improvement throughout the organization. How do we integrate the strategic business plan and the quality strategy plan?

Panel Directors: **Dr. Joe E. Sparks**, Director, Continuous Process Improvement, Teledyne Brown Engineering, and **William L. Williams**, Senior Staff Scientist, George Washington University, Langley Research Center

PANEL B - CONTINUOUS EMPLOYEE DEVELOPMENT FOR TOTAL QUALITY - This panel will highlight the vital role training and recognition play in developing a total quality work force. The importance of assessing training readiness as well as design and implementation tools and techniques will be addressed. The power behind employee recognition and its value to the organization will also be covered.

Panel Directors: **Sally L. Stohler**, Manager, Space Shuttle Main Engine Marketing, Rocketdyne Division, Rockwell International Corporation, and **Larry E. Lechner**, Productivity Improvement Office, George C. Marshall Space Flight Center

PANEL C - EMPLOYEE EMPOWERMENT AND TEAMWORK - Total quality leadership requires the development of each individual in the organization. Employee empowerment and teamwork are strategies for tapping the potential for each employee. This panel addresses the issues of employee empowerment and teamwork by discussing the organizational prerequisites for empowerment, the implementation of teamwork, and the changing role of management as organizations implement TQM.

Panel Directors: **Jessica R. Breul**, Assistant to the Director, Total Quality Process, Grumman Corporation, and **Gail R. Harleston**, TQM Manager, Office of Headquarters Operations, NASA Headquarters.

1:30 - 2:40

Panel A1 - Creating the Vision - Understanding the process that an organization must undergo to develop its vision statement: what it is, what it wants to be, and what it can be. How the vision integrates the continuous improvement process throughout the operating levels, including labor/management relations.

Dr. Harriett G. Jenkins, Assistant Administrator for Equal Opportunity Programs, NASA Headquarters, **Chairman**

David Clark, President and Chief Executive Officer, Campbell Soup Company, Ltd., **"From Breakdown to Breakthrough - Role of Vision as a Catalyst for Total Quality"**

James A. Blue, Vice President/General Manager, Materiel Division, Boeing Commercial Airplane Group, **"Boeing Commercial Airplane, Continuous Quality Improvement (CQI)- Vision to Reality"**

Manager: **Michael W. Foster**, Chief Financial Officer, Unitech Composites, Inc.

Panel B1 - Are You Ready? - This panel will focus on the role of training in a "Total Quality Culture" - from needs definition through evaluation. The speakers will discuss the range of activities needed for effective and continuous employee development - from senior executives through the entire work force. The primary focus will be training as a vital "Total Quality" element.

Charles T. Force, Associate Administrator, Office of Space Operations, NASA Headquarters, **Chairman**

Charles Zimmerman, Director, Education and Training Services, Electronic Systems Group, Westinghouse Electric Corporation, **Manager**

Charles M. Ericson, Manager Product/Process Technology, Westinghouse Productivity and Quality Center, Westinghouse Electric Corporation

Panel C1 - Prerequisites for Empowering Employees - TQM demands empowerment of employees to be successful. Empowerment involves several critical elements - role clarification, supportive organizational policies and procedures, and external customer involvement. It is a process. Empowerment provides an opportunity for the employee to make changes in their work processes which may result in continuous improvement.

George W. Davis, Director, Engineering and Space Operations, Boeing Aerospace Operations, Inc., **Chairman**

Dr. Marco J. Giardino, Center Education Program Officer, John C. Stennis Space Center, **"Setting the Stage for People Involvement"**

Theresa A. Brelsford, Assistant Commissioner for Administration, U.S. Patent and Trademark Office, U.S. Department of Commerce, **"Employee Involvement: Getting Everybody On-board"**

Managers: **Robert P. Hessler**, Manager, Communications, McDonnell Douglas Space Systems Company, Kennedy Space Center Division, and **S. D. (Skip) Montagna**, Director, Quality Assurance/Quality Improvement, Boeing Aerospace Operations, Inc.

2:40 - 2:55 Break

2:55 - 4:05 Panel A2 - Organization for Planning and Implementation - Exploration of how different organizations function within the operating unit and how the perceived barriers are overcome. Defining the goals of TQM with emphasis on the required mindset within the organization. Identifying the availability of existing tools and techniques for implementing TQM.

Gordon P. Carlson, President, GS Aerospace Technology, Inc., **Chairman**, **"Panel Introduction - Implementing the Goals of TQM"**

Hugh M. Brown, President and Chief Executive Officer, Brown and Associates Management Services, Inc., **"From the Ground Up - A BAMSI Perspective"**

Joseph A. Frankovsky, Staff Vice President for Total Quality Management, General Dynamics Corporation, **"TQM - An Implementation Approach"**

Daniel A. Nebrig, Associate Director, Lyndon B. Johnson Space Center, **"Translating Vision into Action"**

Manager: **Joe E. Alcala**, Division Director, Productivity and Competition Advocate, Space Systems Division, General Dynamics Corporation

Panel B2 - Tools and Techniques for Total Quality Training - This panel will discuss the use of large scale systems change techniques as a methodology to position the organization for culture change and prepare it for specific training interventions that promote continuous improvement. The use of a simulated production environment to teach the application of continuous improvement concepts will also be modeled.

Joseph A. (Woody) Bethay, Associate Director, George C. Marshall Space Flight Center, Chairman

C. W. (Pat) Duffy, Director, Continuous Quality Improvement, Boeing Defense and Space Group, Aerospace and Electronics Division, **"Errant Arrows and Maggie's Drawers"**

Phillip R. (Bob) Elder, Director of Total Quality Management, Rocketdyne Division, Rockwell International Corporation, **"CPI Boot Camp"**

Manager: **Leroy A. Mendenhall**, Continuous Improvement Manager, Integrated Information Services, Boeing Computer Support Services

Panel C2 - The Changing Role of Management - Employee empowerment may be threatening to traditional managers whose experience is based in traditional organizational structures. This subpanel addresses changes in the role of management, the relationship between authority, responsibility, and accountability, and what organizations must do to prepare management for its new role and to support the development of effective relationships between non-management employees, managers, and teams.

George R. Faenza, Vice President/General Manager, McDonnell Douglas Space Systems Company, Kennedy Space Center Division, **Chairman**

Paul L. Kruelle, Vice President, Systems and Technology, Unisys Defense Systems, **"TQM Strategy for Complex Systems: Management's Role in Empowering Employees"**

Dean G. Cassell, Vice President of Product Integrity, Grumman Corporation, **"Excellence Through Leadership"**

Robert J. Keymont, Vice President, Production Operations, Martin Marietta Missile Systems, **"Employee Involvement Through Performance Measurement Teams"**

Manager: **Dr. Dean R. Lee**, Director, Quality/Productivity, Systems Services Group, Unisys Defense Systems

4:05 - 4:20 Break

4:20 - 5:30 Panel A3 - Winning Strategies for Total Quality - Planning strategies of organizations successfully implementing Total Quality Programs, including pitfalls encountered and benefits derived.

Roy S. Estess, Director, John C. Stennis Space Center, **Chairman**

Ronald G. Robinson, TQM/People Coordinator, Electronic Systems Sector, Harris Corporation, **"TQM: The Promise Is Real"**

Andrew J. Stofan, Vice President, Technology, Martin Marietta Astronautics Group, **"Change Strategy to Become a World Class Industry"**

Sidney F. Pauls, Associate Director, Langley Research Center, **"Strategic Planning in a Research Environment"**

Manager: **George B. Nelson**, Productivity Manager, Stennis Space Center Group, Sverdrup Technology, Inc.

Panel B3 - Recognition Adds Value - This panel will focus on the importance of recognition in improving quality and productivity. Speakers will emphasize the importance of recognizing each individual at every level in the organization.

Peter M. Alex, President, The Osterland Company, **Chairman**

Lawrence J. Ross, Director, Lewis Research Center, **"Lewis Means Teamwork"**

John G. Johnson, Vice President, Manufacturing, Electronic Systems Sector, Harris Corporation, **"Almost Everything We Do is a Form of Recognition"**

Manager: **Richard D. Clapper**, Chief, Office of Human Resources Development, Lewis Research Center

Panel C3 - Making Teams Work - Teamwork is essential to improving quality and increasing productivity. The subpanel will address methods for making teams effective in achieving TQM goals and dealing with teamwork difficulties. Teamwork today and in the future must adjust to an ever increasing, culturally diverse work force. Teamwork methods will have to address this cultural diversity and find more effective ways to reward team excellence.

David J. Posek, Division Vice President, Government Services, General Electric Company, **Chairman**

Cindy S. Kane, Supervisor of Facilitation, Harris Corporation, **"Performance Excellence: Our People Lead the Effort"**

Dr. Thomas M. Steinfatt, School of Communications, University of Miami, "**Managing a Culturally Diverse Work Force**"

Dr. Maurice M. Miller, Vice President and Engineering and Science Program Manager, Lockheed Engineering and Sciences Company, **"Rewarding Team Excellence"**

Managers: **Dr. Robert A. Emry**, Associate Dean, School of Communications, California State University at Fullerton, and **G. William Kuhfuss**, Product Assurance Manager, General Electric Aerospace

5:30 - 6:30 OPEN

6:30 - 7:15 Reception at the Grenelefe Conference Center featuring NASA Excellence Award Finalists and a NASA Astronaut.

7:30 - 9:30 NASA Excellence Award Banquet (Grenelefe Conference Center), **James R. Thompson, Jr.**, NASA Deputy Administrator, Announcement of NASA Excellence Award Recipient(s).

Thursday, October 25

7:15 - 8:30 a.m.

Buffet breakfast at Grenelefe Conference Center with a special keynote speaker, **Dr. Joseph L. Shilling**, State Superintendent of Schools, Maryland State Department of Education. The topic of the presentation will be **"Total Quality in Maryland Education"**. Introductory remarks will be made by **Margaret G. Finarelli**, Acting Associate Administrator of External Affairs, NASA Headquarters.

8:30 - 11:30

THREE CONCURRENT PANELS

PANEL D - QUALITY ASSURANCE'S ROLE IN TOTAL QUALITY MANAGEMENT - The objective of this panel will be to explore the transition of traditional organizational roles and quality assurance standards in a Total Quality Management environment.

Panel Directors: **Tina M. Doty**, Group Director, Quality Assurance, Relay Division, Leach Corporation, and **Willis E. Chapman**, Manager, Quality and Productivity Improvement Programs, Jet Propulsion Laboratory

PANEL E - NO MEASUREMENT--NO PROGRESS - The purpose of this panel is to: a) generate interest in measurement, showing utility, rewards, and payback; b) discuss techniques and applications; and c) demonstrate successful application through a case study. Prior to the conference, a TQM assessment survey will be distributed to the attendees. The results of the survey will be disseminated at the conference.

Panel Directors: **Dr. Ronald A. Luhks**, Manager, Reliability and Maintainability Engineering, Space Information Systems Operations, Ford Aerospace Corporation, and **Wanda M. Thrower**, Team Excellence Coordinator, Lyndon B. Johnson Space Center

PANEL F - CUSTOMER FOCUS - PRACTICE OR PREACH

Panel Directors: **Linda A. Marvin**, Manager, Administrative Operations, Lockheed Engineering and Sciences Company, and **John L. Reiss**, Staff Assistant, Administration, Ames Research Center

8:40 - 9:55

Panel D1 - The Changing Role of Quality Assurance in a TQM Environment - The objective of this panel will be to explore and define the changing role of a traditional quality assurance organization and how it relates to TQM implementation.

Ron O. Roberts, Director of Quality Assurance, Space Systems Division, General Dynamics Corporation, **"The Evolution of a QA Function within a TQM Environment"**

Ernest Roberts, Jr., Project Manager, Lewis Information Management System, Lewis Research Center, **"The Necessity for Improvisation in TQM"**

Thomas Curry, Corporate Quality Director, Electronic Data Systems Corporation, **"Quality Assurance as a Part of the Continuous Improvement System"**

Managers: **Donald O. Atkins**, Director, Quality Assurance ILC Space Systems, ILC Dover, Inc., and **Thomas H. Forbes**, Quality Manager, Government Services Division, Electronic Data Systems Corporation

Panel E1 - Measuring TQM In The Real World - Members of this panel will offer ideas and discuss issues in the "real time" application of TQM measurement in two diverse environments - hardware and software.

James (Gene) A. Thomas, Deputy Director, John F. Kennedy Space Center, **Chairman**

Max E. Zent, Executive Director, Quality and Productivity, Tenneco, Inc., **"TQM Measurement: Breakthrough or Bureaucracy?"**

Ted W. Keller, Manager, OBS Project Coordination and Configuration Management, Federal Sector Division, IBM Corporation, **"Using Metrics Feedback to Improve Life-Critical Software"**

Manager: **Dr. Karen K. Whitney**, Manager, Productivity, Rockwell Space Operations Company

Panel F1 - Customer Expectations-Everybody's Business - This panel will examine some "common sense" approaches to discovering the real expectations behind customer requirements and successful programs involving all levels of the work force.

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

Robert A. Wolfe, Executive Vice President, Space Propulsion and Systems, Pratt & Whitney, United Technologies Corporation, **"Meeting Requirements Through Customer Partnerships"**

Robert M. Little, Vice President, Information Services, Boeing Computer Services, **"Defining Customer Expectations - Back to the Basics"**

Manager: **John S. Welzyn**, Chief, Administrative Operations Office, Safety, Reliability, Maintainability and Quality Assurance Office, George C. Marshall Space Flight Center

9:55 - 10:15 Break

10:15 - 11:25 Panel D2 - Quality Assurance Standards versus TQM - The objective of this panel will be to explore the primary differences/conflicts between traditional quality assurance standards and TQM and to attempt to provide potential solutions to these conflicts.

Larry Parker, President and Chief Executive Officer, Leach Corporation, Chairman, **"Quality Assurance Standards versus TQM - Overview"**

William Mike Cooney, Vice President, Quality and Reliability Assurance, Texas Instruments, Inc., **"Including TQM in Government Quality Standards-We Can't Afford to Wait!"**

Earl G. Mills, Director, Quality Assurance, Electronics and Missiles Group, Martin Marietta Corporation, **"TQM Implementation - A Success Story"**

Spencer Hutchens, Jr., Senior Vice President, Intertek Services Corporation, **"Resolving the Conflict"**

Managers: **Tina M. Doty**, Group Director, Quality Assurance, Relay Division, Leach Corporation, and **Robert D. Hammond**, Director, Business Pursuits and Special Projects, Space Systems Division, Rockwell International Corporation

Panel E2 - Case Study: Measurements in Action - The purpose of this session is to demonstrate successful applications of measurement in achieving total quality process improvement.

Christopher J. Holloway, Pursuit of Excellence Director, Interior Furnishings and LaGrange Industrial Division, Milliken & Company, **"Pursuit of Excellence"**

Manager: **R. Ross Bowman**, Vice President, Safety, Reliability and Quality Assurance, Space Operations, Thiokol Corporation

Panel F2 - Will the Real Customer Please Stand Up? - Individuals have a tendency to function within an envelope which, while protecting and preserving their autonomy, limits the awareness of internal customer needs. Internal organizational structure must allow and encourage involvement, interchange, and feedback to foster problem resolution and enhancement of customer expectation.

Thomas W. Herrala, Vice President and General Manager, Space and Sea Systems, Hamilton Standard, United Technologies Corporation, **Chairman**

Ronald R. McCann, President, McCannics Air Conditioning and Heating, **"Bound by the Chain of Command"**

S. C. (Carl) Stimson, Vice President, Quality Services, Qualtec Incorporated, **"The Results of Knowing Your Internal Customer"**

Manager: **Bradley A. Johnson**, Director, Space Systems Division, CTA, Inc.

11:30 - 12:45 p.m. — Lunch/Luncheon Keynote Speaker, **Elmer B. Kaelin**, President, Potomac Edison Company, **"Answering Industry's Question: How Can I Help?"** In conjunction with the school systems of three states in its service area, Potomac Edison pioneered a system of computer interactive learning and networked classrooms and created an Instructional Center where thousands of teachers each year acquire the skills needed to design and manage activities in computer integrated teaching.

12:45 - 1:00 — Adjourn for afternoon activities - **George A. Rodney**, Associate Administrator for Safety and Mission Quality, NASA Headquarters and **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvements Program, NASA Headquarters, Conference General Chairperson

1:00 - 4:00 — Potomac Edison Computer Interactive Learning Demonstration - Potomac Edison will provide an afternoon of explanation and demonstrations of computer interactive learning as applied in its marketing region. In addition, banks of terminals will be set up to allow "hands on" participation in the learning process used in the schools. Reflective managers will probably see uses for this educational method in certain kinds of corporate training.

Session Manager: **David H. Kline**, Educational Programs Administrator, The Potomac Edison Center for Instructional Research and Development

1:00 - 5:30 — VIP Tour of John F. Kennedy Space Center

NASA/Contractors Conference Planning Committee

DIRECTORS

Ms. Jessica R. Breul
Grumman Corporation

Willis E. Chapman
Jet Propulsion Laboratory

Tina M. Doty
Leach Corporation

Gail R. Harleston
NASA Headquarters

Larry E. Lechner
George C. Marshall Space Flight Center

Ronald A. Luhks, Ph.D.
Ford Aerospace Corporation

Linda A. Marvin
Lockheed Engineering and Sciences Company

John L. Reiss
Ames Research Center

Joe E. Sparks, Ph.D.
Teledyne Brown Engineering

Sally L. Stohler
Rocketdyne

Geoffrey B. Templeton
NASA Headquarters

Wanda M. Thrower
Lyndon B. Johnson Space Center

William L. Williams
George Washington University

MANAGERS

Joe E. Alcala
General Dynamics Corporation

Donald O. Atkins
ILC Dover, Inc.

R. Ross Bowman
Thiokol Corporation

Richard D. Clapper
Lewis Research Center

Jeffrey M. Corbin
Martin Marietta Manned Space Systems

Dr. Robert A. Emry
California State University - Fullerton

Thomas H. Forbes
Electronic Data Systems Corporation

NASA/Contractors Conference Planning Committee

Michael W. Foster
Unitech Composites, Inc.

Robert D. Hammond
Rockwell International Corporation

Robert P. Hessler
McDonnell Douglas Space Systems Company

Robert A. Horrigan
Electronic Data Systems Corporation

Joyce R. Jarrett
NASA Headquarters

Bradley A. Johnson
CTA, Inc.

Imants (Monte) Krauze
Bendix Field Engineering Corporation

G. William Kuhfuss
GE Aerospace

Dean R. Lee, Ph.D.
Unisys Defense Systems

Leroy A. Mendenhall
Boeing Computer Support Services

S. D. (Skip) Montagna
Boeing Aerospace Operations, Inc.

George B. Nelson
Sverdrup Technology, Inc.

Sherry H. Prud'homme
Lockheed Engineering and Sciences Company

John S. Welzyn
George C. Marshall Space Flight Center

Karen K. Whitney, Ph.D.
Rockwell Space Operations Company

Charles Zimmerman
Westinghouse Electronics Systems Group

COMMITTEE AT LARGE

Peter M. Alex
The Osterland Company

Charles P. Boyle
NASA Headquarters

Alfred O. Brouillet
Hamilton Standard, United Technologies Corporation

NASA/Contractors Conference Planning Committee

Warren L. Camp
John F. Kennedy Space Center

Jerry R. Dangler
Honeywell, Inc.

J. Jeannette Eads
EG&G Florida, Inc.

Nancy A. Falk
Barrios Technology, Inc.

Dr. Neil W. Haars
Sverdrup Technology, Inc.

Johnnie A. Henderson
IBM Corporation

James F. Holloway
Pratt & Whitney, United Technologies Corporation

Richard D. Lander
Marotta Scientific Controls, Inc.

Don C. McAvin
Wyle Laboratories

William R. McMurry
Unisys Defense Systems

Jarvis L. (Skip) Olson
Grumman Technical Services Division

Nickee R. Reynolds
McDonnell Douglas Space Systems Company

Marshall L. Seymour
Sverdrup Technology, Inc.

Lynne M. Stewart
Futron Corporation

Margaret A. (Peggy) Wilson
John F. Kennedy Space Center

Conference General Chairperson

Joyce R. Jarrett
Director, NASA Quality and Productivity Improvement Programs Division
Office of Safety and Mission Quality

Conference Director

Geoffrey B. Templeton
Program Manager, External Total Quality Management
NASA Quality and Productivity Improvement Programs Division

Conference Host

John F. Kennedy Space Center
General Forrest S. McCartney
Center Director

Assistant Conference Directors

Lynne M. Stewart
Futron Corporation

Margaret A. (Peggy) Wilson
John F. Kennedy Space Center

John F. Kennedy Space Center Conference Liaison Officer

Warren L. Camp
Director, KSC Total Quality Management Office

NASA Headquarters Conference Liaison Officer

Joseph McElwee
Program Manager, Internal Total Quality Management
NASA Quality and Productivity Improvement Programs Division

Administrative Support Team

NASA Headquarters
Marsha B. Rubin
Cathy L. Horton

Futron Corporation
Darron K. Fuller
Delora H. Maiden
Eric C. Raynor
Mary Jane Sanzo
Betty P. Tai

A Special Thanks to the NASA Headquarters Exchange for Cosponsoring this Conference

Appendix B – List of Attendees

Mr. Jeff Abbott
Vice President, Sales and Marketing
Aerochem, Inc.
1885 North Batavia
Orange, CA 92665

Mr. Al E. Acuna
Senior Quality Engineer
Space Systems Division
General Dynamics Corporation
Post Office Box 320999
Cocoa Beach, FL 32932-0999

Mr. Paul E. (Ed) Adamek
Director, Safety, Reliability, Maintainability
and Quality Assurance
Lockheed Space Operations Company, Inc.
1100 Lockheed Way, MS LSO-157
Titusville, FL 32780

Mr. J. D. Adams
Project Manager
Jacobs Engineering Group Inc.
Post Office Box 2008
Lakeland, FL 33806-2008

Mr. John F. Adams
Manager
Pasadena Operations - Deep Space Network
Bendix Field Engineering Corporation
129 North Hill Avenue, M/S 507/102
Pasadena, CA 91106

Mr. John W. Adcox
Performance Improvement-
Total Quality Management
Space Systems Company
Martin Marietta Astronautics Group
Post Office Box 179, M/S DC4600
Denver, CO 80201

Mr. John R. Albin
Vice President, Product Operations
Hughes Aircraft Company
7200 Hughes Terrace, C1/A106
Post Office Box 45066
Los Angeles, CA 90045-0066

Mr. Joe E. Alcala
Division Director, Productivity
and Competition Advocate
Space Systems Division
General Dynamics Corporation
Mail Zone C1-7000
Post Office Box 85990
San Diego, CA 92186-5990

Mr. Arnold D. Aldrich
Associate Administrator, Office of Aeronautics
and Space Technology
Code R
National Aeronautics and Space Administration
Washington, DC 20546

Dr. David Aldrich
Corporate Vice President
Space, Energy and Environment Sector
Science Applications International Corporation
1710 Goodridge Drive
McLean, VA 22102

Mr. James M. Alex
Chief Executive Officer
The Osterland Company
2410 Scranton Road
Cleveland, OH 44113

Mr. Peter M. Alex
President
The Osterland Company
Lewis Research Center, M/S 66-2
21000 Brookpark Road
Cleveland, OH 44135

Ms. Paula A. Allen
Manager, Productivity
Quality and Productivity
Shipboard and Ground Systems Group
Unisys Defense Systems
Marcus Avenue
Great Neck, NY 11020

Mr. Robert E. Allen
Chairman of the Board
and Chief Executive Officer
American Telephone and Telegraph Company
550 Madison Avenue
New York, NY 10022

Mr. William C. Allen
Plant Operations Manager
Air Products and Chemicals, Inc.
14700 Intracoastal Drive
New Orleans, LA 70129

Mr. Sanford O. Ames
Vice President, Customer Relations
Technology Applications, Inc.
6101 Stevenson Avenue
Alexandria, VA 22304

Mr. Charles A. Anderson
Vice President and General Manager
Ft. Worth Division
General Dynamics Corporation
Post Office Box 748
Ft. Worth, TX 76101

Mr. Robert E. Anderson
Director, Propulsion, Power and Energy
Code RP
National Aeronautics and Space Administration
Washington, DC 20546

Mr. William L. Anderson
Director of Marketing
Specialty Industrial Business
Milliken & Company
201 Industrial Drive, M-802
Post Office Box 2956
LaGrange, GA 30240

Mr. Hugh R. Angert
Manager, OD/MD
Martin Marietta Astronautics Group
Post Office Box 179, DC-1310
Denver, CO 80127

Dr. Bahman Atefi
Division Manager
Space, Energy and Environment Sector
Science Applications International Corporation
1710 Goodridge Drive
McLean, VA 22102

Mr. Donald O. Atkins
Director, Product Assurance
and Technical Services
ILC Space Systems
ILC Dover, Inc.
16665 Space Center Boulevard
Houston, TX 77058-2253

Joseph D. Atkinson, Jr., Ph.D.
Director, Equal Opportunity Programs Office
Mail Code AJ
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Mr. Charles O. Baker
Vice President, Product Assurance
Space Systems Division
Rockwell International Corporation
12214 Lakewood Boulevard, FC08
Downey, CA 90241

Ms. Kathy T. Baker
Project Manager
MEDB Contract
Brown and Associates Management
Services, Inc. (BAMSI)
150 West Park Loop, Suite 107
Huntsville, AL 35806

Mr. Bruce P. Balcer
Marketing Manager
Norden Systems, Inc.
United Technologies Corporation
Post Office Box 5300
Norwalk, CT 06856

Mr. Walter P. Baleyko
Chief, Internal Control Office
Mail Code AC-ICO
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Lindsay P. Ball
Program Manager
Space and Strategic Systems Operation
Honeywell Inc.
13350 U.S. Highway 19 North
Clearwater, FL 34624-7290

Mr. Richard L. Balogh
Director, Strategic Plans and Programs
Lockheed Engineering and Sciences Company
2625 Bay Area Boulevard
Houston, TX 77058

Mr. Joseph N. Barfus
Deputy Director, Center Support Operations
Mail Code: SI
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. George C. Barlow
Director, Quality Assurance
ICI Fiberite Composite Materials
2055 East Technology Circle
Tempe, AZ 85284

Mr. H. Ray Barrett
Chairman of the Board
and Chief Executive Officer
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058-2799

Mr. Mike Barrett
Marketing Representative
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058-2711

Mr. Bill F. Barry
Vice President
Applied Technology Division
Computer Sciences Corporation
16511 Space Center Boulevard
Houston, TX 77058

Mr. Jerome Barsky
Deputy Program Manager
Space Operations
Bendix Field Engineering Corporation
Aerospace Building, Suite 820
10210 Greenbelt Road
Seabrook, MD 20706

Mr. Saul H. Barton
Deputy Director, Personnel Office
Code PM
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Robert C. Baumann
Director of Flight Assurance
Mail Stop 300.0
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771

Mr. Charles A. Beacham
Vice President, Manufacturing
Fuel Systems Textron Inc.
Textron Inc.
700 North Centennial Street
Zeeland, MI 49464

Mr. Richard C. Beagley
Director, Environmental
and Operational Safety
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212, Code USBI-SF
Kennedy Space Center, FL 32815

Mr. Grady L. Beard
Project Manager
Brown and Associates Management
Services, Inc. (BAMSI)
Building 2104
Stennis Space Center, MS 39529

Mr. Aurelio Bellia
Supervisor, Production Integration
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U10A)
Houston, TX 77058-2775

Mr. Eugene L. Berger, P.E.
Member of the Technical Staff
Civil Systems Division
The MITRE Corporation
1120 NASA Road 1
Houston, TX 77058

Mr. Joseph A. (Woody) Bethay
Associate Director
Code DE01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Stephen J. Biello, III
Manager of Quality
Raytheon Service Company
2 Wayside Road
Burlington, MA 01803

Mr. Robert G. Bilyou
Staff Manager, Quality Assurance
Huntsville Division
McDonnell Douglas Space Systems Company
689 Discovery Drive, M/S 71A1
Huntsville, AL 35806

Mr. Richard A. Bird
Quality Assurance Manager
Boeing Aerospace Operations, Inc.
Post Office Box 946, FC-51
Cape Canaveral, FL 32920-0946

Mr. John H. Bitzer
Director, Product Assurance
Space Systems Company
Martin Marietta Astronautics Group
Post Office Box 179, Mail Stop DC4600
Denver, CO 80201

Dr. Robert A. Bland
Head, Missiles Operations Division
Naval Ship Weapons System
Engineering Station
Code 4R30
United States Navy
Port Hueneme, CA 91320

Mr. Charles F. Blass
Product Assurance Manager
Teledyne Brown Engineering
300 Sparkman Drive, Mail Stop 29
Huntsville, AL 35807

Mr. Ronald B. Bledsoe
Chief, Quality Engineering Division
Office of Safety and Mission Assurance
Code CQ21
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Albert J. Blesi
Program Director, Quality and Operations
Federal Sector Division
IBM Corporation
6600 Rockledge Drive, Suite 403
Bethesda, MD 20817

Mr. Theodore L. Bloomer
Senior Policy Analyst
ATTN: CAMP
Defense Systems Management College
Fort Belvoir, VA 22060

Mr. James A. Blue
Vice President and General Manager
Materiel Division
Boeing Commercial Airplane Group
Post Office Box 3707, Mail Stop OR-HH
Seattle, WA 98124-2207

Mr. Horace I. Bomar
Manager, Process Support
Space Services
Thiokol Corporation
Post Office Box 21237
Kennedy Space Center, FL 32815

Mr. Richard Bonci
Manager of Quality Improvements
Aerospace
Titeflex Corporation
603 Hendee Street
Post Office Box 90054
Springfield, MA 01139-0054

Mr. Alfredo Bonilla, III
Program Manager
BMMS Contract
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 8395, Redstone Arsenal
Huntsville, AL 35808

Mr. Renzo A. Bontempo
Vice President, Space Production Operations
Thiokol Corporation
Post Office Box 707
Brigham City, UT 84302-0707

Mr. Sieg Borck
President
Hi-Temp Insulation, Inc.
4700 Calle Alto
Camarillo, CA 93010

Mr. Gerald Boston
Program Manager
Code TW9
Ogden Logistics Services
Goddard Space Flight Center
Greenbelt, MD 20771

Mr. R. Ross Bowman
Vice President, Safety, Reliability
and Quality Assurance
Space Operations
Thiokol Corporation
Post Office Box 707, A90
Brigham City, UT 84302-0707

Mr. James A. Boyd
President
Hydrodyne Division
F. P. I., Inc.
3125 Damon Way
Burbank, CA 91505

Mr. Charles P. Boyle
Educational Programs Officer
Educational Affairs Division
Code XEE
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Bruce A. Bradford
President
Anchor Plating Company
1734 North Tyler Avenue
South El Monte, CA 91733

Mr. Charles T. Brandt
Director, Quality Assurance
Ebasco Services, Inc.
145 Technology Park
Norcross, GA 30092

Ms. Theresa A. Brelsford
Assistant Commissioner for Administration
U.S. Patent and Trademark Office
U.S. Department of Commerce
Crystal Plaza 2, Suite 908
Washington, DC 20231

Ms. Jessica R. Breul
Assistant to the Director, Total Quality Process
Grumman Corporation
1111 Stewart Avenue, M/S A23-GHQ
Bethpage, NY 11714-3580

Ms. Karen F. Bridges
Executive Secretary
EG&G Florida, Inc.
Post Office Box 21267
Kennedy Space Center, FL 32815

Mr. Marc C. Bridgham
Manager, Organization Development/
Continuous Quality
Huntsville Division
Boeing Aerospace and Electronics Company
Post Office Box 240002, M/S JY-45
Huntsville, AL 35824-6402

Mr. Mitchell L. Britt
Engineering Manager
Space Programs/Ground Systems
Teledyne Brown Engineering
300 Sparkman Drive, Mail Stop 168
Huntsville, AL 35807

Mr. Robert J. Brodkin
Supervisor, Training and Productivity
Pasadena Operations - Deep Space Network
Bendix Field Engineering Corporation
129 North Hill Avenue
Pasadena, CA 91106-1906

Mr. Arthur S. Brookman
Manager, Safety, Reliability, Maintainability and
Quality Assurance-Space Station Freedom
Astronautics Division
Lockheed Missiles and Space Company, Inc.
Post Office Box 3504, O/53-20, B/584
Sunnyvale, CA 94089-3504

Mr. Thomas F. Brooks
Director of Materials
Aerospace and Electronics Division
Ketema, Inc.
790 Greenfield Drive
El Cajon, CA 92021

Mr. Alfred O. Brouillet
Manager, New Business
Hamilton Standard Division
United Technologies Corporation
1 Hamilton Road, Mail Stop 1A-2-A66
Windsor Locks, CT 06096

Mr. Dwayne Brown
Public Affairs Officer
Code Q
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Hugh M. Brown
President
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 1659
Titusville, FL 32781-1659

Mr. Larry J. Brown
Space Systems Marketing Manager
Space and Strategic Systems Operation
Honeywell Inc.
13350 U.S. Highway 19 North
Clearwater, FL 34624-7290

Mr. William T. Browne, Jr.
Senior Vice President Sales and Marketing
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Post Office Box 427
Montville, NJ 07045-0427

Mr. J. R. Buckner
Product Assurance Manager
Advanced Systems Division
United Technologies Corporation
140 Sparkman Drive
Post Office Box 1100
Huntsville, AL 35807

Ms. Stephanie T. Burnette
Supervisor, Administration
Grumman Technical Services Division
1250 Grumman Place, 31-018
Titusville, FL 32780

Mr. Daniel R. Burns
Chief, Construction Division
Corps of Engineers
United States Army
Post Office Box 2288
Mobile, AL 36628-0001

Mr. Mark Burzik
Engineering Manager
Teledyne Taber
455 Bryant Street
Tonawanda, NY 14120-0164

Mr. Fred L. Cain
Director, Electronics and
Computer Systems Laboratory
Georgia Tech Research Institute
Georgia Institute of Technology
Centennial Research Building
Atlanta, GA 30332-0420

Mr. Warren L. Camp
Chief, University Liaison
and Productivity Applications Staff
Code PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Charles B. Cappel
Staff Software Specialist
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U06A)
Houston, TX 77058-2775

Ms. Regina M. Capraro
Productivity/Motivational Programs
Representative
Space Systems Division - Florida Operations
Rockwell International Corporation
Post Office Box 21105
Kennedy Space Center, FL 32815

Mr. Gordon P. Carlson
President
GS Aerospace Technology, Inc.
1307 Wanamaker Avenue
Onterio, CA 91761

Mr. Arthur M. Carr
Deputy Project Manager
Huntsville Operations Center
Advanced Technology Incorporated
555 Sparkman Drive, Suite 410
Huntsville, AL 35816

Mr. Charles Carter
Huntsville Division
Boeing Aerospace and Electronics Company
Post Office Box 240002, M/S JY-41
Huntsville, AL 35824-6402

Mr. Claud M. Carter
Supervisor, Software Engineering
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (05AD)
Houston, TX 77058-2775

Mr. Thomas W. Carter
Vice President/Director VAB Operations
Space Services
Thiokol Corporation
Post Office Box 21237, M/S THI-701
Kennedy Space Center, FL 32815

Mrs. Judyth S. Casper
Senior Public Relations Administrator
EG&G Florida, Inc.
410 High Point Drive
Cocoa, FL 32926

Mr. Dean G. Cassell
Vice President, Product Integrity
and Environmental Protection
Grumman Corporation
1111 Stewart Avenue, M/S A23-GHQ
Bethpage, NY 11714-3580

Mr. Richard L. Castille
Quality Improvement Manager
Houston Operations
Boeing Aerospace Operations, Inc.
1045 Gemini, HQ-90
Post Office Box 58747
Houston, TX 77058

Mr. E. Woody Chambers
Account Manager
FORMTEK, Inc.
Lockheed Corporation
Foster Plaza VII
661 Andersen Drive
Pittsburgh, PA 15220

Mr. Paul C. Chaplin
Contract Director
SYRE
Post Office Box 81
Moffett Field, CA 94035

Mr. Willis E. Chapman
Manager, Quality and Productivity
Improvement Programs
Mail Code 111-208
Jet Propulsion Laboratory
National Aeronautics and Space Administration
4800 Oak Grove Drive
Pasadena, CA 91109

Mr. Johnny W. Chappell
Associate General Manager, Integrated
Operations
EG&G Florida, Inc.
BOC-011
Kennedy Space Center, FL 32815

Mr. William B. Chubb
Director, Systems Analysis
and Integration Laboratory
Code EB01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Harry A. Cikanek, III
Heavy Lift Launch Vehicle Definition Office
Code HA31
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Richard Clapper
Chief, Human Resources Development
Mail Code 15-4
Lewis Research Center
National Aeronautics and Space Administration
21000 Brookpark Road
Cleveland, OH 44135

Mr. David Clark
President and Chief Executive Officer
Campbell Soup Company, Limited
60 Birmingham Street
Toronto, Ontario M8V 2B8
CANADA

Mr. Walter S. Clinton, Jr.
Program Manager
Service Contracts Division - Johnson Operations
Calspan Corporation
Post Office Box 580668
Houston, TX 77258

Ms. Ann F. Cohen
Vice President
Government Services Division
Electronic Data Systems Corporation
13600 EDS Drive, A4S-A47
Herndon, VA 22071

Mr. Otto G. Coldiron
Director, Product Assurance
Space and Strategic Systems Operation
Honeywell Inc.
13350 U.S. Highway 19 North, M/S 226-5
Clearwater, FL 34624-7290

Dr. Dale L. Compton
Director
Mail Stop 200-1
Ames Research Center
National Aeronautics and Space Administration
Moffett Field, CA 94035

Ms. Christie L. Connor
Productivity Improvement Coordinator
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Ms. Linda T. Coon
Senior Secretary
Space Systems Division - Florida Operations
Rockwell International Corporation
Post Office Box 21105
Kennedy Space Center, FL 32815

Mr. William Mike Cooney
Vice President, Quality
and Reliability Assurance
Defense Systems and Electronics Group
Texas Instruments
Post Office Box 630311, M/S 3933
Dallas, TX 75266

Ms. Benita A. Cooper
Assistant Administrator for
Headquarters Operations
Code D
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Robert Cooper
Manager, Electronics and Controls
USBI Company Inc.
United Technologies Corporation
Post Office Box 1900
Huntsville, AL 35807

Mr. Stephen T. Cope
Manager of Administration
Service Contracts Division
Calspan Corporation
110-A Mitchell Boulevard
Tullahoma, TN 37388

Mr. Jeffrey M. Corbin
Manager, Total Quality Management
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3021
New Orleans, LA 70189

Mr. Harry G. Craft, Jr.
Manager, Payloads Projects Office
Code JA01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Mercade A. Cramer, Jr.
President and Chief Executive Officer
Vitro Corporation
14000 Georgia Avenue, NW
Silver Spring, MD 20906-2972

Ms. Susan Crandall
Manager of Productivity
Houston Operations
Bendix Field Engineering Corporation
600 Gemini Avenue, M/S B81A-555
Houston, TX 77058-2776

Mr. Victor C. Cravello
Director, Employee Relations
Space and Technology Group
TRW Space and Defense Sector
One Space Park, E1/4006
Redondo Beach, CA 90278

Mr. Ron G. Crawford
Business Development Manager,
NASA Programs
Science Applications International Corporation
1710 Goodridge Drive
Post Office Box 1303
McLean, VA 22102

Mr. David A. Crook
Product Assurance Manager
Space Systems Division
Grumman Corporation
12000 Aerospace Avenue
Houston, TX 77034-5567

Mr. Philip B. Crosby
Chairman and Creative Director
Philip Crosby Associates, Inc.
Post Office Box 2369
Winter Park, FL 32790

Mr. John W. Crosby
Manager, Quality Improvement
Federal Sector Division
IBM Corporation
Route 17C, Mail Drop 0154
Oswego, NY 13827

Mr. Zack Crow
Engineering Manager
Link Flight Simulation Division
CAE-Link Corporation
2224 Bay Area Boulevard
Houston, TX 77058

Mr. Thomas Curry
Corporate Quality Coordinator
Electronic Data Systems Corporation
4965 Preston Park Boulevard
Plano, TX 75093

Mr. Daniel D'Agostino
Associate Safety, Reliability,
and Quality Assurance Project Engineer
USBI Company Inc.
United Technologies Corporation
188 Sparkman Drive, USBI-HV-QE
Huntsville, AL 35807

Mr. Hendrik Daman
Program Director
Applied Technology Division
Computer Sciences Corporation
Building 3205
Stennis Space Center, MS 39529

Mr. Jerry R. Dangler
Associate Director, Product Assurance
Space and Strategic Systems Operation
Honeywell Inc.
13350 U.S. Highway 19 North, M/S 226-5
Clearwater, FL 34624-7290

Mr. George H. Davidson
Vice President and General Manager,
Electronic Systems
Sierra Research Division
LTV Missiles and Electronics Group
247 Cayuga Road, Mail Stop 107
Buffalo, NY 14225

Mr. Allan S. Davis
Manager, Quality Systems
Aerojet ASRM Division
1 NASA Drive, Department 7450
Iuka, MS 38852-8998

Mr. George W. Davis
Director
Florida Operations
Boeing Aerospace Operations, Inc.
1355 North Atlantic Avenue
Post Office Box 320220
Cocoa Beach, FL 32932

Mr. Philip W. Davis
Space Station Freedom Program Office
National Aeronautics and Space Administration
10701 Parkridge Boulevard
Reston, VA 22091

Mr. Richard M. Davis
President
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3000
New Orleans, LA 70189

Mr. Robert D. Davis
Space Station Lead Engineer
Technical Analysis, Inc.
4910 Corporate Drive, N.W., Suite A
Huntsville, AL 35805

Mr. Ronald S. Davis
Director
Ver-Val Enterprises, Inc.
Apollo Road
Post Office Box 9262
Marshall Space Flight Center, AL 35812-4550

Mr. M. Ray Dean
President
Teledyne Taber
455 Bryant Street
Tonawanda, NY 14120-0164

Mr. Wesley H. Dean
Director, Procurement
Mail Code SI-PRO
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Julianne Dearth
Director, Quality Engineering
Space Systems Division
Fairchild Space Company
20301 Century Boulevard, M/S D-14
Germantown, MD 20874-1181

Mr. Michel deConinck
Sales Representative
Government Services Division
Electronic Data Systems Corporation
13600 EDS Drive, A6S-C51
Herndon, VA 22071

Mr. John deGeneres
Director, Productivity
and Motivational Programs
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3000
New Orleans, LA 70189

Mr. Don Denise
Manager, Quality Assurance
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Post Office Box 427
Montville, NJ 07045-0427

Mr. Oran L. Dial
Operations Director
Applied Technology Division
Computer Sciences Corporation
16511 Space Center Boulevard
Houston, TX 77058

Mr. John N. (Jack) Dickinson
General Manager
Facility Operations and
Support Services Contract
Pan Am World Services, Inc.
Johnson Controls, Inc.
Building 2204
Stennis Space Center, MS 39529-6000

Mr. Charles Dina
Vice President - Administration
Telephonics Corporation
815 Broad Hollow Road
Farmingdale, NY 11743

Mr. John C. Dodd
Director of Quality and Productivity
Enhancement - SEAS Program
System Sciences Division
Computer Sciences Corporation
4600 Powder Mill Road, Room A116
Beltsville, MD 20705

Mrs. Marsha L. Dollerhide
Executive Advisor
Space Systems Division
Rockwell International Corporation
555 Discovery Drive
Huntsville, AL 35806

Mr. Charlie H. Donald
SSFP Product Assurance Director
Huntsville Division
Boeing Aerospace and Electronics Company
Post Office Box 240002, JS-10
Huntsville, AL 35807-6402

Mr. Robert V. Donnelly
Materials Manager
Gates Aerospace Batteries
Post Office Box 2520
Gainesville, FL 32602

Ms. Tina M. Doty
Vice President, Quality Assurance
Leach Corporation
6900 Orangethorpe Avenue
Buena Park, CA 90620-1386

Mr. John W. Doyle
SRB Inspection Chief
Space Services
Thiokol Corporation
Post Office Box 21237
Kennedy Space Center, FL 32815-0707

Mr. Ronald Drendel
Supervisor, Manufacturing Engineering
Applied Science Division
Perkin-Elmer Corporation
2771 North Garey Avenue
Post Office Box 2801
Pomona, CA 91767

Dr. John C. Drummond
Director, Quality Systems
Mason and Hanger-Silas Mason Company Inc.
2355 Harrodsburg Road
Lexington, KY 40504-3363

Mr. James R. Dubay
President and General Manager
EG&G Florida, Inc.
Post Office Box 21267
Kennedy Space Center, FL 32815

Mr. C. (Pat) W. Duffy
Director, Continuous Quality Improvement
Aerospace and Electronics Division
Boeing Defense and Aerospace Group
Post Office Box 3999, MS 85-15
Seattle, WA 98124-2499

Mr. Philip B. DuPriest
Director of Marketing
Government Information Services
Boeing Computer Services
7980-90 Boeing Court, CR-22
Vienna, VA 22180-9990

Mr. Jon A. Dutton
Director, Engineering
Martin Marietta Manned Space Systems
Post Office Box 29304
New Orleans, LA 70189

Ms. J. Jeannette Eads
Manager, Productivity Systems
EG&G Florida, Inc.
Post Office Box 21267, BOC-013
Kennedy Space Center, FL 32815

Mr. Robert E. Eddy
Director of Engineering and Technical Services
Mail Stop 200-5
Ames Research Center
National Aeronautics and Space Administration
Moffett Field, CA 94035

Mr. Scott Edwards
Program Manager
HR Textron Inc.
25200 West Rye Canyon Road
Valencia, CA 91355

Mr. Baron Eickhoff
Boeing Computer Support Services
Post Office Box 21145
Kennedy Space Center, FL 32815-0145

Mr. Phillip R. (Bob) Elder
Director, Total Quality Management
Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue, M/S AA14
Canoga Park, CA 91303

Mr. Eugene N. Elleman
Deputy Project Manager
Lewis Research Center
Cortez III Service Corporation
3000 Aerospace Parkway
Brookpark, OH 441412

Mr. Larry R. Elliott
Director, Design Engineering
USBI Company Inc.
United Technologies Corporation
188 Sparkman Drive
Post Office Box 1900
Huntsville, AL 35807

Mr. James L. Ellison
Manager, CMS Mission Support Program Office
New Technologies Inc.
Post Office Box 5128, Ardmore Station
Huntsville, AL 35814-5128

Ms. Geneviene R. Emry
Director, Organizational Excellence
and Employee Communications
Space Systems Division
Rockwell International Corporation
D/022, 841-AB90
12214 Lakewood Boulevard
Downey, CA 90241

Dr. Robert A. Emry
Associate Dean and Professor of
School of Communication
California State University, Fullerton
Fullerton, CA 92634

Mr. H. Joseph Engle
Chairman of the Board and President
Bendix Field Engineering Corporation
One Bendix Road
Columbia, MD 21045-1897

Mr. George L. English
Director, Executive Management Office
Mail Code EX
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Charles M. Ericson
Manager, Product/Process Technology
Westinghouse Productivity and Quality Center
Route 22/30 and McKee Road
Oakdale, PA 15071

Mr. J. Wayne Esser
Vice President - Program Development
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058-2711

Mr. Roy S. Estess
Director
John C. Stennis Space Center
National Aeronautics and Space Administration
Stennis Space Center, MS 39529-6000

Mr. Charles (Dick) R. Eubanks
Director, Safety, Reliability
and Environmental Operations
Bacchus Works
Hercules Aerospace Company
Post Office Box 98, EUW3
Magna, UT 84044-0098

Mr. J. W. Evers
Director, Manned Space Support Systems
Space Systems Division
Unisys Defense Systems
595 Gemini Avenue
Houston, TX 77058-2775

Mr. George R. Faenza
Vice President - General Manager
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Ms. Nancy A. Falk
Marketing Representative
Barrios Technology, Inc.
1331 Gemini Avenue, BARR-3-105
Houston, TX 77058-2711

Mr. Gordon W. Fasbender
Program Manager
Flight Equipment Processing Contract
Houston Engineering and Space Operations
Boeing Aerospace Operations, Inc.
1045 Gemini Avenue, HF-01
Houston, TX 77058

Mr. Louis S. Favata
Director
Launch Support Services
Martin Marietta Manned Space Systems
Mail Point MMC-1
KSC Launch Support Services
Kennedy Space Center, FL 32899

Dr. Emmett B. Ferguson
Medical Director, EGG-500 Occupational
Medicine and Environmental Health Services
EG&G Florida, Inc.
Post Office Box 21296, BOC-005
Kennedy Space Center, FL 32815

Mr. James G. Ferguson
Manager, Operations
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812-9022

Mr. William K. Fikes
Director, Preliminary Design Office
Program Development Directorate
Code PD01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Ms. Margaret G. Finarelli
Associate Administrator for External Relations
Code X
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Leo C. Fisher
Vice President, Continuous Quality Improvement
The Boeing Company
Post Office Box 3707, M/S 13-07
Seattle, WA 98124-2207

Mr. Jerry J. Fitts
Deputy Associate Administrator for
Space Operations
Code O
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Thomas H. Forbes, CQA
Quality Manager
Government Services Division
Electronic Data Systems Corporation
13600 EDS Drive
Herndon, VA 22071

Ms. Ann M. Ford
Manager of Quality, Security, and Safety
Brown Associates Management
Services, Inc. (BAMSI)
Post Office Box 1659
Titusville, FL 32781-1659

Ms. Helen Ford
Staff TQMI Manager
Huntsville Division
McDonnell Douglas Space Systems Company
689 Discovery Drive
Huntsville, AL 35806

Mr. J. N. Foster
Vice President
Huntsville Region
Brown and Associates Management
Services, Inc. (BAMSI)
150 West Park Loop, Suite 103
Huntsville, AL 35806

Mr. Michael W. Foster
Chief Financial Officer
Unitech Composites, Inc.
10413 Industrial Way
Post Office Box 370
Hayden Lake, ID 83835-0370

Mr. Richard B. Foster
c/o Mr. Thomas S. Marotta
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Post Office Box 427
Montville, NJ 07045-0427

Mr. David S. Foxx
Senior Engineer TQM, ALS
Space Systems Division
General Dynamics Corporation
Post Office Box 85990, M/Z 32-7004
San Diego, CA 92186

Mr. Joseph A. Frankovsky
Staff Vice President, Total Quality Management
General Dynamics Corporation
7733 Forsyth Boulevard
St. Louis, MO 63105-1861

Mr. I. R. (Ray) Frazier
Director Product Assurance
Santa Barbara Research Center
Hughes Aircraft Company
75 Coromar Drive, B1/35
Goleta, CA 93117

Mr. Mark E. Frazier
Division Vice President,
Quality Assurance Electronics Division
General Dynamics Corporation
Post Office Box 85106, M/Z 8921-Q
San Diego, CA 92117

Mr. Jack L. Frier
Vice President of Materiel
and Vendor Development
BFM Energy Products
2040 East Dyer Road
Santa Anna, CA 92705-5777

Mr. Wayne D. Frier
Chief Scientist, Quality Directorate
Electro-Optical and Data Systems Group
Hughes Aircraft Company
Building E53, Mail Stop E235
Post Office Box 902
El Segundo, CA 90245

Mr. Joseph Fuller, Jr.
President
Futron Corporation
7315 Wisconsin Avenue, Suite 400 West
Bethesda, MD 20814-3202

Mr. Alfred H. Fulmer
Operations Manager
Space Systems Division
Advanced Technology Incorporated
555 Sparkman Drive, Suite 410
Huntsville, AL 35816

Mr. Philip A. Gaita
Vice President, Quality Assurance
Loral Infrared and Imaging Systems, Inc.
2 Forbes Road, MS 241
Lexington, MA 02173

Mr. Gregory M. Gallant
Manager, Quality Engineering Department
Delco Systems Operations
Delco Electronics Corporation
6767 Hollister Avenue, A-201
Goleta, CA 93117

Mr. Daryal T. Gant
Deputy Assistant Laboratory Director
Office of Administrative Divisions
Mail Stop 180-504
Jet Propulsion Laboratory
National Aeronautics and Space Administration
4800 Oak Grove Drive
Pasadena, CA 91109

Mr. Robert M. Garceau
Program Manager
Harris Space Systems Corporation
Post Office Box 5000
Rockledge, FL 32955

Mr. U. Edwin Garrison
President and Chief Executive Officer
Executive Offices
Thiokol Corporation
2475 Washington Boulevard
Post Office Box 9260
Ogden, UT 84409

Mr. Keith R. Garrity
Chairman and Chief Executive Officer
Fansteel
Number One Tantalum Place
North Chicago, IL 66064

Mr. Edward U. Gascon
Deputy Program Manager
Houston Operations
Bendix Field Engineering Corporation
600 Gemini Avenue, M/S B23A-555
Houston, TX 77058-2776

Dr. Ekkehart Gasper
General Manager
Systems Engineering and Analysis Division
Planning Research Corporation
1500 Planning Research Drive
McLean, VA 22102

Dr. Clarence R. Gates
Associate Director
Mail Stop 180-900
Jet Propulsion Laboratory
National Aeronautics and Space Administration
4800 Oak Grove Drive
Pasadena, CA 91109

Dr. John Gayle
Percision Fabricating and Cleaning Inc.
505 Canaveral Groves Boulevard
Cocoa, FL 32926

Mr. Dennis J. George
Vice President and General Manager
Split Ballbearing Division
MPB Corporation
Highway 4
Lebanon, NH 03766

Dr. Marco J. Giardino
Productivity Officer
John C. Stennis Space Center
National Aeronautics and Space Administration
Building 1110
Stennis Space Center, MS 39529-6000

Mr. Charles L. Gibbons
Deputy General Manager
EG&G Florida, Inc.
Post Office Box 21267, BOC-013
Kennedy Space Center, FL 32815

Mr. Charles T. Gibbons
Federal Marketing Manager
U. S. Sprint
8229 Boone Boulevard, Suite 500B
Vienna, VA 22182

Mr. Ronald L. Gilworth
Manager, Quality Assurance
Air and Space Division
Parker Hannifin Corporation
18321 Jamboree Boulevard, M/S F9
Irvine, CA 92715

Mr. Jonathan Gispan
General Manager, Ground Systems
Program Department
Military and Data Systems Operations
GE Aerospace
4000 Geerdes Boulevard
King of Prussia, PA 19406

Mr. Benjamin C. Glenn
Director, Safety, Reliability,
Maintainability and Quality Assurance
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212, Code USBI-QA
Kennedy Space Center, FL 32815

Mr. Richard D. Gloor
TRW Space and Technology Group
4843 Blackhorse Road
Rancho Palos Verdes, CA 90274

Mr. William W. Gluyas, Jr.
President
E.G.P., Inc.
1420 West Washington Street
Orlando, FL 32805

Mr. Harvey I. Gold
Director, Engineering
Space Operations Division
Unisys Defense Systems
5151 Camino Ruiz
Camarillo, CA 93010

Mr. Steven D. Goo
IOS Futures Manager
Space Systems Division
Boeing Aerospace and Electronics Company
Post Office Box 3999, 8A-11
Seattle, WA 98124

Mr. Fred H. Goodwin
Product Manager, S&SS
Hamilton Standard Division
United Technologies Corporation
One Hamilton Road, M/S 1A-2-WS9
Windsor Locks, CT 06096-1010

Mr. Alden B. Gorham
Director, Advanced Programs
Aerospace Division
World Services, Inc.
7315 North Atlantic Avenue
Cape Canaveral, FL 32920-3792

Mr. Craig Gorris
Deputy General Manager
Technology Assurance Division
Analex Corporation
21775 Brookpark Road
Fairview Park, OH 44126-3224

Mr. Richard L. Grant
Vice President, Space Station Freedom Program
Aerospace and Electronics Division
Boeing Defense and Space Group
499 Boeing Boulevard, M/S JA-63
Post Office Box 240002
Huntsville, AL 35824-6402

Mr. Jack Grass
Division Manager
Space, Energy and Environment Sector
Science Applications International Corporation
22021 Brookpark Road
Fairview, OH 44126

Mr. Peter E. Graube
Senior Control Systems Engineer
Sverdrup Technology, Inc.
Mail Stop 213-15
Ames Research Center
Moffett Field, CA 94035-1000

Mr. William W. Greer
Vice President, Engineering
and Quality Assurance
Learjet, Inc.
Wichita Mid-Continent Airport
Post Office Box 7707
Wichita, KS 67227-7707

Ms. Phyllis H. Grela
Quality Control Manager
Teledyne Brown Engineering
300 Sparkman Drive, Mail Stop 29
Huntsville, AL 35807

Mr. Clark A. Griffiths
Director of Engineering
Split Ballbearing Division
MPB Corporation
Highway 4
Lebanon, NH 03766

Mr. Barry Grimm
Deputy Manager, Product Assurance
Western Programs Office
Lockheed Engineering and Sciences Company
Post Office Box 168
Moffett Field, CA 94035-5000

Ms. Donna R. Grossman
Total Quality Management Coordinator
Government Aerospace Systems Division
Harris Corporation
Post Office Box 94000, M/S 101/4087
Melbourne, FL 32902

Mr. Gene Guerny
Quality and Productivity Officer
Mail Code 200
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20678

Mr. Robert M. Gunn
Deputy Director, Product Engineering
and Definition
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Dr. Neil W. Haars
Vice President and Deputy General Manager
Marshall Space Flight Center Group
Sverdrup Technology, Inc.
620 Discovery Drive
Huntsville, AL 35806

Mr. John J. Haas
Quality Assurance Manager
Sheldahl Incorporated
1150 Sheldahl Road
Post Office Box 170
Northfield, MN 55057

Mr. Sam Haddad
Chief, Programs and Planning Office
Biomedical Operations and Research Office
Code MD-PLN
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Robert B. Hahn
President
Aerochem, Inc.
1885 North Batavia
Orange, CA 92665

Ms. Florette J. Haisten
Manager, Customer and Business Relations
Huntsville District Office
Rocketdyne Division
Rockwell International Corporation
2227 Drake Avenue, Suite 45
Huntsville, AL 35805

Mr. Maurice G. Hale
Professional Engineer
Space, Energy and Environment Sector
Science Applications International Corporation
6725 Odyssey Drive
Huntsville, AL 35806

Mr. Jim Halfman
Director, Quality Assurance
Aerojet ASRM Division
1 NASA Drive, Department 7400/QA
Iuka, MS 38852-8998

Mr. Walter E. Hall
Manager, Productivity
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Mr. Larry D. Halsne
Vice President, Quality Assurance
Aerospace Division
Rosemount, Incorporated
14300 Judicial Road
Burnsville, MN 55337

Mr. H. Craig Hamling
Vice President, Production Operations
Zircar Products Inc.
110 North Main Street
Florida, NY 10921

Mr. Robert D. Hammond
Director, Business Pursuits and Special Projects
Space Systems Division
Rockwell International Corporation
12214 Lakewood Boulevard, M/C FC08
Downey, CA 90241

Mr. Roy W. Hankey
Photographer
Data Service Center
Rockwell International Corporation
12214 Lakewood Boulevard
Downey, CA 90241

Mr. Edward G. Hantz
Director, Total Quality Process
Grumman Corporation
1111 Stewart Avenue, M/S A23-GHQ
Bethpage, NY 11714

Mr. Charles S. Harlan
Director, Safety, Reliability
and Quality Assurance
Code NA
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Ms. Gail R. Harleston
TQM Manager for NASA Headquarters
Office of Headquarters Operations
Code DR
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Glenn P. Harrigal
Productivity Specialist
Lewis Research Center
Cortez III Service Corporation
3000 Aerospace Parkway
Brookpark, OH 44142

Ms. Jessie J. Harris
Executive Officer
Code AE
National Aeronautics and Space Administration
Washington, DC 20546

Mr. John Harris
Contracts Specialist
Convair Division
General Dynamics Corporation
Post Office Box 85357
San Diego, CA 92138

Mr. L. Steven Harris
Associate General Manager, Engineering
EG&G Florida, Inc.
Post Office Box 21267
Kennedy Space Center, FL 32815

Mr. Stephen J. Harris
Director, Total Quality Management
Space Operations
Thiokol Corporation
Post Office Box 707, Mail Stop A20
Brigham City, UT 84302-0707

Mr. Laurence L. Harter
Vice President, Product Assurance
Fairchild Space Company
20301 Century Boulevard, M/S D-14
Germantown, MD 20874-1181

Dr. Edward J. Hecker
Productivity Applications Staff
Code PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Dean E. Helling
General Manager
Engineering Support Contract
Boeing Aerospace Operations, Inc.
Mail Stop: FA-48
Kennedy Space Center, FL 32899

Mr. Kenneth C. Hendershot
General Manager
Service Contracts Division - Ames Operations
Calspan Corporation
Ames Research Center
Post Office Box 7
Moffett Field, CA 94035-0007

Ms. Johnnie A. Henderson
Development and Verification Quality
Coordinator
Federal Sector Division
IBM Corporation
3700 Bay Area Boulevard, MC 6402B
Houston, TX 77058-1199

Mr. William (Frank) Henley
Director, Huntsville Operations
Systems Services Division
Planning Research Corporation
7911 Charlotte Drive
Huntsville, AL 35802

Mr. Craig A. Henry
Project Manager, Special Projects
American Society for Quality Control
310 West Wisconsin Avenue
Milwaukee, WI 53203

Mr. Leroy J. Henry
Manager, Product Assurance
Space Services
Thiokol Corporation
Post Office Box 21237
Kennedy Space Center, FL 32815-0707

Mr. William R. Henry
Chief, ADP Planning and Analysis Office
Mail Stop 233-15
Ames Research Center
National Aeronautics and Space Administration
Moffett Field, CA 94035

Mr. Richard M. Herman
Program Manager/SPIP
Hercules Aerospace Company
Post Office Box 98, M/S PA2A4
Magna, UT 84044

Mr. Joseph A. Hermann
General Manager, Space Business Group
Aerospace
Cincinnati Electronics Corporation
7500 Innovation Way
Mason, OH 45040

Mr. Thomas W. Herrala
Vice President and General Manager
Space and Sea Systems
Hamilton Standard Division
United Technologies Corporation
One Hamilton Road, MS 1A-2-W61
Windsor Locks, CT 06096-1010

Mr. Robert P. Hessler
Manager, Communications
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Mrs. Jan Heuser
Chief, Core Management Staff
Code DC-DSD-1
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Rickey B. Hicks
Data Analyst Specialist
Grumman Technical Services Division
1250 Grumman Place
Titusville, FL 32780-7900

Ms. Kathy S. Hill
Specialist, Quality and Productivity
Integrated Information Services
Boeing Computer Support Services
Post Office Box 5128, EC-00
Huntsville, AL 35814-5128

Mr. Lonnie D. Hill
Director of Business Management
Boeing Aerospace Operations, Inc.
1355 North Atlantic Avenue
Post Office Box 320220
Cocoa Beach, FL 32932

Mr. Robert W. Hill
Plant Engineering Supervisor
BMMS Contract
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 8395, Redstone Arsenal
Huntsville, AL 35808

Mr. Stanley J. Hill
President
Kaiser Electronics
Kaiser Aerospace and Electronics Corporation
2701 Orchard Park Way
San Jose, CA 95134

Mr. John J. Hoda
Manager, Quality Engineering
Aerospace Operations Division
GE Aerospace
Building 100, Room M2216
Post Office Box 8555
Philadelphia, PA 19101

Mr. Craig V. Hodson
Supervisory Electronics Engineer
Naval Ship Weapons System Engineering Station
Code 4V10
United States Navy
Port Hueneme, CA 93043-5007

Mr. Benjamin E. Hoffman
Operations Manager
Systems and Support Service Operations
Wyle Laboratories
3200 Magruder Boulevard
Hampton, VA 23666

Mr. William A. Holden
Deputy, Project Engineering
and Integration Division
Code SI-PEI
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Christospher J. Holloway
Division Pursuit of Excellence Director
Interior Furnishings and
LeGrange Industrial Division
Milliken & Company
201 Industrial Drive
LaGrange, GA 30240

Mr. James F. Holloway
Product Development
Pratt & Whitney
United Technologies Corporation
Post Office Box 109600, M/S 702-06
West Palm Beach, FL 33410-9600

Mr. Paul J. Holyoak
Program Manager
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812-4603

Mr. Henry R. Hopkins
Contracts Manager, Headquarters
Boeing Computer Support Services
Office Park South, Suite 405
700 Boulevard South
Huntsville, AL 35802

Mr. Napoleon Hornbuckle
Vice President and General Manager
Strategic Electronics Division
Motorola Government Electronics Group
2501 South Price Road
Chandler, AZ 85248-2899

Mr. Robert A. Horrigan
Account Manager, LIMS
Government Services Division
Electronic Data Systems Corporation
2025 Center Ridge Road, Suite 310
Rocky River, OH 44116

Ms. Truda E. Hosler
Manager, Integrated Support Services
Link Flight Simulation Division
CAE-Link Corporation
2224 Bay Area Boulevard, I-1N1
Houston, TX 77058-2099

Mr. Robert E. Howard
Manager of Training and Development
USBI Co., Inc./United Technologies Corporation
188 Sparkman Drive, Code USBI-HV-IR
Post Office Box 1900
Huntsville, AL 35807

Mr. Roy W. Howard
GE Project Manager
Marshall Space Flight Center
General Electric Company
Building 4207
Post Office Box 9003
Marshall Space Flight Center, AL 35812

Mr. Thomas Howell
Vice President and Director of Engineering
Deutsch Engineered Connecting Devices
700 South Hathaway
Banning, CA 92220

Mr. Chun Hsu
Vice President
New Technology Inc.
700 Boulevard South, Suite 401
Huntsville, AL 35802

Mr. Charles O. Hughes
Quality Strategy Director
Bell Laboratories
American Telephone and Telegraph Company
Crawfords Corner Road
Holmdel, NJ 07038-1988

Ms. Frieda Hughes
Editorial Assistant
Association for Quality and Participation
801B-West 8th Street
Cincinnati, OH 45203

Mr. R. Keith Humphryes
Project Manager
Shuttle Processing Project
Pan Am World Services, Inc.
7315 North Atlantic Avenue
Cape Canaveral, FL 32920

Mr. Wayne F. Huning
Program Manager
Engineering Services Division
McDonnell Douglas Space Systems Company
600 Maryland Avenue, SW, Suite 301 East
Washington, DC 20024

Ms. Ann K. Hunt
Graphics Illustrator
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Mr. Spencer Hutchens, Jr.
Senior Vice President
Intertek Services Corporation
930 Indian Peak Road
Rolling Hills, CA 90274

Mr. Norman N. Jacobson
Communications Engineer
Code TE-CID-1
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Bruce L. Jansen
Chief, Plans, Policy, and Compliance Office
Code RQ-POL
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Joyce R. Jarrett
Director, NASA Quality and
Productivity Improvements Program
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Limas Jefferson
President and Chief Executive Officer
Jefferson Associates, Inc.
1120 NASA Road One, Suite 100
Houston, TX 77058

Dr. Harriett G. Jenkins
Assistant Administrator for
Equal Opportunity Programs
Code E
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Kenneth J. Jernigan
Technical Assistant to the Director of Safety,
Reliability and Quality Assurance
Code RQ
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Bradley A. Johnson
Director
Space Systems Division
CTA, Inc.
6116 Executive Boulevard, Suite 800
Rockville, MD 20852

Mr. Gary W. Johnson
Deputy Director, Safety, Reliability
and Quality Assurance
Code NA
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Mr. James A. Johnson
Quality Manager
Alpha Building Corporation
1802 Northeast Loop 410, Suite 104
San Antonio, TX 78217

Mr. James R. Johnson
Assistant to the Director
Administrative Operations Office
Code CO01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. John G. Johnson
Vice President for Manufacturing
Electronic Systems Sector
Harris Corporation
Post Office Box 37, M/S 2-1120
Melbourne, FL 32902

Mr. Philip H. Johnson
Vice President and Director
Space Operations
Bendix Field Engineering Corporation
10210 Greenbelt Road, Suite 820
Seabrook, MD 20706

Mr. Richard Johnson
Program Manager
Space and Communications Group
Hughes Aircraft Company
Post Office Box 92919
Los Angeles, CA 90009

Mr. Victor N. Johnson
Associate Technical Director for Quality
Naval Ship Weapon Systems Engineering Station
Code 4V10
United States Navy
Port Hueneme, CA 93043-5007

Mr. James K. Jones
Division Manager,
Supervisory Electronics Engineer
Naval Ship Weapons System Engineering Station
Code 4L20
United States Navy
Port Hueneme, CA 93043-5007

Mr. Marvin L. Jones
Deputy Director of Center Support Operations
Mail Code SI
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Robert G. Jones
Executive Vice President
Space Systems Division
Rockwell International Corporation
Mail Code AB05
12214 Lakewood Boulevard
Downey, CA 90241

Mr. Robert G. Jones
General Manager
Air and Space Division
Parker Bertea Aerospace
Parker Hannifin Corporation
18321 Jamboree Road, M/S F-2
Irvine, CA 92715

Mr. Elmer B. Kaelin
President
Potomac Edison Company
227 Potomac Heights
Hagerstown, MD 21740

Mr. William C. Kahle
System Safety Engineer
Mail Code FA20
John C. Stennis Space Center
National Aeronautics and Space Administration
Stennis Space Center, MS 39529-6000

Mr. Michael J. Kahn
Director, Quality Assurance Operations
Space Operations
Thiokol Corporation
Post Office Box 707
Brigham City, UT 84302-0707

Ms. Cindy S. Kane
Supervisor of Facilitation
Electronic Systems Division
Harris Corporation
Post Office Box 9900, Room 2-2013
Melbourne, FL 32902

Mr. Darrell A. Katz
Manager, TQM/PMT
Martin Marietta Missile Systems
Post Office Box 555837
Orlando, FL 32855-5837

Ms. Susanne Kavanogh
Quality Engineer
Apollo Systems Division
Hewlett-Packard Company
300 Apollo Drive
Chelmsford, MA 01824

Ms. Sheila H. Keegan
Project Manager
Mail Stop 255-1
Quad S Company
Ames Research Center
Moffett Field, CA 94035-1000

Dr. Andrew L. Keller
Director, Engineering Business Management
Space Systems Division
General Dynamics Corporation
Post Office Box 85990, M/Z 23-8930
San Diego, CA 92186-5990

Mr. Franklin M. Keller
Director, Product Assurance
Space Station Division
McDonnell Douglas Space Systems Company
5301 Bolsa Avenue, M/C 17-8
Huntington Beach, CA 92647-2099

Mr. Ted W. Keller
Manager, On-Board Shuttle Project
Coordination and Configuration Manager
Federal Sector Division
IBM Corporation
3700 Bay Area Boulevard, M/C 6772-A
Houston, TX 77058-1199

Mr. Joseph M. Kerr
Manager Human Resources Development
Aircraft Systems Division
Simmonds Precision Products Inc.
Hercules Aerospace Corporation
Panton Road
Vergennes, VT 05491

Mr. Edgar D. Kersey
Technical Assistant to the Director
of Space Transportation System Management
Code TM
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Robert J. Keymont
Vice President of Production Operations
Martin Marietta Missile Systems Company
Post Office Box 555837, M/P-233
Orlando, FL 32855-5837

Ms. Roxanne Kichar
Senior Training Consultant
Operations Technology
Lockheed Missiles and Space Company, Inc.
1111 Lockheed Way, Building 573 0-48-01
Sunnyvale, CA 94088-3504

Mr. Charles Anderson King
Technology Applications Inc.
6101 Stevenson Avenue
Alexandria, VA 22304

Mr. John P. King
Vice President and Division Manager
Elkton Division
Thiokol Corporation
55 Thiokol Road
Post Office Box 241
Elkton, MD 21921

Ms. Louise C. Kitchen
Senior Systems Analyst
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U01K)
Houston, TX 77058-2775

Ms. Nancy V. Klein
Space Operations NASA Headquarters Liaison
Bendix Field Engineering Corporation
Aerospace Building, Suite 810
10210 Greenbelt Road
Seabrook, MD 20706

Mr. Ron F. Klein
Director, Space Communication
Government Aerospace Systems Division
Harris Corporation
Post Office Box 94000, Mail Stop 101/4740
Melbourne, FL 32902

Mr. John J. Klenert
Systems Consultant
Federal Systems Division
American Telephone and Telegraph Company
8403 Colesville
Silver Springs, MD 20910

Mr. David H. Kline
Director
Center for Instructional Research
and Development
Potomac Edison Company
Downsville Pike
Hagerstown, MD 21740

Mr. Brian T. Knipfing
Senior Group Engineer
Launch Support Services
Martin Marietta Manned Space Systems
Mail Code MMC
Kennedy Space Center, FL 32899

Ms. Cheryl M. Knoer
Staff Engineer
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U03A)
Houston, TX 77058-2775

Mr. Richard W. Knudsen
Director, Quality Assurance
Harris Space Systems Corporation
295 Barnes Boulevard
Post Office Box 5000
Rockledge, FL 32955

Ms. Barbara G. Kolkhorst
Senior Systems Engineer,
Onboard Space Systems
Federal Sector Division
IBM Corporation
3700 Bay Area Boulevard, MC 6272A
Houston, TX 77058-1199

Dr. Albert M. Koller, Jr.
KSC TQM Focal Point
Mail Code PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Roy Koster
Manager, Southeast Marketing
Kearfott Guidance and Navigation Corporation
2702 Camille Way
Lawrenceville, GA 30244

Mr. Samuel Kouvaris
Performance Assurance Manager
COMSAT Laboratories
Communications Satellite Corporation
22300 Comsat Drive
Clarksburg, MD 20871

Mr. Carl R. Kovich
Quality Manager
Alpha Building Corporation
1802 Northeast Loop 410, Suite 104
San Antonio, TX 78217

Mr. Joseph A. Kratovil
Deputy Director, Industrial Relations Division
Office of External Relations
Code XN
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Imants (Monte) Krauze
Director, Quality and Productivity
Bendix Field Engineering Corporation
Department 763
One Bendix Road
Columbia, MD 21045

Mrs. Joan T. Krichten
Government Systems
Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown, PA 18195-1501

Mr. Paul L. Kruelle
Vice President, Systems and Technology
Unisys Defense Systems
8201 Greensboro Drive (11N4A)
McLean, VA 22102

Mr. Gene J. Kucinkas
President and Chief Executive Officer
Datamax Computer Systems
44421 North 10th Street W, Suite C
Lancaster, CA 93534

Mr. Thomas J. Kucskar
Quality Assurance Manager
Teledyne Taber
455 Bryant Street
Tonawanda, NY 14120-0164

Mr. G. William Kuhfuss
Product Assurance Manager
Ground Systems Program Department
GE Aerospace
Post Office Box 8048, Room 22S05
Philadelphia, PA 19101

Mr. Alan M. Kulchak
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Mr. Girard Laborriere
Senior Manager, Logistic Support
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Mr. Richard D. Lander
Executive Vice President
and Chief Operating Officer
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Montville, NJ 07045-0427

Mr. Thomas F. (Rick) Landers
Project Engineer
Launch Support Services
Martin Marietta Manned Space Systems
Mail Code MMC-15
Kennedy Space Center, FL 32899

Ms. Marie R. Larence
Account Representative
Federal Systems
Zenith Data Systems
2455 Horse Pen Road
Herndon, VA 22071

Mr. Jordan A. Law
Vice President and General Manager
Kaynar Manufacturing Division
Microdot, Inc.
800 South State College Boulevard
Fullerton, CA 92634-3001

Mr. Fred Leake
Manager, Quality Assurance
Fibers and Materials Division
B.P. Chemicals (HITCO) Inc.
700 East Dyer Road
Santa Ana, CA 92705-5614

Dr. Jerry Lebo
Senior Scientist
Advanced Technology Incorporated
12001 Sunrise Valley Drive
Reston, VA 22091

Mr. Larry E. Lechner
Productivity Improvement Office
Administrative Operations Office
Code CO03
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Ms. Brenda A. Ledet
Technical Assistant to Site Manager
Federal Sector Division
IBM Corporation
3700 Bay Area Boulevard
Houston, TX 77058-1199

Dean R. Lee, Ph.D.
Director, Quality/Productivity
Systems Services Group
Unisys Defense Systems
8201 Greensboro Drive, Suite 900
McLean, VA 22102

Mr. Fred R. Lee
President
TQM Tracks Inc.
Post Office Box 103
Duluth, GA 30136

Ms. Sharon D. Lee
Quality Consultant
Federal Systems Division
American Telephone and Telegraph Company
8403 Colesville Road, Room 12, SB18
Silver Springs, MD 20910

Mr. Thomas J. (Jack) Lee
Director
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Ms. Jeanne LeFevre
Deputy Program Manager for Process
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U01K)
Houston, TX 77058-6775

Mr. I. Jacob Lefman
Manager, Quality Assurance
Energy Systems Group
Science Applications International Corporation
20030 Century Boulevard, Suite 201
Germantown, MD 20874

Mr. Glen W. Lenox
Senior Vice President and General Manager
Advanced Systems Division
United Technologies Corporation
10180 Telesis Court
San Diego, CA 92121

Mr. Roy C. Lester
Division Manager, Planning
and Technical Support
Space Programs
Science Applications International Corporation
400 Virginia Avenue, SW, Suite 810
Washington, DC 20024

Ms. Jean C. Lewandowski
Code RO
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Herbert Lindsey
Chief, Operations Office
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 8395
Redstone Arsenal, AL 35808

Mr. Robert E. Lindstrom
Senior Vice President and General Manager
Space Operations
Thiokol Corporation
Post Office Box 707
Brigham City, UT 84302-0707

Mr. Richard C. Lindstrom
General Manager, Operations
International Fuel Cells
United Technologies Corporation
195 Governor's Highway
Post Office Box 739
South Windsor, CT 06074

Mr. Robert M. (Mike) Little
Vice President
Government Information Services
Boeing Computer Services
Post Office Box 24346, #7A-49
Seattle, WA 98124

Mr. John Lombardi
Director, Safety, Reliability,
and Quality Assurance
Houston Operations
Bendix Field Engineering Corporation
600 Gemini Avenue, M/S B81A-555
Houston, TX 77058-2776

Mr. John F. Loonam
Director, DSD Information
Resources Management
Grumman Data Systems
1111 Stewart Avenue, B04-111
Bethpage, NY 11714-3584

Mr. Jon Love
Quality Manager
Federal Systems Division
American Telephone and Telegraph Company
1120 20th Street, NW, 4th Floor
Washington, DC 20036

John W. Lovitt, Ed.D.
Manager, Performance Management
Aerospace Division
World Services, Inc.
Building 2204
Stennis Space Center, MS 39529-6000

Captain Mark Lua, USAF
Office of the Inspector General
ATTN: AFLC/IGIB
United States Air Force Logistics Command
Wright-Patterson Air Force Base, OH 45433

Ms. Donna M. Lucas
Code PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Alfonso J. Ludi
Director, Affirmative Action
and Evaluation Division
Office of Equal Opportunity Programs
Code EI
National Aeronautics and Space Administration
Washington, DC 20546

Ronald A. Luhks, Ph.D.
Manager, Reliability and
Maintainability Department
Space Information Systems Operation
Loral Aerospace
1322 Space Park Drive, M/C S1106
Post Office Box 77258
Houston, TX 77258-8487

Mr. Anthony J. Macina
Manager, Onboard Space Systems
Federal Sector Division
IBM Corporation
3700 Bay Area Boulevard
Houston, TX 77058-1199

Ms. Donna Maloy
Lockheed Engineering and Sciences Company
2400 NASA Road One, M/C C24B
Houston, TX 77058

Mr. Reno R. Mancini
Senior Group Engineer
Launch Support Services
Martin Marietta Manned Space Systems
Mail Code MMC-15
Kennedy Space Center, FL 32899

Mr. Alan B. Markow
Director, Quality and Productivity
Unisys Corporation
Marcus Avenue, M/S 1T102
Great Neck, NY 11020

Mr. Michael L. Marlaire
Quality/Productivity Representative
Office of Aeronautics and Space Technology
Code RI
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Thomas S. Marotta
Chairman and President
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Montville, NJ 07045-0427

Ms. Sheryl C. Marshall
Secretary
Code RO
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Stephen T. Marshall
Manager, Quality Assurance Section
Eastomer Products
Chemical Products Division
Lord Corporation
South Street
Post Office Box 556
Saegertown, PA 16433-0566

Mr. Robert J. Marton
Manager, NMOS PIQE
Space Operations
Bendix Field Engineering Corporation
Aerospace Building, Suite 610
10210 Greenbelt Road
Seabrook, MD 20706

Ms. Linda A. Marvin
Manager, Administrative Operations
Lockheed Engineering and Sciences Company
2625 Bay Area Boulevard
Houston, TX 77058

Ms. Inda C. Mathiasen
Senior Software Engineer Specialist
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U01K)
Houston, TX 77058-6775

Mr. Charles R. Mauldin
Director, Systems Safety and Reliability Office
Office of Safety and Mission Assurance
Code CT01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Keith D. Mayer
Quality Assurance Program Manager
AiResearch Los Angeles Division
Allied-Signal Aerospace Company
2525 West 190th Street
Post Office Box 2960
Torrance, CA 90509-2960

Mr. Richard E. Mayo
Director, Project Support
Eagle Aerospace, Inc.
16915 El Camino Real, Suite 200
Houston, TX 77058

Mr. Don C. McAvin
Director, Marketing
Engineering Programs
Wyle Laboratories
Post Office Box 077777
Huntsville, AL 35807-7777

Mr. Ronald R. McCann
President
McCannics Air Conditioning and Heating
10707 Corporate Drive, Suite 101
Stafford, TX 77477

Lieutenant General Forrest S. McCartney
Director
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. William Y. McCaslin
Vice President, Programs
Harris Space Systems Corporation
295 Barnes Boulevard
Rockledge, FL 32955

Mr. William K. McClung
Vice President
Cleveland Electric Illuminating Company
Post Office Box 5000
Cleveland, OH 44101

Mr. Darwin H. McCombs
Director, Quality Assurance
Space Systems Division - Florida Operations
Rockwell International Corporation
Post Office Box 22105
Kennedy Space Center, FL 32815

Mr. Raymond G. McCormick
Deputy Director, Engineering Support
Grumman Technical Services Division
1250 Grumman Place, 31-401
Titusville, FL 32780-7900

Mr. Joe McElwee
Quality Engineering Manager
Code MS-8
National Aeronautics and Space Administration
10701 Parkridge Boulevard
Reston, VA 22091-4398

Mr. Richard B. McFarland
Board of Directors
VSE Corporation
2550 Huntington Avenue
Alexandria, VA 22303-1499

Dr. Michael A. McGaw
Aerospace Engineer, Fatigue
and Fracture Branch
Mail Stop 49-7
Lewis Research Center
National Aeronautics and Space Administration
21000 Brookpark Boulevard
Cleveland, OH 44135

Mr. Byron G. McKenzie
Manager
Houston Operations
Boeing Aerospace Operations, Inc.
1045 Gemini Avenue, HF-00
Post Office Box 58747
Houston, TX 77058-8747

Ms. Kathleen W. McMenamin
Senior Federal Account Manager
Government Systems Division
U.S. Sprint
8229 Boone Boulevard, Suite 500B
Vienna, VA 22182

Mr. William R. McMurry
Manager, Software Engineering
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U07A)
Houston, TX 77058-2775

Ms. Dondie A. McNickle
Director, Program Development
Space Systems Division
Planning Research Corporation
2625 Bay Area Boulevard, Suite 500
Houston, TX 77058

Mr. Mark McNickle
Manager, Product Engineering
Space Systems Division
Planning Research Corporation
2626 Bay Area Boulevard, Suite 500
Houston, TX 77058

Mr. John R. McPhee
Operations Manager
Systems and Support Service Operations
Wyle Laboratories
3200 Magruder Boulevard
Hampton, VA 23666

Dr. Robert A. Meese
Assistant Division Manager
Space Vehicles Division
Hughes Aircraft Company
Post Office Box 92919, SC/S41/B362
Los Angeles, CA 90009

Mr. Leroy A. Mendenhall
Manager, Management &
Organizational Development
Unisys Defense Systems
8201 Greensboro Drive, Suite 1100
McLean, VA 22102

Ms. Janet L. Mengert
Quality Assurance Manager
Hartman Electrical Manufacturing
Figgie International Inc.
175 North Diamond Street
Mansfield, OH 44902

Mr. John D. Millard
President
Millard Controlled Metals
116 Lundquist Drive
Braintree, MA 02184-9054

Dr. Albert R. Miller
Assistant Associate Administrator (Plans)
Office of Space Operations
Code O
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Joseph Miller
Vice President and General Manager
Applied Technology Division
TRW Space and Technology Group
One Space Park, R1/2094
Redondo Beach, CA 90278-1001

Dr. Maurice (Moe) M. Miller
Vice President, LESC and
Engineering and Science Program Manager
Lockheed Engineering and Sciences Company
2400 NASA Road 1, C24
Post Office Box 58561
Houston, TX 77058

Mr. Robert C. Miller
Deputy Director, Systems Safety
Technical Analysis, Inc.
555 Sparkman Drive, Suite 410
Huntsville, AL 35816

Mr. Dale E. Million
Manager, Product Assurance
ITT Aerospace/Communications Division
1919 West Cook Road
Fort Wayne, IN 46801

Mr. Earl G. Mills
Group Director, Product Assurance
Martin Marietta Electronic and Missiles Group
Post Office Box 555837, MP-614
Orlando, FL 32855-5837

Mr. Gary Mims
Manager, Marketing and Sales
Fansteel, Inc.
Precision Sheet Metals Corporation
5235 West 104th Street
Los Angeles, CA 90045

Mr. Robert G. Minor
President
Space Systems Division
Rockwell International Corporation
12214 Lakewood Boulevard, MS AB53
Downey, CA 90241

Mr. Norris A. Monk
Quality Assurance Manager
Dynamic Engineering Incorporated
703 Middle Ground Boulevard
Newport News, VA 23606

Mr. S. D. (Skip) Montagna
Director of Quality Assurance/
Quality Improvement
Boeing Aerospace Operations, Inc.
1355 North Atlantic Avenue
Cocoa Beach, FL 32932

Mr. Jewel W. Moody
Program Manager
Service Contracts Division - Marshall Operations
Arvin/Calspan Corporation
Building 4708, Room 220A
Marshall Space Flight Center, AL 35812

Mr. Arnott A. Moore
Director of Engineering
Rothe Development, Inc.
4614 Sinclair Road
San Antonio, TX 78222

Mr. Donald E. Moore
Division Vice President, Quality Assurance
Space Systems Division
General Dynamics Corporation
Post Office Box 85990, GDSS MS 32-3200
San Diego, CA 92186-5990

Mr. Michael F. Moore
System Effectiveness Manager
ATTN: HQ SSD/XRHE
United States Air Force Space Systems Division
Post Office Box 92960
Los Angeles Air Force Base, CA 90009-2960

Ms. Pat Moore
Manager, Productivity Improvement Program
Mail Stop 255-1
Quad S Company
Ames Research Center
Moffett Field, CA 94035-1000

Mr. Robert Moore
Facility Manager/BMMS Contract
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 8395
Huntsville, AL 35808

Mr. Walter R. Moore
Manager of Contracts
Space and Strategic Systems Operation
Honeywell Inc.
13350 U.S. Highway 19 North, 257-5
Clearwater, FL 33624

Mr. William B. Moore
Manager, Market Development Space
and Aeronautic Services
GE Communications and Services
GE Government Services
Route 38, Building 202-1
Cherry Hill, NJ 08078

Mr. Leonard A. Morgan
Staff Executive,
Corporate Business Development
General Electric Company
3135 Easton Turnpike
Fairfield, CT 06431

Dr. Mark W. Morgan
Manager, Total Quality
Grumman Technical Services Division
1250 Grumman Place
Titusville, FL 32780-7900

Mr. Donald C. Morrisey
Executive Vice President and General Manager
Rocket Research Company
Olin Defense Systems Group
11441 Willows Road, NE
Redmond, WA 98052

Mr. Francis W. Moss
Vice President and Western Regional Manager
Advanced Technology Incorporated
1000 Paseo Camarillo, Suite 215
Camarillo, CA 93010

Mr. Paul A. Mowatt
Deputy Director, Planning
and Business Management
Flight Projects Directorate
Code 400
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771

Mr. Bernie Mueller
Senior District Sales Engineer
Aerospace Division
Kirkhill Rubber Company
300 East Cypress Street
Brea, CA 92621

Mr. R. Douglas Mueller
Director, Space Operations
Aerospace
Cincinnati Electronics Corporation
7500 Innovation Way
Mason, OH 45040

Mr. Mitchell D. Mulder
Lead Quality Engineer
SRM&QA Mission Services Contract-MSFC
Ebasco Services, Inc.
555 Sparkman Drive, Suite 410
Huntsville, AL 35816

Ms. Joanne T. Muncey
Senior Data Analyst
Grumman Technical Services Division
1250 Grumman Place
Titusville, FL 32780-7900

Mr. John B. Munson
Vice President and General Manager
Space Systems Division
Unisys Defense Systems
595 Gemini Avenue, Suite 298
Houston, TX 77058

Mr. Walter T. Murphy
Deputy Director of Engineering Development
Mail Code DE
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Carolyn M. Murray
Manager, IIS Human Resources
Integrated Information Services
Boeing Computer Support Services
Meadow Green Centre
Building One, Suite 750
9238 Highway 20 West
Madison, AL 35758

Mr. Tom F. Murray
Photographer
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U10A)
Houston, TX 77058-2775

Honorable Thomas J. Murrin
Deputy Secretary for Commerce
U. S. Department of Commerce
14th and Constitution Avenues, N.W.
Washington, DC 20230

Mr. Paul D. Myers, Jr.
Technical Assistant to the Director
of Engineering Development
Code DE
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Dr. Arthur B. Naselow
Manager, Materials Technology Laboratory
Technology Support Division
Hughes Aircraft Company
2000 East El Segundo Boulevard, E1/F150
El Segundo, CA 90245

Mr. Daniel A. Nebrig
Assistant Director
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Mr. Kamran Nejati
Manager, CSSP Product Assurance
Advanced Technology Systems Group
Spar Aerospace Limited
1700 Ormont Drive
Weston, Ontario M9L 2W7
Canada

Mr. George B. Nelson
Productivity Manager
Stennis Space Center Group
Sverdrup Technology, Inc.
Building 1103
Stennis Space Center, MS 39529-6000

Mr. Fred E. Newhouse
Business Unit Manager,
Aluminum Powder and Pigments
Extrusion Division
Reynolds Metals Company
4101 Camp Ground Road
Louisville, KY 40211

Mr. Thomas L. Newhouse
Manager, Organizational
and Managerial Development
Bacchus Works
Hercules Aerospace Company
Post Office Box 98, PC1A4
Magna, UT 84044-0098

Mr. Kenneth G. Nickerson
Center Director
Applied Technology Division
Computer Sciences Corporation
16511 Space Center Boulevard
Houston, TX 77058

Mrs. Mary E. Nickerson
Department Manager, Manufacturing Support
Productivity Operations Division
Hughes Aircraft Company
2000 East El Segundo Boulevard, E1/J144
Post Office Box 91919
El Segundo, CA 90245

Mr. Ronald J. Nittoli
Director, Quality Management
Plastics Division
Ciba-Geigy Corporation
7 Skyline Drive
Hawthorne, NY 10532

Ms. Margaret A. Nixon
Vice President
United Service Associates, Inc.
1728 20th Street, West
Birmingham, AL 35218

Mr. Glenn D. Norfleet
Senior Vice President
Sverdrup Technology, Inc.
600 William Northern Boulevard
Post Office Box 884
Tullahoma, TN 37388

Ms. Ruth J. Novak
Network Engineering Manager
Government Services Division
Electronic Data Systems Corporation
20525 Center Ridge Road, Suite 310
Rocky River, IL 44116

Mr. Marshall W. Novick
Vice President and Director-Quality
Space and Technology Group
TRW Space and Defense Sector
One Space Park, Building E1/5024
Redondo Beach, CA 90278-1001

Mr. James P. O'Connor
Director
Austin Division
Lockheed Missiles and Space Company, Inc.
6800 Burleson Road, O/TO-04 B/310
Post Office Box 17100
Austin, TX 78760-7100

Mr. Tom O'Connor
Director of Operations
Advanced Systems Division
United Technologies Corporation
Post Office Box 1100
Huntsville, AL 35807

Ms. Mimi O'Donnell
Senior Manager, Human Resource Development
Bendix Field Engineering Corporation
One Bendix Road
Columbia, MD 21045

Mr. Charles T. O'Rourke
Department Manager, Logistics
Management Department
Naval Ship Weapons Systems
Engineering Station
Code 5C01
United States Navy
Building 1220
Port Hueneme, CA 93043-5007

Mr. Michael F. O'Rourke
Group Manager, Control and Telemetry Group
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue, (U03A)
Houston, TX 77058

Mr. Joseph A. Oddo
CPI Facilitator
Space Programs Division
Teledyne Brown Engineering
Cummings Research Park, MS 52
Post Office Box 070007
Huntsville, AL 35807

Mr. Jarvis L. (Skip) Olson
Program Vice President-
Shuttle Processing Contract
Grumman Technical Services Division
1250 Grumman Place, 31-011
Titusville, FL 32780-7900

Mrs. Barbara A. Ory
Manager, Protocol
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3000
New Orleans, LA 70189

Mr. Carl D. Otsuki
President
Capitol Resource Management, Inc.
1011 Timothy Drive
San Jose, CA 95133

Mr. Clifford M. Overton
Branch Head, Quality Control Safety Office
Ogden Logistics Services
Code 239, Building 16W, Room S79A
Goddard Space Flight Center
Greenbelt, MD 20771

Mr. Bob G. Owens
Manager, Engineering Services
USBI Company Inc.
United Technologies Corporation
Post Office Box 1900
Huntsville, AL 35807

Mr. Kenneth R. Oyer
Senior Manager, Reliability
and Quality Assurance
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Dr. Jack N. Pan
Chief Statistician
Relay Division
Leach Corporation
5915 Avalon Boulevard
Los Angeles, CA 90003

Mr. Larry Parker
President and Chief Executive Officer
Leach Corporation
6900 Orangethorpe Avenue
Buena Park, CA 90622-5032

Mr. Alan J. Parrish
Director of Safety, Reliability
and Quality Assurance
Mail Code RQ
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Robert D. Paster
President
Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue, M/S AA50
Canoga Park, CA 91303

Mr. Gilbert L. Patton
Director, Industrial Relations
EG&G Florida, Inc.
Post Office Box 21296, BOC-002
Kennedy Space Center, FL 32815

Mr. Sidney F. Pauls
Associate Director
Mail Stop 103
Langley Research Center
National Aeronautics and Space Administration
Hampton, VA 23665

Dr. David J. Peake
President
Dynamic Engineering Incorporated
703 Middle Ground Boulevard
Newport News, VA 23606

Mr. Clyde S. Pennington
Project Manager
United Service Associates, Inc.
Post Office Box 21092
Kennedy Space Center, FL 32815

Dr. Dennis G. Perry
Director, Quality and Productivity
Unisys Defense Systems
8201 Greensboro Drive (11S20)
McLean, VA 22102

Ms. Jerelyn H. Perry
Systems Analyst III
DUAL and Associates, Inc.
16811 El Camino Real, Suite 220
Houston, TX 77058

Mr. Robert Perry
Manager, Washington Office
Raytheon Service Company
1215 Jefferson Davis Highway, Suite 1500
Arlington, VA 22202-3526

Ms. Nancy Davis Peters
Manager, Professional Services
Software AG Federal Systems, Inc.
11130 Sunrise Valley Drive
Reston, VA 22091

Mr. Walter Peters
President
Electrodynamic Division
Allied-Signal Aerospace Company
11600 Sherman Way
Hollywood, CA 91605

Mr. Robert Pizzuli
Project Manager
Construction Services Group
The Osterland Company
Lewis Research Center, M/S 66-2
21000 Brookpark Road
Cleveland, OH 44135

Dr. Michael E. Plett
Vice President, SEAS Program Manager
System Sciences Division
Computer Sciences Corporation
4600 Powder Mill Road, Room A115
Beltsville, MD 20705

Ms. Nancy E. Pope
Photo Support
Code TE-CID-B2
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. David J. Posek
Division Vice President
Space and Aeronautics Services
GE Government Services
1331 Pennsylvania Avenue, NW, Suite 930
Washington, DC 20004

Mr. Michael J. Povec
Director, Product Assurance
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3700
New Orleans, LA 70189

Mr. Edward F. Powers
Director, Total Quality Management
Rocket Research Company
Olin Defense Systems Group
11441 Willows Road, NE
Redmond, WA 98052

Ms. Lynn Price
Program Manager, Shuttle Programs
Fairchild Controls
Fairchild Space and Defense Corporation
1800 Rosecrans Avenue
Manhattan Beach, CA 90266-3797

Mr. Sean M. Pridy
Senior District Sales Engineer
Aerospace Division
Kirkhill Rubber Company
300 East Cypress Street
Brea, CA 92621

Ms. Sherry H. Prud'homme
Project Manager
Lockheed Engineering and Sciences Company
2400 NASA Road One, M/C C28
Houston, TX 77058

Mr. John R. Puleo
Project Manager
Biomedical and Environmental Laboratories
The Bionetics Corporation
BIO-1
Kennedy Space Center, FL 32899

Mr. Theodore F. Pykosz
TQM Process Manager
Applied Technology Division
Computer Sciences Corporation
16511 Space Center Boulevard
Houston, TX 77058

Mr. Carl L. Quinn
President and Chief Technical Officer
SIMCO Electronics
382 Martin Avenue
Santa Clara, CA 95050

Mr. Juan M. Ramirez
Chief, Quality Engineering
Launch Support Services
Martin Marietta Manned Space Systems
Mail Code MMC
Kennedy Space Center, FL 32899

Mr. Patrick D. Ranieri
Technical Advisor to the Division President
Space Station Program Support Division
Grumman Technical Services Division
1760 Business Center Drive
Reston, VA 22090

Ms. Linda A. Ranow
Procurement Clerk
Code OP-AMS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Julius E. Ray
Safety and Quality Manager
BMMS Contract
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 8395, Redstone Arsenal
Huntsville, AL 35808

Mr. Max W. Reck
Aerospace Mechanical Systems Division
Sundstrand Corporation
4747 Harrison Avenue, Department 430
Rockford, IL 61101

Mr. William J. Reimann
Manager of Manufacturing Services
Joliet Plant
Alcan-Toyo America, Inc.
1717 North Napper Boulevard, Suite 201
Napperville, IL 60563

Mr. Robert Reinicke
New Business Development Manager
Marotta Scientific Controls, Inc.
17671 Irvine Boulevard, Suite 208
Tustine, CA 92680

Mr. John L. Reiss
Chief, Management Programs Office
Mail Stop 241-11
Ames Research Center
National Aeronautics and Space Administration
Moffett Field, CA 94035

Mr. Frank L. Rentz
Director, Quality Engineering
SRM&QA Mission Services Contract-MSFC
Ebasco Services, Inc.
555 Sparkman Drive, Suite 410
Huntsville, AL 35816

Mr. Paul A. Reveley
Director of Marketing
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058-2799

Mr. Raul E. Reyes
Director, Quality Assurance
Mail Code RO
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Nickee R. Reynolds
Manager, Process Improvement
Huntsville Division
McDonnell Douglas Space Systems Company
689 Discovery Drive
Huntsville, AL 35806

Mr. Barry L. Rhine
Vice President
Space Systems Division
Planning Research Corporation
2625 Bay Area Boulevard, Suite 500
Houston, TX 77058

Ms. Judy C. Rice
CMI Administrator
Electro-Optical and Data Systems Group
Hughes Aircraft Company
Post Office Box 902, EO/E53/E235
El Segundo, CA 90245-0902

Mr. Kenneth R. Richardson
Manager, Manufacturing
Gates Aerospace Batteries
Post Office Box 2520
Gainesville, FL 32602

Mr. Edward L. Ries
Manager, Quality Assurance
American Synthetic Rubber Corporation
Post Office Box 32960
Louisville, KY 40232

Mr. Isom A. (Ike) Rigell
Vice President, Florida Operations
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212, Code USBI-EXO
Kennedy Space Center, FL 32815

Mr. Gerald L. Riggs
Director, Quality and Reliability
Aerospace Division
ABEX Corporation
3151 West Fifth Street
Oxnard, CA 93030

Mr. Jorge R. Rios
Project Manager
Capitol Resource Management, Inc.
Mail Stop 203-6
Ames Research Center
Moffett Field, CA 94035

Mr. David R. Robbins
Data Center Manager
Government Services Division
Electronic Data Systems Corporation
1100 Lockheed Way, LS0-184
Titusville, FL 32780

Mr. H. C. (Robbie) Robbins
Manager, Safety, Reliability, and Quality
Assurance Department
Lockheed Engineering and Sciences Company
2400 NASA Road One, B90
Post Office Box 58561
Houston, TX 77058

Mr. Phil Robbins
Manager, Planning
Integrated Information Services
Boeing Computer Support Services
Post Office Box 5128, Ardmore Station
Huntsville, AL 35814-5128

Mr. Ernest Roberts, Jr.
Program Manager
Information Management Systems
Mail Stop 142-2
Lewis Research Center
National Aeronautics and Space Administration
21000 Brookpark Road
Cleveland, OH 44135

Mr. Ron O. Roberts
Director of Quality Assurance
Space Systems Division
General Dynamics Corporation
Post Office Box 85990, Mail Zone 22-7240
San Diego, CA 92138-5357

Ms. Shannon Roberts
Special Assist to the Associate Administrator
for Space Flight
Code M
National Aeronautics and Space Administration
Washington, DC 20546

Mr. W. Ray Roberts
Director, Quality Assurance
Aerojet Propulsion Division
Building 2001, Department 8630
Post Office Box 13222
Sacramento, CA 95813-6000

Ms. Patricia E. Robinette
Data Management Department Manager
Grumman Technical Services Division
1250 Grumman Place
Titusville, FL 32780-7900

Ms. Emyre' B. Robinson
President
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058-2711

Mr. James A. Robinson
President
Airesearch Tucson Division
Allied-Signal Aerospace Company
Post Office Box 38001
Tucson, AZ 85740-9588

Mr. Ronald G. Robinson
Engineering Manager, TQM/People Coordinator
Electronic Systems Sector
Harris Corporation
Post Office Box 37, M/S 2-8181
Melbourne, FL 32902

Mr. William H. Rock
Manager, Advanced Projects,
Technology and Commercialization
Mail Code: PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. George A. Rodney
Associate Administrator for Safety
and Mission Quality
Code Q
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Donald E. Ross
President
MPB Corporation
Precision Park
Post Office Box 547
Keene, NH 03431-0547

Mr. Lawrence J. Ross
Director
Lewis Research Center
National Aeronautics and Space Administration
21000 Brookpark Road
Cleveland, OH 44135

Mr. Paul A. Ross
Vice President
Quality Assurance and Systems Safety
Rocketdyne Division
Rockwell International Corporation
6633 Canoga Avenue, M/S AB61
Canoga Park, CA 91303

Ms. Marsha B. Rubin
Division Secretary, NASA Quality
and Productivity Improvement Programs
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

Ms. Ann M. Russell
Senior Program Manager
Information Systems and
Technology Analysis Group
Science Applications International Corporation
6725 Odyssey Drive
Huntsville, AL 35803

Mr. Robert S. Sabljak
Associate Industrial Engineer
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Mr. Michael J. Salapack
Manager, Quality Control
GASD, Forest Park Operations
Aviall, Inc.
6114 Forest Park
Post Office Box 7086
Dallas, TX 75209-0086

Mr. Richard S. Sander
Deputy Project Manager
Advanced Solid Rocket Motor Project
Lockheed Missiles and Space Company, Inc.
1 NASA Drive
Iuka, MS 38852-8999

Ms. Mary Jane Sanzo
Administrative Analyst
Futron Corporation
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Thomas V. Sanzone
General Manager
Hamilton Standard Management Services, Inc.
United Technologies Corporation
2200 Space Park Drive, Suite 100
Houston, TX 77058

Dr. Richard S. Sapp
Director of Quality
Lockheed Corporation
4500 Park Granada Boulevard
Calabasas, CA 91399-0330

Mr. Ameen Y. Sarkees
Senior Propulsion Engineer
Launch Support Services
Martin Marietta Manned Space Systems
Mail Code MMC
Kennedy Space Center, FL 32899

Mr. Curtis E. Satterthwaite
TQM Program Administrator
Engineering Support Contract
Boeing Aerospace Operations, Inc.
Mail Stop FA-59
Kennedy Space Center, FL 32899

Ms. Mary Beth Sayre
Workstation Development Manager
Government Services Division
Electronic Data Systems Corporation
20525 Center Ridge Road, Suite 310
Rocky River, OH 44116

Mr. Harold K. Scarborough
Chief, Manpower and Organization Office
Code EX-MPR
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. James P. Schisler
Director, Human Resources and Facilities
Space Systems Division - Florida Operations
Rockwell International Corporation
Mail Code ZK13
Post Office Box 21105
Kennedy Space Center, FL 32815

Mr. J. D. Schmuecker
Manager, Management and Administrative
Support Systems Program
Mail Stop 511-201
Jet Propulsion Laboratory
National Aeronautics and Space Administration
4800 Oak Grove Drive
Pasadena, CA 91109

Mr. Clarence Schultz
Director of Computer Facilities
Houston Operations
Bendix Field Engineering Corporation
600 Gemini Avenue, B34A-30
Houston, TX 77058-2776

Mr. William A. Scott
Vice President, Quality Assurance
Chemical Systems Division
United Technologies Corporation
Post Office Box 49028
San Jose, CA 95161-9028

Mr. John P. Scully
Acting Director of Management Operations
Code 200
Goddard Space Flight Center
National Aeronautics and Space Administration
Greenbelt, MD 20771

Mr. John D. Seiley
Project Manager
Applied Technology Division
Computer Sciences Corporation
Slidell Computer Complex
1010 Gause Boulevard
Slidell, LA 70458

Mr. Marshall L. Seymour
Total Quality Program Manager
Lewis Research Center Group
Sverdrup Technology, Inc.
2001 Aerospace Park
Brookpark, OH 44142

Mr. Jerry L. Shamblee
Staff Engineer
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U05A)
Houston, TX 77058-6775

Ms. Norma L. Shear
Human Resource Coordinator
Grumman Technical Services Division
1250 Grumman Place, 31-017
Titusville, FL 32780-7900

Mr. Duane R. Sheets
Account Manager
Government Services Division
Electronic Data Systems Corporation
1730 NASA Road 1, Suite 105
Houston, TX 77058

Captain William M. Shepherd, USN
NASA Astronaut
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Mr. James F. Sherry
Independent Product Assurance Manager,
Technical & Management
Information System
Space Station Program
Boeing Computer Services
1801 Alexander Bell Drive
Reston, VA 22091

Dr. Joseph L. Shilling
State Superintendent of Schools
Maryland State Department of Education
200 West Baltimore Street
Baltimore, MD 21201

Ms. Maureen A. Simmons
Computer Analyst
EG&G Florida, Inc.
Post Office Box 21267
Kennedy Space Center, FL 32815

Mr. Richard Simon
Program Manager-3
Harris Space Systems Corporation
295 Barnes Boulevard
Rockledge, FL 32955

Mr. Jerry L. Sinclair
Project Manager, Safety, Reliability
and Quality Assurance
Analex Space Systems, Inc.
Post Office Box 21206
Kennedy Space Center, FL 32815-0206

Mr. Nicholas Sinder
Director, Product Integrity
Grumman Corporation
1111 Stewart Avenue, A23-GHQ
Bethpage, NY 11714

Mr. Edgar P. Sitler, II
Business Manager
Engineering Support Contract
Boeing Aerospace Operations, Inc.
Mail Stop FA-59
Kennedy Space Center, FL 32899

Mr. Peter W. Sivillo
Senior Program Engineer
Bendix Field Engineering Corporation
600 Gemini Avenue, B24L-555
Houston, TX 77058-2776

Mr. Donald E. Smith
Vice President and General Manager
Houston Operations
Bendix Field Engineering Corporation
501 Gemini Avenue
Houston, TX 77058-2753

Mr. Frank P. Smith
Vice President and General Manager
Boeing Aerospace Operations, Inc.
1355 North Atlantic Avenue
Post Office Box 320220
Cocoa Beach, FL 32932

Mr. Frank P. Smith, III
President and General Manager
Boeing Aerospace Operations, Inc.
Post Office Box 320220, M/S FA30
Cocoa Beach, FL 32932-0220

Mr. Gregory G. Smith
Program Manager, Aerospace
Ground Support Systems
Austin Division
Lockheed Missiles and Space Company, Inc.
6800 Burleson Road, TI-10/B312
Post Office Box 17100
Austin, TX 787460

Mr. Jackie E. Smith
Director, Safety and Reliability
Code RT
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. James L. Smith
NASA Space Station Freedom, TMIS Project
Boeing Computer Support Services
1801 Alexander Bell Drive
Reston, VA 22091

Mr. James R. Smith
Director, Quality, Safety and Productivity
Grumman Technical Services Division
1250 Grumman Place, 31-501
Titusville, FL 32780-7900

Ms. Jillanna L. Smith
Account Manager
Federal Division
Ingres Corporation
1801 Rockville Pike, Suite 200
Rockville, MD 20852-1633

Mr. Terrance M. Smith
Director, Safety, Reliability, and
Quality Assurance
Kennedy Space Center Division
McDonnell Douglas Space Systems Company
Post Office Box 21233
Kennedy Space Center, FL 32815

Mr. Wayne F. Smith
Manager, Mission Services
Integrated Information Services
Boeing Computer Support Services
Post Office Box 5128, MS EC-00
Huntsville, AL 35814-5128

Mr. Edward B. Smoot
PSCN Services Manager
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812-9022

Mr. Roger R. Snodgrass
Manager, Space Repair Programs
Integrated Logistics Support Division
Westinghouse Electronic Systems Group
1111 Shilling Road
Hunt Valley, MD 21030

Mr. Philip W. Snyder
Director, Training and Development
Technology Applications, Inc.
6101 Stevenson Avenue
Alexandria, VA 22304

Mr. Paul C. Soles
President
Marlin Industries
3603 Prospect Avenue
Riviera Beach, FL 33404

Mr. Curt D. Solheim
Manager, Engineering Technologies
Applied Science Division
Perkin-Elmer Corporation
2771 North Garey Avenue
Post Office Box 2801
Pomona, CA 91767

Mr. Lee D. Solid
Vice President and General Manager,
Florida Operations
Space Systems Division
Rockwell International Corporation
Post Office Box 21105
Kennedy Space Center, FL 32815

Joe E. Sparks, Ph.D.
Director, Continuous Process Improvement
Senior Staff, Office of the President
Teledyne Brown Engineering
300 Sparkman Drive, M/S 14
Huntsville, AL 35807-7007

Mr. James L. Speake, Jr.
Associate General Manager
EG&G Florida, Inc.
Post Office Box 21267/BOC-010
Kennedy Space Center, FL 32815

Mr. David A. Springer
Project Manager
Code DE-PMO-5
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Marlene K. Squires
Secretary
Code RO-ENG
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Wayne M. Stalls
Quality Assurance Manager
Infortec Development Inc.
1333 Gateway Drive
Melbourne, FL 32904

Mr. Wayne Stalnecker
Senior Director, Program Management
Fairchild Controls
Fairchild Space and Defense Corporation
1800 Rosecrans Avenue
Manhattan Beach, CA 90266-3797

Mr. Walter Stammel
Vice President, Product Assurance
Communications Systems Division
Telephonics Corporation
770 Park Avenue
Huntington, NY 11743

Mr. Dennis E. Stange
Technical Chief - Product Assurance
TEAS Group
Sverdrup Corporation
214 Government Street
Niceville, FL 32578

Mr. David A. Stanley
Video Technician
Communications Division
Lockheed Space Operations Company
Mail Stop LSO-113
Kennedy Space Center, FL 32899

Mr. Terry A. Stefanovic
Propellants Engineer
Code SI-PMS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Ms. Donna Stein
Aerospace and Electronics Group
Atlantic Research Corporation
5390 Cherokee Avenue
Alexandria, VA 22312

Mr. Martin Stein
Director for Institutions, Office of
Aeronautics, Exploration and Technology
Code RI
National Aeronautics and Space Administration
Washington, DC 20546

Dr. Thomas M. Steinfatt
School of Communications
University of Miami
Coral Gables, FL 33124

Ms. Lynne M. Stewart
Operations Manager
Futron Corporation
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Roy S. Still
Manager, Safety, Security and Quality Assurance
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812

Mr. S. C. (Carl) Stimson
Vice President of Quality Services
Qualtec Incorporated
11300 U.S. Highway 1, Suite 500
Palm Beach Gardens, FL 33420

Mr. John B. Stirling
Vice President, Electro-Optical Systems Division
Advanced Technology Systems Group
Spar Aerospace Limited
1235 Ormont Drive
Weston, Ontario M9L 2W6
Canada

Mr. Andrew J. Stofan
Vice President, Technical Operations
Martin Marietta Astronautics Group
Post Office Box 179, DC-1002
Denver, CO 80201

Ms. Sally L. Stohler
Manager, Space Shuttle Main Engine Marketing
Rocketdyne Division
Rockwell International Corporation
1745 Jefferson Davis Highway, Suite 1200
Arlington, VA 22202

Mr. John C. Stonesifer
Project Manager
Houston Division
KRUG Life Sciences Inc.
1290 Hercules Drive, Suite 120
Houston, TX 77058

Mr. David R. Stoughton
Program Manager, Flight Systems Division
Code SM
National Aeronautics and Space Administration
Washington, DC 20546

Ms. Patricia J. Stratton
Director Productivity
Lockheed Space Operations Company, Inc.
1100 Lockheed Way, LSO-600
Titusville, FL 32780

Mr. James N. Strickland
Assistant to the Manager
Shuttle Projects Office
Code SA01
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. J. Warren Stultz
APS Program Manager
McDonnell Douglas Missile Systems Company
Post Office Box 516, M/S 106-7107
St. Louis, MO 63166-0516

Mr. Donald Sund
Director, Technology Development
The Marquardt Company
16555 Saticoy Street
Van Nuys, CA 91409-9104

Ms. Anne M. Suter
Manager, Special Projects
Applied Technology Center (ATC)
NSI Technology Services Corporation
155A Moffett Park Drive, Suite 220
Sunnyvale, CA 94089

Mr. Allen Swartz
President
Special Products Division
Tra-Con, Inc.
Post Office Box 306
Medford, MA 02155

Ms. Betty P. Tai
Senior Analyst
Code QB
Futron Corporation
National Aeronautics and Space Administration
Washington, DC 20546

Mr. Alan R. Tatar
Manager
Warner/Osborn/Pardee
26777 Lorain Road, Suite 500
North Olmsted, OH 44070

Mr. B. J. Taylor
Vice President, Product Assurance
Government Systems Division
Contel Federal Systems Sector
15000 Conference Center Drive
Chantilly, VA 22021-3808

Ms. Leila G. Taylor
Administrative Specialist
Code DE-PMO-22
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. James H. Taylor
Vice President, Special Projects
TRW Space and Technology Group
One Space Park, E1/5010
Redondo Beach, CA 90278

Ms. Lucinda (Cindy) A. Taylor
Interface Analyst
Space Operations
Bendix Field Engineering Corporation
Aerospace Building, Suite 810
10210 Greenbelt Road
Seabrook, MD 20706-2218

Mr. Richard L. Taylor
Vice President, Performance Excellence
System Sciences Division
Computer Sciences Corporation
4061 Powder Mill Road, Suite 700
Calverton, MD 20705

Mr. Daniel M. Tellep
Chairman of the Board and
Chief Executive Officer
Lockheed Corporation
4500 Park Granada Boulevard
Calabasas, CA 91399

Mr. Geoffrey B. Templeton
Program Manager, External Total
Quality Management
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

Mr. William R. Tennill
Vice President
American Synthetic Rubber Corporation
Post Office Box 32960
Louisville, KY 40232

Mr. Ronald Terry
Account Manager, LIMS
Government Services Division
Electronic Data Systems Corporation
2025 Center Ridge Road, Suite 310
Rocky River, OH 44116

Mr. Philip A. Therrien
Chief - TQM Operations, Industrial Engineering
Martin Marietta Manned Space Systems
Post Office Box 29304
New Orleans, LA 70189

Mr. James (Gene) A. Thomas
Deputy Director
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. John P. Thomas
President
Unitech Composites, Inc.
10413 Industrial Way
Post Office Box 370
Hayden Lake, ID 83835-0370

Mr. John W. Thomas
Vice President and Project Manager
Advanced Solid Rocket Motor Project
Lockheed Missiles and Space Company, Inc.
1 NASA Drive
Iuka, MS 38852-8999

Ms. Peggy E. Thomas
Director, MCC/MOC Software
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U03A)
Houston, TX 77058-6775

Mr. James R. Thompson, Jr.
Deputy Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Ms. Wanda M. Thrower
Team Excellence Coordinator
Code BY
Lyndon B. Johnson Space Center
National Aeronautics and Space Administration
Houston, TX 77058

Mr. Donald D. Tice
Manager, Quality Assurance
Applied Science Division
Perkin-Elmer Corporation
2771 North Garey Avenue
Post Office Box 2801
Pomona, CA 91767

Ms. Irma J. Tirro
Administrator, SMART Program
Lockheed Space Operations Company, Inc.
1100 Lockheed Way
Titusville, FL 32780

Mr. Henry (Hank) J. Todd
Vice President - General Manager
Product Support Division
McDonnell Douglas Space Systems Company
5301 Bolsa Avenue, Department 199/12-2
Huntington Beach, CA 92647-2048

Mr. Rod Tolar
Quality Assurance and Engineering Department
Corporate Quality Programs Division
Ebasco Services, Inc.
Post Office Box 58128
Houston, TX 77258-8128

Mr. Richard D. Toliver
Senior Research Engineer
SRI International
60 Second Street, Suite 701
Post Office Box 756
Shalimar, FL 32579

Mr. Earl M. Tonkin
Director of Quality Assurance
Loral Data Systems
Post Office Box 3041
Sarasota, FL 34230-3041

Mr. Edward F. Torri
Vice President
Millard Controlled Metals
116 Lindquist Drive
Braintree, MA 02184-9054

Mr. Ralph J. Tortorich
Manager, Performance Enhancement Programs
Martin Marietta Manned Space Systems
Post Office Box 29304, 3020
New Orleans, LA 70189

Mr. Delmar E. Tower
Chief, Engineering Branch
Mail Code TL-FGP-4
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Gregory S. Trachta
Program Director, STSOC Program
Space Systems Division
Unisys Defense Systems
600 Gemini Avenue (U01k-600)
Houston, TX 77058-2775

Mr. Nick L. Traino
Director, Product Assurance
Space and Communications Group
Hughes Aircraft Company
Building S52, M/S K307
Post Office Box 92919
Los Angeles, CA 92919

Mr. Jerry P. Trehy
Senior Vice President
Government Information Systems Group
Planning Research Corporation
1500 Planning Research Drive
McLean, VA 22102

Mr. Allan A. Treutlein
Director, Product and Systems Assurance
Command Systems Division
Telephonics Corporation
815 Broadhollow Road
Farmingdale, NY 11735

Mr. Richard H. Truly
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Mr. David Tucker
Senior TQM Coordinator
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Mr. G. Richard Tyjewski
Manager, Product Assurance Department
Unisys Corporation
12010 Sunrise Valley Drive
Reston, VA 22091

Mr. Ron Unger
Technical Manager
Marshall Space Flight Center Group
Sverdrup Technology, Inc.
620 Discovery Drive
Huntsville, AL 35806

Mr. Pat Valenti
Director, Networks and Telecommunications
Grumman Data Systems
1111 Stewart Avenue, B28-111
Bethpage, NY 11714-3584

Mr. Fred L. Van Buren
Director, Business Management
Boeing Computer Services
Post Office Box 24346, 7A-58
Seattle, WA 98124-0346

Mr. David L. Van Der Griend
Chief Executive Officer
Unitech Composites, Inc.
10413 Industrial Way
Post Office Box 370
Hayden Lake, ID 83835-0370

Mr. Nicholas J. Van Dewerker
Director, Product Assurance
Martin Marietta Astronautics Group
Post Office Box 179, M/S 1007
Denver, CO 80201

Mr. Jerry L. Vanden Bosch
Vice President and General Manager
Technology Assurance Division
Analex Corporation
21775 Brookpark Road
Fairview Park, OH 44126-3224

Mr. William L. Vantine
Manager, Organizational Development
Office of Space Flight
Code M
National Aeronautics and Space Administration
Washington, DC 20546

Ms. Libby E. Varty
Site Manager
The Bionetics Corporation
Mail Stop 239-6
Ames Research Center
Moffett Field, CA 94035-1000

Mr. Frank Verlot
Director, Total Quality Management
Chemical Systems Division
United Technologies Corporation
Post Office Box 49028
San Jose, CA 95161-9028

Mr. Augustine A. (Tony) Verrengia
Manager, Advanced Planning
Space and Aeronautics Programs
GE Government Services
1050 Bay Area Boulevard
Houston, TX 77058

Mr. Deed L. Vest
Director, Rockwell Houston Operations Division
Rockwell Space Operations Company
600 Gemini Avenue, RO6A
Houston, TX 77058-2777

Mr. Ted Vetter
Quality Assurance and Engineering Department
Corporate Quality Programs Division
Ebasco Services, Inc.
Post Office Box 58128
Houston, TX 77258-8128

Mr. Carl L. Vignali
Vice President and Group Executive
Space Systems Group
Honeywell Inc.
13350 U.S. Highway 19 North
Clearwater, FL 33624

Mr. Julian C. Vitali
Operations Program Manager
International Fuel Cells
United Technologies Corporation
195 Governor's Highway
Post Office Box 739
South Windsor, CT 06074

Mr. Brooks S. Vogt
Program Manager
Space and Technology Group
TRW Space and Defense Sector
One Space Park, 154/1508
Redondo Beach, CA 90278

Ms. Glenda Walden
USBI Company Inc.
United Technologies Corporation
Post Office Box 21212
Kennedy Space Center, FL 32815

Mr. Lloyd A. Walker
Vice President, Operations
Aerojet Propulsion Division
Building 2001, Department 8600
Post Office Box 13222
Sacramento, CA 95813-6000

Mr. Kenneth C. Walla
Director, Reliability and Quality Assurance
EG&G Florida, Inc.
Post Office 21267, BOC-003
Kennedy Space Center, FL 32899

Mr. Patrick A. Walter
Information Resource Manager
Barrios Technology, Inc.
1331 Gemini Avenue
Houston, TX 77058

Mr. Linley K. Ward, Jr.
Vice President and General Manager
Stennis Space Center Group
Sverdrup Technology, Inc.
Building 1103, Room 203
Stennis Space Center, MS 39529-6000

Mr. Russell K. Watkins
Quality Manager
Jacobs Engineering Group Inc.
Post Office Box 2008
Lakeland, FL 33806-2008

Mr. Bob D. Welch
Quality Manager
Fuel Systems Textron Inc.
Textron Inc.
700 North Centennial Street
Zeeland, MI 49464

Mr. Ronald L. Welch
Vice President of Operations
ILC Space Systems
ILC Dover, Inc.
16665 Space Center Boulevard
Houston, TX 77058-2253

Mr. John S. Welzyn
Chief, Administrative and Operations Staff
Office of Safety and Mission Assurance
Code CR02
George C. Marshall Space Flight Center
National Aeronautics and Space Administration
Marshall Space Flight Center, AL 35812

Mr. Jim Whaley
Project Manager
Shuttle Processing Contract
Brown and Associates Management
Services, Inc. (BAMSI)
Post Office Box 21187
Kennedy Space Center, FL 32815

Major Whitaker, USAF
Office of the Inspector General
ATTN: AFLC/IGIB
United States Air Force Logistics Command
Wright-Patterson Air Force Base, OH 45433

Ms. Jan C. Whitlow
ISS Communications Specialist
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812-9022

Karen K. Whitney, Ph.D.
Manager of Productivity
Rockwell Space Operations Company
600 Gemini Avenue, R04A
Houston, TX 77058-2777

Mr. M. Leigh Whitney
President
Government Services Division
Philip Crosby Associates, Inc.
Post Office Box 2369
Winter Park, FL 32790

Mr. Herman K. (Fritz) Widick
Technical Assistant to the Director
of Shuttle Operations
Code TP
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. James H. Wiggins
Executive Vice President
and Technical Director
Technical Analysis, Inc.
2525 Bay Area Boulevard, Suite 200
Houston, TX 77058

Mr. Harry J. Wilkinson
President and Chief Operating Officer
SPS Technologies
Route 332
Newtown, PA 18940

Mr. Henry (Hank) L. Williams
Manager, Product Assurance
Space Industries, Inc.
711 West Bay Area Boulevard, Suite 320
Houston, TX 77598

Mr. James K. Williams
Program Manger
Space Systems Division
Rockwell International Corporation
555 Discovery Drive
Huntsville, AL 35806

Mrs. Mary E. Williams
Manager, TQM
Virginia Propulsion Division
Atlantic Research Corporation
5945 Wellington Road
Gainesville, VA 22065

Mr. R. Gordon Williams
Vice President and General Manager
Federal Systems Division
TRW Space and Technology Group
One Space Park, R11/2712
Redondo Beach, CA 90278-1001

Mr. Wiley E. Williams
President
Grumman Technical Services Division
1250 Grumman Place
Titusville, FL 32780-7900

Mr. William L. Williams
Senior Staff Scientist
Joint Institute for Advancement
of Flight Sciences
George Washington University
Mail Stop 269
Langley Research Center
Hampton, VA 23665-5225

Mr. Manfred Willuhn
Manager, New Products and Aerospace Sales
Marotta Scientific Controls, Inc.
78 Boonton Avenue
Post Office Box 427
Montville, NJ 07045-0427

Mr. James H. Wilson
Director, Trades Administration
Newport News Shipbuilding
4101 Washington Avenue
Newport News, VA 23607

Mr. Jim H. Wilson
Director, Trades Administration
Newport News Shipbuilding
4101 Washington Avenue, Department 067
Newport News, VA 23607

Mr. Joe Wilson
Huntsville Division
Boeing Aerospace and Electronics Company
Post Office Box 240002, M/S JY-32
Huntsville, AL 35824-6402

Ms. Margaret A. (Peggy) Wilson
Productivity Program Specialist
Code PT-PAS
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Steve M. Wilt
Manager, IIS Program Services
Integrated Information Services
Boeing Computer Support Services
Post Office Box 9022
Marshall Space Flight Center, AL 35812

Mr. Richard E. Wingfield
Program Manager
White Sands Test Facility
Lockheed Engineering and Sciences Company
Post Office Drawer MM
Las Cruces, NM 88004

Mr. Thomas C. Wirth
Vice President
External Tank Program
Martin Marietta Manned Space Systems
Post Office Box 29304, M/P 3000
New Orleans, LA 70189

Mr. Robert A. Wolfe
Executive Vice President
Space Propulsion and Systems
Pratt & Whitney
United Technologies Corporation
Post Office Box 109600, M/S 702-27
West Palm Beach, FL 33410-9600

Mr. John J. Wood
Vice President-General Manager
Systems and Support Service Operations
Wyle Laboratories
3200 Magruder Boulevard
Hampton, VA 23666

Ms. Susan L. Woodard
Code PT-AST
John F. Kennedy Space Center
National Aeronautics and Space Administration
Kennedy Space Center, FL 32899

Mr. Vernon E. Woodin
Director, Product Assurance
and System Safety
Martin Marietta Information Systems Group
9110 East Nichols Avenue, HC-1700
Englewood, CO 80112

Mr. Ted Woods
Vice President and Director of Operations
Strategic Electronics Division
Motorola Government Electronics Group
2501 South Price Road
Chandler, AZ 85248-2899

Mr. Earle Wright
Director of Quality Engineering
Relay Division
Leach Corporation
5915 Avalon Boulevard
Los Angeles, CA 90003

Mr. Richard O. Wright
TQM Facilitator
Aircraft Systems Division
Simmonds Precision Products Inc.
Hercules Aerospace Corporation
Panton Road, M/C 5 ADM
Vergennes, VT 05491

Ms. Deborah A. Wyscarver
Manager, Human Resources
Space and Technology Group
TRW Space and Defense Sector
One Space Park, R11/2760
Redondo Beach, CA 20278

Mr. Anthony N. Yaeger
Vice President and Program Manager
System Services Division
Planning Research Corporation
600 Maryland Avenue, SW, Suite 850
Washington, DC 20024

Mr. Thomas J. Yelle
Management Analyst II
Space Programs Division
Teledyne Brown Engineering
300 Sparkman Drive, M/S 168
Huntsville, AL 35807-7007

Mr. David B. Yohe
Vice President,
Aerospace Business Management
Learjet, Inc.
Wichita Mid-Continent Airport
Post Office Box 7707
Wichita, KS 67227-7707

Mr. John B. Young, Jr.
Manager, Quality and Compliance Systems
Military and Data Systems Operations
GE Aerospace
Post Office Box 8048, Room 8089B
Philadelphia, PA 19101

Mr. Thomas M. Young
President/Program Director
Harris-Magnavox Systems Company
Post Office Box 061615
Palm Bay, FL 32906-1615

Mr. Robert B. Young, Jr.
President and Chief Executive Officer
Lockheed Engineering and Sciences Company
2400 NASA Road 1
Houston, TX 77058

Mr. William R. Young
Compliance Director
Corporate Quality Assurance
Reynolds Metals Company
6601 West Broad Street
Richmond, VA 23230

Mr. Max E. Zent
Executive Director, Quality and Productivity
Tenneco, Inc.
Post Office Box 2511
Houston, TX 77252-2511

Mr. Charles Zimmerman
Director, Education and Training Services
Westinghouse Electronics Systems Group
Box 746, Mail Stop 4445
Baltimore, MD 21203

Mr. Joseph P. Zimonis
Vice President, Space Propulsion
Pratt & Whitney
United Technologies Corporation
Post Office Box 109600, M/S 702-06
West Palm Beach, FL 33410-9600

Mr. Steve A. Zobal
Senior Manager, Quality Systems
Houston Division
McDonnell Douglas Space Systems Company
16055 Space Center Boulevard
Houston, TX 77062

Appendix C – Acknowledgments

The papers, graphics, audio presentations, and panel notes from the conference were used as the basis for writing this report.

Many individuals deserve recognition for their work in organizing the Seventh Annual NASA/Contractors Conference: **Geoffrey B. Templeton**, NASA Headquarters, Conference Director; **Margaret A. (Peggy) Wilson**, Kennedy Space Center, and **Lynne M. Stewart**, Futron Corporation, Assistant Conference Directors; **Warren L. Camp**, Kennedy Space Center, Conference Liaison Officer; The Conference Panel Directors: **Dr. Joe E. Sparks**, Teledyne Brown Engineering, and **William L. Williams**, George Washington University *(Panel A – Building on Strategic Planning to Advance TQM);* **Sally L. Stohler**, Rocketdyne, and **Larry E. Lechner**, NASA Marshall Space Flight Center *(Panel B – Continuous Employee Development for Total Quality);* **Jessica R. Wilkes**, Grumman Corporation, and **Gail R. Harleston**, NASA Headquarters *(Panel C – Employee Empowerment and Teamwork);* **Tina M. Doty**, Leach Corporation, and **Willis E. Chapman**, Jet Propulsion Laboratory *(Panel D – Quality Assurance's Role in Total Quality Management);* **Dr. Ronald A. Luhks**, Ford Aerospace Corporation, and **Wanda M. Thrower**, NASA Johnson Space Center *(Panel E – No Measurement – No Progress);* and **Linda A. Marvin**, Lockheed Engineering and Sciences Company, and **John L. Reiss**, NASA Ames Research Center *(Panel F – Customer Focus – Practice or Preach);* the Conference Panel Managers: **Imants (Monte) Krauze**, Bendix Field Engineering Corporation *(Panel 1 – 1990 George M. Low Trophy Finalists – Small Business/ Subcontractor);* **Sherry H. Prud'homme**, Lockheed Engineering and Sciences Company *(Panel 2 – 1990 George M. Low Trophy Finalists – Hardware/Mission Support Contractors);* **Jeffrey M. Corbin**, Martin Marietta Manned Space Systems *(Panel 3 – 1990 George M. Low Trophy Finalists – Service Support/Mission Support Contractors);* **Michael W. Foster**, Unitech Composites, Inc. *(Panel A1 – Creating the Vision);* **Joe E. Alcala**, General Dynamics Corporation *(Panel A2 – Organization for Planning and Implementation);* **George B. Nelson**, Sverdrup Technology, Inc. *(Panel A3 – Winning Strategies for Total Quality);* **Charles Zimmerman**, Westinghouse Electric Corporation *(Panel B1 – Are You Ready?);* **Leroy A. Mendenhall**, Unisys Defense Systems *(Panel B2 – Tools and Techniques for Total Quality Training);* **Richard D. Clapper**, NASA Lewis Research Center *(Panel B3 – Recognition Adds Value);* **Robert P. Hessler**, McDonnell Douglas Space Systems Company, and **S. D. (Skip) Montagna**, Boeing Aerospace Operations, Inc. *(Panel C1 – Prerequisites for Empowering Employees);* **Dr. Dean R. Lee**, Unisys Defense Systems *(Panel C2 – The Changing Role of Management);* **Dr. Robert A. Emry**, California State University at Fullerton, and **G. William Kuhfuss**, General Electric Corporation *(Panel C3 – Making Teams Work);* **Donald O. Atkins**, ILC Dover, Inc., and **Robert A. Horrigan** and **Thomas H. Forbes**, Electronic Data Systems Corporation *(Panel D1 – The Changing Role of Quality Assurance in a TQM Environment);* **Tina M. Doty**, Leach Corporation, and **Robert D. Hammond**, Rockwell Space Systems Division *(Panel D2 – Quality Assurance Standards versus TQM);* **Dr. Karen K. Whitney**, Rockwell Space Operations Company *(Panel E1 – Measuring TQM in the Real World);* **R. Ross Bowman**, Thiokol Corporation *(Panel E2 – Case Study: Measurements in Action);* **John S. Welzyn**, NASA Marshall Space Flight Center *(Panel F1 – Customer Expectations – Everybody's Business);* and **Bradley A. Johnson**, CTA, Inc. *(Panel F2 – Will the Real*

Customer Please Stand Up!); members of the Seventh Annual NASA/ Contractors Conference Planning Committee not previously mentioned: **Peter M. Alex,** The Osterland Company; **Charles P. Boyle,** NASA Headquarters; **Alfred O. Brouillet,** Hamilton Standard, United Technologies Corporation; **Jerry R. Dangler,** Honeywell, Inc.; **J. Jeannette Eads,** EG&G Florida, Inc.; **Nancy A. Falk,** Barrios Technology, Inc.; **Dr. Neil W. Haars,** Sverdrup Technology, Inc.; **Johnnie A. Henderson,** IBM Corporation; **James F. Holloway,** Pratt & Whitney, United Technologies Corporation; **Richard D. Lander,** Marotta Scientific Controls, Inc.; **Don C. McAvin,** Wyle Laboratories; **William R. McMurry,** Unisys Defense Systems; **Jarvis L. (Skip) Olson,** Grumman Technical Services Division; **Nickee R. Reynolds,** McDonnell Douglas Space Systems Company; and **Marshall L. Seymour,** Sverdrup Technology, Inc.; members of the NASA Kennedy Space Center/Contractor Support Team: **Jonathon L. Bradley, Thomas R. Braxton, Karen F. Bridges, Regina M. Capraro, Christie L. Connor, Linda T. Coon, Sally A. Hencin, James D. Horton, Ann K. Hunt, Brian T. Knipfing, Thomas (Rick) F. Landers, Jean C. Lewandowski, Lou Ann Linton, Donna M. Lucas, Sheryl C. Marshall, Joanne T. Muncey, Juan M. Ramirez, Linda A. Ranow, Patricia E. Robinette, William H. Rogers, Robert S. Sabljak, Ameen Y. Sarkees, Maureen A. Simmons, Marlene K. Squires, David A. Stanley, Terry A. Stefanovic, Leila G. Taylor, Irma J. Tirro, David A. Tucker, Dennis A. Weatherby, Susan L. Woodard, Paul F. Giusti, Norman N. Jacobson, Paul E. Joas, Joe W. Calderone, Chip Knudsen,** and **Nancy E. Pope;** and members of the NASA Headquarters/Contractor Support Team: **Cathy L. Horton, Marsha B. Rubin, Darron K. Fuller, Delora H. Maiden, Kimberly B. Muratore, Eric C. Raynor, Mary Jane Sanzo,** and **Betty P. Tai.**

A special note of appreciation is extended to **Barbara Moller** and **David Stillerman,** Moller Communications, for synthesizing the thoughts presented by the conference speakers and writing this document; to **Lauren C. D'Alessio** and **Lynne M. Stewart,** Futron Corporation, for editing this publication, and to **Cindi Potter,** Ideas in Type, for editing and preparing this publication.

Joyce R. Jarrett
Director
NASA Quality and Productivity Improvements Program
Conference General Chairperson

Editor-in-Chief

Geoffrey B. Templeton, NASA Headquarters

Editors

Barbara Moller, Moller Communications
David Stillerman, Moller Communications
Lauren C. D'Alessio, Futron Corporation
Lynne M. Stewart, Futron Corporation

"Extending the Boundaries of Total Quality Management"

EIGHTH ANNUAL NASA/CONTRACTORS CONFERENCE AND
1991 NATIONAL SYMPOSIUM
HOTEL INFORMATION

The Wyndham Warwick
5701 Main Street
Houston, TX 77005

713/526-1991

Rates:	**$66 + tax**	**Government (Single)**
	$89 + tax	**Government (Double)**
	$89 + tax	**Corporate (Single or Double)**

Reservations must be made by October 5, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference.

Allen Park Inn
2121 Allen Parkway
Houston, TX 77019

713/521-9321

Rates:	**$51 + tax**	**Single**
	$59 + tax	**Double**
	$67 + tax	**Triple**
	$75 + tax	**Quads**

Reservations must be made by October 15, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference. Advance payment of one night by check or money order is required by the Allen Park Inn to guarantee reservations.

"Extending the Boundaries of Total Quality Management"

Eighth Annual NASA/Contractors Conference and National Symposium

November 6-7, 1991

George R. Brown Convention Center, Houston, Texas

Hosted by the Lyndon B. Johnson Space Center

Sponsored by the NASA Office of Safety and Mission Quality, NASA Quality and Productivity Improvement Programs Division

"Extending the Boundaries of Total Quality Management"

The Eighth Annual NASA/Contractors Conference and National Symposium will build on and expand the continuous process of learning, improvement, and implementation of Total Quality Management. The conference provides participants a forum to exchange ideas, success stories, and lessons learned as well as theory and practical application of continuous improvement strategies that fit their organizational structure and environment. *Sessions include: The Development, Implementation, and Evolution of a Quality Driven Strategic Plan; World Class Quality - Tools for Survival; It Takes Two-The Customer and You; Continuous Process Improvement-Success Stories; Empowerment and Teamwork; and Training and Recognition in the World of TQM.*

Community Partnerships For Quality

This year's conference offers an added dimension. Six panels, including two panels by satellite from concurrent conferences in Greenbelt, MD, and Denver, CO, will explore the vast and largely untapped potential of "Community Partnerships." Specifically, we will explore how communities can partner to improve education, government, the environment, and other issues that are fundamental to the continued progress of this country and the world. Panels in these two special sessions include: *TQM Partnerships with Education; Partnerships in the International Community; Changing Work Force Demographics; Focus on Quality in Education (via satellite from Greenbelt, MD); Partnering to Work Quality Issues in the Houston Community; and Community Partnerships for our Environment - A Rocky Mountain Region Report (via satellite from Denver, CO).* **Satellite links will afford thousands of people in other parts of the country the opportunity to participate.**

Who Should Attend?

Leaders of industry, government, education, and communities, and team members capable of affecting change within their organizations and beyond.

FOR MORE INFORMATION CONTACT:

Patricia D. Rodriguez
202/453-2681

Lynne M. Stewart
202/453-9832

NASA Quality and Productivity Improvement Programs Division
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

EIGHTH ANNUAL NASA/CONTRACTORS CONFERENCE AND
1991 NATIONAL SYMPOSIUM
HOTEL INFORMATION

***Doubletree at Allen Center (* Conference Headquarters)**
400 Dallas Street
Houston, TX 77002

713/759-0202

Rates:	**$62 + tax**	**Government (Single)**
	$77 + tax	**Government (Double)**
	$94 + tax	**Corporate (Single)**
	$104 + tax	**Corporate (Double)**

Reservations must be made by October 6, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference.

Days Inn - Downtown Houston
801 Calhoun Street
Houston, TX 77002

713/659-2222

Rates:	**$50 + tax**	**Single**
	$60 + tax	**Double**
	$70 + tax	**Triple**
	$80 + tax	**Quads**

Reservations must be made by October 4, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference.

Four Seasons Hotel, Houston Center
1300 Lamar Street
Houston, TX 77010

713/650-1300

Rates:	**$95 + tax**	**(Superior, Single and Double)**
	$115 + tax	**(Executive Suite, Single and Double)**
	$400 + tax	**(Parlor Suite, 1 bedroom)**
	$495 + tax	**(Parlor Suite, 2 bedroom)**

Reservations must be made by October 15, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference.

EIGHTH ANNUAL NASA/CONTRACTORS CONFERENCE AND
1991 NATIONAL SYMPOSIUM
HOTEL INFORMATION

The Wyndham Warwick
5701 Main Street
Houston, TX 77005

713/526-1991

Rates:	**$66 + tax**	**Government (Single)**
	$89 + tax	**Government (Double)**
	$89 + tax	**Corporate (Single or Double)**

Reservations must be made by October 5, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference.

Allen Park Inn
2121 Allen Parkway
Houston, TX 77019

713/521-9321

Rates:	**$51 + tax**	**Single**
	$59 + tax	**Double**
	$67 + tax	**Triple**
	$75 + tax	**Quads**

Reservations must be made by October 15, 1991, to receive conference rates. Identify yourself as attending the Eighth Annual NASA/Contractors Conference. Advance payment of one night by check or money order is required by the Allen Park Inn to guarantee reservations.

EIGHTH ANNUAL NASA/CONTRACTORS CONFERENCE AND 1991 NATIONAL SYMPOSIUM

"Extending the Boundaries of Total Quality Management"

Date: **November 6-7, 1991**
Place: **George R. Brown Convention Center, Houston, Texas**
Sponsor: **NASA Office of Safety and Mission Quality**
NASA Quality and Productivity Improvement Programs Division
Host: **Lyndon B. Johnson Space Center**

Request for Information Form

NAME: _____ _____ ____ _____

Mr., Ms., Dr. First Name MI Last Name

TITLE: _____

DIVISION: _____

COMPANY: _____

ADDRESS: _____

_____

_____

CITY: _____ **STATE:** _____ **ZIP:** _____

PHONE (COMMERCIAL): ( ) _____

RETURN THIS FORM BY JULY 31, 1991, TO:

NASA Quality and Productivity Improvement Programs Division
Code QB
National Aeronautics and Space Administration
Washington, DC 20546
ATTN: Eighth Annual NASA/Contractors Conference Registrar
FAX: 202/426-1729

FOR MORE INFORMATION, CONTACT:

PATRICIA D. RODRIGUEZ
202/453-2681

LYNNE M. STEWART
202/453-9832

Appendix E - Summary Report Survey

Seventh Annual NASA/Contractors Conference Proceedings Customer Survey

1. **Did you attend the Seventh Annual NASA/Contractors Conference?**

   Yes _____ **No** _____

2. **How much of the proceedings did you read? (Circle one)**

   A. None
   B. Skimmed sections of document
   C. Skimmed whole document
   D. Read portions of document
   E. Read most/whole document

3. **How valuable are the proceedings to you and/or your organization? (Circle one)**

   A. Not Valuable
   B. Little Value
   C. No opinion
   D. Somewhat valuable
   E. Very valuable

4. **Do you think the proceedings are: (Circle one)**

   A. Too Short
   B. Just Right
   C. Too Long

5. **What would you add or exclude from the proceedings?**

   Add:

   Exclude:

6. **Rate the timeliness of the proceedings: (Cirlce one)**

   A. Takes so long it's not useful
   B. Takes a long time but worth the wait
   C. Timely

7. **Any additional comments?**

Please return completed survey to:

NASA Quality and Productivity Improvement Programs Division
Code QB
National Aeronautics and Space Administration
Washington, DC 20546

☆ U.S. GOVERNMENT PRINTING OFFICE:1991-523-540/40311