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8th Annual NASA/Contractors Conference and 1991 National Symposium on Quality and Productivity

"Extending the Boundaries of Total Quality Management"

Summary Report

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Summary Report of the Eighth Annual NASA/Contractors Conference and 1991 National Symposium on Quality and Productivity

"Extending the Boundaries of Total Quality Management"

Hosted by:

NASA Lyndon B. Johnson Space Center
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THE WHITE HOUSE

WASHINGTON

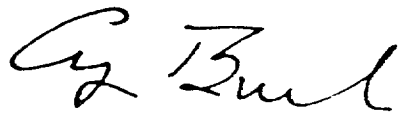
October 31, 1991

I am pleased to extend warm greetings to Admiral Truly and to all those who have travelled to Houston to take part in the Eighth Annual NASA/ Contractors Conference and the 1991 National Symposium on Quality and Productivity. Congratulations to the eight finalists for NASA's Quality and Excellence Award, the George M. Low Trophy.

You gather at a time when historic and unprecedented change is taking place throughout the world. If the United States is going to remain a leader in science and space technology in the rapidly expanding global arena, we must continue to produce top-quality products and services at a competitive price. We need to find ways to do things faster and more efficiently in space. And we're depending upon America's great research and technology centers to get their brightest engineers and scientists to come up with bold, innovative ideas and to devise new technologies for a new tomorrow in space.

I commend NASA for providing this forum for the exchange of ideas and information on the ways that the Federal Government and private businesses can work together to lead the aerospace community into the 21st Century and beyond. This conference is indeed one step forward on the path to a better future for all mankind.

Barbara joins me in sending best wishes for a productive and rewarding conference. God bless you, and God bless the United States of America.



Foreword

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Continuous improvement encompasses a broad range of activities. It commands commitment from all levels of an organization. It requires identifying and focusing on customers and their expectations, both internally and externally. It prescribes the development of specific strategic and tactical plans to ensure customer satisfaction. It depends upon measurement and analysis to improve processes and necessitates exacting techniques for reliability and quality assurance. It extols workers as an organization's primary asset and insists on empowerment, training, and rewards and recognition. It also advocates building and nurturing teams and partnerships within an organization, with contractors and suppliers, with customers, with communities, and with counterparts in industry, education, government, and the international market place.

The Eighth Annual NASA/Contractors Conference and 1991 National Symposium on Quality and Productivity provided a forum to exchange knowledge and experiences in these areas of continuous improvement. The more than 1,100 attendees from Government, industry, academia, community groups, and the international arena had a chance to learn about methods, tools, and strategies for excellence and to discuss continuous improvement strategies, successes, and failures. This event, linked via satellite to concurrent conferences hosted by the NASA Goddard Space Flight Center in Greenbelt, Maryland, and Martin Marietta Astronautics Group in Denver, Colorado, also explored extending the boundaries of Total Quality Management to include partnerships for quality within communities and encouraged examination, evaluation, and change to incorporate the principles of continuous improvement.

Today's global market demands much more than merely maintaining current standards of excellence. We must all nurture a culture of continuous improvement throughout our organizations if we are to succeed. I applaud the commitment of the NASA/contractor team to continuous improvement and encourage your pursuit of this quest for quality in all your endeavors. You have my support.

Richard H. Truly 3/24/92
Administrator

Introduction

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"Extending the Boundaries of Total Quality Management" was the objective of the Eighth Annual NASA/Contractors Conference and 1991 National Symposium on Quality and Productivity. The attendees at this event explored various aspects of continuous improvement theory, strategies, and tools, and how these tenets could be applied to implement improvement efforts throughout their own organizations and within their community.

This conference brought the announcement of the recipients of the 1991 George M. Low Trophy: NASA's Quality and Excellence Award. I congratulate all eight finalists and the two recipients of this honor: Grumman Technical Services Division and Thiokol Space Operations. These two organizations have demonstrated a commitment to quality and continuous improvement that serves as an example of excellence in the aerospace industry.

The conference 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

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Opening Address --
"Extending the Boundaries of Total Quality Management"

Admiral Richard H. Truly
Administrator
National Aeronautics and Space Administration

This two-day meeting is about quality and continuous improvement processes. It's about being prepared and open to fresh ideas. But it's also visible proof of the growing importance of the total quality management concept, not only in this country, but around the globe.

Admiral Richard H. Truly

Today, over a thousand representatives from government, business, and academia — from the U.S. and nine foreign countries — have chosen to participate in this conference. Another 800 people will join in from concurrent conferences in Denver and the Goddard Space Flight Center in Maryland via NASA Select satellite telecasts.

This conference is a barometer of things to come. It represents the cutting edge of innovative ideas that are sweeping across our nation, and, I'm happy to say, have swept through our agency. Why does Total Quality Management come so naturally to NASA? Because the high visibility of the American space program has always demanded quality from beginning to end.

We're proud of our achievements. For over 30 years, NASA has lead the world in the exploration of space and aeronautics research, and we intend to continue this leadership. Just a few months ago, we launched the Gamma Ray Observatory and it has already discovered emissions so powerful that they defy present theory. We have just completed mapping Venus with the Magellan Radar Orbiter. Earlier this year we launched an ozone monitor on a Soviet spacecraft that has detected another spreading ozone hole over the Antarctic. Our TDRSS Communication Satellite Network is healthy and on station, and the Hubble Space Telescope is doing so well that it's swamped by interested investigators.

In the Space Shuttle program, we have launched eighteen flights in the last three years. That's an average of one flight every other month. This year, when we delivered the "Endeavor" spacecraft to the Cape, we returned to a fleet of four orbiters. But all this pales comparison to what will be accomplished in future years once we have a permanent presence in space. Space Station Freedom's restructuring is now complete. Despite being terminated at one point, a team effort from NASA and people across this nation enhanced strong bipartisan support from Congress and the White House to restore funding, and now, hardware fabrication is underway.

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But what about the future? As budgets tighten further, everyone, both in the public and the private sector, will be forced to become more efficient and more productive with fewer resources. NASA has made a commitment to lead the way again, actively testing these innovative management improvements. Sure, improvement means change, but change is imperative if we're going to succeed in achieving our dreams of tomorrow.

Our commitment to total quality even extends beyond the boundaries of our own workplace. NASA has been engaged in helping to improve American education, developing innovative math and science improvement programs in classrooms. We are full and eager participants in America 2000, and when President Bush chose to send his education message out to American students last month, he did so over NASA Select. Whether your organization is business, government, or academia, your commitment to quality must extend into your local school system.

As NASA moves into an exciting future, we intend to attract workers and contractors who can meet tomorrow's even-tougher quality requirements. Over the years, NASA, like many others, believed that the best way to ensure excellence was through inspections designed to find defective work. Although this approach has valid applications in space hardware, we have learned to shift our emphasis to problem prevention, with final inspection devoted to confirming quality. Where errors do occur, we want to know why. That's why knowledge capture and transfer systems are now an important part of our quality improvement strategy.

What are the most important things you will learn today? That successful managers do two things very, very well; they learn to determine and satisfy their customer's needs on the one hand, and their employee's needs on the other. You can't satisfy your customer without knowing what he wants. If you think you can best judge what your customer wants or needs without consulting him or her, you stand to lose a lot of customers to your competition. That's why you'll hear a lot about customer input and feedback today.

How do you satisfy employees? Give them a stake in the decision-making process. Empower them by pushing decision-making responsibilities downwards. Once you've empowered them, reward productivity. Nothing bolsters the ego more than recognition for a job well done. I think it's fair to say that in coming years, an organization without an awards program will find itself losing its competitive edge. Praise in public; criticize in private. By consistently rewarding innovative ideas you create what we call a continuous improvement culture. Only in this climate can you provide services and products that are considered to be of the highest calibre in the eyes of the customer. This is the essence of Total Quality Management, and the core philosophy of today's conference.

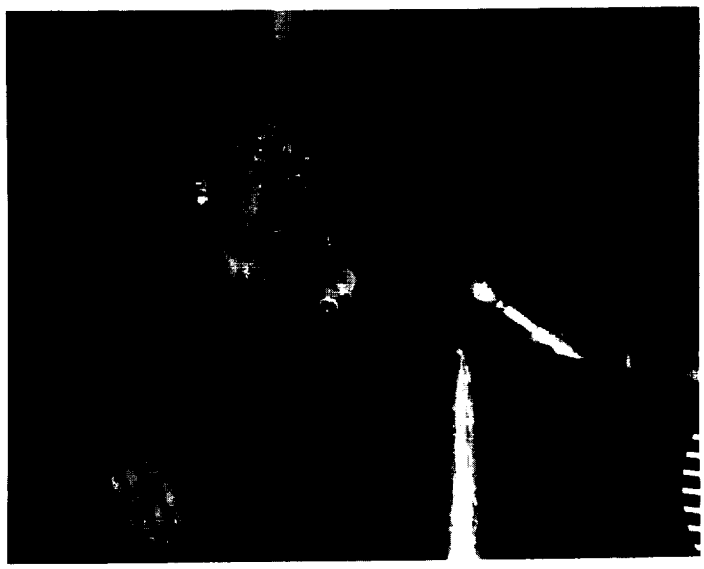
So take the messages from this conference back to your organizations and take action. Encourage meetings to challenge and improve your procedures. Empower your employees. Meet with your customer and refine your products and services to meet his needs. Develop strategic plans to chart your course, implement changes, then measure and analyze your progress. Above all, stress quality.

The President has set a goal for NASA — to inspire America through our achievements in space exploration. To reach that goal, we must look beyond our old way of doing business. We must all strive for excellence. I assure you that as long as I am leader at NASA, that is my top priority. It is my hope that you will join us in this quest for quality.

Conference Overview --

Joyce R. Jarrett
Director, NASA Quality and Productivity Improvement Programs Division
NASA Headquarters
Symposium Chairperson

Welcome to each of the over 1,700 participants at this site and at our other two locations. Your attendance is a mark of commitment, and I expect that commitment will be amply rewarded at this two-day event.



Joyce R. Jarrett

This gathering is the culmination of the efforts of many people. Planning an event of this magnitude is no easy matter, and my office was assisted by an enthusiastic and able planning team, which included representatives from many of your organizations. Our goal was to provide first-hand customer input and participation from the design phase and throughout the entire conference.

Thank you for taking the time to respond to the TQM Self Assessment included with your pre-registration materials. Over 550 individuals responded, and as in most cases, there's good news and bad news. Looking at this year's data, the good news is relatively high scores in management leadership and support, and quality assurance. The bad news is relatively low scores in strategic planning, training, and measurement, and all the scores are still only average on the 1-5 scale. So we still have a long way to go. This data will be used as a benchmark for future conference planning and evaluations.

At this conference, we offer a wide variety of quality topics for your consideration that will help address many of these weak areas. Over the next two days, over 110 presenters will share with us the important message of quality. At previous conferences we have stressed the absolute necessity for a culture change in American industry, or, to use the words of a recent public series, "to point out that we face a choice of quality or else." We will have quality operations, or else we will fail. Here we're going to explore how to extend the boundaries of our knowledge and practice.

As the conference planners have matured in their own understanding of quality, we have included more and more specifics on how to implement Total Quality Management. This year, we offer some new tools we believe will be helpful. There will be six sessions devoted to the principles and basics of Total Quality Management, but we also offer two sessions dealing with two aspects of community.

One community is global. We are extending our concept of community beyond the city limits of Houston, the state of Texas, or even the United States. As Lloyd Dobbins, who hosted the *Quality*

or Else television series pointed out, the price of tulips in Holland does have a direct effect on the flower vendors on the streets of Washington, D.C. Therefore, this year we have invited a number of international guests who represent the global community, from whom we have much to learn and share.

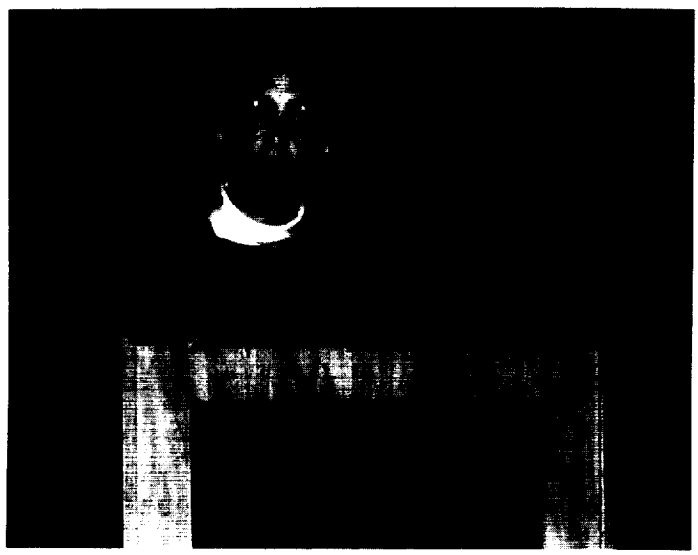
The second community is NASA and its contractors who, at each location, depend on an infrastructure of education, health care, environment, and the like to sustain and develop our current and future work.

In this spirit, we welcome many members of local communities from here and around the country.

Opening Remarks --

Darleen Druyun
Assistant Administrator for Procurement
NASA Headquarters

I hope that one of the messages you will carry away from this conference is that change is in the wind at NASA. Throughout NASA, both at the Centers and Headquarters, we have embraced the concepts of continuous process improvements. NASA's employees are being empowered through process improvement teams to find better methods to accomplish NASA's critical mission.



Darleen Druyun

Upon my arrival at NASA in July 1991, I made a special effort to meet with the customers as well as our own personnel in Headquarters to discuss their views of the procurement process. I soon discovered that my organization had serious deficiencies. As a result, I formed a process improvement team in the grants area and gave them a very simple charter: comply with statutes; comply with the OMB circular; and use good business judgment to rebuild a more responsive process.

We benchmarked the process and met with all of our key customers including the universities. We basically rebuilt the entire process. We visited some of the other grant organizations in the Washington, D.C., area who had a reputation for excellence, and tried to pick out the best of their ideas and fold them into the rebuilt process for Headquarters grants. It didn't take long to get some positive results. In three weeks the team came forward with 45 recommendations in the area of

educational and research grants, and an additional eight recommendations in the area of centers for commercial development type grants.

Some of the changes we are making include writing unilateral grants as opposed to bilateral documents and using a simple postcard for the university to acknowledge receipt of that document. Instead of writing a grant every single year, when we know that it's really a three-year program, we're going to start writing multi-year grants which will reduce our work load by about two-thirds.

We're also going to limit the size of interim and final reports to three pages instead of having universities run around and grab papers written by their students to fulfill some of the lengthy paperwork previously required. In my own organization, in the middle part of September I had a backlog of over 500 purchase requests for grant actions. I told my team that I wanted to have that whole backlog cleaned up by the end of September and, I'm very proud to report, empowerment of our folks reduced that backlog to zero.

Our lead time used to be 103 days. I told them the new goal I wanted to establish was 30 days. They are doing even better than that. It's taking us now an average of 24 days to get a grant through the system. We're also in the process of completely revising our grants handbook. If any of you ever had the chance to read this handbook, you'd find that it was certainly not a user-friendly document. In addition, recognizing that industry is really one of NASA's key customers, I have also established a standing process action team which meets with industry every two weeks to outline some of the problems they see in the contracting business.

These are just a few examples of the achievements of process improvement teams in our Procurement Office. I believe that the changes taking place in NASA under the spirit of TQM are beginning to bear fruit, but let me assure you, you ain't seen nothing yet.

Keynote Address — "Without a Finish Line"

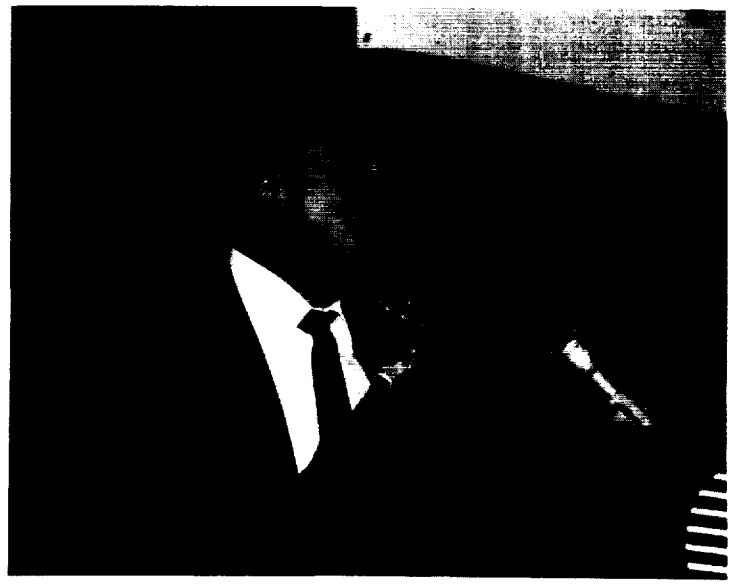
Dr. Renso L. Caporali
Chairman of the Board and Chief Executive Officer
Grumman Corporation

The other day, I was watching the New York Marathon on television. It got me thinking about the idea of a race without a finish line being a pretty horrible idea. However, when you sign up for total quality, that's the deal — you can't stop, because quality has no finish line. Our mission must be to strive for continuing improvement in all operations; perfection in our processes; and the full dedication of all our people.

In a marathon, the majority of competitors or participants are done when they cross the 26 mile mark. However, for the truly dedicated, the finish line is just one more marker on the way to the real objective of total quality.

As Americans, we're not used to that. We like to think of ourselves as people who can put out fires with brash decisions and find the shortest distance between two points. Continuing to refine a process can be dull, tedious work.

Often, we have preferred campaigns. At their worst, quality campaigns are a collection of truisms, a lot of empty rhetoric camouflaging an organization that really hasn't changed and doesn't want to. Sooner or later, the customers, the employees, and everyone knows it's a fake, and the results show it. What's left of the campaign just fades away.



Dr. Renso L. Caporali

Total quality, however, is the power to change, to improve, to succeed. But even at its best, improvement can be painful. Change is especially threatening for people in line management. Most line managers have worked very hard to get where they are, and they don't particularly relish the idea of giving up control or looking like they're backsliding. They believe in their way of doing things and resist changes which may weaken their control. A management trying to implement total quality has to understand this and be prepared to educate, and be prepared to make the personnel changes required if education is not enough.

The former Xerox Chairman, David Kearns, once said, "if you can stand the pain, look at yourself through the eyes of your customer." We at Grumman did that a few years ago and we weren't particularly happy with what we saw. We wanted to think of ourselves as forward-thinking, high technologists, cutting-edge kind of people. What we saw was a bureaucratic company which was living from one crisis to the next. We were convinced that our technological solutions were, if not the only solutions, then certainly the best ones. If our customers didn't agree with our ideas, obviously, they were wrong. We've been working very hard for a number of years to change all that and we've made some very good progress.

We began training all employees in total quality awareness, ensuring they knew and understood the techniques for analyzing the process, how to work in teams to find solutions to problems, and how to implement these solutions. Most importantly, our employees got to know who their customer was, and how their customer viewed their contribution.

For example, we thought we were doing an adequate job fabricating detail parts, with a turnaround on products of 90 days. Then we received a new contract but the first batch of parts took 108 days. The customer was pleased with the quality but not particularly enthusiastic about the cost. In addition, the customer was not enthusiastic about the time it took, and informed us that if we couldn't step it up a little bit, they wouldn't be able to continue doing business with us.

A team of 10 first-line managers went to work on completely re-engineering the way parts flowed through the plant. They found plenty of red tape, and plenty of places for improvement. They cut flow time to 50 days, reduced costs by 15 percent, and improved the quality of the output. The best part was that the people on the team and in the plant knew they'd made a real contribution. They've set a new goal of 30 days. They will succeed, and then strive for an even greater improvement. Perhaps that's why people sign up for a race without a finish line. It's not just that they want to win, it's that they love to run.

Mark Twain once said, "nothing is harder to stomach than the annoyance of a good example," so I'll give you a bad one. One of our groups wondered why it was taking 60 days to hire people. The

entire hiring process was reviewed, and the group discovered that 17 signatures were required for approving a new hire. Approval signatures were reduced from 17 to two, which reduced the hiring time to 10 days. Then time started to pass and for some reason, the hiring cycle started to grow. First to fourteen days, then twenty, twenty-eight, and in a matter of months, it wasn't very far from sixty again. The team reviewed their approval form with only two signatures, however, stapled to the back was another sheet of paper with the other fifteen signatures. This proved to us that you really can't let up.

Last year, we unveiled a 5-year plan for achieving world-class quality which we call Vision '95: Total Customer Focus. Vision '95 sets difficult but attainable goals, such as reducing critical work process times and defects by some very specified percentages, and achieving them by given calendar dates. However, Vision '95 does not represent a finish line, but rather an additional marker, because today the competitive environment mandates that we run continuously. Long-range expectations and participation in Total Quality Management have to address broad and complex issues, such as the changing U.S. market, global competition, environmental concerns, and the rate of technological advancements. Our customers, specifically NASA and the Department of Defense, are facing unprecedented fiscal, schedule, and quality pressures. In total quality or process improvement, the customer's concerns are our concerns.

Total quality is not a substitute for strategic thinking, sound financial planning, and luck. However, to create an organization that can deal with today's environment and tomorrow's challenges, you need to be grounded in the total quality process. You need a fundamental understanding of the importance of process improvement and how to execute it continuously. In the exploration of total quality, as in the exploration of space, there is no finish line. Where we go is limited only by our dedication, by our enthusiasm, and by our imagination. The trip may be endless, but fortunately, so are the possibilities.

Keynote Address —

How Much More Productive Can Education Become? 100%? 200%?

Dr. Tor Dahl
President
Tor Dahl and Associates

I first came to the University of Minnesota because of the man who won the first Nobel Prize in Economics. He wrote his thesis on production functions theory there and then applied it to actual people. If you're familiar with his theory, it's land/labor/capital technology, and I became interested in applying it to people as well, and expanding the theory.

My opportunity to apply production functions theory came about when an instrument called the Extensor Unit came to the United States. The device would signal the wearer at random times throughout the day. Each time a signal was received, the wearer would answer a series of questions called dimensions of performance; what you were doing; the time of day; whether the function you were performing should be done by you or somebody else, or nobody; how stressed you were; and how satisfied you were. You then stated how "productive" you were; because if there's one thing people hate, it is to be told by others how productive they are. The scale was from one to five

and, when the study was over, we could take the productivity as listed by each individual and express it as a function on their behavior, attitude, and judgments simply as an equation, with the positive coefficients indicating the productivity potential for any one behavior and a negative, the obstacles.

Dr. Tor Dahl

We were able to explain people's behavior in retrospective, with more than 95 percent accuracy. We were also able to express their stress the same way, using a different function and different coefficients, but the same principle. We were also able to express their satisfaction the same way, and, if you have the risk variables, their life expectancy. The idea was that we could simulate changes in their lives on computer and create conditions which simultaneously increased performance, reduced stress, increased job satisfaction, and lengthened their lives. The reason you have never heard about this work before was that the dissertations which were later published were totally unreadable.

Essentially, this allowed us to uncover the definition of productivity because each time a participant listed something that made him or her perfectly productive, or that was perfectly non-productive, the item in that equation that did so was perfectly correlated. This is how we discovered that there are only five elements to performance definition. We also identified the dimensions that affected performance. There are about two dozen of these dimensions with which you can explain variations in performance with at least 90 percent accuracy. In addition, we found that when you provide people with feedback on their performance, they will become roughly 15-30 percent more productive. That may not seem like much to you, but in terms of the U.S. overall, that's many times what the U.S. improves in performance every year.

Then I took to the field. I remembered working in a company where one superior salesman was 400 percent more productive than another salesman. They both went out with the extensor units, and they both improved 15-30 percent after applying the same performance feedback. I realized that the difference between these two salesmen was the important thing to discover. From that moment on, we stopped doing the extensor studies and switched to what we called performance histories.

We collected the history of this super salesman to see if there was anything which could be taught to others. We knew what questions to ask him. They were the questions which related to the two-dozen dimensions that effect performance. Then we decided to interview the 100 most productive people in the world because if the data began to converge, we felt might be able to put together the most important principles of performance. At that time, I was in charge of the World Confederation of Productivity Sciences and they knew pretty well who these people were. After interviewing the best people, I discovered the biggest disappointment in my life. When the data was analyzed, it did not converge at all. The only thing these people had in common was that they were all different.

At that point we were saved by a request from General Motors, IBM, Xerox, Fortune Magazine, and Corning. They wanted us to identify the factors which enhanced their productivity from input to output. After 90 days, we had identified 30 of these factors, after a year, 37. Suddenly we realized

that these factors were the same ones which had been selected by these 100 prominent people across the world, but each selected a certain bundle of them which fit their personality, their outlook and their way of being. We realized that a country like Japan had naturally selected the bundle which fit their country. This is a bundle which would not fit the United States, even if you tried, because this country needs a different bundle.

Then we were interested in how do you find the bundle that fits a country. So we selected a country, Norway, on which to conduct an experiment. We learned that there were five structural problems in Norway. We refer to them as a logjams. Norway had several logs: lack of willingness to change; the framework of the laws and regulations; the organizations; the government; the lack of competence; and the public attitudes towards productivity. But the single most important log was public attitudes towards productivity.

In Norway, productive people are punished , first through the tax system, then through other punitive laws. However, we found an exception, a way to break the logjam. We found that professional atheletes were exempt from that law. No matter what they did they were carried on this wave of enthusiasm by the population. As a result of this discovery, now the Norwegians are trying to treat high performers like professional athletes.

The next place we studied was a hospital. The key log there was that the hospital was not for the patients, but mainly for doctors, nurses, etc. Once it was decided that the hospital was for the patients, the institution transformed from 52 departments to 18, with much of the work contracted out. Once the logs are found and disposed, the factors that remain constitute your strategic bundle.

We found that these basic principles of productivity seem to be universal. Now let's apply this theory to education. I'm a product of the European-Latin school, which means that we were all educated alike. My daughter is the product of the American educational system, which tries to educate everyone differently. America is the only nation which attempts to provide a tailor-made education to students. No other country has the resources to do it. By using the same productivity analysis techniques, we can free up educational resources and perhaps increase productivity by 100 ... even 200%.

Candy Johnson Rausch

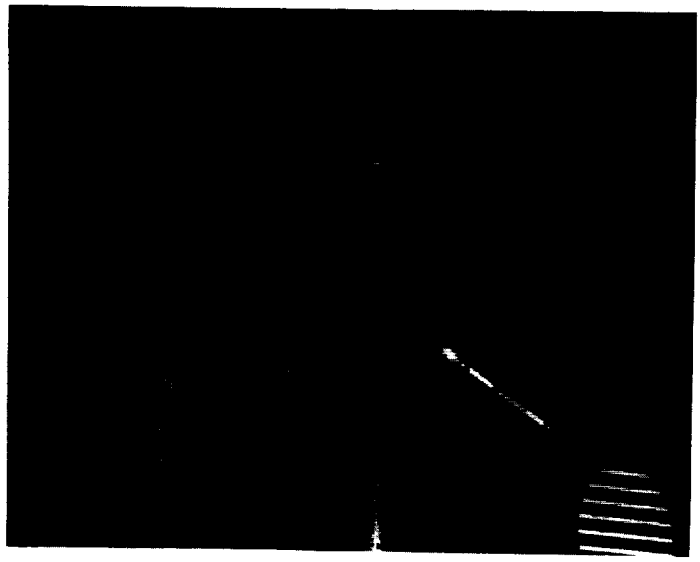
Executive Secretary
World Confederation of Productivity Sciences

"Why can't Johnny read?" That's the question that epitomizes the failures of the American educational system. If there was ever a system ripe for productivity analysis techniques, this is it. Our experience in the school district of Chaska, Minnesota, illustrates the problems of organizations trying to improve quality and productivity.

When we began the project, about five years ago, the teachers of Chaska had just come out of a long embittered strike, one of the longest in history in our state. The teachers were sincerely committed to producing quality, but they weren't sure how to change the 100-year-old system. It's the same dilemma school districts across the nation are going to have to face sooner or later, how to satisfy societal demands for improved quality with flat or declining resources and a burgeoning school population?

How do you go about changing a 100-year-old system in a whole new way that fosters creativity and risk-taking? Chaska did this beautifully because they attacked the problem systematically. They learned the cognitive skills involved with productivity analysis and applied them. They had

a chance to think, judge, and will their way through their problems using the principles that we're going to discuss.



Candy Johnson Rausch

First, they all got together and brainstormed to identify the problems. One of the first problems they identified was waiting time, the time teachers wasted just waiting for something or someone. They found that 6.7 percent of their school day could be saved by implementing strategies to cut waiting time. The average teacher spent 2.4 weeks of the school year just waiting. This was time that could be easily freed up.

Next on their analysis list was delegation. This means determining who is the ideal task performer for a certain job, and then assigning it to them. For example, teachers end up doing a lot of clerical work which people of lower skills could easily do. In any case, they determined that on average, 14.5 percent of their time, 5.2 weeks per year, could be freed up by eliminating the things which no teacher should ever have to do. In education, delegation is one of the key elements in successful reform.

The teachers of Chaska looked at a whole range of productivity issues, and the bottom line was that 68.1% of their time could be freed up for more productive pursuits if things were only organized better. Among the 192 teachers who took part, that's a total savings of 130.8 teacher-years saved each and every year. If implemented permanently, taking into account that the average teacher in Chaska had 26.4 career years left to them at an average salary of $30,000, that's over $100 million worth of teacher's time saved merely by inspecting and changing their processes. If previously, only 31.9% of a teacher's time was being used productively, then eliminating these logjams increased productivity by over 200%.

Then the teachers of Chaska did another interesting thing. Not wanting to waste their hard-fought gains, they asked themselves where they would want to reallocate these saved hours. The first thing on their list was to increase the self-esteem of the students. This project has had a drametic effect on the teachers and the students in the Chaska school system. One high school teacher reported, "What I learned from this project was to open up to my students and to take an individual interest in each one, rather than just lecturing to the whole. Now we learn in teams, and I work with other teachers to integrate subject matter so that kids start to make the interconnections so necessary to real learning. Now, they are really excited about learning because they know that I'm interested in their success as individuals."

I think that says a lot to anyone trying to motivate individuals in any sort of organization. In Chaska, the teachers went through seminars. They figured out how to free up resources, how to reallocate, and then reported this information to their administration. Everyone developed a plan to make some early successful changes so that people would realize they were serious.

They learned that one of the first things needed when you're starting a project is to have some early successes. One of the first successes in Chaska was related to waiting time. The superintendent decided that each teacher should have a telephone in the classroom. Why not? Every business person should have a telephone. That way, teachers would be allowed to communicate with parents immediately to figure out why Johnny might be having a problem. There would always

be that telephone access instead of waiting until the class was over and then walking to the office and perhaps waiting several minutes to get a turn to use the telephone. Now, when it was critical to get hold of a parent right now, they could do it.

Another age-old question for American educators is how do you meet diverse learning backgrounds of children when you only have one teacher for 30 to 35 students? In Chaska, they went out looking for qualified volunteers. They approached local colleges about their MBA candidates in education. The colleges offered a one-year internship in our school district for credit. The MBA students came into the schools and provided another adult in the classroom. Then the parents were asked to spend some time in the classroom. We all realized there were a lot of working parents who wouldn't be able to help out, however, a surprising number of them were enthusiastic, and others asked that we send projects home so they could participate.

In short, the community became involved. They began to get para-professionals into the classroom so they could mainstream children with deficiencies. The school system decided on some creative, innovative, new ways to tackle the issues without adding more financial problems to the district. Suddenly, extraordinary things began to happen. They now have one of the national models for educational reform. In one school, they have ten children to one adult in every classroom, and not one of those children lose out on important lessons because they're always caught before falling through the crack.

They won the Ashland Oil Team Excellence Award in this district. They also became one of ten learning labs for the National Education Association in the entire United States for their efforts to reform education. They've integrated curriculum. They have thematic learning, project learning, and they've done wonderful things to change.

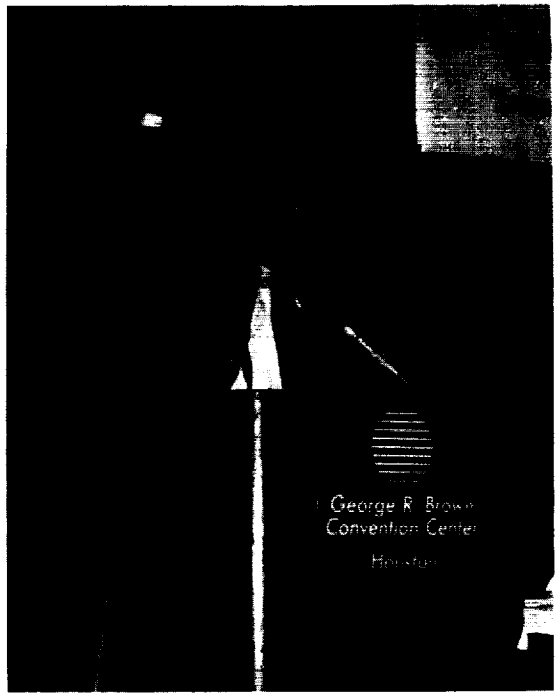
Thanks to the Cray Research Foundation, which sponsored the research, Chaska was able to embark on this change process in education. Also, thanks to NASA and a lot of the businesses represented here today, education is getting the support that they need to change a 100-year-old system.

Keynote Address — "Total Quality Customer Service"

Jim "Mac" McIngvale
President
Gallery Furniture Company

Gallery Furniture is a 30,000 square foot retail furniture store servicing the medium to medium-high price furniture market in Houston, Texas. From the beginning, Gallery differentiated itself from its competitors by offering same day delivery of furniture. You can come to Gallery Furniture any day of the week, Monday through Sunday, from 9:00 a.m. until 10:00 p.m. and buy furniture, and we will deliver that furniture the same day. Every Saturday, for example, we would deliver up to 300 pieces of furniture in a single day.

Gallery Furniture has always been a sales driven organization with highly paid, commissioned sales people. The impetus from day one was to make the sale by any method as long as it was legal. Gallery grew from a $5,000 investment in 1981 to $50 million in sales this year, in spite of our conventional management structure which featured management-by-results, goal-setting, incentive pay, ranking, and rating of employees.



Jim "Mac" McIngvale

However, I became frustrated because of store closing percentage. The number of customers divided by the number of sales never seemed to get above 40 percent which, in a furniture store, is pretty good when you consider the industry average is 20 percent. However, we wanted to do better, but no matter how many extra incentives were offered to our people, how many contests were started, or how many threats were made, the sale percentage never went above 40 percent.

Then management came up with a brilliant idea—keep the store open with only the best sales people. We had 80 sales people at that time, so we decided to have a monthly contest. At the end of the month, the top ten producers could take as many customers as they pleased the next month. This was judging performance using arbitrary goals which fostered short-term thinking, misguided focus, and much internal conflict. This contest created ten people who were embarrassed because they had won the contest and had to go in front of their friends continuously the next month (customers were taken in a sort of batting order). It also created 70 other people who felt like losers and failures.

By judging the performance on these arbitrary goals, we also fostered fudging of figures, and created fear in the work place and total blindness to customer concerns. In addition, if on any Saturday or Sunday you sold less than 30 percent of your customers, you were forced to sit out the following day until all the other sales people were busy. In other words, you couldn't make any money. There were rewards for so-called producers and achievers, and punishment for supposed deadbeats.

Of the 80 sales people, 10 to 15 turned over every month, and management wondered why half the people were still below average. We had a daily sales goal. If it was reached at the high point of this madness, the first place person received $300, the second place $200, and third place $100. The thinking was that people worked harder for a carrot, but nothing ever changed. The closing percentage never got above 40 percent, and the sales people would do great one month and poorly the next. I knew there had to be a better way to manage the business.

Then in October 1990, five Gallery people and myself attended Dr. W. Edwards Deming's 4-day seminar on quality and productivity in Houston, Texas. Most of the concepts Dr. Deming was talking about made sense to me; but eliminate merit pay, incentive pay, and commissions? Never! That built the business, or so I thought. But Dr. Deming's concept of continuous improvement intrigued me. I figured if his 14 points were good enough for Toyota, Honda, Sony, General Motors, and Ford then parts of them, the ones I liked, would be good enough for Gallery Furniture.

After the seminar, I bought the Deming library tapes and I watched them, and I began to get the message. Gallery Furniture had been lucky and successful in spite of myself, in spite of bad

management practices which crushed people and their intrinsic motivation. After attending another Deming seminar, I began to get the message from Dr. Deming that cooperation worked and competition didn't. Upon returning home we had four to five of our people who were quality commandos ready to take the plunge to salary pay, but the other 85 people were skeptical.

Before January of this year at Gallery Furniture we had winners and losers in the sales game. The winners had to produce $7,000 a week in sales volume, shipped out the door, plus $400 in add-on chemical sales, to achieve a 20 percent commission or basically $700 a week. However, this zero sum gain also produced losers. If you did not meet the quota, no matter what the circumstance, you're into 5 percent commission or $300 a week.

Obviously, all types of games were played to reach the quotas on a weekly basis. For example, some sales people would work six to seven days a week to reach the quota. Deliveries were forced out on Thursday night at the end of the week to meet quota. Customers were not allowed to buy what they wanted if that item had little or no profit in it. The sales people would turn down sales or switch the customer to a higher profit item causing the customer to become agitated and frustrated. And it was an everyday occurrence on Thursday night to see sales people leaving with their arms full of 30 bottles of furniture polish. In addition, furniture was stored in employees garages before it was to be shipped to the customer.

In January of this year we decided to remove all quotas. We still paid everybody commission, but quotas were removed. Amazingly, sales went up and attitudes improved. Our closing percentage spiked up tremendously in December because that's the best month in the furniture business.

In retrospect, those months of discussing the pros and cons of Dr. Deming's philosophy with our people was good preparation for the change. I had learned at the seminar that any change would bring with it a new set of problems, but at least the problems would be new. I was tired of the same old problems, like battles over commission and the weekly payroll nightmare.

We decided in April 1991 to pay all sales people a salary and, if the company profited, everyone would share equally in our profit-sharing, gain-sharing plan. There was fear that the sales people would become lazy; they would have no incentive to do their share. The sales people thought they wouldn't make enough money, they would not be dependent on their own efforts for success, and feared they would still be evaluated, appraised, ranked, and rated on the same old tired criteria and measurements.

After 6 months, we discovered that people actually do more work, not less, and they're eager to prove their worth. Success at Gallery Furniture is now measured in ways other than the daily figures. Management doesn't look at individual figures, we look at the whole system. We see the business in a new way. People take joy in their work because, finally, they are allowed to use their abilities and participate in education, teams, buying, decorating, and delivering furniture. Cross-training is now rampant at Gallery Furniture, which we previously could not justify. Performance appraisals have been eliminated, and people are encouraged to contribute to the good of the system using their special talents, whatever they may be.

For example, right now, this week, we are currently remodeling our store, and adding a new display showroom of about 6,000 square feet. This is a state-of-the-art showroom. We had commercial contractors bid the job for $70,000. Some of our sales people convinced me that they could complete the construction for less than $5,000. The construction will be done tomorrow, and the showroom will look better than if we'd paid $70,000 for it. This was done without any sales people worrying about losing commission or sub-optimizing.

Older sales people now help the new people, seeing the new people as an asset, not as a threat to their income. Sales turnover is down from 10-to-15 people every month before April, to 2 in the last 6 months. Sales ads in the Houston Post and the Houston Chronicle at a cost of $1,000 per newspaper per week have been eliminated. People are more secure and, for the first time, they're

able to budget their income without wild swings in a month's time.

People cross-train in all areas, the warehouse, unloading trucks, going on deliveries, and are able to see the business as a totally interrelated system. We are now problem solvers not product pushers. The customer is now allowed to buy what they want, what will best suit their needs, not what would have paid the highest commission. Sales people now spend their down time working on improving techniques, not pouring over computer printouts wondering how close they are to their quotas.

We have learned that the customer is the business and the business is the customer, and we are now concerned with one thing — by what method can we delight customers. Payroll now takes an hour a week, not 9 to 10 hours. Management is able to spend time helping people by coaching and nurturing, not rating, ranking, and firing. A learning environment is being created and people love to learn and excel at their jobs for the shear joy of just doing it. And most importantly, from a business standpoint, sales, closing percentages, and profit margins are way up. Cost of sales is down, and customers are happy.

The store closing percentage has gone from 40 percent on the commission days to currently over 55 percent, an amazing increase. Employees are happier, management is happier, and most importantly our customers are delighted. Unfortunately, in this country we think competition is good . However, I believe we must realize that the lessons learned in sports and athletics of "I win, you lose," do not apply in business, education, or life. We must, like Dr. Deming says, let everybody share in an ever-expanding market, and ever-expanding pie, by innovating and expanding the market for everyone. We must let everyone win.

We've made a transformation in management thinking at Gallery Furniture in the last six months. Before, we focused on individual events, we found people to blame. Now we view the organization as a holistic body. We do not focus on individual events. Before we made great efforts to run off below average employees. Today we see our employees as the only asset of the company. Before we had no education. Why? Because employee turnover was too high. Today we invest large sums of money in developing our only asset - our great people.

Before we couldn't understand why certain people couldn't handle certain situations effectively. Dr. Deming has taught us that different people react in different ways. Before when a problem arose, we focused and dwelled on the problem. Before we stuck people in slots and ignored their potential. Now we found out that everyone has marvelous things to contribute to the good of the business.

At Gallery Furniture we're trying to establish a culture that takes high risk and reaps high rewards. We must encourage our people to take risks and sure, they're going to fail, but often they will succeed and will reap the benefits. Other benefits are that people now improve their training and education. We've cut our supplier base from 150 to 40. Management now listens to the people, our employees are transforming into system improvers.

There is now, at Gallery Furniture, intense cooperation. It is a long and arduous task, but I'm here to tell you that it can transform American business and American society, and change the thinking that is putting us farther behind our international competitors everyday. We must saturate every area and every activity, and we must begin today. TQM is indeed a long hard climb, and there will be lots of growing pains, but the gains are certainly worth the few pains.

At Gallery Furniture, we learned that as you improve quality, you decrease costs, you improve productivity, you decrease your prices to your customers, you increase the share of the market and the entire market size, and you stay in business. Everybody wins, nobody loses. We are sold at Gallery Furniture on group processes with people working together.

Cooperation works. Competition doesn't.

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

I'm particularly honored to be joined on the Top Leadership Panel this morning by Bob Gower, President and Chief Executive Officer of Lyondell Petrochemical Company, and Arthur R. Taylor, Dean of the Graduate School of Business Administration and Dean of the Faculty at Fordham University. You've all heard a few remarks by me on quality so I won't make another presentation myself this morning. All three of us will be more than happy to try to respond to your questions at the conclusion of Bob Gower's and Dean Taylor's presentations.

Top Leadership Panel *(from left to right): Admiral Richard H. Truly, NASA Administrator; Arthur R. Taylor, Dean, Graduate School of Business, Fordham University; Dr. Bob G. Gower, President and Chief Executive Officer, Lyondell Petrochemical Company; Joyce R. Jarrett, Director, NASA Quality and Productivity Improvement Programs Division.*

1.2 Panel Presentation

Bob Gower, President and Chief Executive Officer, Lyondell Petrochemical Company

Lyondell was formed six years ago by combining two substantial, money-losing businesses and was at that time a division of Atlantic Richfield Company. In 1989 we became a publicly traded company and Atlantic Richfield continued to maintain a major stake in the operation.

Our company includes a 265,000-barrel crude refinery located in Houston, which produces an array of hydrocarbon fuels, lubricants, and petrochemicals such as ethylene, propylene butylene, methiodal, aromatic chemicals, and a variety of other chemical products. Now these are the basic building-block chemicals of many products that you use every day.

When Lyondell was formed in 1985, the historical performance was not very good. The operations had been losing money at the rate of 200 million dollars, before taxes, each year. Morale was at rock bottom, and performance was middle-of-the-road by any other measurement that you would use to compare yourself within the industry ... productivity, safety, environmental. And the future outlook was every bit as poor as the historical performance. We real-

ized that we had no unique assets, we had no unique technology, no unusual market position by which we could differentiate the company. We were very proud of our assets and very proud of our technology, but they were not unique. We believed that we were very strong marketers, but we had no unique position in our marketing area.

The only way that we could differentiate Lyondell was through the performance of our people. So we set out to improve this strength. We changed the management style to empower our people to do their jobs, to enhance communication, to emphasize low costs, to emphasize quality in every action, to seek continuous improvement, to encourage teamwork, and most importantly to strive to be the very best in every business in which we participated.

We began Total Quality Management in 1985 when Lyondell was formed, although we did not call it that at the time. We talked about it as a culture change; we talked about it as survival. I strongly believe that the key to quality is management style. If people are empowered to do their jobs, quality is almost certain to result. That's the route that we took in converting Lyondell to a high performing company.

We have several underlying beliefs that have become the foundation of what we call managing the Lyondell way. They are the core of our quality effort. First, we believe in operating with minimum people. Only those that are necessary to do the job. We have no frill groups to massage the egos of top management. We have no staff assistants to make managers feel more important. We have no headquarters to duplicate and check the work done at the plants. Our goal is to do each job one time only.

Secondly ... and this one is far more important ... we believe in minimum management. Most large companies are severely over-managed. They have added layers of management until they have no idea what's actually required. These excess managers just get in each others way and they certainly get in the way of productivity. They create rules, regulations, reports, presentations, and lots of bureaucracy. We eliminated 2-4 layers of management when Lyondell was formed.

Third, we believe in high responsibility to every employee. Our employees are intelligent and they do not need full-time guidance. They do not need a manager watching every move that they make. We empower our people to do their jobs and to make decisions. And that's how we get superior performance, and that's how we achieve consistently high quality products and service for our customers. With responsibility, we expect accountability. Every employee is accountable for results. Every person must take his or her job seriously enough to become the best they are capable of being.

Fourth, we minimize reports and ritualistic presentations. We just cannot afford to collect data which no one wants to look at. And we virtually eliminated the slide presentation mentality. That may be the proudest accomplishment that we have at Lyondell. In most large companies you can get anyone to believe almost anything if you put it on a slide. If it had neat lettering and color, that would be the same as if Moses brought it to you himself. Some absolutely preposterous decisions have resulted from good slide presentations. I know because I've given some myself. We don't use slides very much at Lyondell, and when we do, we don't give any special reverence to them.

Fifth, we do not conduct search and destroy hunts. When something goes wrong, we used to do a thorough inquisition, find the people who were responsible, and then thoroughly embarrass them or frighten them so that they wouldn't do anything else ever. Now this is a very effective tool to virtually guaranteed to prevent independent employee action. Of course, it also virtually guarantees mediocre performance. Now, we don't need search and destroy hunts. We don't need to assign blame. We do need to learn from each experience, and we do need people who are willing to take action on their own. That is our life blood.

Sixth, we have tried to create an environment where people <u>want</u> to do their jobs well. This is the only way to get sustained high performance and sustained high quality. You cannot force people, you cannot scare people into high performance; they have to want to do it. They will want to if you tell them what's going on, what the goals are, and what's expected. That's why we have employee meetings every month at each of our locations. At these meetings we talk about goals, progress, and quality measurements. Every aspect of the business is covered at each one of those meetings.

Seventh, we believe that employees can have a major impact on performance. That's why we have a profit sharing program, and that's why we continually ask for ideas. After all, the people who know the most about how to improve something are invariably going to be those who are working on it. Over the past five years, we've received over 3,500 ideas from our first and second level employees. That's an average of about two ideas per person at that level in the company. And these ideas have averaged over $10,000 annual improvement per idea.

Eighth, we emphasize low cost. Now that's an absolute essential in our type of business. It's the

only way that we can survive. But it also is relatively easy. Employees know that we need low cost. I think people are born knowing that, and they'll help you keep the cost down once they believe that management is actually serious about it. Now that's the hard part ... getting management to be serious about it.

Ninth, we believe in fast reaction. We cannot afford six-month studies which are just excuses for our inaction. We expect people to make decisions when the issue comes up.

Tenth, we emphasize motivation. Motivation is easy. Just watch for people doing the job right, and then commend them for it. Give people responsibility commensurate with their ability. Treat everyone with equal importance. When ideas are submitted, be sure to handle them with respect and praise if they are good ones. Be honest with people.

Eleventh, we emphasize teamwork. Most of us are far more valuable as part of a team than we are as individuals. And teamwork goes across all operations at Lyondell. We expect close cooperation and team function across department boundaries. Teamwork is the best route that I know of to achieve quality and productivity.

Twelfth, we pay attention to keeping the credibility of our management high. Companies and management groups rise and fall based on credibility. Management must be credible. You do not achieve credibility by double standards, by inconsistency, by blaming others for your mistakes, by avoiding questions, or by giving dishonest or misleading answers. Employees evaluate managers full time for credibility and they grade hard. I can assure you they grade real hard. For an organization to achieve its total potential, the management must be credible.

Thirteenth, we accept responsibility for our operation. The business environment, as overpowering as it may be, is not responsible. The government, as much impact as it may have, is not responsible. We are in these jobs, we are paid to do them, and we are responsible. We will succeed or we will fail by our own decisions.

And finally, our most important belief is in ourselves. We expected to succeed when Lyondell was formed, and we still expect to succeed today. Lou Tice, who is a leading business speaker, says that to achieve something you must first set the goal. Then he says you must want to achieve that goal so much that you develop an image in your mind of what it will be like when you achieve that goal. How good it will feel when you achieve that goal. Then he says that you have to want to achieve it so much that you get sick when events begin to veer you away from achieving that goal. Now that's the route that we took at Lyondell. Every person expected to succeed. That's the way you achieve success, and it's also the way you achieve quality.

You achieve quality when everyone knows what is wanted and when everyone develops an image of quality in his or her mind. You develop quality when everyone in your organization, top management, and every employee, wants quality so much that you get sick when events prevent you from reaching that goal. When quality is that important, you will achieve high quality.

From the first day of operation at Lyondell we've built on some very basic human traits. Number one, most people want to do their jobs well. Our responsibility then is to make sure that they know what constitutes doing the job well. Our job is to let them know what is wanted. Number two, most people want to succeed. Our job then is to lead in a manner which provides them with a good chance for success. Number three, most people have a lot of pride. Our job then is to provide opportunities to take pride in themselves, in their job, in their company. Four, most people have ideas and want to see them used. Our job then is to provide them with an open environment where they can express and implement those ideas. And number five, most people want to have responsibility. Our job then is to hold down our own egos and our own self-importance enough so that other people can have responsibility.

These are the things which turned a demoralized employee group into a highly motivated team. These are the things which helped us become a leader in quality and one of only nine companies in the large manufacturing category to receive a site visit this year for the Malcolm Baldrige National Quality Award. These are the things that changed Lyondell from an unprofitable operation, to a company which has earned more than 1.7 billion dollars after taxes since 1985. These are the things which helped Lyondell become the most productive large industrial company in the United States, ranking number one in the Fortune 500 companies in both sales-per-employee and profit-per-employee for the last two years. We have ranked number one in those categories for 1989 and 1990.

We set out to change Lyondell in 1985. We believed that we could improve on the way the business was run. We believed in ourselves, we believed in what we could accomplish working together, and we believed that a lot of management techniques which were known by conventional wisdom to be right, were in fact dead wrong. We changed that style and we have succeeded.

1.3 Panel Presentation

Arthur R. Taylor, Dean, Graduate School of Business, Fordham University

I left Stuttgart late last night and got here at 3 a.m. this morning because I wanted to say just one thing: the people in this room can make a difference. And what difference am I talking about? The difference is that if you're not trembling for this beloved republic, you should be trembling. Because we are in financial difficulty, we are in political difficulty, and we are in industrial difficulty.

My job this morning is to talk about how you educate leaders for TQM. I'm only going to touch on a few of the most important aspects. Number one, this audience is too old. You all look like me. And I'll tell you what's wrong with being too old. Just as we are beginning to define the age of quality in America, it's going to mutate. And because most of us are in our final chapter of life, the question is, will America have enough business executives with TQM experience to be able to grasp the changes and keep us competitive? We need people now who can invest 20 years, 30 years, 40 years, and 50 years, and that, indeed, is a different group than is here today. So I encourage you in the future, they're never too young to bring into the fold.

How in the world did we get ourselves in such a mess. How did we liquidate the industrial base of the United States, once so superior. Part of it was political. Part of it frankly was the responsibility of our friends on the other side of Asia, South Asia, and part of it was the Japanese. But a lot of it is our fault, and a lot of it is my fault.

We have trained an entire generation of managers in this country not to take chances and to only look at the short-term profits. As you come through middle management, and you get to the top, and you say to yourself "If only I can get through to age 65 without disaster overtaking me, my success will be assured." Now those are the kind of people we can't have anymore. In addition, this idea that you can run huge, diverse corporations through financial manipulation and artifice (and that's what we taught) is dead, and it deserves to be dead because it's the source of a lot of our difficulty. Now, we have to train our chief executive officers to give that up.

Today, we run the Fordham School totally on a TQM basis. The turning point came one day when my middle-management asked me, "What do you want us to do?" This was important because schools don't have much money so when you're deciding how to commit funds, it's a big deal. I gulped hard, and decided to take the plunge myself. I empowered them to find the answers and make the decisions. I told them to come back and see me only if they couldn't find the answers themselves. No one ever came back. Decisions got made. Mistakes were made occasionally, of course, but the truth of the matter is, it is working beautifully, absolutely beautifully. And so, if there are those of you who haven't jumped into the jacuzzi yet, the jacuzzi of Total Quality Management, come on in. The water is indeed just fine.

You know, *Business Week* recently discussed something called the Chief Executive Officer disease. And the symptoms are recognizable. It's a boss who doesn't seem to understand the business anymore, who's decisions come slowly and then can be abruptly changed, it's the CEO who purposely surrounds himself by "yes" men who will not offer innovative options or opinions. I knew such a man once, and we accused him. We said, "Henry, you are a "yes" man." He said indignantly, "Oh no I'm not. When my boss says 'No', I say 'No'."

I spent the day with Dr. Deming last week. It is no exaggeration to say that after him, they threw the mold away. I was very impressed. The main impression he left on me was his incredible integrity. He doesn't fool himself. He doesn't fool anybody else. The ultimate ethic of TQM is integrity. Unless the people in the operation have integrity, you can't say to the customer, "I hear you customer; I'll change, customer; I will give you a better product, customer." You can't listen to them, and they aren't likely to listen to you.

The question is, can we change fast enough? Although the quality movement is now rolling, it is still very small. Only a few American companies are participating. It interests me tremendously how much the American military has shown leadership in this field. I've just become associated with the Defense War College at Fort Belvoir, and I'm impressed by what goes on. The problem in the past has been that the middle-management system tended to eliminate the very types of innovative managers who are now the stars of TQM. Middle management has a very hard time, because the pressure to conform is very great. The worst thing it does is squeeze out innovative thinking. If we're going to be competitive, we need innovation. We have to teach management systems which encourage men and women who think innovatively, who take risks and are not punished for the occasional failure.

Many executives have seen the light. Last week at Fordham, we had a meeting of our visiting commit-

tee of 92 Chief Executive Officers. What they said to us was, "stop already." Stop already with financial artifice and manipulation, and excessive preoccupation with calculation. Concentrate on the soft skills, human skills, human resource skills, the building of teams, the building of organizations which are not hierarchical, the building of organizations where middle managements can be supportive, if it exists at all. At Fordham, we'll train students in these techniques, and we'll give them experiences, and when they come out, they will be a joint product of education at the graduate level and experience on the industrial level.

Now let me tell you one other conclusion our research has led us to, and incidentally, we have been doing research in TQM longer than any other university in America. If you don't believe that, ask Dr. Deming and Dr. Juran. We think TQM is totally applicable to the reorganization of the American educational system from kindergarten through high school. That's a very important conclusion. Remember, when people talk about our miserable educational system, it's not all bad. Fifty percent of the system is superb, the best in the world. It's the other 50% that does not bring enough people into success.

Let me leave you one last thought concerning a dynamic factor with which management of the future here in America will have to contend: by the year 2010 more than half of the work force in the United States will be of color. These are people who very often have not gotten a fair shake, and who will want a fair shake, who deserve a fair shake. This will present enormous new management problems. To attempt to address that within a hierarchical management mode is insanity, and you have to get that message through. And I will go anywhere. I will travel any night, any morning because it is my mission in life to help get that message through.

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

Highlighting the George M. Low Trophy: NASA's Quality and Excellence Award - 1990 Recipients Marotta Scientific Controls, Inc., and Rockwell Space Systems Division, and the eight 1991 Finalists.

2.1 1990 George M. Low Trophy Recipients

Panel 1 - 1990 George M. Low Trophy Recipients (from left to right): Darleen A. Druyun, Assistant Administrator for Procurement, NASA Headquarters; Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc.; Robert G. Minor, President, Rockwell Space Systems Division; (not pictured - Robert Medina, Office of Aeronautics and Space Technology, NASA Headquarters).

2.1.1 Introduction

*Darleen A. Druyun, Assistant Administrator for Procurement, NASA Headquarters, **Chairperson***

The George M. Low Trophy recognizes those contractors that have met and surpassed the rigid award criteria that stresses achieving the highest quality and excellence in their field. This panel provides us with an opportunity to hear first-hand about success. The 1990 recipients of the George M. Low Trophy will provide both a small business and a large business perspective on the continuous improvement efforts that enabled them to achieve this award-winning level of excellence.

2.1.2 Total Quality Management - The Foundation for Continuous Improvement

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

For the past year, I've spoken to many audiences on the subject of managing for continuous improvement on behalf of NASA and the George M. Low Trophy program. I'm particularly honored to present at this conference. While America is making concerted efforts to raise the quality of all of its goods and services, it is you who are the leading edge of the quality revolution, and you who will apply your knowledge and ingenuity to bring about excellence in all that we are to accomplish. Total Quality Management and the quality culture that's nurtured for TQM is the foundation for continuous improvement. Notice I say a quality culture, not the attainment of total quality. We all know that quality organizations, comprised of quality people, produce quality products and services. The very definition of quality—meeting or exceeding our customers' expectations—means that we never achieve the goal of total quality because our customers' expectations keep changing and our organizations must operate in an environment which allows us to respond to these changing needs. Continuous improvement is not just being better, but doing a better job of providing what the customer really wants.

Marotta Scientific Controls was started by my father, Patrick T. Marotta, in the basement of his home and garage almost 49 years ago. The business grew, and he moved the operation into an old abandoned schoolhouse in January of 1944. At the present time, we have 250 employees operating in a state of the art facility in Montville, New Jersey. Marotta Scientific Controls designs and manufactures high-performance systems, valves, and fluid control products for specialty liquid and gas control applications. Marotta products have been used by NASA since the beginning of the space program on such programs as Jupiter C, the Explorer 1 satellite, the Space Shuttle, and the Space Station program.

Since Marotta first embarked on formalizing its approach to quality based on a strong foundation which we had, our people have accomplished a great deal. Measurable improvements at Marotta include a 27% increase in sales per employee in two years; a 60% reduction in past due backlog in 3 years; a 23% improvement in on-time delivery in six months; a 4-fold increase in the number of computer-aided design (CAD) drawings annual over the past 3 years; and a 23% improvement in our safety rating for workman's compensation and employers liability insurance. Also, two major customers were convinced that their onsite inspections at Marotta were no longer required to ensure receiving a quality product. Both of these customers presented Marotta with an award, and, more importantly, the authorization to use Statistical Process Control (SPC) in lieu of their source inspections. This is an example of how TQM is used to build partnerships between vendor and customer.

Quality is not about the performance of a product as an end unto itself, but how that performance impacts on the goals and objectives of our customers. We have found that success in moving the organization forward toward quality calls for us to address the interpersonal as well as the rational issues. The rational issues deal with the processes in place, the equipment that is used, the statistical methods employed, and all the other tangible things that we can measure. The interpersonal issues deal with people. Addressing the people issues is critical to success. The attitudes and behaviors of both management and employees can make TQM a great success or a dismal failure. The principles and values developed by my father have provided a solid foundation which has led to the development of a quality culture that allows us to successfully address the rational issues associated with TQM. It is when the rational issues are integrated with the interpersonal issues that organizations move forward. Pareto charts don't generate results, people do. SPC techniques are used to monitor many of the quality processes within Marotta and ensure that we have measurable variables to manage. It is management's responsibility ensure that you have measurable things to manage.

We introduced SPC to our employees in 1988, beginning with management. Since that time, we have trained nearly every employee in SPC methods. Encouraging our people to properly implement and use SPC is a continuous challenge. Management must be 100% committed to building quality into the product with the people who design, build, assemble, test, and service the product. By giving our employees SPC, we give them a method of measuring self-improvement of each process. We also give them the tools and the responsibility of performing quality work. When we try to inspect quality in, we absolutely send the wrong message. Corrective action programs never built a product right the first time.

Corrective action must be applied to the process and not to the product. Management must take a leadership position in getting our customers and vendors to accept SPC and our employees must clearly understand that management will not waiver when cost and delivery schedules conflict with meeting performance and reliability requirements. The commitment to quality is not evident when everything is running smoothly. The commitment is evident when there's a question on the product's performance and the truck is backed up to the loading dock, and a ship or no-ship decision has to be made. That's what separates those who are committed to quality from those who think, "It's a neat idea but we'll have to get to it later." True management commitment means paying people to meet, communicate, solve problems, and take action, not just meet production goals.

One of the challenges of a small business is to meet the initial start up costs and the continuing long term costs for training. The first step is to realize that what might appear on the income statement as a training expense is in fact an investment in your future. In order to bring our people up to speed regarding SPC, we first utilized an outside consultant for the initial training of management and some other key employees. We invited the local community college to join our classes and we worked with the college to develop an SPC curriculum that provided continuous upgrading of our employee's SPC skills and initial training for new employees. We presently run a four-day in-house SPC course every three months, taught by the local college. By working with the college, we realized additional benefits. The college offers SPC training for our vendors and suppliers, many of whom are also small businesses; the public continues to benefit, because this course is also taught in night school at the college; and this partnership has significantly reduced Marotta's in-house training costs while maintaining very high standards in the quality of the training.

We advocate employee teams to solve problems, improve processes, and ensure that we meet our goal of a truly satisfied customer. Our culture allows for the process of improvement to be addressed, instead of focusing on who or what is an obstacle to that improvement. In this positive environment, committees of involved employees are continually being formed to attack systemic problems. The operation of our organization is a result of systems we have in place. All of our employees operate within these systems and we have found that it is absolutely critical that everyone in the system have a broad understanding of the way the system operates and what's expected of them.

Most of our improvement teams are interdepartmental and multi-level, since few issues are totally contained within one department. At any one time, 20-25% of our employees are active on various improvement teams during the year. Root cause analysis using pareto charts are employed in addition to cause-and-effect diagrams. Where applicable, management is represented so that decisions can be made quickly and action implemented on the spot. Improvement teams clearly delineate and document the work flow process beginning with the receipt of the customer's purchase order and ending with the delivery of the final product. We found that for improvement to occur, each department involved had to be aware of what the total process looked like, how it functioned, and what were the expectations of each department in line. By employing this internal customer concept, changes are made that result in improved delivery and performance, which moves us closer to achieving our goal of a truly satisfied customer.

All of our activities are directed towards the achievement of our mission: to be a leader in providing the highest quality fluid control products and services and control systems for specialty applications throughout the world. Growth isn't a strategy, but excellence is, and that is the target of our pursuit. With all the resources we have attained since that first valve was constructed in the home basement and garage almost 49 years ago, no other asset is of greater value than our people. Computer systems and high-tech equipment might make our business more efficient, but it is people unleashing their creativity that solve problems and seize opportunities. Management's critical responsibility is to ensure that a quality environment is maintained where this creativity can blossom.

2.1.3 Sustaining Commitment to Excellence - Our Ultimate Customer

Robert G. Minor, President, Rockwell Space Systems Division

Rockwell Space Systems Division is in the manned and unmanned space business. We produce a number of products and services for NASA and the Department of Defense. We have approximately 11,500 employees, we design, build, and test the Global Positioning Satellite, we design, build, and help modify the Space Shuttle orbiter, we support

the Johnson Space Center in Houston, and we have a small contingent in Washington supporting NASA Headquarters.

It's very important when you begin any program of this type to be very clear about what you stand for. At Rockwell, we have a corporate credo, which is a vital cornerstone for each one of our employees and their attitudes, to make sure they give their very best. To summarize our credo: We believe in maximizing the satisfaction to our customers; in providing superior value in all our products and services; that people are our most important asset; that we have an obligation for the community in which we live and work; and that excellence is our standard in everything we do.

When we developed our credo, we felt that it was also important to have a credo for our individual division. Our Space Systems Division vision is to increase our position as a world class leader in manned space and to become a world class leader in unmanned space; to provide superior value for our products and services to our customers; to manage our division strategically to achieve financial returns necessary to sustain growth and leadership; and to provide an environment that places premium on excellence and values, respects the individual, and fosters a sense of pride in ownership in all we do.

I think it's very important, whether you have been in the quality and productivity journey for 20 years or you're just beginning it, to examine what you do stand for, share it with your employees, and, as they say, "walk the talk."

Excellence and quality are very personal things. They require open, candid, and interactive communications, without which you can not be successful. That communication has to occur at all levels of your organization. It must be timely, and it must be systematic. It's not only required within your organization, but also with your subcontractors, suppliers, and, of course, your customers.

We were involved in the George M. Low Trophy process and had competed four times before we finally were recipients, so I think I've probably had as much experience with this award process as anybody. The bottom line is that it is a fantastic self-assessment tool. The one thing that we found as we competed each year is that the competition got tougher and tougher each year. The bottom line is that participating in this award process is a lot of hard work, but it is worth every minute of it. Being a recipient is sort of a culmination. Of course, in continuous improvement it can't be a culmination, so it was a highlight of the process, a very positive experience for all of our employees and managers. I hope all of you have the opportunity to share in that some day if you haven't to date.

Being an award recipient has some responsibilities. We, along with Marotta, travelled the country on numerous occasions, sharing some of our stories at a number of symposia. We and Marotta also held a conference of our own in the summer of 1991. The purpose of this conference was to share (and that's what quality and productivity is all about, sharing with other people) some of our programs, some of our experiences, and telling people who had not competed before how to go about competing. We were worried, with today's economy, about how successful a conference like this was going to be, but we had 154 companies participate.

In the orbiter program, our subcontractors are a tremendous part of our team. We actually do about 50% of the shuttle business through our suppliers and subcontractors. Even if we had the greatest program in the world, but if we don't make these suppliers and subcontractors a part of our program, we can only be about 50% successful. In today's world, 50% is not going to get it done.

We have a "Supplier of the Year" award and we had seven recipients last year. We try to multiply the effects of our program down to our suppliers. They have been extremely gratified, and this has made a great difference in all of their products and services to us.

You've heard a lot about people. There's no question that without the people part of the equation, none of these programs can be successful. In the corporate credo, our people are certainly our most important asset. The most vital part of any successful quality and productivity program is an involved and enthusiastic team. If you can get people involved and make them a part of the program, you are about 90% there. I firmly believe that our competitive edge comes from the enthusiastic commitment of our people, through team activities and through genuine top management support.

Performance and growth initiatives are a part of all of our companies and endeavors. Two examples of these types of initiatives at Rockwell are Centers of Excellence and Product Development Teams.

Centers of Excellence provide an opportunity for us a Rockwell to share resources with other Rockwell businesses across the country. What results from this sharing is significant cost savings. Our Data Services Center in Downey, California, provides graphics and photo services to other Rockwell divisions like Rocketdyne, North American Aircraft,

and our corporate office. In the past 2.5 years we've saved approximately $8.5 million by sharing this resource. We have an Aerospace Simulation and Systems Test Center that handles simulation activities for North American Aircraft, our Strategic Defense Center, and Space Systems Division, and, in assets alone, we have saved approximately $10 million in the last 3 years. Our Rockwell Operational Software Engineering System (ROSES) allows us to share software capabilities with all of our Rockwell businesses. In addition, we just formed a Rockwell Transportation Excellence Center in Downey that is doing all the transportation work for all the divisions in the Los Angeles Basin, and we anticipate savings of more than $1.5 million in this first year of operation. These efforts take enthusiastic teams working together and management support to make them successful.

Product Development Teams encourage a multifunctional way of doing business. Up until a few years ago, we were a very traditional business with our vertical lines of organization and communications. We found, however, that to stay competitive and to be productive, we had to be multifunctional. We formed teams, bringing engineering, manufacturing, and product assurance, and all the disciplines together. We collocate team members and, most importantly, we empower them. Without empowerment, the teams cannot do their jobs. The improvement is truly remarkable. If you can break down organizational barriers it's amazing what you can accomplish.

Our quality and productivity program is based on team concepts and fostering long term commitment. The results are world class quality, cost containment, true competitive edge, and a continuous improvement culture. I believe very firmly that the NASA George M. Low Trophy process provides a significant stimulus to energize this kind of program. In the business world, we all know that the bottom line is customer satisfaction. That's what it's all about.

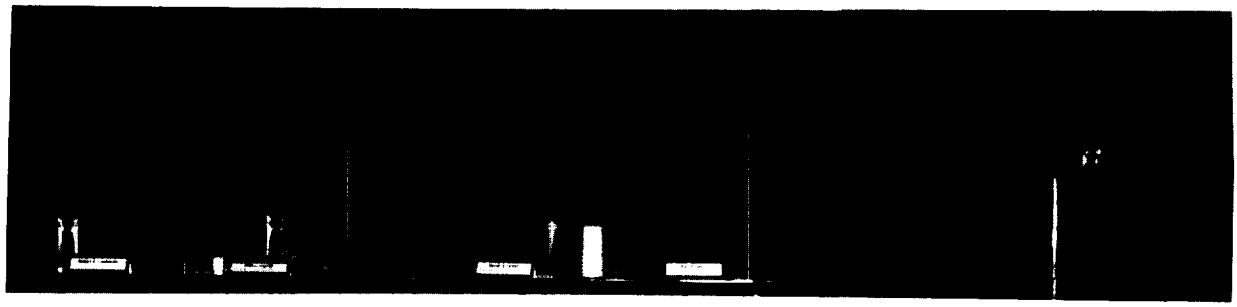
2.2 1991 George M. Low Trophy Finalists - Manufacturing

2.2.1 Introduction

Aaron Cohen, Director, Lyndon B. Johnson Space Center, Chairman

By their selection as finalists for the George M. Low Trophy, these companies are being honored today as aerospace leaders, leaders on the journey of continuous improvement. For if NASA, the aerospace community, and the nation are to maintain our position as leaders in space and technology, continuous improvement must be an integral part of our culture, not something that we do just once.

For those of us within NASA, I wish to thank all three companies for the fine support you have provided over the years. Your selection as finalists demonstrates that we can expect even higher levels of performance in the future.



Panel 2 - 1991 George M. Low Trophy Finalists - Manufacturing (from left to right): Robert E. Lindstrom, Senior Vice President and General Manager, Thiokol Corporation, Space Operations; Carl L. Vignali, Vice President and Group Executive, Space Systems Group, Honeywell Inc.; Daniel S. Goldin, Vice President and General Manager, TRW Space and Technology Group; Aaron Cohen, Director, Lyndon B. Johnson Space Center; (not pictured: David P. Heimann, Presidential Management Intern, NASA Headquarters).

2.2.2 TQM: How the Best Get Better

Daniel S. Goldin, Vice President and General Manager, TRW Space and Technology Group

TRW Space and Technology Group is like the rest of American industry, a victim of its own success. We are on top of the world technologically, but that's not enough. Today's marketplace, everything from video games to space systems, is truly global. To compete, we can't rest on our technological laurels, we must also lead the world in productizing, executing, and cost competitiveness. We have to cost-effectively translate technology into products. TQM is a challenge not just for TRW, but it is a challenge to America.

In our case, cultural change was hard to sell, because the people take a look at the successes that we have had over the decades, and they say, "this works, why do you want to change it?" Our spacecraft consistently out-perform specifications, they have delivered over $5 billion of extra service life to our customers. Our advanced technology is at the cutting edge, and in many cases, we are world class, but that is not enough.

Three years ago we surveyed our customers, our employees, and our vendors about our performance. The feedback was that we made great products but they cost too much. Our employees said we were drowning in bureaucracy. Our vendors agreed, our bureaucracy was stifling, and it forced them to increase their costs when dealing with TRW.

We clearly heard the clarion for change. The problem wasn't what we do, it was how we do it. The "how" will keep us competitive; if we don't respond, it will put us out of business. That recognition is the first step to change, and probably the easiest step to change. Our TQM effort began with a vision, a definition of our corporate purpose. The function of a

vision statement is to align corporate objectives and individual performances. This close coupling is absolutely essential. Not everyone connects their jobs with TRW goals. That's what our employees told us in the surveys.

We developed the following vision statement: "People committed to serving our customers' needs, pioneering technology, space and defense systems of unsurpassed value, integrity, quality and innovation. The last half of this statement was written by management: "pioneering technology, unsurpassed value, integrity, quality and innovation." But when we asked for feedback from our employees, vendors, and customers, they said, "Hey, you forgot about people, you forgot about commitment, and you forgot about customer needs. All you wanted us to do was perform." So, in this case, management had to do the realigning. We changed our vision statement so it made clear who we are, what we are, and where we want to go.

Once that vision statement had been aligned to include both employees and management, we set up a transition team to implement TQM, with myself as the leader. I spent 30 to 40 percent of my time listening and talking, interacting, empowering, planning, and strategizing. I wrote the transition team report, there are no helpers. It was a direct, one-for-one relationship that was designed to start a cultural revolution from the top, and change the management behavior from one of controlling and directing to the enlightened role of an empowering leader.

The transition team was the first to attend a workshop designed to support our in-house TQM initiative called "Continuous Process Improvement" or CPI. CPI is a formal methodology that allows us to pinpoint ingrained operating procedures that take time, cost money, but serve no real master other than bureaucracy. Our CPI workshop is an intense, two-day boot camp. Participants go through an actual process-improvement exercise where they build a product.

In my class, we were charged with building printed circuit boards, efficiently and quietly, with no inspection at the end. We had 15 leaders of the electronics industry, but using our old ways we couldn't build 12 printed circuit boards in an hour with just six terminals and two pieces of wire. After learned to identify the problems, and brainstorm innovative solutions, we were able to build 12 printed circuit boards in 30 minutes with almost no discussion. That convinced all of us that there is a better way.

Since then, 2800 of our employees have graduated from this course. We will continue these workshops until each and every employee attends the CPI class. Now, we have included our customers, suppliers, and vendors in these workshops. We've also found that the most effective factor is when people go through in teams, so you build that teamwork, you build that capability amongst the customer, and the supplier, and the executor. So it's important to have all three aspects in the team.

As a result of these learning experiences, we have 200 CPI teams, people are working on their own, with management support and guidance, but without management direction. They streamline processes, tighten schedules, and cut costs. CPI has probably been the single most effective TQM initiative we have undertaken.

How about the results? Our margins have improved 30 percent. We have objectives of cutting our fundamental costs for building spacecraft in half. On our Tomahawk program we have deficiency-free units going from 85 to 99 percent. Non-conformance on programs like TDRSS have been cut in half. Our subcontractor problem reports have decreased 80 percent. TQM initiatives in this year alone have saved over $70 million on spacecraft programs.

Recently we met a major milestone on the Advanced X-Ray Astrophysics Facility. The telescope's mirrors successfully passed calibration tests and an end-to-end test. These are the largest X-ray mirrors ever built. The specifications were unheard of five years ago. The root mean square tolerance on those mirrors is measured in angstroms. We launched Flight 5 of the Tracking and Data Relay series in August of this year and it had an absolutely flawless activation. We went way ahead of the plan schedule. There wasn't one problem with that whole process. That is a perfect spacecraft. Our Gamma Ray Observatory, launched in April, is being hailed by many scientists as the world's finest flying machine. These achievements are a source of pride to our employees who worked so hard to make those total quality activities happen.

We won the NASA Goddard Excellence Award in 1990 and we are honored to be finalists this year for the George M. Low Trophy. Internally, we encourage individual excellence via our Chairman's Excellence Award for Innovation and we have a Technical Fellow's Program for Outstanding Contributions in Technology.

At TRW Space and Technology Group, we are making incredible progress, we have confidence in ourselves and the future. I am seeing the development of characteristics of this new TQM culture, even in these very difficult, uncertain times. The winds of change are gusting across America. Industry can dig in against the rising force and founder, or hoist its

sails and ride the tempest forward. At TRW we have chosen to catch the wind.

2.2.3 TQM: Lessons Learned by Management

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

I'm going to give you four examples of our TQI efforts and the lessons we've learned. I used the term TQI, not TQM. TQI stands for Total Quality Involvement, because we decided early on that if we called it Total Quality Management, then people might think only the management should be involved. We recognized that unless there was involvement by all employees, it really couldn't happen. So we changed the name to Total Quality Involvement.

We started working on quality improvement about 1981. We have developed a TQI philosophy and focused on process improvement and teams. We believe that all functions in the organization must be involved; finance, human resources, information systems, even marketing. We believe that TQI implementation requires a variety of tools. Not every tool is right for every job. We had to develop a variety of tools to go after the process improvements we needed.

For example, we have 51 teams working on improvements in the Space Shuttle main engine controller program. One of these teams dealt with the acceptance data package. We had an acceptance data package that was 960 pages. It took many, many hours to put this thing together, and the people on the floor thought it was too big. So we formed a joint team with Rocketdyne, the DCMC people, and the Honeywell people from various organizations, and did a process flow analysis on that data package to determine what was needed and what wasn't needed. The results were remarkable. The 960 page data package was reduced to 56 pages. The Rocketdyne people found it much more useful to get a 56 page data package than a 960 data package, which nobody could read anyway.

This has been very gratifying for our people, and for the people who work at Rocketdyne to realize that you can put together teams from organizations that don't report to each other and make significant improvements. The lesson that we learned from this is that if you have a lot of people involved in total quality, you are going to get a lot of improvements. If you have a few people involved, you will get a few improvements. In our organization, virtually everybody is involved in some kind of a process improvement activity.

The next example has to do with a design function. Some people have been intimidated to believe that the design function is not subject to Total Quality Management, and I guess I have to admit that engineers are probably the most resistant people to change. With every culture change that has ever taken place in an organization that I know of, the engineering department was always at the back of the pack.

We decided to try to use a process improvement method known as Taguchi Analysis on an analysis task. Taguchi Analysis is an analysis technique that has traditionally been used to design experiments where you are going to test things to try to optimize a design. It's a statistical process that gives you the minimum amount of testing to get the maximum confidence that you have arrived at the optimum process.

The analysis task that we chose was a landing simulation for a re-entry capsule, to try to optimize a whole lot of parameters. There were three thrust control parameters and four noise parameters and the task was to find the optimum, most robust design that would have the greatest resistance to disturbance and variation.

We estimated that to do the analysis, by conventional techniques which we've used for the past 20 years, would have taken 33,936 computer runs. But, by investing a little bit more in the planning via Taguchi Analysis, we were able to reduce the number of computer runs to 844. That is a 97 percent reduction in the amount of computer runs that were needed.

Now, the question is, do you get just as good an answer? The answer to that is yes. Since this was the first time we had used Taguchi to do this kind of an analysis, we went ahead and did the 33,900 runs and got the answer that was the same as the answer we got with the 834 runs. We have learned that during the design phase, you can use these techniques to make significant improvements in the design process.

Let me talk about another example which has to do with statistical process control. I have always been a big believer in statistical process control. We had this precision instrument business which is just a perfect application for statistical process control because it is all process-dependent. They put in 65 process control charts and they plotted those babies every week. And what we found was we had 65 processes, all of which were out of control, and they

never got better.

We said there must be something wrong here, this is supposed to work. And so we finally said, "we want you, the quality people, the production people, the engineering people, to do statistical process control but we want you to decide what to plot. You plot whatever you think will help control the process."

They plotted a lot fewer parameters, and the results have been remarkable. Virtually all of the things have gotten in control in the last 18 months. The yields have gone up substantially. In the precision instrument business, yields of 50 and 60 percent were considered great. Now they are 80 and 85 percent.

The very important lesson I learned here is how does management approach the work force? You need to endorse the use of total quality but edicts don't work. Top management has to support the effort, they have to endorse it, they have to encourage it, but the people have to do it, and believe it's the right thing to do and it is going to help.

I want to cite one other example, which is in the finance area. It has to do with closing the financial books. If you are a line manager, you finish up the month on Friday, and you want to see your results immediately. You don't want to wait two weeks to find out what happened, you want it immediately. However, finance was taking two weeks to produce the results. The finance organization did a process flow analysis, streamlined the operation, and this year they have closed the books twice in five days to their great satisfaction. It not only gives faster feedback, it saves costs and errors.

These are just four of the hundreds of examples of improvements that have been made. And I wanted to pick these four because each of them illustrates a lesson we have learned, and the lesson here is that TQM works in all functions. It has worked in every function we have.

I really am encouraged to see what I think is the groundswell of TQM in this country. This is just exactly what we need.

2.2.4 Total Quality at Thiokol Space Operations

Robert E. Lindstrom, Senior Vice President and General Manager, Space Operations, Thiokol Corporation

We have three basic goals at Space Operations: to satisfy our customers, to have satisfied employees, and to have satisfied shareholders, and to continually increase that satisfaction. We believe we can achieve that through total quality.

Our operating priorities differ somewhat from many of you. While holding down costs are extremely important, because we are in a very hazardous business, our top priority is safety. And when we talk about safety, we are talking about both industrial safety for our people, flight safety for the astronauts who fly on the shuttle, and safety for these very-expensive missions. We believe this can be achieved only through total quality.

To us, total quality means not just building the motor, but it means quality in typing a letter or a report, preparing or presenting a briefing, or even cleaning the building, and it applies to every person on the Space Operation work team, the operators, test technicians, the managers, and the executives.

Quality is both a perception and reality. Quality, from our standpoint, means everything is done right, that the product we produce meets or exceeds the customer's expectations, that good enough is never good enough. And I want to point out that total quality will only be achieved through teamwork, hard work, and through knowledge.

I'll briefly cover some of the TQM initiatives we are conducting. In terms of a positive culture, the first thing we do is listen to the work team. We conduct a broad opinion survey, then the work teams, as well as management examine the results. We keep everyone well-informed on the actions management is planning to take as a result of these surveys, and encourage additional feedback.

We regularly have employee dinners, where management tries to establish a personal relationship with each of our employees and their spouse. We always have a Q&A session at each of these dinners where either employee or spouse is encouraged to ask any question they want. Management also seeks feedback on their personal management styles. The work teams tell us what we are doing right, and what we are doing wrong, and what their concerns are.

We have established a very team-oriented human resources staff and program. These are some of the things we are trying to do to promote a very positive culture. We provide a basic TQM education, classes on the various TQM tools, how to build teams, group dynamics, and facilitation.

It's also important that our people understand why we have to do a quality job, why we need total quality through something called the Manned Flight

Awareness Program that NASA and we conduct jointly. We have quality meetings with regular visits by astronauts.

In terms of empowerment, management is committed, and has the responsibility to implement employee empowerment. This is a line responsibility within Space Operations, and we measure all executives' performances in all facets of the TQM program.

We have decentralized the TQM effort. We do have a small staff at a TQM center that provides education, advice, and assistance, and they develop a three-year total quality plan with different milestones. From there, our TQM effort is subdivided into 24 improvement centers that generally follow organizational lines. Each is in control of their own TQM program for their specific needs. Each provides semi-annual reports, in terms of what they have done, what they have planned, what they have achieved, and what they need to do.

How about improvement? In the three years, calendar 1989 through 1991, we have had a significant reduction both the number of incidents that occur in our test operation, and their costs. Our workmanship errors have come down dramatically. Today, we have less than 10 workmanship errors on one set of motors, out of 120,000 different inspections. Scrap and repair costs have gone down similarly. We have very few problem reports and waivers in our final assembly operations. These are the very positive results of our programs.

With awards and recognition, we have completely revamped the awards program and have decentralized the authority to give awards. We have booster awards which, at the foreman level, are given to the individual on the spot for doing doing quality work. But we have taken that one step further. As I mentioned, we have 24 improvement centers. We set up a $500,000 pool, and annually the employees compete for this pool. They can give it to charity, they can have a party, but generally, they are taking gift certificates or cash.

Now, we obviously have many things we need to improve. I think we must do a better job explaining to everyone why total quality is so necessary in our business. Everyone must understand why they must turn out a quality product, and how they can do it. We need to increase the knowledge of the customer requirements and expectations. We also have to do a better job of sharing the results with the work team. I think results bring pride and recognition, and pride and recognition bring more success and more results.

TQM provides the tools, the techniques, and the basic approach to achieve total quality. It must be used by each and every one of us to produce quality products. I would like to emphasize that it does require consistent, persistent hard work to make people understand that good enough is not good enough.

2.3 1991 George M. Low Trophy Finalists - Mission Support

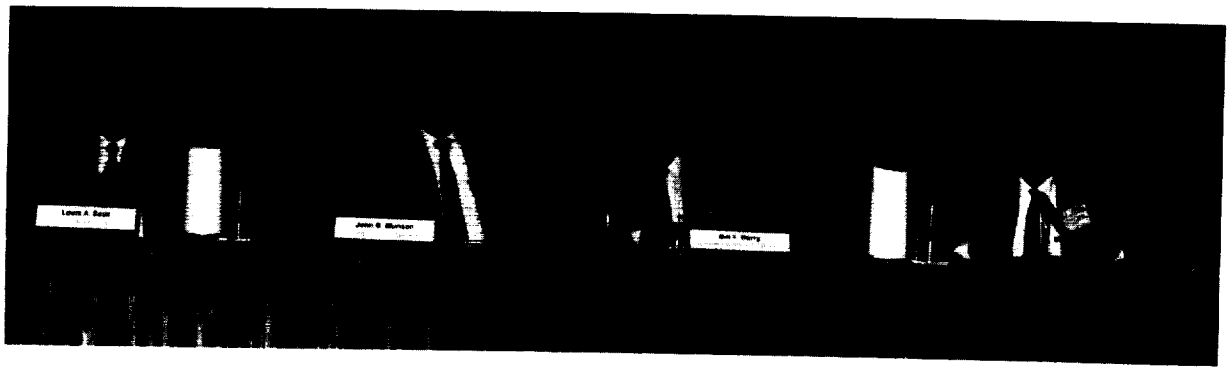
2.3.1 Introduction

Charles S. Harlan, Director, Safety, Reliability and Quality Assurance, Lyndon B. Johnson Space Center

Mission support, as many of you are aware, is a necessary ingredient to the way we do business in NASA. We have to have mission support teams built up between the government and the contractors in order to achieve the NASA missions.

We rely on our contractors very heavily in the conduct of missions for several reasons. One reason, of course, is that we don't have the manpower base within the government to achieve that type of activity. Another reason is that we don't even have the skills necessary, and we have to go out to industry to get the aggregate skills necessary to accomplish the various kinds of missions that we have in NASA.

We have three companies represented here today. Two of the companies are related to direct mission support, and one represents a highly specialized business whose product provides the mission support. They are all finalists for the 1991 George M. Low Trophy, and we are going to hear how they view continuous improvement as it relates to the mission support function. Each company has a slightly different approach to how they deal with the subject of TQM, but the strategic objective is the same.



Panel 3 - 1991 George M. Low Trophy Finalists - Mission Support (from left to right): Louis A. Saye, Vice President of Manufacturing, Manufacturing Division, Cray Research, Inc.; John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems; Bill F. Barry, Vice President, Applied Technology Division, Computer Sciences Corporation; Charles S. Harlan, Director, Safety, Reliability and Quality Assurance, Lyndon B. Johnson Space Center; (not pictured: Paul E. Cate, NASA Quality and Productivity Improvement Programs Division, NASA Headquarters).

2.3.2 People: Stakeholders in Quality

Bill F. Barry, Vice President, Applied Technology Division, Computer Sciences Corporation

The theme of this year's conference is "Extending the Boundaries of TQM." This means make TQM bigger and better and continuously strive to improve the process. In keeping with this general theme, what I want to talk about this morning is the importance of our employees when it comes to TQM expansion and continuous improvement.

CSC is firmly convinced that we, as a company, must encourage our employees to become bona fide stakeholders in quality or else the program will fail, regardless of the technology and the processes we have in place. And what, exactly, do I mean by employee stakeholding? This is when each of our employees cares enough about TQM to take ownership responsibility for his or her primary work area and to share ownership of associated interfacing processes.

I want to share with you this morning some of the specific actions that CSC has taken to insure quality

stakeholding by our employees. First, let me quickly review the evolutionary background of our TQM program in Houston. We began our NASA contract back in 1978. From the outset, quality was important to us, and we used sound system-engineering principles to build in quality.

In 1983, we convinced our NASA customer of our ability to identify parameters against which our improved productivity could be measured. Our contract was modified to include a clause allowing us to share fees, based on our measured productivity improvement.

In 1985, we embodied these quality and productivity drivers into a formal PIQE program. Last January, we officially started our program expansion, wherein we began our transition from PIQE to a more encompassing TQM program.

To effect our transition from PIQE to TQM, I appointed a task force and they came up with seven TQM implementation strategies. I bought off on these strategies, with the added emphasis that I wanted to get the employees even more involved, and I wanted management to do an even better job of letting the employees know that we valued their ideas and recommendations.

So, we not only expanded and revitalized our TQM program, but we took a big step forward in getting our people more even involved. We encouraged employee stakeholding. We encouraged employee empowerment. And by that, I mean I asked my managers and my supervisors to back off a step and let the employees accept and execute their stakeholding responsibilities.

We also expanded quality training for all of our employees. We dispensed with the old quality circle concept and formed new process action and corrective action teams, and we openly solicited employee input.

To facilitate the capture of employee ideas, recommendations and attitudes, we actually implemented a very comprehensive quality focus survey. This cultural survey was modeled after a similar one conducted by our NASA customer here at JSC. The survey contained a total of about 127 questions, categorized into 12 different areas encompassing overall CSC culture and values, Total Quality Management, overall work satisfaction, pay and performance, career-pathing, and communications. For each question, the subjective rating scale ranged from 1 to 5.

Once the survey was completed, we formed three volunteer teams of non-managerial employees to analyze the survey results and then make improvement recommendations to management. The three teams, Communications, Morale, and Career Pathing and Planning, carried their recommendations to our formal TQM steering committee, which we refer to as our TQM council.

As chairperson of this committee, I personally met with each team. The team recommendations were finalized, a report was prepared and distributed to all employees and CSC management accepted and implemented 34 out of 39 recommendations.

Here are some of the more significant recommendations we implemented. We established an employee information center, where employees can go to read non-technical information that is not conducive to general distribution, things like organizational charts, career pathing guides, open position requisitions, selected policies and procedures that CSC has.

We agreed to provide a means by which employees could anonymously evaluate their supervisors. A special supervisor appraisal form designed by our employees was implemented. This completed form went to the supervisor's boss who then summarized all such input and discussed it with the supervisor during his or her performance appraisal process.

We implemented other employee-recommended improvements, like more frequent management employee meetings, ranging from all-hands meetings to one-on-ones, to more skip-a-level meetings. We better focused our employee recognition system to include such things as awards for both individual and team efforts, greeting and recognizing our new employees, and sending congratulatory letters to those employees who had earned their degrees from college while working for us.

We have just completed our second annual survey, and the results to me, as a manager, were most gratifying. There was a significant upward trend in key areas, including employee morale, employee recognition, our own business culture and values recognition, open communications, and training. Making our CSC employees a stakeholder in quality did work and is continuing to work. Our expanded and revitalized TQM program is better than ever thanks to our CSC employees.

2.3.3 TQM Tools and Techniques for Manned Spaceflight Mission Support

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

We try to concentrate on reliability, productivity, and responsiveness, and if we can accomplish those three elements, we believe we've achieved at least 95 percent of customer satisfaction. Of course, the only way you can achieve those levels of quality is to get the employees involved. In order to get employee involvement, you have to give them tools to work with, and these tools fall into the metrics and measurement area.

Metrics and measurement is the only way you can really tell whether you are achieving continuous improvement, or are you just milling around doing things differently. First, you have to decide where you are today, then define what you consider your objectives for the next period of time. Next, you have to provide an action plan, implement those actions, and then track the progress to see if those actions are really contributing positively to the improvement of the program.

It's not always easy to pick the metrics that you need to judge your process. Here are some of the attributes I recommend you look for when selecting your metrics. First of all, ease of collection. You don't want to spend all your time and effort trying to find out what is going on. But, there is a trap here. Many times you tend to collect the metrics which are merely easy to collect, not the ones which are important to collect. So, more than easy, what you collect has to be important. In addition, your metrics have to be controllable, and they have to represent the process reasonably.

We have two tools we use, the Oregon Objectives Matrix, and the Team Excellence Board. The advantage of the matrix is it allows you to measure where you currently are, then when you set your goals, it measures your progress towards meeting that goal. This is a very visual display of information to management and to the employees.

We use the excellence board to evaluate the results from not only the Oregon Objectives Matrix, but other metrics we use to measure increased performance. We are very metric-oriented because of the nature of the products with which we deal. We can see how the organization is doing as a whole, and how the individual elements with the organization are progressing in meeting their objectives.

We use a variety of other things to help track our progress to see if we are on the right track, such things as competing in NASA George M. Low Trophy program, as a way to measure ourselves against a national benchmark. We are currently using the measurement program of the Software Engineering Institute to evaluate our software processes against a national standard.

An example of some of the accomplishments that have been achieved by our excellence teams. We were able to chop off 850 man-hours from one flight-to-flight process. We were able to free up the simulator by using off-line tools and let the astronauts get on the simulators and do their training. In one end-to-end process, we were able to replace one whole major element and eliminate a computer in order to save about $600,000. This sped up our reconfiguration process significantly. We are talking about, on the average, reducing 100 man-years of effort per year in the software support area. Our number of discrepancy reports has dropped significantly. This is what happens when you suddenly start paying attention and when you make a metric out of it you can make very rapid improvement.

For the future, there are a lot of challenges in the software business as concerns the issue of metrics. One of the issues that we consider a challenge is to get involved with the product metrics. How do we really measure the goodness of the product that we deliver? Just conformance to specifications isn't enough. There are a lot more issues relative to the quality of a software product that we need to explore, and we have set our challenge to explore those issues for the future.

2.3.4 Evolution of a Quality Icon

Louis A. Saye, Vice President of Manufacturing, Manufacturing Division, Cray Research, Inc.

I was first exposed to the term "mission support" approximately 25 years ago. That's when I was fresh out of school working for General Dynamics. But, as much fun as the daily tasks were, there was nothing like the exhilaration of seeing a launch at the Cape. My point is that the focus was always the launch, and the mission support was just something that happened.

The same concept existed at Cray Research when I

went there in the mid-1970's. We were focused on the end product. We did all the things to bring a product to market, but the exhilaration was still the first time you turned the thing on, watched it run and literally belch useful numbers out. The environment basically consisting of one product at that time, one technology, long life cycles and basically one focus.

In the mid-1980's things changed, we had new customer requirements, multiple products, multiple technologies, broad product base, new applications, and new methods for accessing the output of these machines. For manufacturing, we needed new ways to build the systems. Previously, our focus had been on performance, now we had renewed focus on reliability, costs, time-to-market, and automated processes. We needed to shift our culture from the product or task focus, to a total mission focus.

During this period of time, our products changed dramatically. Initially, the product was a single processor. We now deliver up to 16 processors. We started out with 500,000-word memories, and we are now at 500-million-word memories. Our disks moved from 300 megabytes to over 20 gigabytes. As the product and the market gained in complexity, we found that the tasks necessary to support the overall mission became pretty complex. We had a myriad of support tasks, new processes, initiatives, and it became pretty clear that people were losing insight into what we were really doing, and how all these factors integrated. We needed a technique to give everyone a sense of how they could best support the mission of delivering goods and services to our customers. Basically, how did it all fit together? How did each individual contribute, and why was each critical to success?

We developed a very simple flow chart to help us focus our communications to everybody within the division. We have used it very consistently in all the discussions we have with our people. This flow chart has been the foundation of our total quality environment. It also allows us to evolve over time, so that we can bring in the continuous improvement and an environment of defect-free performance we need. It allows us to change without seeming to shift gears every couple of years.

Now, what changes are we asking of everyone to do to bring about a continuous improvement culture? We like to boil it down to our five C-words: commitment, communicate, cooperate, coordinate and finally consummate. First of all, we need commitment. We need to get all of our people committed not just to the finished product and it's quality, but to support the entire mission with quality. It's not easy to get people to change their culture. After commitment, there are some lessons that must be learned. You have to get people to effectively communicate, then get them to willingly and very aggressively want to cooperate, not only within their departments but within the division, then the corporation, and finally with our vendors and with our customers. On top of that, we need them to coordinate it, and coordinate it as deeply in the company as possible. Finally, we need them to bring these things to a conclusion and consummate the task.

We want to keep these things at the heart of all we do. We want them as our first line of defense, and our offense. We need them as a way to integrate and boil down rampant complexity. To stay competitive, we need this continuous improvement, converging to a defect-free performance in our planning processes, people and product. And this type of performance is what we need to sustain and grow at Cray Manufacturing and Cray Research, in particular, and the country at large.

2.4 1991 George M. Low Trophy Finalists - Service Support

2.4.1 Introduction

Margaret G. Finarelli, Associate Administrator for Policy Coordination and International Relations, NASA Headquarters, Chairperson

The NASA/contractor team is comprised of many players. Integrating the activities of NASA's contractors, subcontractors, and suppliers is one of our more interesting and challenging management tasks. And our panel today presents the two finalists for the 1991 George Low Trophy in the Support Service area.

These companies represent one important aspect of the NASA team that absolutely must be in place and functioning at peak performance if the U.S. space program is going to be successful. These companies do not build launch vehicles or spacecraft, per se, but let me assure you that nothing would fly without their involvement and support.

The support service function is immense, and it presents very special challenges. The missions assigned to our support service contractors cover an amazingly broad range of services and all are essential to the overall success of the space program. These companies are critical members of the team.

The men here today and their organizations have met the support service challenge in such a manner that they have been recognized as quality operations. We will hear from both of them on continuous improvement and how that has helped them achieve performance levels that set them apart within the aerospace industry.

They both recognize that continuous improvement is assisting their companies to become world class in every respect. Now, the phrase "world class" may have become a cliche, but it certainly does describe the relevant standard for the U.S. aerospace enterprise today. It is a standard that moves constantly higher, pressed on by other countries if not by ourselves. Continuous improvement is a journey without end and it's a path that we must take if America is going to remain competitive in the world marketplace.

Panel 4 - 1991 George M. Low Trophy Finalists - Service Support (from left to right): Candace D. Livingston, Office of Commercial Programs, NASA Headquarters; Jarvis L. Olsen, Program Vice President, Grumman Technical Services Division; James R. Dubay, President and General Manager, EG&G Florida, Inc.; Margaret G. Finarelli, Associate Administrator for Policy Coordination and International Relations, NASA Headquarters.

2.4.2 Achieving Excellence - The "Grassroots" Approach

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

Service is a business that we Americans don't understand very well. Our mentality as a nation is not one of service, our mentality is one of technological prowess across a very broad range of technical disciplines, factory-oriented, production-oriented, product-oriented. But that privileged position has

seen a substantial erosion. We let it get away from us. As a result, now, we find ourselves involved in service more than ever, so it's critical that we all have a better understanding of what service really means. Service means serving, and you don't serve by talking, you serve by listening.

Another aspect of our national mentality which is holding us back is a lack of understanding of the concept of teamwork. Our heritage has been that of individualism. We all labor under the misapprehension that none of the pioneers that conquered the west did it in teams and that all of those pioneers, whether it is in science, industry or exploration, were individualists. But in today's world, we have come to the point where we are either going to sink or swim based on our ability to understand that we are a team.

EG&G handles a broad range of things at Kennedy. We have about 3,000 employees. We believe in treating each customer individually and being sure he is pleased with our service. We service the airplanes the astronauts fly. We service those as if that astronaut was a customer. Each of them have their peculiarities, each of them like things done a certain way. And we take it down to the individual level in terms of what that customer considers to be 100 percent service.

TQM is really not new. I think we have always individually taken pride in doing a good job. TQM is simply a focus that causes us to look beyond ourselves to a larger problem we usually have some trouble dealing with. We have now put TQM concepts in place which articulate who we are, where we are headed, and empower our employees to improve. Our motto is, "We are going to set the standard in the business we are in, or we are not going to be in the business."

For example, we have developed the state-of-the-art air pack. It is, in fact, based on liquid air. It is far superior to any other air pack ever developed. It is not yet commercially available, but it is the air pack of the future in terms of all hazardous environments and all requirements for extended life support. We also designed, from the ground up, a state-of-the-art tanker that will be used to haul hazardous gases and liquids under the Department of Transportation regulations. It can withstand a direct impact at 50 miles-per-hour without any loss of commodity.

The most important facet to our TQM implementation was a total change in management mentality. Now, our managers exist to delegate, to facilitate, to coach, to empower the employee, and then get out of the way. You have to delegate authority and responsibility across the board to the people who can do the job, and once you delegate responsibility, if you don't get out of the way, your employees are either going to run over you, or they are going to discover that you are not serious.

Authority in the hands of those who know how to get the job done is a wonderful thing. Typically, the people who understand how to get the job done are the people on the line with the wrench. A group of our people in the warehouse decided that receiving inspection was taking too long, so they reduced the typical flow time from 72 hours to less than a day. Another team is building the prototype document for TQM, the TQM handbook. I believe it is going to be the prototype for implementation documentation within the NASA system. It's a very substantial work which took all of the mystique out of TQM and put it into very common terms, and made it understandable to every member of the team.

The value of rewards and recognition cannot be underestimated in a grassroots TQM effort. We give an award to the suggestor of the year as part of our suggestion system program. We give very large awards to the branch of the year, several hundred thousand dollars for one group of hands-on people who were given the opportunity to facilitate continuous improvement, and took us at our word.

We also give on-the-spot awards to individuals, instantaneously and spontaneously. The speed of recognition is important. The closer to the actual event the better. This is much more effective than the formal evening on the town, black tie, all of the pomp and circumstance that goes typically into award programs.

In the service business measurement is fraught with controversy. Once it was thought that there wasn't much that could be measured in the service business. Now we know that anything can be measured.

How are you going to implement a TQM culture change? First of all, put your management in the classroom. It gives management a sense of the new equation they are living in, from being the man in control, to being of service and being a coach.

Open communications is essential. We have a program that allows any employee, at any point in time, to send an express memorandum to anyone in management, and the requirement is that he get an answer within 24 hours. Needless to say, that took us a while to implement, and if I said we never violated that, I would not be telling the truth. I am probably one of the worst violators because they ask me such terrible, difficult questions that I have to go seek help and it takes me longer than 24 hours.

One of the big things we decided to do was a full-blown employee opinion survey. Beforehand, we thought we had a pretty good handle on what they thought. What an eye-opener! We have spent many, many a fruitful day subsequently walking through the problems that survey revealed. This is not a trifling thing. If you get into it, be prepared to be awakened. Bring a large dose of humility with you, because it is a humbling experience.

Remember, senior management sets the tone. If you just want to talk the game, you might as well save your breath. You have got to be in the aisles. You have got to be in the shops. You have got to be in the classrooms. You have got to demonstrate absolutely and unequivocally that you are committed.

The grassroots approach for us has been very successful. We are today performing at a very high level of efficiency. In terms of being able to access available fee, our last grade was 96, and this year, we are going after 97 with great vigor.

Where are we as a nation? We are really just beginning. If anyone thinks that we are really well down the road of changing America's corporate culture, they are deceiving themselves. You don't change cultures in one, or two, or three, or four, or five, or ten years. The sooner we buckle down and appreciate how far we have to go, the quicker we will galvanize the force to get there.

We are historically a nation that really doesn't get interested until the heat in the kitchen gets so bad that the house is about to burn down. But once we decided to get our act together, there isn't anybody who ever got in our way and survived. So let's get together. We can learn as much from you as you can learn from us. And the sooner we all sign up to the same team and realize that it's all win or all lose, the quicker we'll get there.

2.4.3 Superior Customer Service at KSC

Jarvis Olson, Program Vice President, Grumman Technical Services Division

Our TQM initiative is known simply as Grumman Quality or GQ. We are a subcontractor to Lockheed Space Operations Company on the Shuttle Processing contract. We are in unique position of having two external customers, Lockheed and NASA.

We provide operations and maintenance support of launch processing system, several instrumentation systems, calibration support for shuttle processing, as well as numerous other service support activities.

All of our teams are united under one motto which describes the KSC attitude, "Here is how we can, not why we can't." But GQ is much more than a motto. GQ is totally integrated into our work processes and has become the way we do business. Our GQ effort is built on the principal that every employee and every team makes a contribution to continuous improvement. We have established a multi-level team structure that defines a role for everyone, senior management, middle management, and every work team.

My staff and I make up the steering team responsible for creating the right environment for total involvement. We define plans, allocate resources, monitor key indicators, and charter teams when improvement opportunities are identified. We review teams' improvement plans and assist them as needed and we get out of their way when it isn't needed. Most importantly, we recognize team efforts and show appreciation with awards, certificates, and a sincere thank you.

Our steering team is also a link to our Lockheed customer, the SPC continuous improvement process, and to NASA's TQM efforts. But our current approach isn't a miracle cure that happened over night. It is an effort which has been ongoing since our contract award in 1983. It began with introducing our new Grumman SPC team to the same family culture which existed at KSC during Apollo.

Some of you may recall our Project Sterling Excellence Program, which goes back to 1965. Our journey toward excellence has evolved into an approach we call process management. We think process management is really just a systematic way to apply common sense. This involved a change in our approach as we moved from quick response, problem resolution by a limited number of people, to a new environment where we identify and measure our processes. Now we use everyone's efforts and ideas for continuous improvement, and we are learning to anticipate and correct problems before they occur.

Successful transition to process management again didn't happen automatically. Each of our 42 natural work and process management teams first had to define and determine how to measure their processes. Working with a facilitator, each team was required to define their suppliers, inputs, processes, outputs, and measures. We also asked teams to define the requirements that they place on their suppliers and the requirements placed on them by their cus-

tomers. This helps to determine how the team will measure the process performance.

The teams measure their processes by graphing key indicators. Our teams are encouraged to use measurements to define and identify specific areas of improvement. Fortunately, not all of our processes are broken. But they are monitored to insure they stay within controlled limits.

Today we no longer depend solely on management skills or gut feelings to identify problem areas. Our measurements give us hard data to isolate, analyze, and understand specific problems. Once problems are pinpointed, management and the natural work teams use this data to charter an improvement team.

Improvement teams use a technique called the fade cycle. This cycle guides a team toward clearly defining a problem, analyzing root causes, brainstorming and analyzing viable solutions, and selecting a cost-effective solution. Certified facilitators teach the teams the fade cycle and use of tools which allows the team to be a self-sufficient problem-solving unit.

By focusing on processes instead of problems, we gain the advantage of fully understanding what we are doing, how it links to the customers' needs, and how we can make it better. By repeating the process improvement cycle, we systematically streamline work, minimize idle time, reduce hassles, and eliminate waste.

Empowering and providing teams with the opportunity and tools to continuously improve the process is our goal. Again, common sense and good management practice says you show timely appreciation for their achievements. And, again, continuous improvement extends into our award program, which recognizes individual work performance, and team efforts.

We have learned and accomplished much since our initial involvement with the NASA award process. Not only has our improvement process allowed us to manage to an average of nine percent below budget, but we have achieved cost savings of over $14 million in the past three years. We have enjoyed a significant increase in the number of employee suggestions by streamlining the system in 1990. Numerous process improvements have resulted from the added flow of suggestions.

One of our work teams is responsible for installing strain gauges in the SRB hold down posts on the mobile launch platforms. Going back to STS-1, 100 percent of these gauges were destroyed in the launch blast and had to be replaced. The team began a series of unrelenting improvements in the gauge installation process. Over time, they have achieved a zero failure rate in what has to be the most severe environment I can think of.

The most important measure of our success is impact time. Impact time is defined as the percent of required support time we miss due to hardware and operational problems. To achieve customer satisfaction, our goal is zero impact. We are very proud of our team for achieving that, especially since the LPS hardware is nearing 20 years old.

Allow me to wrap up with a few lessons learned.

First. Make sure you have a well defined plan with clear goals. You and your people need to understand why you are doing TQM, and just as importantly, what do you expect from the effort.

Second. Define responsibilities for everyone on your team. TQM takes a total team effort and everyone needs to know what is expected, what he is expected to do.

Third. Fully define your processes. It is not glamorous work, but it is necessary in establishing priorities and maintaining customer focus.

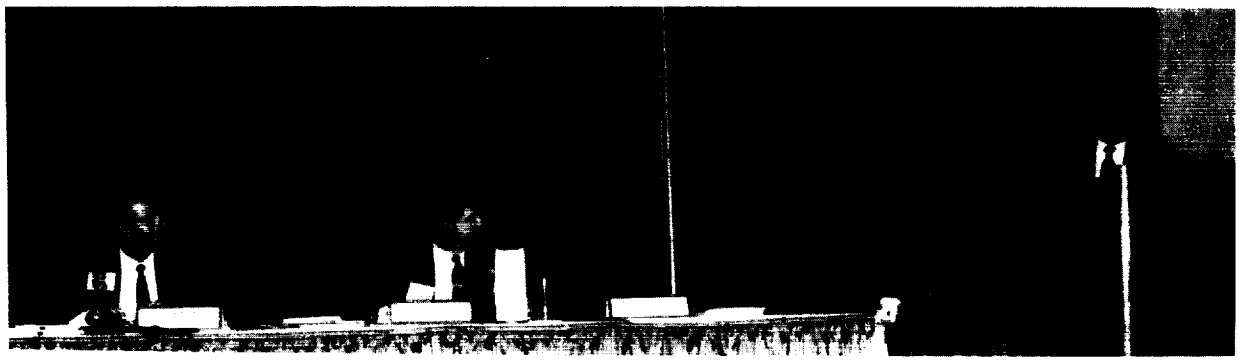
Fourth. Be aware that your customer and suppliers are probably trying to spread their TQM wings. Collaborate and learn with them. You will both be richer for the effort.

My fifth recommendation is to be persistent. Patience is tough at times, but you need to keep pressing. Good things will happen.

My final comment is a suggestion to use the criteria and feedback from the NASA George M. Low Trophy process. If there is any magic to this, and actually there is not, it is the power of listening and responding to your NASA customer.

3.0 The Development, Implementation, and Evolution of a Quality-Driven Strategic Plan

Provides a focus on the infusion of quality principles into the strategic planning process; investigates successful implementation of quality-driven strategic plans, and discusses the evolution of partnerships with our stakeholders.



Panel A1 - The Process of Strategic Planning (from left to right): Richard M. Simon, TQM Program Manager, Harris Space Systems Corporation; Thomas R. Curry, Manager of Business Planning, Electronic Data Systems Corporation; Robert B. Young, Jr., President and Chief Executive Officer, Lockheed Engineering and Sciences Company.

3.1 The Process of Strategic Planning

The Panel focuses on the"process" of strategic planning while infusing the principles of Total Quality.

3.1.1 Introduction

Robert B. Young, Jr., President and Chief Executive Officer, Lockheed Engineering and Sciences Company, Chairman

Our basic approach at Lockheed since 1981 to TQM has been on how to change the culture. We have focused primarily on how to empower people? How do you shift from a basic focus on control, to a basic focus on empowerment. In the past, we've focused on controlling because we put our emphasis on systems. In today's world, with things moving fast, we're more interested in betting on people and having systems support the people.

Before, management style has always been controlling comes first, and empowerment comes second. Now, it's got to be employee empowerment first, and control second. We want our people to contribute and not just be busy looking good in the system. So it's a question of whether people focus on results or whether people focus on good reasons, and we've been interested in focusing on contribution. Because then we're looking for results. When you focus on looking good we look for good reasons.

This orientation that we have is inherently strategic in nature and what this particular session is about is strategic planning. It's a real unusual approach that we've taken to have a single speaker on a panel to talk to this, and then have a subsequent panel flesh it out. This gives us the opportunity to see the whole

story rather than the bits and pieces of it like we sometimes see when we see multiple panelists who don't have time to put the whole story out. So it's an unusual panel by design and we hope to get one story instead of the several.

3.1.2 A Quality Perspective

Thomas R. Curry, Manager of Business Planning, Electronic Data Systems Corporation.

What we're here to talk about today is quality strategic planning. The purpose of the strategic planning process starts and ends with the customer. We have to understand our customers' needs, now, and in the future; and then configure our organization to satisfy those needs with precisely-targeted, highest-quality products or services. Actually, we don't really want satisfied customers — what we're looking for are loyal customers. So, our goal is really more than customer satisfaction, it's providing our customers with a level of satisfaction that keeps them loyal.

How do we focus on customer needs? Dr. Deming used to tell me that customers very rarely know what they want, and spending a lot of time sitting down with them trying to understand their needs can sometimes be a very frustrating experience. So, when we talk about focusing on the customer, we're not just necessarily focused on who, directly, is our customer, but we're trying to understand the whole voice of the customer. And voice-of-the-customer means the industry that the customer is a part of. It means understanding who their customers are. If you want to be world class, you are analyzing your customer's needs in a more thorough way than he probably has. So, we've got a process here that starts and ends with the customer. To get there, we need a strategic plan.

What are the key concepts of any strategic planning process? First of all, you have to establish the scope of your plan, then you have to have a vision of where you're headed. Next comes situation analysis, which is where we are today. Then comes something called bridge to the future, how we're going to get there.

So let's look at these in a little more detail. In the scope phase, the planners, usually the senior leaders, agree on the organization's mission and planning boundaries within which they'll conduct the planning effort, and basic guiding principles of the organization, first of which should be quality. Scope addresses things like what markets do we serve, what products do we have, what geographical areas do we want to begin to look at, and the basis on which the company is going to compete? What do we bring to the marketplace that differentiates us from everyone else? The scope phase sets the boundaries of our planning horizon. If we're going to establish a plan, we need to know how far out to look.

I recently heard of a group outside of Mazda that sat down and did a 500-year business plan. They decided they needed to visualize what the automotive industry would look like in 500 years, so they could begin to make plans today for how they were going to get there. For most American companies, going out six months is a real tough effort. This is what we mean by establishing the planning horizon.

The guiding principles that are developed during the scope phase will typically include references to the way the organization intends to treat its customers, its people, and its suppliers. Among the other key factors captured as guiding principles by the leaders of the organization should be their commitment and approach to quality.

The next phase, the vision phase, is probably the most important of the planning phases. Vision is where you begin to establish where you're going. The vision phase sets the direction for the final plan and thereby, the organization's future. In the vision phase the leaders look into the future and envision the business environment in which the organization will find itself, and they try to envision the environment in which its prospects, customers, and competitors will be operating. The leaders then develop a summary of opportunities and threats facing the organization. They describe how they would like their organization to be functioning within that future environment.

The first part of vision usually involves examining customer-driven processes and the future challenges facing the organization's prospects and customers. In this exercise, what's frequently useful is for the people who are a part of the planning process to do some role-playing pretending they are the customers. Let's pretend to be customers and look at the world from that perspective.

In Steven Cubby's book, *Seven Habits of Highly Effective People*, he talks about sitting on the customer side of the table. When you're doing win-win type negotiations, sit on the other side of the table with the customer for a while and look at their perspective. This goes back to customer focus and the idea of voice-of-the-customer. Going out and asking the customer what they think might not always be enough. We've got to go out and do some research on our own and understand where our customers'

industries are going and understand our customer's customers. What we're about in most businesses is helping our customers succeed.

An integral part of what all companies do is to establish a relationship with the suppliers which is somewhat like a partnership. We want very much to be partners with our customers. Likewise, our suppliers want to be partners with us. We need to anticipate the future challenges faced by our suppliers, and explore how linkages can be established between our organization's value chain, what we think is important, and that of our suppliers.

We're also going to take a look at the competition. You have to try to predict how your competition will position themselves in the future environment. You have to try to predict the resulting changes they can be expected to make in capabilities and strategies. To do this you even have to analyze their internal operations. Functions which are typically addressed are marketing, product development, and human resources. So not only understanding the external, but the internal operations of your competition is going to affect your plan.

Next, we need to look at how we look at ourselves. We begin by examining a variety of measurements that determine how well the organization currently operates and competes. We identify the organization's key strengths and weaknesses so we can determine where we need to focus some of our efforts. This next step is known as situation analysis. Situation analysis is an objective analysis of the organization. Useful information should include some idea of what your customer thinks of you, some benchmarking and competitive-type information, financial trends, and the like. This kind of information then begins to build a picture of where we are, what we are currently doing, and what we are currently capable of doing? That's the voice of the process.

After reviewing this information, and highlighting specific areas, the planners are ready to list the key strengths and weaknesses of the organization. In addition, from a quality perspective, the current situation analysis should address the following: the degree to which the organization is customer driven; the degree to which its leaders are committed to quality; how well the continuous improvement concept is deployed through the organization; the degree to which fast-response-to-market is being improved; the degree to which decisions are based on facts; and, finally, the degree to which employees are empowered and involved. This brings us the concept of bridge-to-the-future.

In this phase, leaders decide, based on their vision of the future and their assessment of where they are today, what the organization needs to do to get from where it is to where it needs to be. In the bridge to the future phase, the leaders decide the future of the organization. Out of this step should come targets, supporting strategies, and specific initiative and action plans.

The last phase, however, is really the most important. Planning really is almost a one-time deal. You establish a good strategic plan and go through this process only once, and then what's important is the process you implement to continuously update and continuously improve that plan. That's what we call strategic management.

There's a communications aspect to strategic management. Typically, when you deploy a strategic plan, you create big notebooks and send them out to everyone. But what we should be striving for is the concept of deployment more as the Japanese use it, which means hitting everyone's buy-in and understanding the plans that everyone will make as a part of the strategic plan.

So really, the process up to this point is pretty simple. It's the idea of deciding where you want to go, understanding where you are today, and building the plan to get there. The hard part is what comes after that, and that's making sure you have a plan flexible enough to shift as things begin to shift. The last idea is that we also have to be able to continuously improve the planning process. This is one way to get things planned and organized. There are lots of techniques and there's no right or wrong; it's what fits your organization. We could sit here the rest of the day and debate whether scope ought to be first or vision ought to be first, but it's really unimportant.

What we are about is business, and we talked about some business fundamentals. Quality and planning not really two separate things. I see many organizations build quality plans and build business plans and they're not two plans, they should be one plan. Our goal is to understand our customers' needs and satisfy our customers. Having two competing plans is not going to provide the consistency of purpose we need to satisfy the customer.

Panel A2 - The Continuing Role of Strategic Planning (from left to right): Dr. James E. Ashton, Division Vice President and General Manager, Naval Systems Division, FMC Corporation; Ian L. Rushby, Chief of Staff, Western Hemisphere, British Petroleum Exploration; Dr. Cecile C. Blake, President, STATWATCH; Dr. Robert A. Emry, Associate Dean and Professor, School of Communication, California State University, Fullerton; (not pictured: David L. Stoner, Manager, SRM&QA Technical Support, Loral Space Information Systems).

3.2 The Continuing Role of Strategic Planning

How to maintain strategic quality-driven viability and flexibility while responding to organizational and cultural transitions.

3.2.1 British Petroleum Project 1990

Ian L. Rushby, Chief of Staff, Western Hemisphere, British Petroleum Exploration.

The topic of my address today is continuing role of strategic planning and how to maintain flexibility while responding to organizational and cultural transitions.

The British Petroleum Company, or B.P., has changed its nature considerably in the 15 years since I've been with the company. It is the third-largest oil company in the world. It is actually transatlantic now since our acquisition of Standard Oil of Ohio in 1987, and we probably have 40% of our assets in the U.S. We take pride in being the largest producer of oil in the United States, often not recognized as such because of our significant position in Alaska and the Gulf of Mexico. And we're also the largest producer in the North Sea. Those are the two major sedimentary basins that have been developed in the last 25 years and we have a preeminent position there.

But the history of the company is actually very different. It really started life as the Anglo-Persian Oil Company back before the First World War. Twenty-five years ago, our operations were principally in Iran, Libya, Kuwait, and Nigeria, all of which were successively nationalized in the 1960's and 1970's which changed the nature of the company. The reason that I got invited to such an august gathering was that BP has been forced for these reasons to take a leadership role in the cultural change process. Certainly in the U.K., cultural change has been synonymous with BP.

The oil business is demanding. It's a difficult climate to do business in, and we believe only the best companies in the industry will survive into the 21st century. Oil field sizes are declining. Access to acreage is more competitive, costs are accelerating, and, at the same time, we're finding it difficult to attract technically-skilled people to an industry which isn't held in high esteem in the public arena. Clearly

an incident like the Exxon Valdez in 1989 in Alaska has made our business even more difficult. So, it's an industry in which strategic planning is very important.

There is no such thing as the corporate strategic plan in our business, as with any business. Nobody constructs a plan and sticks to it stubbornly. Planning has become a changing, evolving process. In fact, we describe our process as the living plan. It's not something that gets written and put on the shelf and forgotten about. We examine and reexamine it continuously based on new information and new inputs.

The major strategic change that came about in our last review, two years ago, was a decision to spend at a consistent rate in the so-called frontier areas of the world where oil and gas exploration in the past have either been nonexistent, superficial, or incomplete. The world has been fairly well explored by now. The set of entry basins in which oil and gas are likely to be found are pretty well identified. That means that most of the major producers who are able to do so are pursuing the same objectives in the same acreage.

The areas that we identified as frontier actually fall into two categories. First of all, those which were technically frontier areas, for example, the deep water Gulf of Mexico where we recently drilled a well in 6,000 feet of water. But also those which are geographically previously inaccessible, the former Soviet Union, Vietnam, Yemen, parts of Soviet-influenced Africa, and parts of Central and South America. In order to focus on those particular areas we also found we had to restructure our business. Since 1989 we've eliminated more than 2,500 staff positions, disposed of 2.5 billion in assets, redirected spending, and set a framework to encourage teamwork.

So, BP has been going through change for some time. The major element of both quality and change is employee behavior. In my view, much of Total Quality Management stresses process, and insufficiently stimulates changes in behavior. And I believe without the changes in behavior, any process or program is doomed to failure.

Our major restructuring effort was dubbed Project 1990, after the year in which it began. It represented a fundamental change in our management style and a new vision. The aim was to improve motivation and morale, and to develop a climate of openness and trust. And that really characterizes the way we do business now. The most important change was in behavior; how management treats employees; how much authority and independence people have to make decisions on their own; and how we can help our people develop towards their own personal aspirations.

This change caused an upheaval within the organization, particularly for those of us who had worked 15 years knowing that the way to get ahead was get things done, and the style often was secondary. We removed old systems and roles and accountabilities became more clearly defined as the project continued to evolve. We reduced the number of management-level committees, reduced the size of headquarters staffs, and did a considerable amount of contracting-out of non-core functions, such as our bookkeeping, accounting, and recordkeeping.

Coming into the 1980's we had 11 separate businesses which we've now divested and consolidated into just four. The total value of acquisitions during that period was 14 billion dollars. Any of you who have been through acquisitions will know just how difficult it is to absorb new cultures and new organizations. We went from a highly fragmented, 17-nation structure, to being organized into three broad regions. We took ourselves from a very complex matrix structure where it seemed that everybody had input to every decision, with an executive board covering all facets of business service and regional governments, to a more streamlined, more responsive organization. This all created considerable consternation in the organization.

Management's biggest mistake in these years was underestimating how much effect all this was having on the people. A single-minded effort to restructure had weakened the staff's orientation. However, we heard the grumblings, and after about two years we decided to get a fully detailed attitude survey to find out what the employees' concerns really were. The company got good marks for social activism, for its business acumen and professional standards, but lousy grades when it came down to being sensitive and caring about people. This may well be typical behavior for the global oil industry as a whole. We're used to working hard in a volatile business environment, but this doesn't give us much time for the caring and nurturing of staff, and even less time to listen open-mindedly to suggestions for improvements. We're usually too busy doing something to study what we're doing.

So how did we start caring more about people? First, we educated our top management. A series of pilot workshops were conducted amongst the top 300 managers in the corporation, don't forget this is an organization which employees 120,000 people. Those 300 people in turn conducted workshops for their own people. And this is no small task because

you know any large organization is not a single culture, but an accumulation of many different ones. We communicate in 15 different languages in our organization and, as you can imagine, when you recognize the problems that English and Americans have in understanding what the other's saying, if you've got to go through 15 other languages as well, it makes it doubly difficult. The basic messages that these workshops attempted to convey were the encouragement of personal initiative, the development of team work, the establishment of trust, and the building of networks. And in fact, we came up with a very simple acronym of "OPEN" which stands for Open thinking, Personal impact, Empowerment of the individual, and Networking.

The two most effective factors in assisting our culture change were, first of all, being clear on our goals, and secondly, soliciting employee involvement in suggesting ways to reach the new goals. The assumption of management that they knew best was one of those faults in BP, as I'm sure it is with many others.

In BP, some very intelligent employees, who normally knew that they knew best, had to be changed into learning individuals to be able to reach these goals. But management has to lead. People do observe what's going on. They want to know whether managers are still just giving "do-as-I-say" orders, or whether it's a demonstration of "do-as-I-do." And indeed, one of the successes has been the promotion of candid employee communications, both verbally and printed. It seems to me that unless we can talk to each other as individuals, we don't stand a chance of getting our problems out on the table and resolved.

So what has been accomplished at BP? BP is sailing into smoother waters where moral improves, employee retention increases, and people stop complaining. As a result, people feel better, and the business performs better. Now, none of this was altruistic. The whole goal was, in fact, to improve business performance. We have groups of people who feel comfortable. They no longer need to double check before going ahead. We've expanded the use of self-managed teams, particularly in our operational areas, replacing the institutionalized and combative units of the past. The manager's role has changed from that of director and chief-doer to one of primarily coach and facilitator and provider of resource. Now, instead of our meetings beginnings with the words, "Here's what we're going to do," they begin with the words, "How are we going to tackle this problem? How are we going to tackle this issue?"

I don't want to leave you with the impression that BP is now perfect, thanks to Project 1990. We certainly still have some problems to overcome. But I think there's a recognition that we're running in a marathon, and not a sprint, and it will take several years for this to blossom. There's been a recognition that the organization has become candid, quick, and forthright and much more open. We have pledged no new initiatives. Those of you who live in Houston will find every week in the newspapers another oil company making major reductions in staff. We're at a stage where we believe that job reductions in the future will be carried out through voluntary separation and attrition and through the creation of partnerships in fairly humanitarian ways.

So we're still trying to balance that competitive business performance with organization and stability. I don't think organizational stability is, in fact, something that any learning organization will have in the future, but I'm confident we'll get to our goals, and I hope that some time in the future I'll again be asked to tell you whether we've been successful or not.

3.2.2 A Practitioner's Approach to Implementing Continuous Improvement

Dr. James E. Ashton, Division Vice President and General Manager, Naval Systems Division, FMC Corporation

Over the last two decades there's been lots written about TQM and Just-In-Time and a lot of people have read at least antidotal information on how good these concepts can work. But most of the examples are in fairly high volume, consumer businesses such as automobiles, tape recorders, etc. A lot of people think those same ideas probably don't work very well in low-volume batch production. But my message is TQM is just as applicable to the aerospace business, despite the relative uniqueness of our products.

The kinds of places that I have worked in and managed, system job shops, tend to always have a very high cost-to-sales. That is, the product costs too much to deliver to the customer. You also tend to have a very large inventory and very low inventory

turns. In addition, these job shop kinds-of-places, in spite of lots of inspection and testing, tend to have poor-to-mediocre quality, and very poor delivery reliability, in spite of very long delivery lead times.

Historically I think we have believed that in order to have a very high quality product we probably have to sacrifice delivery, performance, or cost. Or, if we wanted to be the low cost provider then we probably would be the kings of shoddy goods. But today, we've learned that the idea of trading off quality, cost and schedule is not what it's all about. We've learned in the 1980's that a truly different management approach is necessary to be world-class.

For the total improvement effort to succeed, we must be convinced that there is an incredible opportunity for quantum improvements. The way we get people turned on to go do these things is we set goals that are so much higher in terms of performance improvements that they know they can't get there with any of the conventional approaches to management. You don't go get these things done by trying to make three and four and five percent improvements. Furthermore, most of the folks who write and talk about these things talk about a very long road with four of five years to even start to see some results.

I'm convinced that you can get very significant improvements with an aggressive approach within approximately 2-3 years. In a typical job shop, it's not unusual to be late worse than 50% on time. Two years after implementing the aggressive approach I'm going to talk about, you can get that up to 95-plus percent. You can improve your lead times by 40% to 90%. Defects can be cut by up to 95%.

Part of the problem with doing this is that people have to decide they want to. There as a very simple formula to achieve this, unfortunately, it isn't easy. The idea of continuous improvement requires more out of the work force, and getting more out of the work force means management's got to have less power. To achieve that necessary continuous improvement culture change we're always talking about, it has to be led and lived by the top operating management. I don't believe you can force the folks above you to go make this happen. You can probably make it happen from you on down, if you're a believer, but it must be led and lived by the person from the top.

I think the mission of virtually any business is a quality product. That doesn't just mean defect free, it means a better product from the customer's point of view, delivered when you said you would, and at the lowest achievable cost. In other words, you have to do it faster and faster. So if you can do it faster, and keep getting better at it, then you'll succeed. There are lots of techniques to go do that. They are different in different parts of the organization. We're not only talking about the manufacturing floor, but techniques such as cellular manufacturing, set up reduction, and kanban systems. All those things are just techniques to help you achieve faster throughput.

One very convincing advantage to faster throughput is it motivates the corrective process. It says, "I not only want to fix a problem when it goes wrong, I want to keep it from happening again." And as you keep doing that, over time you eliminate the things that go wrong and decrease costs.

The essence is that you find the things that go wrong in your processes in all the various areas, and then you change the process so the mistakes won't be repeated. And this self-examination process is most successful when the people who do the work and have first-hand knowledge of what takes their time, are empowered to take corrective action.

The first thrust is to get everybody motivated to find ways to have less things go wrong. The other essential ingredient is changing the culture to create an environment for your people that allows innovation, that allows you to have continuous change. I often ask the question of folks when they gather, how many are in favor of continuous improvement. Everybody is. Then I ask how many are in favor of continuous change. Not nearly as many raise their hands. But in fact, what you really want is continuous change, not stability, not constancy.

How do you cause effective change? First of all, I think the top person has to be the leader of this effort. Secondly, management has to provide clear objectives, but not detailed directions. When you provide detailed directions to people, you take away their freedom to come up with the best way to do it. Everybody says they're going to delegate, but they don't really want to delegate. You have to allow failures if people are trying to find good and better ways to do things. You cannot expect your organization to bat a thousand.

Also, you have to stress effectiveness, not effort. In this country we are prone to want everybody to work hard. That's a terrible motivation. We want people to <u>not</u> work hard; we want them to get a lot of work done. When you're working hard, you won't have time to figure out how to avoid doing that work, which should be the real goal of improvement. Along these lines, we should emphasize rewards rather than punishments. If you can convince folks that they'll get patted on the back for doing something good rather than kicked in the butt for not

working hard, they're more likely to work hard at doing something good.

I believe in using the project management approach to doing continuous improvement. Part of that is a thing I call Operations Reviews which we do in gory detail once a month. One of the tenets of project management is first you must have a plan, then you must measure how you're doing the plan. And if you're not doing it exactly the way you wanted to, you must do something about it. I'm convinced that this very simple idea will motivate and allow you to coach and bring things along in a continuous improvement approach.

We challenge the various parts of the organization to come up with their own plan. They determine what they measure to see if they are building a quality product on schedule, at the lowest achievable cost. We do that at the lowest possible levels in the organization. Our people get stroked when they do good, and coached when they don't, and they move along in the direction of continuous improvement.

The Naval Systems Division of FMC is about a 300 million dollar producer of defense goods. We build big guns for navy ships and missile launchers for navy ships. It's a very low-volume, unionized, archaic craft industry, and we set out to make major improvements in our processes. I've only been there two-and-a-half years. When we started, 34% of the master schedule items were past due, 733 items. They averaged 106 days past due. So if you multiply those two together we were 75,000 days behind schedule, and that wasn't all that unusual. By January of 1991 we got that down to 40 items behind schedule, or about 500 days behind schedule.

I don't want you to think this only works on factory floors. It works in the office functions and it certainly works with respect to vendors. We went from 930 vendors to under 400, and to stay qualified as a vendor, they had to start inspecting their own products. Now, instead of inspecting 99% of the material received, we now inspect less than 50%. In the process, the quality of what we receive is way up. Back in the second quarter of 1989, 34% of the material we received was late and 17% was rejected. Now, less than 4% is late, and only 2.4% are rejects.

To summarize, TQM means doing things faster and faster, yet by demanding continuously improved quality, your people get a strong motivation to get rid of the problems. TQM can be implemented rapidly under those kind of conditions, as long as you empower your hands-on people to make the necessary changes. No matter how fast you're doing it, you can always set an objective to do it faster, with tremendous results in virtually any kind of a business.

3.3 Planning for Evolving Partnerships

A discussion of how Rockwell International and the United Aerospace Workers committed to a joint partnership to achieve competitive advantage and how company and union officials reached a landmark contract agreement by "issue" bargaining instead of "position" bargaining. How USAA built a world-class service organization through quality-driven strategic planning and business partnerships.

3.3.1 Introduction

Eileen T. Crowley, President and Chief Operating Officer, Chamber of Commerce Division, Greater Houston Partnership, Chairperson

The Greater Houston Partnership is the economic development group for the greater Houston area. Our organization includes the Greater Houston Chamber of Commerce, the Houston Economic Development Counsel, and the Houston World Trade Association. We provide assistance ranging from public education reform, to government relations and lobbying, to bringing new companies to town, to working on the building of emerging companies.

Panel A3 - Planning for Evolving Partnerships (from left to right): Eileen T. Crowley, President and Chief Operating Officer, Chamber of Commerce Division, Greater Houston Partnership; Geneviene R. Emry, Director, Organizational Excellence and Employee Communications, Space Systems Division, Rockwell International Corporation.

So, if partnership is in our name, there's a reason for that. Our business community works very closely with NASA and the Johnson Space Center because we see that as key to our future. We've seen a tremendous emergence of small companies in the commercial aerospace area over the past decade in the Houston region. We hope to see more of that happening. A lot of it is tied to very exciting innovative research done by our universities and research institutions, and they are very closely connected with the emergence of these companies.

We know that our economic vitality and our quality of life is directly tied to our intellectual resource space, and that's one of the reasons that we welcome you here today.

3.3.2 New Beginnings: United Aerospace Workers'/Rockwell International's Breakthrough Approach to Contract Negotiations

Ernest Shelton, International Representative, United Aerospace Workers, Region 6, AND ***Frank L. Chabre****, Vice President, Human Resources and Communications, Space Systems Division, Rockwell International Corporation*

Chabre: The United Aerospace Workers has represented Rockwell employees in the aerospace business for a long time. That relationship has generally been peaceful, but also it's been a very tough, hard-nosed, confrontational type of relationship.

During a series of meetings in preparation for our 1990 negotiations, it became clear that Rockwell and the UAW were in a process of changing how they

Panel A3 - Planning for Evolving Partnerships (from left to right): Robin S. Lineberger, Manager, Space, Aerospace and Defense Consulting, KPMG Peat Marwick; M. Staser Holcomb, Executive Vice President and Chief Financial Officer, United Services Automobile Association; Ernest Shelton, International Representative, Region 6, United Aerospace Workers; Frank L. Chabre, Vice President, Human Resources and Employee Communications, Space Systems Division, Rockwell International Corporation.

were going to do business. We were faced with customers who had fewer resources and increased requirements. That added up to both union and management having to increase performance. We both were in the mode of finding that the old ways were really not going to be good enough anymore. We were moving towards an operating style of cooperation and involvement with our stakeholders, our customers, the members of the union, our employees, and our suppliers.

Once we discovered we both had a common strategy, quality-driven results for our customers, we also found that we had a common implementation philosophy, having highly-involved, well-trained, committed employees working the process. Having a confluence of those two strategies and philosophies made it possible for us to come up with a new way of bargaining which we call issue bargaining.

Shelton: Since our last round of contract negotiations, our membership had dropped from 22,000 down to only 8,000. So, the members were aware of the problems the company was facing. It wasn't that all of a sudden we woke up and fell in love with each other, we realized that we had to adapt to the changing world or we wouldn't survive. Normally, during the opening negotiating session, the union has its suitcase of demands, and the company has their two suitcases of no's. That's the old way of doing things.

Chabre: None of the underlying elements and techniques we used in the process of issue bargaining were unique, but when you put them together the way they were put together, we got a rather pleasant result for both parties.

Rockwell knew we had to change the style of the negotiations, so first of all, we had a leadership commitment to solve problems, not win battles. We also had an in-depth understanding of each other's issues. We spent many many days trying to understand where each other was coming from. We also had a willingness to work each other's needs. In other words, we had some common objectives.

In addition, we had a well-structured education process aimed at building trust, changing behavior, and solving problems. We had highly competent facilitators in both the union and the company. They were interested in improving the process. They weren't negotiators.

Lastly, we used a nontraditional setting. We didn't sit around rectangular tables across from each other. We had round tables. Both sides sat together, side by side as we conducted our discussions. We had joint teams, not separate teams, to address the issues. For example, we had a team to improve employee involvement. Ernie led the team on operating issues. We also had teams specializing in benefits, another on economics, and so forth. So it was a very focused kind of process.

All our sessions started with an educational session. Everyone participated equally in these sessions. We didn't splinter them into hierarchical groups which are normally used in these kinds of negotiations. In our first session, we started off with a day-and-a-half of training aimed at building trust and teaching teamwork. From the trust point of view, we went through a series of exercises that explored the tactics of win-win, win-lose, and lose-lose scenarios.

The result was a commitment by both parties to a win-win ethic. That committment was carried through the entire negotiation process, and it is carried through to this day. Another interesting exercise we did was at the end of the negotiations, we changed sides, the union took the company's side and the company took the union's side, and we caucused. That's why we have a good contract today.

Shelton: One of the most interesting exercises we did during negotiations was we ran a Myers-Briggs profile on all participants. As a result, we all got a very good understanding of where everyone was coming from. The most interesting thing we found was that two-thirds of the group were introverts. And so, what was happening was that one-third of the participants were getting most of the air time. So we had to change the process around so that everybody got some air time, and we didn't have people just sitting there nodding their heads, and not really believing what was going on.

As the negotiations proceeded and we got close to the end, our training sessions focused on how to solve problems in a team environment, i.e., brainstorming, listening, how to run a meeting, how to set goals, etc. In these negotiations, we really focused on the process, not just the substance of the issues.

In terms of results, we really got a consensus on all the issues. We didn't leave the room until everyone agreed on a consensus solution, and I think that was unique in a labor negotiation. As a result, we were able to get 85% of the membership to ratify the contract. There was some skepticism on their part until they found out that the company was willing to put their money where their mouth was in creating a fund to implement employee involvement.

Chabre: What came out of the negotiations is probably way more important than the economics or the work rules that you usually get out of negotiations, it was employee involvement and understanding. At the foundation of that involvement and understanding is the concept that a joint partnership between labor and management is the only way to provide high quality to the customer, and maintain a competitive edge in the marketplace.

Shelton: The consensus result also allowed us to create a working environment of mutual trust, respect, equality, open honest communications, job satisfaction, growth, rewards, recognition, and above all, job security.

Chabre: As a result, we are going to get customer satisfaction and employee satisfaction through the continuous improvement technique. We have established a new way of thinking about contract negotiations. In fact, we just completed a set of negotiations with the UAW in our automotive business, and we used these concepts and techniques to solve some problems for both sides.

Shelton: Results? After we established the employee involvement program, we have been able to cut the turn around of rework from 140 days, to 60 days. Initially, some of the members thought that if we found all these shortcuts in how to do this, the company would need fewer people. But, to the contrary, we were not only able to get a new contract, we were able to increase our membership by 25-plus.

Chabre: Rockwell is so pleased with the results that we now have these teams at work in most of our locations. We think it's working, and most importantly, the employees think it's working. The employees, the customers, the UAW workers, and Rockwell all won with this technique.

3.3.3 Partnerships: A Strategy for Success

M. Staser Holcomb, Executive Vice President and Chief Financial Officer, United Services Automobile Association

USAA, the United Services Automobile Association, is a unique, San Antonio-based company formed in 1922 when 25 army officers found it difficult to get insurance. Two years after they began, they admitted officers from all of the armed services, thereby becoming the United Services Automobile Association. After 69 years of growth, we are, today, a diverse supplier of financial services and insurance to more than two million members, with 13,000 employees.

We're a niche marketer. With some determination and pride, we stay within a clientele made up of military officers and their families. This is an exceptional demographic group of highly-educated, very conforming, self-disciplined people, with very high expectations. They dedicate their lives to serving their country, and they expect to be well-served by this member-owned association.

Our obsession with quality began long before we

worried about what TQM had to say about it. All of the elements of what the modern quality movement talks about have been in the culture of USAA for many, many years. This ability to deliver service to these two million people of unquestioned quality and high reputation has made USAA a positive force in whatever industry it appears.

In gee whiz numbers, USAA is the fifth-largest insurer of private automobiles and homes in the country. We rank about 49th out of some 3,000 companies that sell life insurance. Its bank is the second-largest MasterCard issuer in terms of sales volume. Because there are no agents, or middlemen, our clients deal with either by mail or telephone. Consequently, we've become the largest mail-order outfit in the country, L.L. Bean and Sears included, and the largest single-site transaction point for information systems. It takes six of IBM's biggest engines to provide this continuous, automated, insurance environment which is the core of the company. Some 3,500 1-800 telephone lines feed into the San Antonio office, or one of the seven diverse locations, and the system in San Antonio provides the information data support for all of that.

Due to the type of business we are in, we set two strategic goals very early on. One was that technology should be used as a strategic weapon. It should be the center of the way the service is going to be delivered. The other strategic vision was that our business should be done with a minimum of paper.

As a result of these goals, a number of strategic partnerships have evolved. For the first fifty years, USAA could go it alone, but when the age of information service came along 10-15 years ago, it became clear that we needed help. There were too many other sources of service and products out in the marketplace to be ignored. You simply couldn't reinvent it all, so USAA began, 15 years ago, to develop strategic partnerships towards our goal of making technology work for us.

The computer systems we installed 10-15 years ago would be called expert systems, or almost artificial intelligence, today. Then, it was a matter of survival for us. We deal in a complex insurance environment with 50 different regulatory jurisdictions. Reducing all that to a computer-supported system which allows a contact-person to quickly provide an accurate insurance quote in whichever jurisdiction the member may be calling from took a giant leap in technology.

Other technologies came along as a result of that leap into an automated insurance. One of them was imaging. Quite consistent with a paperless approach to doing business was the idea of developing an information technology where the transactions and the papers that were required by law and by custom to support an insurance policy could be imaged, and paper could be gotten rid of by the ton. But we needed partners to develop this system.

Two of the early partners were IBM and Image Systems. In the early 1980's IBM really didn't think there was a market for imaging documents normally stored as hard-copy. But, after being prodded by several vendors who were competing to do this, IBM took the big leap and produced what is today probably the most successful document-imaging system in the business. Now IBM is running down the road with Image-Plus and Image-Plus-Plus improving on the ideas we had to twist their arms to prototype in the first place. Now, they handle photographs and voice communications the same way they learned to handle our printed documentation, by digitizing it.

Another partnership came out of the position that USAA held in the telecommunications business with all those incoming wide-area telephone service lines and the need to have a system that could be accessed economically from anywhere in the world. From that came a partnership between AT&T for the big network, and between USAA and Sprint to provide some of the spinoff services like special arrangements for USAA members for their own, personal long-distance telephone calling. A product and a service to the member grew out of a strategic business relationship between USAA and a provider of service.

Another partnership helped us improve our adjustment and settling of claims. For years and years in the early days, a collection of mom-and-pop appraisal shops were used all over the country where USAA members might be. Over time, that proved to be less and less satisfactory, and permanent, long-term relationships grew between USAA and General Adjusting Bureau, and Crawford & Company when their quality standards could be raised to the level of service that the USAA member had come to expect.

These kinds of business partnerships lead to community partnerships as well. For example, we've developed a mentoring program in San Antonio, Tampa, Sacramento, and wherever we've got a sizable presence. The idea in mentoring is to keep people in school who otherwise might drop out by giving them individual recognition. Now, this is beginning to expand, so there's been a spreading of the gospel and the spirit of mentoring. Actually, mentoring is a very selfish thing from our point of view. We want good graduates coming out of high schools and we want good high school graduates

going to college so that our employees can be drawn from a wider, more intelligent, and richer pool of graduates. Our partnership with school systems and the communities can make this happen.

USAA has been recognized for our pioneering pursuit of quality. We have been a finalist a couple years in a row in the Malcolm Baldrige competition. Our basic concept has been to do the right things right and to do unto others as we would have them do unto us. We believe strongly that you can invent a future and there's no end to that journey. You've got to be looking all the time at where the competition is, and how you can improve your service a notch or two higher, and everything else will fall into place.

4.0 World-Class Quality — Tools for Survival

Focusing on the use of three assessment tools which are critical for the survival of the organization today: Benchmarking, Supplier Certification, and Quality Standards for Services.

4.1 Benchmarking: Competitiveness, Survival and Territoriality

A discussion of techniques for assessing the quality of internal processes, and techniques for implementing changes based on sensitive benchmark data

Panel B1 - Benchmarking: Competitiveness, Survival and Territoriality: Dr. Robert M. Krone, Chairman, Systems Management Department, University of Southern California.

4.1.1 Introduction

Dr. Robert Krone, Chairman, Systems Management Department, University of Southern California, Chairman

Some time ago, Homer described the ten years of travels of Odysseus to his home in Ithaca, following the Trojan Wars, as a long journey marked by wondering, adventure, and hardships. American industry, government, NASA, and even American education began a similar odyssey in the 1980's, with the philosophy and tools of the quality management movement. How fitting it is, I think, that here in Houston in 1991, with satellite up-links to NASA and other places around the country, that we have the nation's leaders in quality management in the audience, as well as on the platforms and especially at this panel on benchmarking. After all, aren't the stars the benchmarks of the universe. And, we cannot navigate anywhere without first knowing where we are, and where it is we want to go.

4.1.2 Quality Benchmarking

Wallace J. Luther, Vice President of Quality Assurance, North American Aircraft Division, Rockwell International Corporation

Since the loss of the B-1B bomber program, we've had to down-size considerably, and we transitioned to a much smaller, multi-program company. This necessitated redesigning our fundamental processes and streamlining our operations. Benchmarking has been a key element of our improvement process to reshape our organization.

This is a dictionary definition of benchmarking: "a point of reference from which to measure and something that serves as a standard by which others may be measured." I think that Merriam-Webster probably was pretty much on track, it matches the way we think about benchmarking today.

Another, more technical, definition says that benchmarking is a semi-quantitative tool for establishing

Panel B1 - Benchmarking: Competitiveness, Survival and Territoriality (from left to right): Charlotte R. Scroggins, Senior Vice President, American Productivity and Quality Center; Ken Potashner, Corporate Quality and Technology-Staff, Digital Equipment Corporation; Wallace J. Luther, Vice President of Quality Assurance, North American Aircraft Division, Rockwell International Corporation; (not pictured: Kenneth R. Shipe, Product Assurance-Staff, Martin Marietta Astronautics Group; Leslie J. Sullivan, Chief, Management Analysis Office, Lyndon B. Johnson Space Center).

position within a marketplace for all key, competitive parameters. Benchmarking, being a semi-quantitative tool, means you usually will have to fill in some of the blanks yourself. You will not get all of the information you're after using only benchmarking. Or, if you do, it may be so lengthy a process it's not worth the effort.

Another definition states that; "benchmarking allows understanding of the selected processes as compared with other companies excelling in that process." First, we have to define our own critical processes which need benchmarking, and then, and only then, are we ready to compare our processes to those that we understand to be best-in-class. Benchmarking may be done on sister divisions, or on your direct competitors, but, if you are benchmarking with somebody other than who you consider to be best in class, you may just be practicing the art of benchmarking. Benchmarking forces us to understand what our competitors are good at and where we must improve.

What should be benchmarked? Every process that describes the health and vitality of a business. Benchmarking as a TQM improvement tool can be used at all levels, for any selected processes, to facilitate continuous improvement. This TQM change is what's known as "incremental change." Processes that can create a competitive advantage for your organization in the eyes of your customer are known as "fundamental processes." Measuring those processes is known as "fundamental change benchmarking."

Fundamental change is frame-breaking change. It radically alters the way we do business. We have redesign teams dedicated to studying our current, critical market processes at North American Aircraft. They are using benchmarking as a really important tool to understand the competitors, and understand the best-in-class in selective processes where we need improvement. We've challenged our fundamental change redesign teams to come up with improvements measurable in the 30-to-50% range. We do that because we know it is possible to make fundamental, frame-breaking change with that kind of improvement if you really free your mind up to redesign the way you do business. That's in contrast with the 5% or 10% gain that you normally can get through incremental change.

There are five basic benchmarking steps the teams go through.

- Strategic reassessment of customer needs.
- Refocus the business strategy.
- Realign the organization structure.
- Develop an unbiased understanding of competitive position.
- Really understand the best-in-class.

You really want to culturally institutionalize benchmarking as a process-improvement tool. At North American Aircraft, we have made benchmarking a part of our top quality management process. And, more importantly, it has become an attitude of continuous analysis of our competitors.

I have laid out what I call a path to successful benchmarking. It is pretty accurate, and in the right sequence, and delineates the basic steps you need to follow. You need to know your customer, you need to know your own operation, and you need to know your own process that you're going to be benchmarking. You need to know your competitors' strengths and weaknesses. To do that you also have to search out the very best—the world-class—the worldwide leader in whatever process you're working on and then, learn from that best performer.

Benchmarking requires that you change your processes. And, hopefully, by doing that you will be able to leapfrog your competitor. Then, you delight your customer as far as your own performance goes. Probably the most important thing is to really keep at it, do it again, do it some more, do it with another process, keep measuring your processes, and keep improving them.

4.1.3 Total Quality Management

Ken Potashner, Corporate Quality and Technology-Staff, Digital Equipment Corporation

We went through a six month period of launching our TQM effort at Digital which we defined as the time needed to take our executive team from a state of unconscious incompetence — not knowing what they didn't know — to a state of conscious incompetence. Then, we positioned benchmarking and positioned other initiatives, all focused on total quality.

Early on, we found we had to significantly alter our leadership model. The most important realization was that we were seeing ourselves as only a member of a given function. We were either part of engineering, or part of manufacturing, or marketing, and all of us were driven by a set of functional goals rewarded in the functional context, and all aggressively pursuing "functional excellence. "

However, in the first phase of our benchmarking process we took a look at the attributes which are important to our customers. Low and behold, we found a tremendous need for cross-functional execution. Secondly, we began to benchmark ourselves on a function-by-function basis so we could compare ourselves with our competition.

We assembled a cross-functional team. I came from engineering in Europe. We analyzed the situation and found we had literally no quality involvement. We adopted Six Sigma, a waste-elimination program which drives defects out as aggressively as possible. We adopted a goal of reducing defects by 60%, and we're achieving that. We also adopted a goal of reducing cycle time by 35%, and we're achieving that as well. Why such big numbers for goals? Because, we can't afford only a 15% improvement on our productivity curve. We are driven to those numbers by our understanding of the competitive reality .

We established an internal benchmarking effort to mobilize our work force of 120,000 people towards benchmarking and total quality. This effort includes the process we developed called A-delta-T. In this formula, A depicts how the job is being done today, T is the best theoretical execution that the employee thinks is currently possible, delta depicts the difference between the two.

Work processes are mapped so that those activities that do not add to the quality of the output of the process become visually apparent. The A-delta-T process produces a map which enables our employees to identify areas of waste in the process and remove them. In other words, the theoretical map shows our objectives to move forward. We have used this mapping process in products and services with individuals and groups, and we keep a data base of these mapped processes so that we can share improvements across organizational lines.

Our people have come to understand by mapping their processes that it is no longer their job to just execute the process, but it is also their job to continually and aggressively improve their processes.

What TQM and our benchmarking process have brought us is a four-step process which is fairly simple. First, we benchmark the factors we see as critical to our success. Secondly, we benchmark our processes as they exist today, not as we would like to see them tomorrow. Thirdly, we determine who is world-class at the practice-level and benchmark these processes. We've found that looking at the result-level won't do you any good. The results might lead you into the correct practices, but you really need to get into the practice level. The fourth step is to determine what practices we need to adopt to become world-class, and how do we institutionalize them within our activity.

Continuous improvement requires a combination of bringing innovation in, driving continuous improvement at all levels, and having the discipline to institutionalize the gains in a company-wide activity. With continuous improvement comes a high degree of failure. If you are going to take the risks for high innovation, you will also have more failures.

You need to learn from the failures and you need to ensure that your employees know what doesn't work as well as what is successful. You need to measure and benchmark your processes, not only against those considered "best in class," but also against the theoretical best possible processes. You should set your target for the theoretical best.

4.1.4 International Benchmarking Clearinghouse

Charlotte R. Scroggins, Senior Vice President, American Productivity and Quality Center

The American Productivity and Quality Center's (APQC) International Benchmarking Clearinghouse effort got underway in early 1991 to assist a number of companies with expertise in benchmarking that were being bombarded by calls from other companies that wanted to learn more about benchmarking. The expert benchmarking companies wanted to help these companies, but they couldn't answer all the requests.

The APQC started out representing about 20 companies. Last April, that jumped to 84. To join our clearinghouse, companies designate two people to be representatives on this effort. These people work with us in a variety of different ways. We have frequent meetings where they all come together and we share information. We also have them grouped into task forces, where they are working on different components and different aspects of the clearinghouse.

We have them all on an on-line computer network. A company might go on the bulletin board and say, "We want to do some benchmarking in the area of career counseling. Do you know who does that well?" This computer network has probably been the most significant thing we've accomplished. It has been amazing how much information is out there. We have also been very surprised at the pockets of information that are out there in the international companies .

The clearinghouse saves companies lots of time and money by depositing benchmarking information in one central resource that's available to everyone. Most of the companies that are just now getting started in benchmarking, the majority of the companies in the United States, don't know where to start. If they find out which company has expertise in the area they want to benchmark, they have a difficult time in locating the right person in the company to work with. We try to put these people together.

Certainly we run into some territoriality. When you share benchmarking data, sometimes you get into some delicate areas. We had one group develop a code of ethics and a protocol for working with one another. There are going to be very specific levels of security and access — some companies will share a lot of information and others won't. By talking and working through these issues, we've all come to realize that unless we share the data we're not going to get the data.

We provide a library search of articles, of data, of metrics, of processes and information on benchmarking studies, and referral services. This will all reside in a data base. The first few years it will be accessible by calling in and working with a person at the end of the phone line and tapping into this data base. In future years it will all be computerized, and you will be able to do your own search.

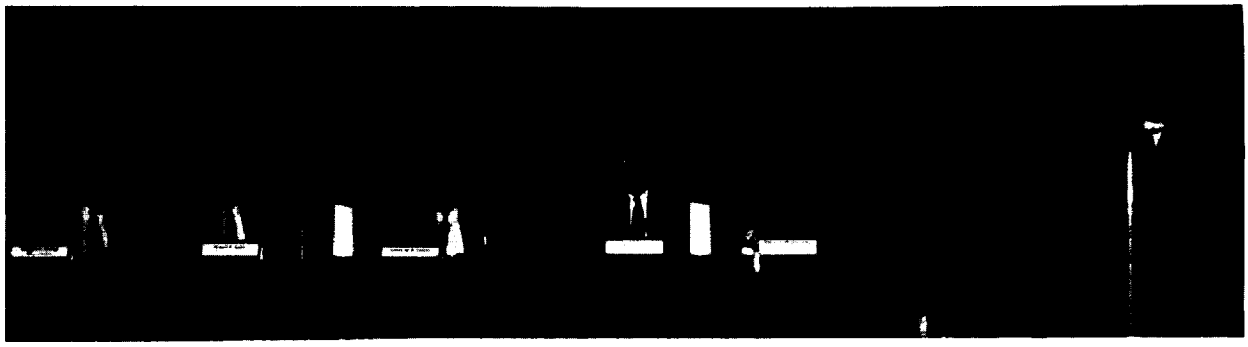
Another need we have identified is a guide on how to organize and manage the benchmarking process. We are working to standardize the benchmarking process and to have a standard process of what you do at each step, what you do before you ever go out and do benchmarking, and once you've got your process established, what you do to keep it going and manage it so that it doesn't run you.

We'll also do screening services. Some of the companies such as Xerox, L.L. Bean and American Express are overwhelmed by calls. They've asked us to screen people before we refer them so everyone is up to speed and speaking the same language.

We will also do consulting, because of the 84 companies we are working with, there are probably about 20 companies that consider themselves to be fairly advanced in the benchmarking process, but over 40 consider themselves to be beginners.

We are not putting ourselves forward as the only repository of this information. We want to have resource partners. There are a lot of organizations out there that have been collecting benchmark data, some in the human-resource area, some in the manufacturing area. There is a lot of existing data and there is no reason to recreate it We're working with these organizations. We have two groups going, the Health Care forum in San Francisco and the National Center for Manufacturing Sciences in Ann Arbor, Michigan, who are working with us on this data collection.

We want to help firms do a self-assessment and reduce duplication of benchmarking. We want to offer a single source for both national and international data. We don't have every answer, but what we'll do is we'll tell you where you can find answers to your questions.



Panel B2 - Exploring Quality Assurance Standards in a Services Environment (from left to right): Richard H. Bhend, Senior Reliability Engineer, Application Business Systems, IBM Corporation; Dr. Robert R. Spear, Manager of Quality, The M.W. Kellogg Company; James W. A. Cearns, Vice President - Aerospace, LRE, Munich, Germany; Dr. Dale L. Compton, Director, Ames Research Center; Sherry H. Prud'homme, Project Manager, TQM Office, Lockheed Engineering and Sciences Company.

4.2 Exploring Quality Assurance Standards in a Services Environment

Meaningful quality standards in non-traditional areas, such as, research and development, engineering services, and white-collar work are discussed. The use of requirements, definition tools, process analysis, peer reviews and other innovative approaches are also considered.

4.2.1 Introduction

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

The theme of this year's conference is "Extending the Boundaries of Total Quality Management." The intention of the conference is to expand the underlying principles of TQM beyond the traditional boundaries, which is on the manufacturing floor. In addition, our purpose is to extend discussions of TQM to an international audience, to the service side of the economy, and to local governments and community organizations.

This panel addresses situations that extend beyond the manufacturing floor, into what I would loosely call the service environment. There are many differences between applying TQM in the service environment and applying it in the manufacturing environment. The differences include such factors as the degree of interaction of the customer in the service/production process, the variability of work processes within the services environment, and the ability to measure results and to establish standards for quality.

Because the service sector is such an vital and growing part of the economy, it's important for us to learn as much as we can, as rapidly as we can, about improving quality and productivity in this area. As a director of one of the three NASA research centers, I am a member of the service sector of the economy, and I know from trying to implement TQM in various ways in my own organization, how difficult it is to identify the customer requirements for service and to measure the results.

4.2.2 Quality Standards in Service Environments

James W.A. Cearns, Vice President-Aerospace, LRE, Munich, Germany

I run engineering, sales, marketing, and most of the services in our company. We were set up as a subsidiary of Leach Corporation in 1961. We diversified into medical glucose instruments in 1970. We separated from Leach in 1973. And then, we commenced manufacturing in France and the U.K. for aerospace products in 1973 and 1980. We came back over into the USA with our medical products in 1987.

Today, we are a 90-million-dollar company, with over 1,000 employees worldwide. We have the

widest range of aerospace relays in the world. We're the largest manufacturer of hand-held medical blood glucose measuring instruments. We manufacture an wide range of intelligent, switching power controllers, and we've been very successful in all of the major applications that have occurred in the world so far.

When I was asked to do this, I asked eight companies for their definition of quality, and they were all different. My definition tries to differentiate between people and investment and in my view, people predominate in the end result of quality in a product. The people who design it probably figure most in this. The people who produce it have to be involved, but if the design isn't right, the product is no good.

Fortunately, quality is a culture or an ethic in Germany. The people eat, sleep, and drink quality. The only bonus system we ever introduced in the company is purely quality-based. It's a company confidential thing, but it's been the most successful thing that we've introduced in our production facility. One of our major customers recently told us that of the 300,000 relays we have sold him in 22 years, we've only had two returns, which is quite a reasonable quality level.

We commenced TQM in its original format in 1979, and by 1985 most of the investments and people changes had taken place. That was predominantly on the production side. To us, the most important factor with respect to quality in the services environment is the selection of your design engineers. In our environment, it takes six months minimum, because of the legal situation in Germany, to replace an engineer if he leaves. It's vital to select the right engineer. The system doesn't give us too much flexibility, but it ensures us continuity and stability. This is very vital when you're producing components because you have a five-to-seven year design cycle. Therefore, it's essential to have continuity. We don't have many engineer changes.

In the selection process, qualifications are essential. We require what equates to something between a Master's and a Ph.D. for most of our design engineers. Interviews are very thorough, and we don't confine them to engineering disciplines. We also cover management, manufacturing skills, and sales. For the first six months, we monitor new engineers' performance very carefully, because if they don't come up to scratch, we're allowed to get rid of them in the first six months. We monitor the engineer's output, adaptability in teamworking, and efficiency, and efficiency is critical. This is done by Engineering, Management, and myself. We have to do this almost clinically to make sure that we have the right guys. It's a cruel world in Germany, but I'm afraid that's what we have to do.

After we have the right person, we do regular checks on the viability of his designs. It's very critical to us. We check all of his designs using the standard methods, particularly Murphy's Screening. You'd be amazed how much Murphy still occurs, even in aerospace.

On the medical side, we focus on software, because all of our designs are software-oriented. We check weekly on the soundness of the engineers' input by teamwork. We still use the old quality circles which were introduced years ago. That principle I think was very good. All projects, production problems, and customer problems are logged. We will not allow any fragmented meetings outside of the group or team in our company. People must not and do not take up fragmented problems without bringing them forward to our coordination teams. This helps us to log our programs with respect to problems, and designs, and it gives a log of our continuous improvement. We have five teams and they are product-based. We include very senior managers in these meetings because we frequently have to make very difficult decisions at these meetings. This is key to our improvement as a company.

In sales and marketing, our customer interface, we pride ourselves on the fact that most of our people have the equivalent of a Bachelor's or Master's Degree. They are very highly technically qualified, and with most of our products this is critical. In the Boeing Design Manual, I understand it states that 90% of all relay and contractor problems are as a result of misapplication, not as a result of the product. We make sure that our customer doesn't misapply our equipment. Also, we do now give a lot of assistance to people with respect to the application of the new solid state devices. All our sales engineers communicate regularly with the quality departments of our customers to make sure that we're not doing anything wrong.

Our administration personnel are randomly audited by the Quality Department with respect to correct product documentation. There's nothing worse in this industry than receiving something that has the wrong documentation, and so, we make sure that this doesn't happen.

We don't do enough benchmarking, That's also something we're going to introduce. I was very interested in preparing for this, so I sat next to a guy who is lecturing in benchmarking. I learned a lot from him in the few minutes that we were putting our heads together. All our production machinery, all significant investments and tooling, are subject to

critical benchmarking tests. We've come up with some very surprising results in savings. In one instance, we found that a half-a-million mark piece of equipment did a better job in a shorter time and was more reliable than one costing 50% more, but we didn't know about it until we did our benchmarking tests.

As far as products are concerned, we do a lot of competition analysis. On the medical side this is done by our major customer. On the aerospace side, with most of our products we know so much about our competition that we almost know the color of the underwear their production line people wear.

I have recently spoken to eight companies in Europe with respect to Total Quality Management, one German, two French, one Scandinavian, and four British. The latest thing in TQM in Europe is a new series of quality standards called ISO 9000. I don't know whether anyone has heard of it over here, but it is becoming an industry standard, not just in aerospace. They have been explaining to their vendors that this will be a necessity after the end of 1992. We'll design an entire manufacturing company to ISO 9000 standards by the end of 1992. And soon, hopefully, all our companies will comply with this requirement. It's going to be difficult, it's a lot of work to do. The only criticism I found in these documents is that they replace our more specific standards. The ISO 9000 standards are a little too generic, but I think that will be resolved.

4.2.3 Building Quality into Project Execution

Dr. Robert R. Spear, Manager of Quality, The M.W. Kellogg Company

As an engineering contractor, we live in a project world. We design and build petrochemical plants, refineries, and so forth, and provide a full spectrum of services from project management down through engineering procurement and construction.

What are the fundamentals of quality management which, when applied to a project environment yield a clean and therefore a profitable project execution? The most important thing is to establish clear requirements up front. Plan the work so that you can do it right the first time, a very simple concept, but hard to do in a project environment. We've found that the root cause of most of the problems we have on a project are caused by the lack of well-defined requirements, and sooner or later you can track almost every problem back to that. Whenever that happens, you have unnecessary delays, unnecessary cost, and a lot of hassle. The interesting thing is, most of the time somebody knew there was a problem with the requirement, it just didn't seem to get into the system early enough.

We still believe that our ability to accurately define requirements with our clients is probably still rated as a two on the scale of zero-to-ten. In other words, it's really lousy. I suspect the same might be true in the type of environment that you work with in NASA.

For example, if you ask a project manager on either the client's side or our side if the requirements are well known, they'll swear up and down that they are. But, it's just not true. One of the things that we do is log in all of the rework hours that are spent during the design phase of a project. Every time an engineer has to rework something that he/she has already done, it's logged in. These are accumulated, and then plotted on a weekly basis for that particular project.

As a result, we've found three key points in the early part of an engineering construction project that cause lots of re-work which is attributable to not defining requirements up front. One has to do with the P&D release, which is basically the system design and how the whole system hangs together. After the client comes in to review those P&D's there's generally a spike of rework, because we're going back and making changes based on those client comments.

We work a little further, and then we lay that system out into its geographical, a plot plan. The client comes in again, and again you'll tend to see a spike in the rework as we make the adjustments because they'll want this part of the plant moved three feet to the left or four feet to the right, or whatever. Meanwhile, there are more and more people being added to the client's review staff. We do some more design, and finally this culminates in a model, either an electronic model in the computer or physical model. Now the client, and all of the various people within the client's organization come in, including the end users, and now we really get serious about the requirements, and the rework spikes again.

So, much of this rework can be prevented if we and the client learn to communicate better in the front end of the project. We regard every hour of rework as something to be avoided, and something that can

be avoided if we do a better job of defining requirements up front. Obviously, this is a very tough kind of thing to do in a project environment, because the kind of projects we're talking about may cost 150 million dollars, and be built in two or two-and-half years, and have a million to ten-million individual parts to them.

To get a better grasp on defining requirements up front, we have had to get more involved in the client's processes. Understanding our client's market strategy and what he is trying to do is key. Once we understand that, we and the client build an execution strategy together, as a team. As soon as we have the right strategy, we try to take it up one level to the client's business management to make sure our project strategy is in line with their business objectives.

There are four main elements to structuring this execution strategy. The first element is just to provide an overview. The next thing is to make sure we know what our client's business objectives are. We ask our clients to tell us how this particular project fits into their total world. We ask them, what's feeding this project, what's up stream of it, what's down stream, who's your primary customer, and so forth. It usually takes 6-12 different people in the client's organization to paint you a total picture of the project.

Once you understand their global view, you have to understand where the major interfaces are between this project and other things in the client's world. Normally, when we do analysis for the clients, there will be at least two or three things that nobody in the client's world has recognized, yet they must be done for the project to be a success.

Then, we make sure we all understand what the scope of the facilities are, basically the major component parts of the facility. Then, we make sure we understand how the client is contractually subdividing the total project. It is not just enough for us to understand our own contract, we have to understand what other contracts there are, and how they interface.

If you take all the major elements of scope and the various execution phases of the project and you simply overlay the contractual responsibility on top, you have a very nice diagram of where the contractual interfaces are. Very often, you discover some gaps or areas where no one has responsibility. So, this is an excellent tool of coordinating all the different contracts.

Next, we ask the client to prepare a list of priorities. For example, the operating costs are generally at a higher priority then the capital cost, but occasionally you'll find it the other way, and if you don't have it explicitly spelled out to your project team, they'll be merrily optimizing on the wrong thing.

Then, we get into looking at the schedule milestones. Why were those milestones set, and what do they tie to in the marketing plan of the client. How firm are they? Very often, those dates are selected quite arbitrarily and have no relationship to what it really takes to do the job. So, understanding the key assumptions about the milestones is very important. Surprisingly, this is something that is very rarely done in our experience. The reason this is important is that when you go back and you look at some of the major problems, most of the time it's because some of these assumptions turned out to be wrong. Often times, it's because the assumptions were not realistic in the first place. So, if you get the assumptions out on the table, somebody can tell you real fast if they're reasonable.

These are the critical issues, and usually it's easy to resolve them up front, but very difficult to do later. It avoids a lot of unnecessary delays and costs. The contractor comes out better because it helps us proceed with very little rework. The key to success is that all the stakeholders in the project have to be there, from the R&D people to the plant people. Everybody has to be a part of this process. It has to be a teamwork process. It has to start with the global picture and work its way down, and there has to be clear accountability established all the way down on a contractual basis.

4.2.4 Rochester Excellence, Customer Satisfaction - The Quality Journey Continues

Richard H. Bhend, Senior Reliability Engineer, Application Business Systems, IBM Corporation

Within Rochester, our commitment is excellence within the facility, excellence from one engineering group to another, excellence across functions, excellence across administration, etc. It is all related to customer satisfaction. Customer satisfaction could be somebody in the marketplace outside IBM or somebody internal between groups, between functions, between organizations, which is very key.

We are rather diverse. We have manufacturing development projects worldwide. We also have teams from these other countries who work and live

in Rochester, and this helps us establish our engineering and production capabilities in the other countries also. Of our 8,100 people, about 85% are on work teams involved in various projects related to quality and reliability. The teams are diverse, organized, and driven by managers and employees.

Our basic beliefs are respect for the individual and the best customer service. In 1988, we made a major shift in our corporate philosophy. Now, all aspects of the design team, from the engineers, to the administrators, to the lab and it's associated functions, must interact with the customer, understand the market place, and understand the customers needs.

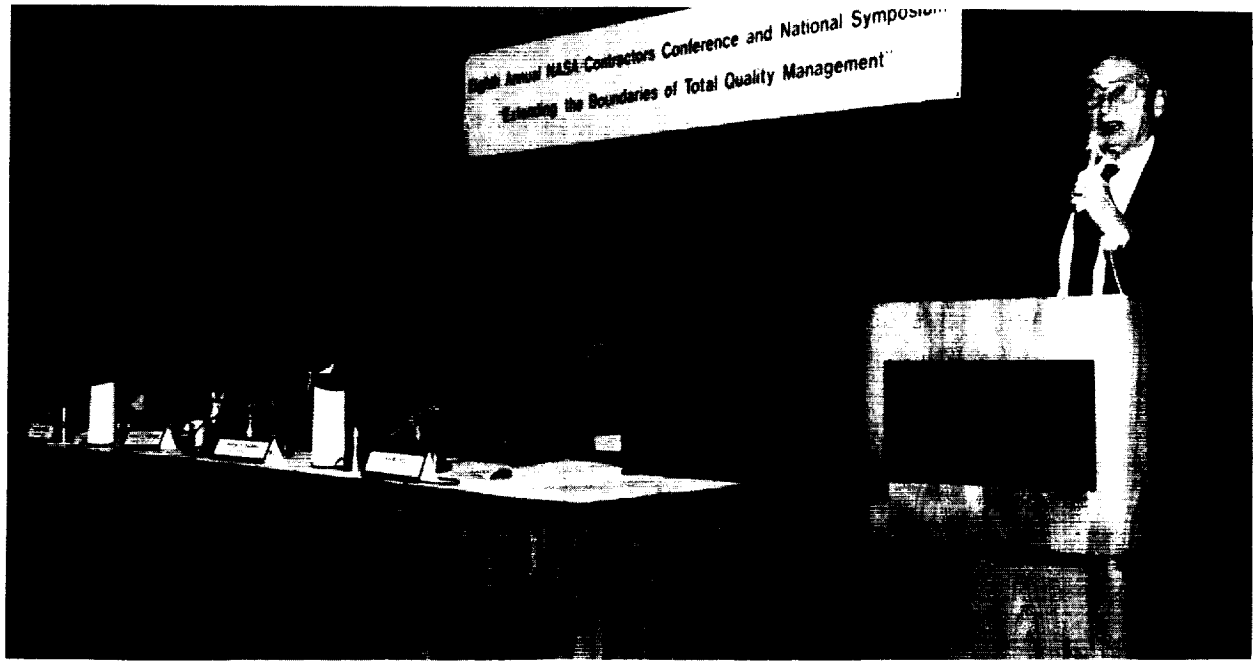
The customer is the final arbitrator from the outside. This customer-based approach was something new, especially to the engineers. Before, the engineers providing the design did not interface with the customers. Today, the engineers interface with the customers. In the old structure, the one that was causing us difficulty in 1986, we would design a new product in total secrecy. We wouldn't even announce it to our marketing department until we announced it to the public. This turned out to be nearly our downfall.

Now, we try to involve everyone in the process, especially the customers, in monthly meetings on current products — those to be announced in 1992. Meetings on products being announced in 1993 and 1994 are held quarterly. Meetings for products in the pipeline for 1995 to 2000 are done every six months. This new involvement brings in customers from diverse backgrounds world wide to Rochester. They interact with the engineers, the designers, the hardware and software people, the sales force, the administrative, the documentation, the education people, etc.

Also, now we are using process management. We identify the process, we manage the process, we analyze the feedback, and we look at the continuous improvement we can get out of that. As a result, our cycle time has been reduced dramatically. We used to operate on a five-year cycle time. We currently operate on a two-year-or-less cycle time, depending on the scope of the project. We announce a new product every year, and make a major announcement of a total system change every two or three years.

We are also looking at defect prevention. The engineers are now using simulations to detect defects. We simulate both hardware and software. We begin at the chip level, then move on into the card level, then to a system level, and then to a network level. Once we allow things to go to a tooling state, there are already millions of dollars involved. Our goal is no different then anybody else's, we'd like to achieve 100%, zero defects, but our target is 95%.

I think the whole thing rests on attitude. If you don't have the right attitude, you are not going to succeed. We can talk quality until we are blue in the face. Quality has to be an attitude of every employee in our company and in our suppliers' companies; their mindset must be: "the way I answer the phone is quality, the way I write my letters is quality, the way I do my job is quality."



Panel B3 - World-Class Suppliers: Making Sense of Supplier Certification (from left to right): Donald O. Atkins, Director, Product Assurance, ILC Space Systems, ILC Dover, Inc.; Joseph N. Buzzelli, Director of Quality Assurance, Magellan Systems Corporation; Lynne G. Kunster, Manager, Supplier Development Program, Leach Corporation; Dr. Lawrence M. Malinowski, President, Advanced Quality Systems; Tina M. Doty, Corporate Vice President, Quality Assurance, Leach Corporation; George A. Rodney, Associate Administrator for Safety and Mission Quality, NASA Headquarters.

4.3 World-Class Suppliers: Making Sense of Supplier Certification

Examines various supplier-certification programs and provides recommendations for implementation and/or participation in supplier's certification.

4.3.1 Cultivating a Supplier/Customer Partnership

Dr. Lawrence M. Malinowski, President, Advanced Quality Systems

In the cultivation of supplier/customer partnerships, the objective of partnership documents is to develop a true business and technical partnership with the supplier and the customer. The goal of these partnerships is to reduce costs, improve quality, improve reliability, reduce inventory, and improve understanding. It provides each partner with an understanding of the others' methods, procedures, processes, problems, and applications.

There are lots of quality initiatives which speak to supplier/customer relationships. These documents include the D1 9,000 document from Boeing, the ISO Series from Europe, RMN 2,000 from the military, many other quality initiatives now taking place at the statewide level.

Interestingly, the areas of commonality between these documents is much greater than the differences. A lot of people are constantly looking for the differences. Basically, the documents ask you to make your investment in people and in the continuous quality improvement process.

The key issue here is investment of your time and your resources into your people. Many companies are out there and they constantly preach that people are their most important product. Yet, they really don't take the time, the effort, the resources, or the money to cultivate this most important product.

There are five phases to developing a supplier/customer relationship. Phase 1 is process identification and development. You have to establish a team

within your own organization to begin to develop these relationships. You must define the ground rules, what you're there to do, how it's going to look, and how is the whole relationship is going to shake out. You must ensure that you have top management approval and commitment. The first responsibility of this team should be to define the training needs and how you are going to determine the effectiveness of the training methods.

Phase 2 is partner selection. You can't just go out and say to all your suppliers, everybody is going to do this all at once. You have to select the best partner you have to begin implementing this relationship. Who is going to be the most receptive? Where are we going to get most return on investment?

You should do a supplier history survey and find out who will be the most receptive to a quality pilot program. Who helped you in the past get the best quality at the most reasonable price? Look at your backup suppliers to see who might be interested and eager to give it a try. Suppliers all claim that they want to be a part of this process, but it never happens. It's sort of like the old adage my mother used to constantly drill into my brother and myself on Sunday mornings when it was time to get up and go to church. She'd say, "You know boys, everybody wants to go to heaven but nobody wants to pay the price to get there."

Phase 3 is a partnership agreement. My advice again is don't try to turn the whole process around at once. The entire ship won't turn, I can guarantee it. There are always a few pockets of forward thinkers in your company who will welcome these changes. Ask them to spearhead your plan.

Get everyone involved in the part of your process that you are going to try to turn around with the partnership. Let management, marketing, the people on the floor who produce the product ,and the people in the offices who produce the paperwork see how the partnership will fit into the process. Let them see what impact poor quality has on the entire process. What you are doing is team-building.

Get your partner/supplier to assemble a similar team. Put the teams together. Discuss and agree on the training requirements. You are going to have to take an interactive role in helping your suppliers get trained. You have to be responsible for training as well as assisting them in finding training. If we're no longer going to inspect everything that comes to the door, you're going to have to train your inspectors on sampling procedures.

Phase 4 talks about supplier qualification. Do a supplier quality survey. Ask your supplier, "What are your written quality procedures in-house right now? How are you inspecting? What are your processes for inspection?" Let them know that if they are not up to your new specifications, then they have to have a plan to bridge the gap between where they are now, and where they want to be, and you want to make sure that those are valid. The survey can be done by mail, it can be done by telephone, it doesn't matter. And then, if you're the customer, schedule an on-site survey. If you're the supplier, welcome the customer into the plant or into the paperwork process. Show your customer what you do and how you do it, and explain the reasons for your procedures. Ask your customer for suggestions.

Phase 5 is product and process qualification. Find out what your process is truly capable of doing, define it, and then measure it. You have to teach your people to trust the system you are putting in place. We have to learn to trust each other and mentor each other. Ideally, if the process isn't working, you should be able to go to your customer for assistance.

I hear a lot of talk out there about how we've empowered our people. This empowerment thing is sort of nebulous. It's like handing out rifles during a war. Everybody gets a rifle, you feel empowered, but what we failed to do is enable you. The enablement part is when you give them the bullets to shoot with. That's what we're asking. If you are going to hire me on as a subcontractor to supply you with product or information, trust me to give it to you straight, enable me to do it, don't just empower me, enable me to do it. The key points of any type of cultivation of a supplier/customer relationship are, define it, measure it, and improve it.

4.3.2 Performance-Based Supplier Certification

Lynne G. Kunster, Manager, Supplier Development Program, Leach Corporation

We have just completed our pilot program with two suppliers. Over 90% of our supplier base are categorized as small-sized companies. Our objective was to try and find a very simple and very basic certification program utilizing Total Quality Management principles.

Supplier certification is necessary, and without it we will never be able to meet the challenge of global and domestic competition. To achieve our goal to become a world-class supplier in our industry, the

Leach Corporation went through several training programs. We went through Total Quality Management training, we went through cross-functional team training, we went through statistical process control (SPC) training and just-in-time training. This was incorporated throughout the entire facility.

A team of eight individuals was formed about July of 1990. This team was lead by a director for world-class manufacturing, and included a Ph.D. statistician, two representatives from procurement, and one each from manufacturing, engineering, quality engineering, and quality control. This group prepared the vision. They modified our survey and changed the old QC survey from a yes/no to a quantitative scoring system. In addition, we added a technical materials management checklist to give the surveying team an idea of technical capability and what operational measurements were in place.

We had been telling our suppliers for over a year that we were very serious about the partnership concept, and the supplier certification concept. This information was formally conveyed to them at our annual supplier conference day in November of 1990.

Our vision was to form one-to-three year, single-source partnership contracts for certified parts and sub-assemblies. We wanted to reduce our vendor base by 50% within one year. We wanted to lower the total cost, the cost of quality, and the purchase price itself. We wanted to obtain guaranteed-quality parts with no incoming inspection. We wanted our suppliers committed to continuous improvement, investing in SPC, quality systems, new designs, new equipment, and world class manufacturing techniques for long-range mutual benefit.

Some of the benefits were long-term contracts, much larger volume, improved communication, trust and loyalty, win-win relationships, financial rewards for both sides, and the ease of doing business.

We made the certification process very simple. We broke it down into five phases and a preliminary phase. The preliminary phase emphasizes supplier commitment. In this phase the supplier development team has already completed the screening of the candidates for certification. The supplier is briefed in great detail on the entire supplier-certification process, and all questions and concerns are addressed at this time. A meeting with the top management personnel of both companies is arranged at the supplier's facility to further emphasize top management's commitment to this process and the willingness to establish that partnership. At this time, a commitment agreement is signed.

In phase 1, we hold a meeting at the supplier's facility, where goals and objectives are identified along with a complete specification review. The surveys are conducted at this time to determine effective tests of their quality control system, their SPC practices, process capabilities, and to determine what operational measurements are in place. Observations and findings of the surveying team are documented and shared with the supplier at this time.

In Phase 2, we develop a control plan. The beginning of this phase can be accomplished at the first team meeting, depending on the geographic location, but entails prioritization of the deficiencies noted during the survey. This is backed up with written corrective action plans to eliminate the defects found. Just as important are the processes identified by the team, where SPC would be effective. The latter part of this phase involves monitoring the supplier's progress towards process control, which is reported at each meeting.

Phase 3 is the finalization and gradual elimination of incoming inspection. This phase is very flexible in that it could overlap with phase 2 depending on the supplier's experience in SPC. In this phase, it is very critical that the drawings and specifications related to the part numbers we are trying to certify are complete. Another critical characteristic of this phase is test-and-inspection correlation. Many of the rejections that were recorded occurred simply because we were not testing and inspecting parts identically. Any rejections which may have occurred to date are thoroughly analyzed and corrective action takes place. The last part of this phase involves employee involvement. Each employee must accept responsibility for the quality of his/her own work.

Phase 4 is the actual certification by part number or by process. This phase involves the completeness of all the work evolving out of the previous phases. If the supplier has demonstrated process control, statistically, along with effective corrective action, and no rejections have occurred at higher levels of assembly, then the supplier qualifies for certification. In addition, procurement negotiates a long-term contract, one-to-three years to start, along with a just-in-time delivery formula.

Phase 5 is ongoing audit and maintenance. Random audits are conducted on incoming material. Technical evaluations may also be performed at this time as changes are made.

What were some of the lessons learned? First of all, your team members should be people who are experts within their own fields. They also must be good at working with people because they will be interfacing with all levels of management. Secondly, top management's commitment is very important.

Without their support, the program will be short-lived. In addition, make sure procurement people are part of your team.

There is an old saying that if you feed a man a fish you fed him once, if you teach him how to fish you fed him forever. Giving assistance to your suppliers on an occasional basis is like feeding them only once. Training him is feeding him forever. The establishment of direct lines of communication can never be over-estimated. There's no longer just the buyer and the sales contact. It's engineer-to-engineer and inspector-to-inspector. Supplier involvement must take place in the design state as well. The supplier must be recognized as the expert in his business. Fewer problems arise after production starts. If a thorough job is not done up front, then problem after problem after problem will occur.

Other lessons were to clarify all requirements and eliminate the possibility of misinterpretation. Standardize your tests and inspection. You can't deal with apples and oranges, they must be the same. Meeting the commitments by mutual consent is important. Let your suppliers know how serious you are about meeting commitments. Promises that are not commitments are worthless. Lastly, you must establish a regular meeting schedule with your supplier to let him know that progress is being made on your end and determine what progress he is making.

Documentation is very critical. I visited Japan just recently, where I learned about a black book called "Lessons Learned. " In this book, the development team records all their failures and pitfalls during the development cycle. Naturally, the purpose was to avoid some of their mistakes, but the black book also recorded the successes and reasons for such successes. The message here is that very few American companies take a good hard look at the lessons they have learned before they start the next project, or before they start to work with the next supplier. So, the idea is to think proactive.

The ultimate goal of supplier certification is quality at the source, which must evolve out of a supplier partnership based on trust and communication. Supplier certification requires effort, time, and commitment to eliminate non-value added operation and waste.

4.3.3 Supplier Certification

Joseph N. Buzzelli, Director of Quality Assurance, Magellan Systems Corporation

We are a GPS company, but that doesn't stand for Great Profit Source. It stands for Global Positioning Systems. GPS allows somebody to navigate either a car, a boat, a train, or whatever vehicle they would like. We started out four years ago doing $8 million, and have grown to our projected $60 million this year. The GPS market is a fast growing market and it's predicted that it will be $12 billion in the very near future.

To understand what GPS does, consider this scenario. In the near future, your cars will have a little gadget that will look like a computer with a screen. Say you are on the Highway 10 in Los Angeles. All of a sudden your GPS screen emits a signal alert, which means there is a traffic jam ahead with a two-hour backup, an everyday occurrence in L.A. You press your buttons and your little screen will light up and tell you how to get out of the mess with alternate routes. It sounds kind of unbelievable, but it is happening, and that's what the world of GPS is all about.

We have 70-some distributors in 61 countries and, here in the United States, we have approximately 260 dealers covering the GPS market. They are all around the water area because our basic claim to fame right now has been the boat market, although our units got a lot of good publicity during Desert Storm. With the use of our equipment, our troops could hit a target within six inches, and that helped win the war.

We had been growing so fast that we had not had the time to really get a quality assurance system working. We did know one thing, that unless we got everybody involved, the word quality wouldn't mean a thing. We had to identify our needs, our suppliers' needs, and then we had to identify our supplier requirements so we could work with them. We wanted to improve cost-effectiveness. We wanted to get away from the mom and pop stores that we were using to supply us, and into just-in-time type of suppliers. We needed a supplier control system. We wanted to have source inspection and not receiving inspection. But, we wanted everybody signed up to do the job as a team member.

In our first year of quality, we reviewed our list of 240 suppliers. Now, we have approximately 100 suppliers and we categorized them as Class 1 - Critical, Class 2 - Major, and Class 3 - Minor. We are reviewing all of our Class 1 suppliers and getting them ready for certification.

We will use a team approach for this. We have encountered almost every possible type of quality atmosphere we could, including supplier meetings, technical round tables, brainstorming, and others. Our goal is for us to work together with our suppliers to solve our problems, to ensure customer satisfaction, and to become a recognized world leader.

Our plan of action was to focus on the entire business, our business and our suppliers' businesses. How would this joint operation work? We identified the opportunities for improvement, and then we accelerated a schedule to try and reach them. We strengthened the teamwork at Magellan, as well as with our suppliers. We tried to develop and maintain a long-term relationship. As we moved forward, we developed a rating guide. This showed the supplier what we expected of him, and how we were going to get it. It also showed what we expected from ourselves. Our performance guidelines incorporated not only product quality and schedule, but also management and customer support.

In addition, we accepted a scoring chart from each of our suppliers. It is divided into three major sections. One, planning for quality; two, organizing for quality; and three, monitoring the quality. And I'm proud to say that at this point, all of our suppliers in our basic group are in various stages of development, planning with us, organizing for us, and getting ready to monitor their program.

5.0 It Takes Two, The Customer and You

Exploring successful methodologies for identifying customer needs and expectations, and forming unique and effective partnerships.

5.1 It's 10 O'Clock, Do You Know Where Your Customer Is?

Identifying a customer's real expectations may require unique approaches which must ultimately be integrated into responsive actions. This panel explores techniques for obtaining these data and reviews case history successes.

Panel C1 - It's 10 O'Clock, Do You Know Where Your Customer Is? (from left to right): James F. Holloway, Program Development, Space Propulsion, Pratt & Whitney, United Technologies Corporation; Jessica R. Wilke, Assistant to the Director, Total Quality Process, Grumman Corporation; Larry Parker, President and Chief Executive Officer, Leach Corporation; Judy K. Landrum, Development Specialist, Coors Brewing Company; Gerald H. Sandler, President, Grumman Data Systems.

5.1.1 Introduction

Richard Clapper, Chief, Office of Human Resources Development, Lewis Research Center, Chairman

I believe that the keys to success in today's world involve a number of things. First, it's the acceptance of the concept that we all have customers. Secondly, it's the skills we develop identifying our customer's needs. Another key is recognizing and valuing the process of viewing customers as partners, or as teams, or as being in a team relationship. A fourth key is the fostering of a total organization involvement, where employees can all be involved in the customer partnership and improvement concept.

Richard D. Clapper

In today's highly competitive and resource-restrained society, it's becoming more and more clear

that those organizations which pay attention to customers and customer needs and strive to understand their customers are clearly the ones which will not only survive, but prosper in the days ahead. This is true whether you are a private industry, a government organization, or an educational institution.

5.1.2 Identifying Customers' Real Expectations

Gerald Sandler, President, Grumman Data Systems

When customers expect one thing and get something else, you have unhappy customers on your hands. This unfortunate situation is often caused by the gap between the customer's expectations and the contractors and suppliers understanding of the customer's requirements. Sometimes, this gap is so big, you could drive a Winnebago through it.

We need to look at how to close this gap. For example, let's imagine that our customer is an agency of the federal government, either civil or military. In the requirements phase, as it relates to customer expectations, there is usually a gap between the customer's expectations and the customer's requirements, long before a contractor gets anywhere near it. The reason for this gap is that the requirements are not set by the people who are using the product or service. People in the acquisitions group are managing these requirements, and they are juggling a lot of different priorities, affordability, technical practicality, delivery times, and so forth. They have to make lots of trade-offs, therefore, they set up different sets of requirements.

That could be bad enough, but now the contractor that has to interpret these requirements and the gap, of course, is getting larger. Now, carry the process from the contractor to the subcontractor, or subcontractors, and the potential gap between customer expectations and the product or service he actually receives can be huge. These gaps in interpretation and expectation are one of the biggest reasons for rework and changes, which stretch out design and development time, increase costs and risks, and, of course, reduce customer satisfaction.

Any attempt to close these gaps must look at the total process and the relationship between the customer, contractor, and subcontractor. One way to close this gap is the use of prototypes. With a prototype you get something real to deal with. It is not just paper anymore. This helps close the gaps that come from the contractor and subcontractor's interpretation, especially if the subcontractor elements are part of the prototype. It also helps the expectation gap because the user is now working with the prototype.

There are people who see disadvantages in this. They say that since all aspects of the final product can't be incorporated, it might just be a lot of extra work. I disagree. I think the future will show that the use of prototypes shortens schedules and reduces cost because they minimize the changes caused by all these gaps. In my own experience, all it takes is a good program plan that intelligently integrates prototype development with production. The real advantage of prototyping is that is forces everyone involved to communicate. If people talk to each other, they can resolve these problems.

Another way to resolve the gap is by aligning the customer, the contractor and the subcontractor in the process, that is, putting them all together on the same side of the fence. That might sound like a nice idea, but it's hardly ever possible if corporate organizational boundaries and contractual structures all work against it. These things obviously are hard to change. But, what we can do is to get management to focus in on the total process. In a joint partnership you have to get everyone to acknowledge their responsibility to work with everyone else. If you can collocate them, put them all together physically, it simplifies communications, relationships develop, and the team happens.

One example of this is our work with Air Force Logistics Command. The first thing we did was to put everybody together in the same facility. The Air Force people, ourselves, and all our subcontractors and suppliers. It simplified communications and accelerated decision making.

With the Air Force, we are developing one information management system that is being used by eight different Air Force sites. Each site has its own expectations for what the system must do. Right from the start we have held team reviews, and attendance is mandatory by the users, the acquisition people, ourselves, and our subcontractors. We are also producing prototypes for each one of these sites, so that they can have a practice system and become comfortable with it. This also helps us make modifications to suit their particular needs. It helped us convince them that the system we are developing will do a better job for them then any system they presently have.

Another benefit of this approach is easier transition to training. Even before they get the new systems, they become familiar with it. These techniques are reducing the expectation gaps within those areas. You might think that the more people involved, the harder it is to define requirements and to maintain schedules. We were worried about that too, because we had a fixed-price contract. However, just the opposite has happened. The program is right on schedule, right on the money, and meeting all the technical requirements, and this results in a satisfied customer.

We like to use customer surveys once a year to get feedback on how we are doing. They are extremely useful, but we also look for information in less formal ways. For instance, from personal conversations at all levels of customer organizations, through complaints or whatever else works. We take them seriously, and we act on them, because it does not really matter how we think we are doing, it ultimately boils down to the customer's opinion of how well we are doing. For companies to meet the challenges ahead, I believe that we have to shift focus from our products to our customers and start feeling like partners with our customers as opposed to just meeting contractual obligations.

We have to concentrate on work processes within our businesses and those of our customers and our suppliers. We have to eliminate the gaps that cause all of this rework, delay, and customer dissatisfaction. This challenge is a little easier because buyers and sellers are beginning to see these advantages.

We also have to get acceptance by the many layers of management and technical support people from all of the companies. That takes a long time, even with the emphases throughout industry on Total Quality Management. What will make it work? I think technology will be a big part of that. Information systems available today and in the future can very easily make it a reality. Also, there are government-sponsored programs that can provide the basis for total quality by fitting together work processes. Companies who use these new technologies will have competitive advantages, and others will soon follow.

It is going to change the way we do business. If you accept that the biggest gains will come from better interactions between customer, contractor and subcontractor, think how you can accelerate that with electronic data interchange. From my vantage point it's already happening. Today's aerospace companies communicate design data electronically. They can access each other's files and data bases. Customers can order spare parts through contractor computer systems. Down the road, we will see common user interface methods between powerful work stations, where everyone can simulate before design, an essentially try-before-buy. That will really help us do the right things right the first time and get rid of all the gaps.

The way we do business is largely driven by the skills and abilities we have at hand. But, the demands of total quality will drive the development of better information systems and technologies, and, I think that is going to happen very quickly. Maybe by 11 o'clock, we will know where our customer is — safe and sound, wrapped in the satisfaction of total quality.

5.1.3 Customer Satisfaction Builds Our Future

Judy K. Landrum, Development Specialist, Coors Brewing Company

The Coors Brewing Company is located in Golden, Colorado, we employ approximately 6,500 people, and we are the third-largest brewery in the country. We believe that customer satisfaction improvement is a very simple process that any company can use whether service or manufacturing-oriented. It is a simple concept that asks employees to look at the people within the company as their customers.

I am going to use an example of the can line. The beer comes in from our brewing process, the aging cellars, and goes into the can line, and then afterwards, it goes into the warehouse. We are trying to get employees to see that the can line's customer is the warehouse.

At Coors, we had a resistance to this idea. A lot of people were not willing to talk to people in the different departments because they were worried about turf or afraid that somebody is going to get the credit.

We implemented an 8-hour training which taught our employees the relationships between customers and suppliers. We showed them that as suppliers, they needed to know who their customers were and find out what their customers' needs were by obtaining feedback from them.

This is part of a very simple four-step process we taught the employees and that we are trying to use throughout the brewery. First, the work unit in preparing to meet the customer, filled out a cus-

tomer worksheet with their customer's name on it. They used one of these sheets for each customer; a number of them have a number of different customers. They then thought about what each of their customers needed from them as the supplier.

Then, we made each group come up with what value they were adding to the product before they passed it along to the customer. So, for example, it would state the mission of the can line is to be the leader in customer satisfaction by providing high quality beer in cans at a low cost.

In the second step of the process, a couple of representatives from the can line went to talk to representatives from the warehouse. Like every other supplier in the world, the can line had a perception of what their customer's needs were, but they first asked the customer. Then, they discussed, discovered, and probed to find out how those needs might be better fulfilled. There were needs the can line had never thought of. There were other improvements which the can line had thought of which their customer had not thought of. They just shared thoughts at this stage. It is very important that at this stage there are no negotiations that occur. It is just an exchange of information.

In the third step, the entire can line work unit got back together, and listened to the report of their representatives on their customer, the warehouse. Here they discussed innovative ideas to solve the customer's problems. It was hourly workers talking to hourly workers. At Coors, we firmly believe that the people who are doing the job know that job better than anybody else. So, we don't want managers or directors talking to managers and directors, we want the people who are doing the job to talk to each other.

During this meeting also there are four options of responses that they could give to their customers. One was that they are already meeting the needs and this is how they are meeting those needs. The second was that they would try to meet the needs, and these are some of the ways that they are going to do it. The third response was that the suppliers cannot meet the customer's needs, and so they need something from their customer or from their supplier. This was not something we focused on very strongly in our training, though we learned later that we should have. The fourth reply is that they can't meet the needs for whatever reason. Sometimes when people ask us to do things, but it is just not a feasible solution and there is just no way that you can do that. So, they want to educate their customers on that point.

The fourth step in the process was to go back to their customer and they discussed some of the things they had talked about as a group. They presented the responses they discussed in their work unit meeting and clarified their capabilities as a supplier. At this point, there is a negotiation that goes on. There is quite an exchange of information and ideas of how to get some of those needs met. They also discussed how they were going to know when the customer was satisfied, and also how to measure that satisfaction. This is another area at Coors where we can probably do better, we are not giving employees enough training on measuring satisfaction. You can always measure tangible results, but it is very hard to measure the intangible. It is important that both the customer and supplier come up with these measurements together.

At Coors we believe that customers are satisfied when they have received the right product, on time, at the right cost, with cooperation and innovation. Cooperation and innovation are those warm and fuzzy words which nobody likes to hear about, but that is where most of the advantages are. We are trying to train employees to understand that this is an ongoing, never-ending process. They need to continuously go back to their customer to keep improving quality, more quickly, and with better service.

At Coors, our motto is, "Quality in all we are and all we do." This is something we are striving for as a company and I believe strongly that customer satisfaction is going to be one way for us to get there.

5.1.4 Customer-Focused, World-Class Manufacturing

Larry Parker, President and Chief Executive Officer, Leach Corporation

There is no doubt about it, to become world-class you have to become customer focused. Not only in our minds, but in our very heart and soul we have to believe that the customer is right and that the customer is our purpose, our single purpose, the reason we draw our paycheck.

Once we change our attitudes, once we develop this faith, this trust, this commitment, this belief, then, and only then, do the new performance standards make any sense. We can then adopt parts per million in quality, perfect on-time delivery, and continuous improvement in cost and accept these as

the only reasonable performance standards.

To achieve customer satisfaction, we should move away from the old competitive models, and to move into partnership models. But to do that, we have to change our attitudes. One of the things we need to change is to view our relationships as long-term. Short-term relationships do not provide the motivation for a long, enduring partnership. We have to develop trust, we have to believe that our customer wants us to succeed. We also have to become more sharing and more honest and open in our relationships, sharing not only our strengths but also our weaknesses so that we can use our strengths in this partnership and overcome our weaknesses.

The benefits of these types of win-win relationships are amazing, tremendous, unexpected for both the customer and the supplier. It is a lot more fun to do business this way. Some time ago we adopted an approach to differentiate ourselves based upon customer service and customer satisfaction. As a result we have been able to achieve a market share which allows us to survive and prosper during the current down-turn. We are a long way from perfect. We have a long way to go. The single most important thing that accounted for the success was that we changed our attitude about our customers.

Let's talk about attitude. Now, it's kind of like mom and apple pie, I do not believe that there is anyone here today that would argue with the fact that your customer is your best friend. We believe that. I know I believe that. I did not believe that satisfying that customer was the sole purpose of my job. And, often I placed my own priorities above my customers priorities. And that is what needs to be addressed.

Some of us see customers as a nuisance, as a distraction in fact, from our real purpose in work. And, some of us do feel that fellow employee down the hall, the individual in the next office, is not a customer at all. So, the question is, how do we change that attitude? There are, I believe, six things that can help accomplish this. Those six things are to focus on commitment, trust, faith, reaching out, patience, and determination.

Let me talk a little bit about the first one, commitment. After two years of practicing TQM, I was committed. We were failing, but I was committed. We did recognize that we were not achieving the successes that were available to us, and so I searched around for some better ways to do it. I attended a three-day symposium which began with a discussion about the concept that Total Quality Management was defined as meeting your customer requirements, and that we were all responsible. My response was one of superior boredom. I had heard it all before a hundred times at least.

The discussion then turned to the concept of management elements and a description of eight elements for which management was responsible. The first element described was commitment. After about 30 minutes, I finally understood that I didn't understand at all what commitment meant. I didn't understand that I had to place my commitment to Total Quality Management on at least the same level of priority as the other things that were important to me like the bottom line.

For me the very first step was the understanding of what commitment meant to me as an individual. With the commitment then came trust, the understanding, the belief that I would succeed if my customer succeeded, and a faith that this was the right way to do it. The faith, that no matter what the challenges are to my priorities, no matter what the challenges are to my business, that this is the right way to do it, and all the things I want, status, security, promotion, profit, would come to me if and only if I satisfied my customer.

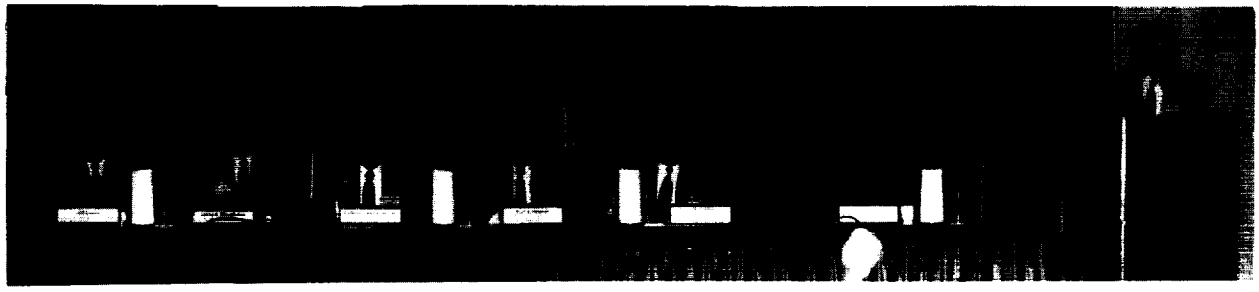
After commitment, trust, and faith, the rest is easy. The next step for me, was to reach out and take the first step. A little dab of patience and a little dab of determination and it happens. The most important part of the process that I discovered was to focus on changing our attitudes. The question boils down to what can we do to change our attitudes? Where do we start? I suggest that you focus on yourself to begin with. Think of the benefits that will come to <u>you</u> if you could achieve customer satisfaction.

Vision the possibilities, vision how wonderful life would be. I think we only have two possibilities, we can stomp around and grouch about it or we can see it as a wonderful opportunity. The first step for a change in attitude is to see these things as a wonderful opportunity. With that will come the commitment, which will lead to the faith, and the trust, and then, that will bring on the enthusiasm for innovation and the joy of the pursuit.

So, take some time out to dream about your wonderful possibilities. And then, I think we will see, we will believe, we will know, that the expectations of our customers are the only reasonable standards that we can adopt. We will see that parts per million quality, perfect on time delivery, continuous reduction in cost, are the only acceptable standards. At that point, truly we will be world class.

5.2 Let's Get Together!

Successful partnerships result from establishing trust and eliminating barriers. How to build collaborative relationships that integrate customers and suppliers into all phases of operations, from planning through implementation, to ensure common alignment and ownership of goals.



Panel C2 - Let's Get Together! (from left to right): Jeffrey K. Evans, Manager, Total Quality Management, SR&QA Directorate, Lyndon B. Johnson Space Center; Leroy A. Mendenhall, Manager, Management and Organization Development, Unisys Defense Systems; Colonel Loren J. Shriver, Astronaut, Lyndon B. Johnson Space Center; Paul J. Holyoak, Program Manager, Integrated Information Services, Boeing Computer Support Services; Dr. F. Max Croft, Director, Information Systems Office, George C. Marshall Space Flight Center; Thomas J. (Jack) Lee, Director, George C. Marshall Flight Center.

5.2.1 Introduction

Thomas J. (Jack) Lee, Director, George C. Marshall Space Flight Center, Chairman

Welcome to this session on Achieving Customer Partnerships. We have at NASA begun some degree of continuous improvement or Total Quality Management. A lot of people are a lot further along than we are. Most of us started out by looking very closely at our own organizations. If you are like me, you started with yourself, and then you kind of branched out to look at how you identify customers, and how you interact, and how you deal with this introduction of Total Quality Management and continuous improvement throughout the whole organization.

This panel focuses on how to establish partnerships between customers and suppliers. One partnership which we would like to highlight is the government-to-contractor relationship. We think it is timely. You have to ask yourself what do we want to do in NASA in the future? Obviously, we want to do Space Station Freedom. We would like to start a new launch system. We would like to have an earth observation system program. We would like to get started in satisfying the challenge President Bush gave us two years ago to return to the moon, stay there and go on to Mars and beyond.

If you look at the budget outlook today, with NASA, the last three years were very good, up until Fiscal Year 1992. We got 18-to-20% increases in our budget, and it looked like we were on our way for a continual increase in real budget money for the next few years. We got a rude awakening in 1992, we only got about a 3% increase in our budget over Fiscal Year 1991, and that was below the established inflation rate. We also got another rude awakening when we were told not to look forward to more than 5% increase over the next few years.

We have to face the fact that our budget is going to be pretty well stabilized for the next few years, and we have to deal with that. In fact, the only way that I know we are going to be able to achieve these desires of Space Station Freedom and returning to the space exploration initiative in our lifetime is to change our way of doing business; our mode of operation.

One of the things that we need to start early with, from a planning standpoint, is altering the relationships between the government and contractors. We need different kinds of partnership arrangements, where we deal with the conceptual definition phase in much more detail and work more closely with our contractor partners in this early phase. If these budget estimates hold, we will certainly have some time to start up these new programs. But it will

require us to be honest about the risk areas. We have to do as much as we can to drive out all those risks in the early parts of the program.

We are going to think longer term, because there are not going to be a lot of major new starts over the next few years. There is going to be time for competition to go into the full-scale development phase. We are not trying to eliminate the competition, we are trying to establish a different kind of a relationship early, to get the best out of industry and government so that our planning is proper. If we do go into full-scale development on what we want to accomplish, don't be surprised or depressed by the fact that we have to make some changes. There are going to be changes in statutes, changes in the acquisition process, and changes in the form of process.

5.2.2 Service Excellence Through Partnership

George C. Marshall Space Flight Center and Boeing Computer Support Services

***Dr. F. Max Croft**, Director, Information Systems Office, George C. Marshall Space Flight Center*

Our theme is service excellence through partnership. In particular, we want to examine the partnership that developed between a NASA organization and a mission contractor, the Boeing Company, and how it has contributed to our goal of service excellence.

Our partnership provides telecommunication services to the Marshall Space Flight Center and to NASA. Our intent is to demonstrate that our partnership has resulted in achieving a higher level of service then would have otherwise been possible. In the early 1980s it became clear that the divestiture of AT&T would occur. As a result, there would be no single providers for NASA's communication services. In order to provide more effective and more efficient services, NASA decide to build a corporate administrative common-user telecommunications network. The Marshall Space Flight Center was designated as the lead center and the communications office was given the assignment to implement and operate that network.

In 1984, Boeing Computer Support Services was awarded the contract to support the communications office in its mission. This contract did include all of the local telecommunication services for Marshall, but the major challenge was represented by the requirement to develop and implement the Program Support Communications Network (PSCN) for all of NASA.

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

The Program Support Communications Network is a digital, integrated network that is designed to provide a wide variety of telecommunication services, such as data transmission, voice and video teleconferencing, electronic mail, facsimile, and long distance telephone services. The current PSCN serves over 100,000 users throughout the United States and the world, covering both NASA, civil service, and contractor personnel. The PSC network implementation consists of installing hardware, software, and circuits at each of the 15 NASA Centers. Over 800 suppliers were needed to accomplish this task. The installations at each location required between 500 and 2,300 square feet of facility space at each Center depending on that Center's telecommunication requirements. The most critical point at that time was a firm requirement to implement this complex, geographically-disbursed network in only 12 months.

This schedule was critical to meet NASA's growing needs for telecommunication service. The PSC network implementation was already on an extremely tight schedule. It then became evident that the facilities which would be government-provided would not be ready on time to meet our schedule. Our original reaction was shock. We quickly shifted to view it as an opportunity to excel and help our customer with a solution. We all began an all-out effort to find solutions and work-arounds.

We had to begin early to work very closely with Boeing and with the other Centers in order to make the schedule. We built a relationship out of this implementation crisis. Boeing brought to the job good technical skills and a lot of experience. The civil servants at Marshall knew the NASA way of doing business and had contacts at the other Centers to help speed things along.

We established joint government-contractor teams to go to the Centers to make initial visits to create the relationships that we needed with them to assure that the facilities were on schedule. Boeing worked

as a team player. They were helping to meet the schedule rather than placing the blame on the government or any delays regarding the facilities.

We had a government representative and a Boeing service representative at each of the Field Centers and at NASA Headquarters. These were to be focal points for any activities related to the implementation of the network. In each case, a close team relationship developed. This relationship was aided by quarterly conferences. Also, every three months during the implementation period, Boeing and NASA representatives met to discuss issues, to look at common problems we had, and to have very frank and open discussions about how to face them.

Another critical success factor was continuous open communications. Boeing held weekly reviews with NASA. When barriers and problems were identified, we worked jointly to overcome them. Of the 15 locations of the NASA Centers, fewer than half of them had their facilities ready to meet the implementation schedule. We immediately began to develop collaborative work-arounds. We changed the sequence of the entire 30,000-element installation plan. At two locations we installed in temporary facilities, and then when the permanent facilities were ready, we transferred to those permanent facilities. At some locations, we had to construct facilities. In other locations, we even assembled equipment in the parking lots in parallel while the construction was going on in order to meet the schedule.

We all had a single goal, to implement a high-quality network within 12 months, no matter what effort it took. Everyone was committed. We had to rely on each other to succeed. The openness and the frank discussions and the joint solutions helped build trust on both sides. We learned to trust each other to succeed.

One factor that contributed to building this partnership was the trust and the open communications that came from the joint experience in the implementation phase. We believe that there were at least three other factors that contributed to this partnership. They are shared responsibility, a common vision, and a focus on the needs and the expectations of our NASA users.

To the maximum extent possible, and with as little government interference as possible, the contractor was empowered to have responsibility for accomplishing the mission. But, this was more than a contract requirement, it was a cultural change and a paradigm shift. It meant recognizing that the contractor and government were on the same level with a mutual respect for the skills and the resources and the respective contribution of the other. It also meant a significant shift of roles and responsibilities.

We now strive towards effective partnerships throughout our entire organization. All the people that we have assigned to work in these various branches alongside NASA are specifically told to form partnerships. Partnerships promote the free exchange of ideas and open constant lines of communication so that we can have this early and continuous feedback throughout the process of developing a product that we are going to use on orbit. As a result, we have a more functional product when we get to orbit, which means our productivity is increased when we are on orbit. We have a safer product or operational procedure, which means that we have a maximum return for everybody involved, and, of course, that means that we have helped contribute to the NASA goal of continuously increasing productivity in our manned space-flight program.

5.2.3 Colonel Loren J. Shriver, Astronaut, Lyndon B. Johnson Space Center

I have had the good fortune to be able to fly a couple times in space so far in my roughly 13 1/2 years with NASA, and so I was pleased to be invited to come to the conference today and talk about what perhaps is a little bit different prospective on partnerships and our method of establishing contacts and partnerships with other organizations with which we deal.

The astronaut office has for a long time recognized that the ability to reach out and touch other people and other organizations and establish partnerships is absolutely essential to our way of existence. We, as an office, don't really produce very many tangible products. We deal mostly in thoughts and ideas and we pass those along to other people to turn into actual products which we can use. So, we have found that in order to do that effectively, the earlier that we can get involved, the better off it's going be for everybody involved in that partnership.

We found that typically the earlier we are involved the better the product is. That means that usually the returns to the investor are maximized in terms of data that he might be looking for in space flight. The safety factors of the products and procedures that

we use are also enhanced when we get involved earlier.

All that, of course, means less redesign, less wasted effort, and so everybody is happier all the way around. Almost everything that the astronaut office does involves partnership. We are involved with every other NASA Center and all of their contractors. A lot of universities from around the country are coming in with ideas and suggestions about things that they would like to do in space, and that means that we have to be involved in every aspect of a system, an idea, a concept of how to work, or any experiment that might be produced.

We try to start at the very beginning with mission scenarios and the objectives of a program or a system, so that we can get involved in the specification of the design or of the operational requirements. We then follow up by participating in the critical and the preliminary design reviews along the way, and then as the production process starts, we also like to be involved in that process at most of the steps along the way to see whether the product as it's being developed is actually what everyone had in mind. Will this thing really do what we thought we wanted it to do? If not how can we change it? Critical functions also include testing of the product along the way. Testing either of the hardware or, if it's a procedure, getting into the simulator and testing the procedure as well.

The processing for flight is a key function that we try to get involved with. This occurs mostly at the Kennedy Space Center in terms of the shuttle elements but for other experiments it can occur at other places, other NASA Centers or other contractors' sites as well.

In flight operation, if there is any place that's a partnership it has to be the actual flight of a manned spacecraft mission. Any Space Shuttle mission involves thousands of people working for contractors and the NASA Centers. I guess we are the lucky ones because we get the benefit of all that tremendous effort and all the benefits of the partnerships that have taken place up to that time. The actual flight operation is the ultimate in partnership experience.

5.3 Consider Yourself One of Us!

A discussion of breakthrough approaches to continually meet evolving customer expectations in an interactive community, both domestic and international.

5.3.1 Introduction

Arnold D. Aldrich, Associate Administrator for Space Systems Development, NASA Headquarters, Chairman

The world I see moving into the 1990's is definitely an interactive community. We're finding it more interactive everyday. In that regard, for the last several years, as Associate Administrator for Aeronautics and Space Technology, I have worked on a joint technology program between government and industry to see that technology is transferred among government, industry, and academia, and to provide for a meaningful incorporation of technology needs of the commercial sector in the federal program activities.

This panel focuses on two programs where innovative approaches to organizational teaming and partnerships are now providing significant benefits to the programs as well as to the organizational participants themselves.

First, is the Space Station Freedom Program (SSF), which is multi-national program supported by a series of unique international working agreements and by joint partnerships with industry which are also executed on an international basis. Secondly, we will look at the National Aerospace Plane Program (NASP), which features significant government and industry joint cooperation as well as contracting, but also features an unprecedented teaming relationship between five major airframe and engine companies.

I personally have had very direct involvement with each of these programs, SSF through my new office with Space Systems Development and NASP through my previous responsibilities in the office of Aeronautics and Space Technology. I believe these two programs provide excellent examples of alternative approaches to conventional ways of doing business which can serve our community and our industry well in the decades ahead.

5.3.2 International Working Agreements and Partnerships on Space Station Freedom

Richard Grant, Vice President, Space Station Freedom Program, Missiles and Space Division, Boeing Defense and Space Group

The Space Station Freedom is the love of my life at the present time, and I think for the rest of my life and for the lives hopefully of my children and my grandchildren. Let me start off first by talking about the countdown to total quality. That is important to us at Boeing, to the Marshall Space Flight Center, and to a lot of the NASA operations that are ongoing as part of Space Station Freedom.

As a participant in this program, we have a difficult time sometimes determining who our customers are. The Marshall Space Flight Center controls our worthy evaluations and that seems like a pretty simple answer to who the customer is. However, a little more than half of the total dollars that we put together on the Space Station program goes to subcontractors. You quickly realize with so much money in the control of these subcontractors, you must treat them as customers, and we try to do that. Two other Centers are involved, the Lewis Research Center in Cleveland, OH, and the Johnson Space Center here in Houston, TX. The program will not work unless you also treat them as customers. They have prime contractors, those prime contractors have subcontractors and guess where that story leads? All of them then report to Level II, NASA, in Reston, VA. Now, there is a customer which we also have to be very careful of and very cooperative with in order to make this whole enterprise come together.

The contractors, subcontractors, primes, and Centers all are customers. The internationals, the Canadian Space Agency, European Space Agency, and the National Space Development Agency of Japan are all partners in this program as well. And believe me, all of them really need to be treated as

Panel C3 - Consider Yourself One of Us! (from left to right): Nancy H. Fussell, Product Integrity Manager, Space Station Freedom Program, Missiles and Space Division, Boeing Defense and Space Group; Marsha L. Dollarhide, Executive Advisor, Huntsville Operations, Space Systems Division, Rockwell International Corporation; Joseph P. Zimonis, Executive Vice President and General Manager, USBI Company Inc., United Technologies Corporation; Dr. Robert R. Barthelemy, Program Director, NASP Joint Program Office, Wright-Patterson Air Force Base; Richard L. Grant, Vice President, Space Station Freedom Program, Missiles and Space Division, Boeing Defense and Space Group; Arnold D. Aldrich, Associate Administrator for Space Systems Development, NASA Headquarters.

customers to make a success of Freedom. They all have their prime contractors, and all of those prime contractors have subcontractors, and all of those have to interact, and, it doesn't stop there. The customer for the Space Station that has to take the top role is the scientific and commercial user.

In March of 1990 in Tokyo, at a partnership/customer meeting, we had contractors and subcontractors all putting together the International Standard Payload Rack Agreement, which is the user rack that everybody is going to utilize in the Space Station regardless of where it goes in the Space Station, to house experiments.

The first Tokyo agreement on the International Standard Payload Rack definition specification worked and served its purpose for a while. But NASA and Boeing decided we had to provide another vehicle to give our customers the right prospective on his importance in our program. We put together a very high-fidelity mockup of an International Standard Payload Rack. It was a real rack, with real payloads in it, the real interfaces, the real cables, the real connectors, all the things that are real to the extent that we can define them now, put together in one place. This then became the vehicle for the customer satisfaction route for the customers I just described, where we could all now collaborate. We embarked on a world tour, which is still in progress, with this rack. The user community is now rallied around something that we can use to communicate our mutual desires. They can communicate with us as to what they need from us and we can make it happen on the spot.

There is another collaboration going with a foreign customer. Out of the restructure came an early requirement for a pressurized logistics module. This had a cost associated with it that needed to move out in order to satisfy the constraints of the restructure. The Italians came through for us. We, together with NASA, the Italian Space Agency, and their contractors conceived a mini pressurized logistics module that the Italians could bring to the party to get the Space Station going. The Italians had to hammer out a memorandum of understanding between two of their companies and the Italian Space Agency, then our two governments hammered out a memorandum of understanding that they are going to sign in just a few weeks. We are all there as partners, we are all there as customers for each other, and with each other, to serve the ultimate customer, which is the user and the person who is going to inhabit this laboratory.

I recently had the occasion to spend two weeks in Japan. There is something that is magic about what they are doing, which makes them so successful competitively. We went over to study their processes. The Japanese were very hospitable. They briefed us, they toured, they shared and answered every question that we asked about how they implement the quality that they put in place. I am absolutely sure that the Japanese are doing the right things, and it is also equally clear to me that everything they are doing we have a counterpart for, here in the fledgling American TQM movement. Their TQM, CPI, CQI, and all the processes that we talk about, are, in fact, in use in Japan and they all understand exactly what they mean.

There are cultural differences, there is no question about that, but the Japanese cultural difference cannot supplant our work force in this country. We are

not going to change the culture of our work force overnight. We are going to evolve with our work force. That is the way it has got to happen. Policy deployment in Japan is a magnificently detailed form, which most managers in the United States think they don't have time to do or some other equally plausible excuse. We know how to do it, we just have to set out and do it. What keeps the Japanese engine of progress going however, is the continual flow of dedicated people that come to the companies that are run by older dedicated people. That is the process, that is their long-range plan, that is the thing that allows the Japanese to be successful in so many ways that we consider magic of some kind. It is not magic, it is hard work.

They are preparing a new generation to supplant the old generation. It is empowering those people by a process that we don't understand. However, this is also the process by which we can come back into the competitive market place in this country. In our homes, our schools, and then finally government and industry are the processes by which we can build a new America that can compete favorably on any international marketplace. But that has got to be the process for doing it. It is not going to happen any other way.

Let me remind you of something that always startles people until they think about it for a minute or two. Every single solitary engineer that will go to work for anybody in the first decade of the 21st century is alive on the face of the earth today as we speak, every single solitary one of them. That resource is the only resource we will have, and we had better prepare and empower these people to make the future of our children and grandchildren what we want it to be.

5.3.3 Government/Industry Partnerships on the National Aerospace Plane

Wright-Patterson Air Force Base, AND USBI Company Inc., United Technologies Corporation

Robert R. Barthelemy, Program Director, NASP Joint Program Office, Wright-Patterson Air Force Base

About a year ago I was asked to write a book on the Aerospace Plane. I accepted, not knowing exactly what the book should contain, but I did know one thing. I knew what the title should be. The title is going to be the logo we have carried in this program since its inception in 1985, "The Sky is Not the Limit," because we are going to build an airplane that will go all the way into space.

Perhaps one biggest contributions the Aerospace Plane Program can make to America is not technical, it will be the managerial innovations, the approach which we have been forced to adopt because of the technical challenges, the conceptual challenges, and the political challenges of the program.

Due to the expense of the program, the first prototype we built will actually be a flying, experimental vehicle. This is one of the greatest challenges. In the Air Force we have never done a focused Research and Development program like this, where very basic fundamental technology is carried out in concert with the eventual vision of the program as an airplane.

Normally, what we do is to develop technology, look at it at some point and decide what kind of an airplane we want to build and then go ahead and build that. However, this was a focused R&D program, so most of our rules, most of our contracting and acquisition procedures, and most of our management approaches had to be changed.

There are many challenging technologies. Almost every subsystem of this airplane required a breakthrough. We were not looking for enabling technology, we were looking for breakthroughs in about five of the major areas. And amazingly, in the last five or six years, industry, the government laboratories, and the academic world gave us most of the breakthroughs we needed.

For example, it has only been about 90 years since the first experimental airplane was developed. The Wright Brothers did create an experimental airplane that in any calibration of its speed flew about mach 0. It was not flying very fast, but it was the first experimental airplane. Twenty-five years later, the X-1 flew and broke the sound barrier at mach 1. Since that time, in the last 45 years of the airplane, we've only gone about two to three times the speed of sound. Today, we are trying to develop an airplane that will go 25 times the speed of sound. In other words, we are trying to advance the science in 10 to 15 years about twelve times farther than it went in the first 45 years in the airplane business.

One of the most interesting technical challenges is the shape of the airplane. Three of our airplane companies, McDonnell Douglas, General Dynamics, and Rockwell, all had different approaches. From McDonnell Douglas came an airplane which looked

like what they are good at, large commercial airplanes. From General Dynamics, which predominantly is focused on fighters, you got a sleek airplane that resembled a military airplane. From Rockwell, which is very involved in the space shuttle business, came what we call a wing body, which was essentially a tank which contained the hydrogen for the airplane with some wings on it.

They were all great ideas, but none of them were exactly what we wanted. We asked them to come together as a joint team to produce a single design that gave us all of the features we needed. The airplane they came up has been on the cover of *Aviation Week* so you probably have seen it before. It contains features from all three of the designs. The engines are a combination of the very best ideas that came from Pratt & Whitney and Rocketdyne. Pratt & Whitney is primarily in the jet engine business, and they had some tremendous ideas on how to get the air into an engine like this. Rocketdyne is an excellent company in terms of rocket systems, and they knew how to burn that air with hydrogen to give us the thrust we needed. In the NASP engine are the best techniques for air-capture from Pratt & Whitney and the combustion processes of Rocketdyne. We really were able to get the synergism that most of us are after, and that synergism gave us the breakthrough that we needed to pull off this design.

Some of the materials that were developed a couple of years ago allowed us to build a powerful fuselage part and test it. To give an example of the strides that were made, this is a composite material like fiberglass, but, in reality, made out of metal. You can build an airplane out of this that will take the high temperatures of re-entry, but it also can accommodate a cryogenic tank inside that could take the minus 420 degrees of liquid hydrogen. This is a major breakthrough. It moves the whole technology along so fast that now the spinoffs to many other applications are already taking shape.

We also learned to build a wing structure out of these high temperature materials, and these are under test now in the NASA Centers and in the government laboratories of the Department of Defense. Suffice it to say that progress could never have been made if we maintained the competitive environment that we started the program with.

There have been many management challenges as well. We started off this program with 100 people in 1985. We could only find 100 people because the interest in hypersonics has gradually been diminishing since the X-15 flew at mach 6 in the 1960's. Very few people remained in the hypersonic business. There were a few folks at NASA Centers, a few at government laboratories, the Department of Defense, the Navy and the Air Force, and a few people in industry, but that was it, about 100 folks.

Over the last five or six years, we have built a major infrastructure that includes several thousand people all over the country. There are five major companies that are involved in this program joined together in a loose consortium. There are some 300 smaller organizations which are subcontractors of those five. Every government agency that has anything to do with aerospace is involved, and every laboratory center in the nation that does hypersonic air-space activity is part of the national team, as are about 40 universities.

With such a large, diverse organization, fairness and equality became an issue. We established a joint program office in Dayton, Ohio. The Air Force became the executive agency, and we had representation from all five of the agencies so that all of our decisions were made in conjunction by consensus. We are now under the National Space Counsel and today we essentially report to the Vice President of the National Space Counsel through a steering committee of the heads of these five agencies.

Why did we go to a national team? We suddenly realized that the competition wasn't between General Dynamics and McDonnell Douglas, or the NASA and the Air Force laboratories, the competition was between the United States and foreign competition. There are foreign activities going on which are directly competitive with the aerospace plane. France, Japan, the Soviet Union, Britain, and several other countries not only are individually involved in R&D for their own aerospace plane, but they are teaming as well. Recently, there was a joint venture between the Soviets and the British, and there are more joint ventures coming about. We are not in a competition to try to determine the best company to build an aerospace plane in the U.S., we are in a competition where America's leadership in aerospace is at stake.

It's difficult to say whether the new technology we are developing will ultimately be the most important legacy of this program, or whether the new management systems we have had to develop will eventually prove more important to our future competitive viability.

Another aspect of all this is we wanted to find ways to interest students in this program. Just recently, we briefed a million students all across the United States on this aerospace plane. This is a long program. We are going to need these kids to grow up to become engineers as part of it.

We are trying to involve students in a variety of

ways. We asked one university to build us a mockup so that we could show it at our national air show in Dayton. Even though it was only an 80% mockup, it was so big that the only thing we could pick it up in was an Air Force C5. It came in on time, and under budget. We were so pleased with it that instead of flying it to Dayton, we flew it and 50 of the kids who had worked on the plane to the Paris air show a year or so ago.

We just led another activity for a group from Mississippi State about a week ago. So, we are going to continue this outreach program to students and try to get future engineers involved early.

Joseph P. Zimonis, Executive Vice President and General Manager, USBI Company Inc., United Technologies Corporation

Classically, teams have been formed by contractors in the past to compete against other teams. In the case of the NASP project, we put a team together because we had a national need, because of challenges from other countries, and because of extreme challenges due to the high technology requirements.

We have a requirement for flight in the late 1990's. This is a very significant challenge. In order to satisfy this requirement, it became clear that putting together a national team could provide a much stronger approach. We could mix our technical skills, our past experience, and our facilities. In the economic area, we could provide a significant risk reduction by sharing ideas and reducing the amount of duplication of effort that would come about as a result of competition. Additionally, the team could provide a rather broad relationship to support political efforts which are very important these days in the area of shrinking budgets.

Prior to the formation of this team, there had been several down-selects. After about four years of work, there were five of us left: General Dynamics, McDonnell Douglas, Rockwell, Rocketdyne, and Pratt & Whitney. Our challenge then became to turn from a competitive stance and learn to pool our resources, work together, and focus on a goal which had a lot of mutual requirements.

Initially, the government was working with each one of us individually. As the magnitude of the project became clear, the government began to point out the advantages of a more cooperative organization, and began asking us about anticipated problems and also the anticipated benefits of a team approach. After that, we had numerous requests from the government for information concerning how we would approach the technical, legal, and financial aspects of teaming.

From this, a very complex teaming system was developed, far different from any we were used to dealing with in terms of facing the normal rules and regulations involved when the government seeks a product from industry. Finally, we were issued a series of principles defining the government's position in terms of the requirements for a team.

They ask that the five contractors get together to form this team. They asked that the team designate a lead organization, because the government saw the need for a single entity with whom they could deal. So, the team that was ultimately put together designated a lead company, and this lead company put together an office and an organization.

The other important aspect of the government requirements were that each of the team members would have an equitable piece of the work. We would split the work up equitably and we would be paid equitably for the work. It was very important that we all felt that we were being treated fairly, and that all the team members would all have the information, and the know-how, and the experience, so that in the future, they could compete equally for further requirements.

Right after we received the government principles, industry took the initiative to pull together a meeting known as the Singer Island Summit which occurred in January of 1990 at a place near West Palm Beach in Florida. A couple of representatives from each of the major companies got together, and within three days we had progressed through a series of discussions which concluded in an interim teaming agreement. After that, a very complex sequence of events took place, ending in a final contract with the government in late January of 1991. It took a whole year to consummate the principles that were agreed to at that initial teaming meeting.

During this time, the five companies all had their legal departments and their technical departments working to try to hammer out this team. At one point, we realized that we were all working very hard to put together a teaming agreement that protected us from each other, but weren't really creating an efficient team to produce the best product for the customer, in this case, the government.

It was a first for a lot of us and we had to go through some painful soul-searching to be able to establish a

working relationship with each other that allowed us to really live up to the principles that the government had requested and to provide for a true team. I am sure that many more of us will be going through similar arrangements in the future to provide the kind of team, the kind of resources, and the kind of talent required to do our jobs with shrinking budgets and more intense competitions.

Now the final question might be, "How is it working?" It is working very well. The team has been in place for well over a year. We have gotten through the growing pains of learning how to deal with each other. We have made some genuine accomplishments in the way of putting together the best that we could all bring to the table, and we feel fairly certain that as long as the funding continues and everything goes well, that we will be well on the way to meeting the goals of getting NASP into flight.

6.0 Community Partnerships: TQM Applied to Systemic Organizational Performance

Successful experiences of community/cooperative action dealing with deep, pervasive "outside" issues stymieing organizational performance and competitiveness.

6.1 TQM Partnerships with Education

The panel presents successful models of business/education TQM partnerships.

Panel D1 - TQM Partnerships with Education (from left to right): Dr. James Stoner, Professor of Management Systems, Graduate School of Business, Fordham University; Dr. H. E. (Rusty) Marr, Quality/Productivity Manager, Operations Systems Business Unit, American Telephone and Telegraph Company; Jess Arnold, Manager, Community Interface Programs, Space Systems Division, Rockwell International Corporation; (not pictured: Ned Hamson, Editor, *The Journal for Quality and Participation*, Association for Quality and Participation; Nora G. Williams, Director, Program Excellence, Space Systems Division, Unisys Defense Systems).

6.1.1 Herding Cats — Observations on Implementing Quality Management in Academe and Beyond

Dr. James Stoner, Professor of Management Systems, Graduate School of Business, Fordham University, Chairman

Herding cats is a metaphor. I've heard a number of times that being a Dean of a business school is much like herding cats. Imagine a big group of cats trying to move in some direction or another with all those things that happen when cats get together. I think that's not an unfair description of a business school in many respects. The same metophor is used, however, in describing law firms. So maybe it's a generic phenomenon that there are certain institutions in our society that are pretty tough to manage, and I'm talking about herding them in a direction of teaching and implementing Total Qual-

ity Management.

We have a variety of approaches at Fordham. Despite the best efforts of some of the faculty, our TQM efforts are not command-driven. Other members of the management faculty and business faculty are doing a lot of other things. We have a lot of alignment around teaching TQM and researching TQM, but it's still a very emergent movement.

Consequently, we are trying to teach TQM as we try to research it. Therefore, one of our themes is integrating teaching and research. What many of us do in our classrooms is try and put in front of our students a vision of what it is like when you are really doing TQM, when you're really 100% there. Then we try to show them how to move towards that vision. For the last five years my course has attempted to answer the question, "What is this vision of this TQM, and how do I move my organization towards it?"

Many of us look at TQM as an inquiry and as a shared journey. In the classroom we're exploring this phenomenon rather than teaching it. We're inquiring into it rather than lecturing about it. Five years ago, we threw away what we had been teaching at our core required Management Organizational Behavior course, and replaced it with a required MBA course based upon the work of Deming and Juran and others. In 1987, we started implementing specific courses in TQM. One course was oriented towards the quantitative methods and tools. The other one was oriented towards making it happen, the behavioral side.

In 1989, we started looking at how the various functions of organizations transform as they move from traditional management to Total Quality Management. We initiated a course in corporate finance examining companies that are leaders in TQM. We had top TQM experts come in and lecture about what was happening in corporate finance in companies that are quality leaders. This year, we're doing the same thing in accounting. Next term we're doing it in business law—what's happening in the corporate legal function and are there any law firms doing TQM? Next summer we do it in marketing.

The 1989 course, the corporate finance course, has now led to a major research project which is being integrated in the course right now. In 1991, Frank Warner, one of our Finance faculty, who we describe as the leading finance professor in the country in the area of quality and finance, started teaching a course on finance consistent with Total Quality Management from the textbook manuscript he's working on. Students from when we started this program five years ago are now implementing TQM in their companies. They come back to us and give us updates on what their corporations are doing. We're much more coaches and facilitators to students than teachers now.

We were very much influenced by W. Edwards Deming. Seven faculty members attended his seminar in 1986, and were profoundly affected by those four days. Joseph Juran has repeatedly been helpful to us. Other universities have been very helpful to us. We're consulting with other universities and helping them move towards TQM.

In managing ourselves with TQM we broke down barriers very early by combining our quantitative methods and production faculty with our management faculty. In 1991 our faculty got together at its annual conference and we made a formal commitment that we would start doing TQM formally in the school. We have our first quality improvement team working on the registration process in the graduate school. Our computer center has just formed its first quality improvement team to improve some of their processes.

As you try to help a business school, let me advise you, humility is appropriate. Don't expect them to respond the way a business does, quickly. Don't expect to create miracles overnight. You may do it, but we are resistent. We are tough to change in many ways. Patience really pays off. I like to say you can't bribe a faculty member, but you sure can tempt them. We've had a lot of luck tempting people on our faculty to move forward. I don't think we've bribed anybody very effectively. Deming's fourteenth point is the one I find most valuable here. That's the one which says, "Just start." Just encourage the people you are working with to start. We could easily have put our 1986 start off for two years, but it would have been a big mistake.

I would like to be able to tell you how much fun it is to be a management faculty member at this time in the history of management. This shift of paradigm from traditional management to Total Quality Management makes my field the most exciting it has ever been. Being a management faculty member at this time in the world is something I feel enormously privileged to participate in. My work is a constant joy. It is constantly learning. I don't know what this paradigm shift looks like. I don't think you can know what a paradigm shift is when you're in it, but it is so much fun to explore it.

6.1.2 Quality New Jersey — The Role of Volunteers in a Business/Education Partnership

Dr. H. E. (Rusty) Marr, Quality/Productivity Manager, Operations Systems Business Unit, American Telephone and Telegraph Company

What's a guy from an R&D lab got to do with education? My background intersects both the world of quality and the education community.

When I graduated from college I went to work for a quality control lab and I learned to appreciate what process control can do for you. Then I went to work for a defense contractor in Washington, D.C., who was working on bacterialogical warfare. My job was to grow the cultures that had all these strange sounding disease names, and again, process control was part of survival. Later on I got into quality management where the idea is you focus on the customer's customer. About this time I realized that for 20 years I'd had my children in either New Jersey or Maryland public schools and I realized that perhaps the principals of TQM could be effectively applied to education.

In November 1989, myself and several other quality professionals put together a seminar and invited speakers from manufacturing industries, service industries, education, government, and health care to present success stories about the application of TQM to their organizations. A few weeks after that, a lot of us got together again and we created a number of different focus groups that would discuss the issues associated with specific arenas in which TQM might be applied. I joined the education focus group, mostly in the role of a parent who's concerned with the quality of my children's education.

The education focus group got together and used the quality process to create goals. Our goals were to influence the educational system in New Jersey and to increase the application of TQM principles to the education system in New Jersey. We were looking at the whole education process; at higher education, at the structure of the commissioner of education, the department of education, and the K-12 structure. We also wanted to see if we could increase opportunities for applying quality management to our local school system.

We wanted to increase the teaching of quality tools into our school curriculum. So what could we do? As volunteers we struggled first with figuring how quality professionals could effectively interface with educators and the school administrators so that we could all speak the same language. Our group was very fortunate at that time to have some very dedicated and talented educators from both the K-12 community and higher education, as well as support from the Education Commissioner's office. We had some quality professionals volunteer to go out and talk to school administrators and supervisors in New Jersey school systems. Soon, school systems were asking us what they could do to implement TQM into their school systems.

The interest in New Jersey is still snowballing. Each month our Quality New Jersey Education Focus Group meets to share ideas and puts on a program. We tried to keep these 2-4 hour meetings fairly structured. Originally, in the first part of our meeting, we usually had a little talk about some quality tools from a quality professional. Then, we had an education professional talk about some successes in the education community with the applications of TQM. And then we had the reports of a number of different sub-focus groups which try and get things done each year. These activities were so successful, however, that they grew from 2-4 hours, one day a month, to all-day seminars. This shows the increasing interest among the education community in New Jersey to learn about Total Quality Management.

Now, at the beginning of the year we pick six projects and create six teams to work those projects. At each of our monthly meetings the task team leader reports back on the progress during that month. For example, this year, Team 1 wanted to link Quality New Jersey to the national TQM movement. As we got more involved, we realized there were a lot of people around the country doing the same thing we were, so we wanted to find a way to link them. One of this team's goals was to put together a TQM seminar on education for New Jersey educators this year. Last year that was done at Trenton State College and had good participation from both the education community and the business community.

Four of us have become founding members of the Total Quality Alliance which started up about a month ago in Washington, D.C. It's an organization sponsored by the National Learning Foundation to merge the TQE movement — they call it Total Quality In Education — with the TQM movement. Another assignment of Team 1 was to develop a program for the 1991 World Quality Day Conference. In addition, we're going to put together a five-day workshop for early 1992.

The second team was to document the industry/academia/government linkage in New Jersey. We

knew a lot of our businesses and industries were doing things with educators but nobody had compiled or collected what was being done. At AT&T we were doing such things as loaning employees to become professors at universities and school systems. Bell Labs has a Speakers Club that provides speakers on science and technology to any school in New Jersey.

AT&T and other New Jersey businesses are partnering in tutoring programs for disadvantaged youngsters all over the state, and even all over the country. An organization called Partnership For New Jersey, which is a coalition of leaders from business and industry, manages a number of Adopt-A-School programs. AT&T also invites teachers to participate in management training courses at AT&T. If there are open slots left in our training programs, we offer them to the local school systems, and if they want to send their teachers or administrators through our management training course, they are given that opportunity.

The third team is developing a training model to identify materials which can be utilized by colleges and universities in support of TQM principles. We think that's where TQM is going to be applied first in New Jersey. Some of our universities are trying to apply TQM to the administrative side of the university, trying to run it more like a business.

The fourth team is developing a training model for deploying TQM in K-12 education. Some of us are participating in a national quality improvement team that's looking at opportunities to introduce these concepts into state teacher's colleges. We think somehow we've got to reach the people who are going to be the teachers, not the ones who are teaching now.

The fifth team is to evaluate the Malcolm Baldrige National Quality Award criteria for education, so we can implement the New Jersey Quality Achievement Award. Next year in New Jersey we are going to have a state-wide equivalent of the Malcolm Baldrige National Quality Award. We're going to develop mechanisms to introduce the concept to the education community.

The sixth team is putting together a number of articles about TQM in education. We try to get them published in journals that the academic people read, like the New Jersey Education Association Journals and the Journal for Administrators.

For those of us in New Jersey this has been a really great opportunity to connect with professionals in other fields and in other types of businesses to help implement quality in education.

6.1.3 Partnerships for Progress

Jess Arnold, Manager, Community Interface Programs, Space Systems Division, Rockwell International Corporation

At Rockwell International, I created a system called Community Interface Program. It's over 22 years old now. I've actually made a career out of it.

The Community Interface Program is quite different from when I first started out. I had to find people who knew how to communicate at all levels of the community. With the right people, we were able to make a difference in some areas where the private sector usually was not involved, in a time where no industry to any kind of degree was focusing on the community as an important place to seed for academic excellence.

As a large industrial employer, Rockwell International long ago recognized the need for skilled labor to ensure continued productivity. It also recognized that the surrounding communities will provide the skilled manpower to meet this need. To accomplish this, we had to pay attention to not only our traditional customers, like NASA and DOD, but to our non-traditional customers as well, the community surrounding our facilities. These non-traditional customers are our school students, and these students need a lot of attention, support, and expertise.

We stress teamwork in the Community Interface Program. Everyone from the top down is participating in this process. Our chairman has taught on a high school level and a junior high school level. We are working with customers and key government representatives and agencies to enhance educational partnerships. Our most important resource is our employees, who volunteered willingly to go into the classrooms, and who really make our community partnership efforts work.

One of our executives goes to lunch at McDonald's every week with kids from a school we adopted. We not only have some of our chief executives working in schools, we also support interactions with communities which ensure the economic stability and continued skill development process. I do want to emphasize that economic stability factor because, we're talking about tough times here. And if it's tough times on the major industries, then you can be sure there are very tough times in some of these

communities. These tough times encourage drug use, and drug use is banging heads with the educational system, and we need to try to find ways to try to curtail a lot of those activities.

One of our major thrusts is our teacher improvement program, or TIP. Here we bring in 250 teachers from the 11 school districts in our geographic area to attend various workshops which we sponsor. On the elementary level we sponsor Adopt-A-School programs. We feel, however, that you've got to spend most of your seed activity in the middle school area. This is where you have got to put a lot of your money and expertise because this is the place where these kids get their basic foundation.

We also sponsor programs on the high school and community college level. Our focus is to keep these people moving along in the direction you want them to go. On the college and university level, we get involved in a process which stresses productivity and quality and we're working with a lot of business students.

Part of our Community Interface Program also recognizes the top 10 teachers in our area. We believe that recognition is very important. If you're doing a good job, you get a pat on the back. We also believe that if you recognize that someone is not doing a good job, then it's your responsibility not to just criticize and walk away. If there's something you can criticize, there's some way you can help.

We work with government officials. Congressman Glenn Anderson has spoken to classes at one of the schools for us. We strive for urban enrichment within this partnership structure. The way we do this is to not only provide the various kinds of technical assistance through civic organizations to encourage skill-development organizations, but to foster a continuous improvement educational culture, a life-long learning process.

Our activities with the 11 school districts within our area have gained us recognition from the White House. We have the opportunity to transfer technology and valuable knowledge to tomorrow's work force. Even the children of Rockwell employees are encouraged to participate in our educational programs. Employees receive recognition for volunteer services and contributions to their company and community. This last year when we had the Recognition Banquet for our volunteer instructors, every member of Management Counsel from Rockwell International was there.

These programs benefit both Rockwell and our community. We're building a skill bank that we feel we'll need for the future. Our customer relations and government relations have never been better, and what's most rewarding to me is that the real beneficiaries are our nation and our children.

6.2 Partnerships in the International Community

The panel explores the formation of partnerships in Europe and Japan that address quality and productivity issues in a rapidly changing global economic environment. Comparisons with the United States' efforts will be presented based on a study performed by Columbia University's Center for Operations.

6.2.1 Introduction

Dr. William B. Lenoir, Associate Administrator for Space Flight, NASA Headquarters, Chairman.

Quality is important to NASA. It's as important to our Earth Observing Satellite system as it is to our manned space flights. Within my own Office of Space Flight, we have a formal continuous improvement program with a variety of action teams working on issues that range from getting the Space Shuttle more efficient and less costly and more safe all at the same time to planning how we intend to use the Space Station and how we can operate the Space Station in such a fashion that our customers, the users, will see it as being customer friendly. We're always looking for change. We're always reviewing ourselves, our organization, and our people, in relationship to today's environment and looking toward the future. We're seeking frankly to change our culture so that we think differently, so that change is a way of life, and that we seek change to get better, and that we don't feel the least bit afraid of change. With respect to the international community, as with the domestic community, we need to compare and contrast various techniques, various programs, what we are doing and how it works, taking into account the different cultures, in a corporate sense, in a government sense, and in a people sense. Our own Space Station Partnership is a partnership of the United States, the European Space Community, the Japanese Space Community, and the Canadian Space Community, and is a partnership not where one is a customer and one is a supplier, but where together we will build, assemble, and operate a Space Station for each of our own benefits. Frankly, that's a challenge. We've not tried something like that on a national level before, so that it's important not that we just compare techniques back and forth, but that we have a joint team applying quality precepts to operating in a way that the total product comes out better, not just some subsets. Our challenge is going to be working together.

6.2.2 Quality Control Activity in Japan and the Relationship of International Cooperation Activity

Masayuki Shimodaira, Director, Reliability Assurance Department, National Space Development Agency of Japan.

International cooperation in quality assurance and quality control is an important aspect of our quality program. We have used quality precepts for many years in Japan. During World War II, the Japanese government used control and inspection to try and establish quality standards. At that time, and after World War II, quality was poor in the factories and the economy was bad. The General Headquarters, controlled by General MacArther and the occupied force in Japan, introduced Total Quality Control (TQC) and statistical quality control procedures and included some theory. Japanese industry, with General Headquarters, established the Japanese Union of Scientists and Engineers (JUSE) in 1946 and the Japanese Society of Quality Control set up the Deming Prize in 1951.

The Japanese Society of Quality Control provided a resource to make the Japanese business policy acceptable in all areas, resulting in better quality and a foundation for Japanese social operation.

In Japan, we use a variety of quality improvement efforts, including TQC, statistical quality control (SQC), and quality control circles. Our quality control circles use between five and seven people per process. The groups are successful because they discuss the indicators for improvement for each process and each person, and they share their experience and techniques using actual characteristic data and diagrams, for example, the cause and effect

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diagram to improve their techniques. We have found that each company has some process to apply the quality control circle concept to improve quality, productivity, safety, durability, and reliability. Our employees like quality control circles because it is easy to concentrate on specific items and find the problems and solutions using statistical quality control and engineering design methods within the group.

We have a modernized development activity, based on the management of development. Configuration management includes design review, and commercial areas, and each company performs design review activity. We use design phases and practical techniques, FMEA, FTA, and other reliability techniques for high reliability product production. That's our purpose: safety and product reliability with no defects.

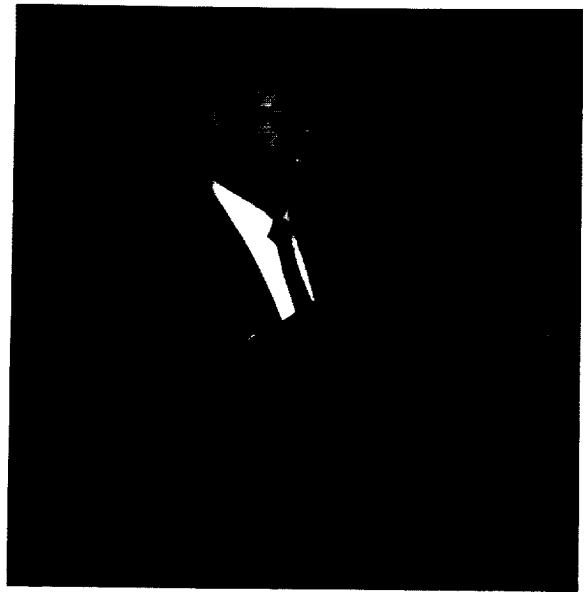
We have adopted the United States' quality control standards dogma. We have developed a surveillance and inspection plan for each contract. We have also applied introductory supervision for subcontractors and suppliers. We understand and believe that quality assurance must be accomplished by contractors, not just a NASDA support to the contractor's activity.

We have a quality audit performed each year. We must perform select audits because if a contractor incurs item problems or an actual flight problem, we must review it and audit that company. Audits are performed by a NASDA auditor, with a checklist finding sheet and an interview with management. Our auditor reports to NASDA's top management.

We have meetings on and off site each month. We have reliability assurance conferences to discuss documents, personnel arrangements, and so forth. We also have lectures for contractor and quality assurance, parts, and materials training and workshops, both within NASDA and with our contractors. We also have many academic and non-profit quality organizations and productivity centers.

Information exchange is a very important element of quality. We believe that information exchange should take place at all levels, from the first-line worker to the supervisor to the director. We also participate in international symposiums and forums sponsored by American, European, and Japanese quality organizations. In Japan we have several other symposiums and conferences. We also meet and discuss issues regularly with our customers and partners.

We believe that in quality assurance, it is most important to proceed with mutual understanding of



Masayuki Shimodaira

quality assurance systems. We have a fellowship to invite foreign people to stay in Japan for three months, a half year, and 1 year. We hope your company or organization will visit Japan in order to better understand the similarities and differences our different cultures have in the areas of TQC and TQM. Finally, we're establishing information exchange organizations such as information centers, training centers, and research centers.

I believe it is necessary to promote TQC aspects to proceed with the quality control effort. Each contract, each company, and the government must motivate employees to believe that they are involved in the company or organization. Quality should be the number one subject for top management, with emphasis on reliability assurance and safety.

6.2.3 Cultural Decoding: A Must for Cooperating in Europe

Fabio Corno, Scientific Coordinator, Center of Entrepreneurial Studies, Valmadrera, Italy

International cooperation: two key words which are well know to every manager confronted with today's global competition. Indeed, they seem to represent an appropriate and successful strategic response for many businesses operating in this environment. Still, despite the increasing general awareness, the implementation of successful part-

nerships turns out to be a more complicated matter than most companies originally envision. In particular, the high failure rates documented seem to derive from underestimating the need for a strong communication among the partners: a communication that, while keeping in mind the partners' different goals, objectives, actions, as well as values, visions, and attitudes, allow them to understand each other's motivations and, therefore, to build the basis for a mutual exchange.

I will discuss what I believe to be a crucial factor in determining the success of a cooperation program: a deep understanding of each other's culture and philosophy, based on what I call "cultural decoding." Also, I will try to weave this theme into the complex and diversified scenario of Europe 92 and explain what impact cultural decoding can have on the end result of an intercompany negotiation via a few examples, also drawn from my consulting experience.

When looking for variables that play a role in determining the effectiveness of international relationships among companies, the greatest attention is usually paid to "hard" factors, such as economic indexes (performances, productivity, and so on), to the detriment of "soft" variables, such as culture, communication style, and the like. Yet, this generally accepted "hard data approach" underestimates the fact that cooperation is indeed quite a complex multidimensional issue, which requires not only an exchange of company information amongst the partners, but also the establishment of a deeper degree of communication, concerning above all the objectives of the partnership as well as its strategic implications on both sides.

It's here, then, that "cultural decoding" comes into play. As a matter of fact, whenever two people or two companies come in touch, they start communicating, each using its own language and code; for a cooperation to develop, they need to develop some sort of common language. Yet, one has to bear in mind that the process is not quite as easy as it may seem, since it requires mutual understanding on three different levels: the semantic (the inmost and most valuable one), the syntactic, and the pragmatic. Most people limit themselves to the last level, which concerns the effects of actions taken. Or they stop at level two. And most often the semantic level is left aside. Still, it won't be until the partners get down to this level that they will be able to grasp the "reasons why" of their counterpart, and go beyond mere facts and formal expressions.

Now, these considerations appear to be particularly significant when applied to the European scenario, characterized by a strong cultural diversity. A recent study has pointed out a tight connection between company location and corporate culture and philosophy: according to it, European communities can be grouped into three categories, Latin (Italy, Spain, Portugal, Greece), Anglo Saxon (United Kingdom and Ireland) and Northern European (Germany, Scandinavia, France, BeNeLux, Switzerland, and Austria) following clearly distinct managerial philosophies. The importance of such diversities gets even larger when you consider small and medium sized enterprises, whose leaders strongly emphasize "uniqueness," independence, and flexibility, while sticking to very centralized structures.

Fabio Corno

Such specificities represent a real challenge not only for a non-European manager willing to start a cooperation in Europe, but for any European company looking for a partner within the EEC. Most certainly, a variety of factors is pushing European companies towards more intense cooperation programs: just to mention some of them, the growing strategic emphasis given to quality and to the philosophy of Total Quality Management implies more integrated relationships amongst products, suppliers, and customers. Secondly, the rising establishment of Japanese companies in Europe requires the creation of new boundaries among enterprises. Thirdly, the 1992 single market is forcing European enterprises to grow in size in order to ensure the competitive dimension essential to survive in the new environmental conditions. Last but not least, the European Economic Community (EEC) itself has

established dedicated offices and special tools (such as Direction Generale XXIII (DG XXIII), Euro Info Centers Network, BRE (Bureau de Rapprochement des Enterprises), BC-NET (Business Cooperation Network), ESPRIT, BRIT, EURAM, and others) in order to encourage the smaller companies to develop through cooperation.

Despite such diversified initiatives, the results are not always encouraging: the results of quite a few programs I had the chance to come across as a consultant prove that new forms of cooperation are too often approached without considering the need for cultural decoding.

For example, in the automobile industry, where the interaction between producers (large corporations) and suppliers (mostly SME's) has consolidated itself through the years, the scenario is changing rapidly: the leading European manufacturers are now requiring from the suppliers higher and higher degrees of cooperation and new quality-oriented investments. Unfortunately, though, the producers have failed communicating their subcontractors the objectives and the implication of the new requirements (semantic communication), replicating instead the communication approach they were used to (syntactical). Cooperation has thus become an "imposed" process rather than a shared one, resulting in a "pro-forma" participation from smaller partners who try to achieve a "facade quality orientation." Needles to say, the effectiveness of such TQM efforts is poor and demotivating.

Even the perfectly well-organized Japanese seem to be not that successful in Europe as far as their relationships with European subcontractors are concerned. A recent study by JETRO shows that 67.6% of the Europe-based Japanese firms have unsatisfactory relationships with their European subcontractors and that they intend to slow down the creation of new cooperative agreements in the future. Failing to go beyond the pragmatic level, they do not understand the cultural differences between European countries and the subsequent need to adapt to each of them in a different way.

From SME's point of view, a recent CIS research led on 1400 European SME's has pointed out a grown in SME's orientation towards international cooperation. Still, due to the general lack of managerial skills and of cultural support actions (i.e., specific training, information, etc.) that characterize SME's, they tend to face international activity and transnational cooperation with little knowledge of the problems concerning dealing with foreign markets and cooperating with other firms. As a consequence, they often adopt unsophisticated approaches which fail to result in well-balanced alliances and in solid settlements abroad. CIS research clearly shows that, despite the efforts of EEC authorities aimed at changing this attitude, the awareness of the tools provided by DG XXIII remains still insufficient. Moreover, even among those enterprises which have used the EEC tools, not many have revealed to be knowledgeable about the services available and almost everyone has declared to need stronger external supports, to be able to upgrade their cultural level.

The experiences which have been presented should help you to understand how difficult international cooperation may be. International cooperation can be fostered only by stimulating conscious approaches, based on a full recognition of cultural diversities and a deeper acquaintance with them. Those who are involved in these processes should be trained in order to be ready to cope with diversity and change: that is, learn to go beyond the pragmatic level, working on the semantic and syntactic ones. That's why I firmly believe they should be exposed directly to problems, passing through a gradual series of experience. A hands-on approach is in my opinion a unique way to prepare a company and its people to the decoding challenge of the future.

6.2.4 Comparative Performance of Foreign Affiliate and U.S. Firms in America

Dr. Martin K. Starr, Professor, Center for Operations, Graduate School of Business, Columbia University

I want to report on our studies of foreign-affiliated firms in America. Columbia Business School's Center for Operations has been tracking the performance of Japanese-affiliated firms (JAFs) in America for over ten years and of European-affiliated firms (EAFs) in America for five years. We have been able to observe the interactions of many different cultures within these companies which are located all over the United States. For example, we did an in-depth study of five JAFs in Tennessee.

When we began our tracking studies in the early 1980s, we were able to locate about 700 JAFs in the United States. There are now well over 2000 such firms and many thousands of EAFs as well. In our studies we compare performance of JAFs and EAFs with U.S. firms that have no foreign affiliations.

There are a great number of measures that have been collected and our studies are rich in comparisons. For this presentation we will limit our reporting to some unexpected results.

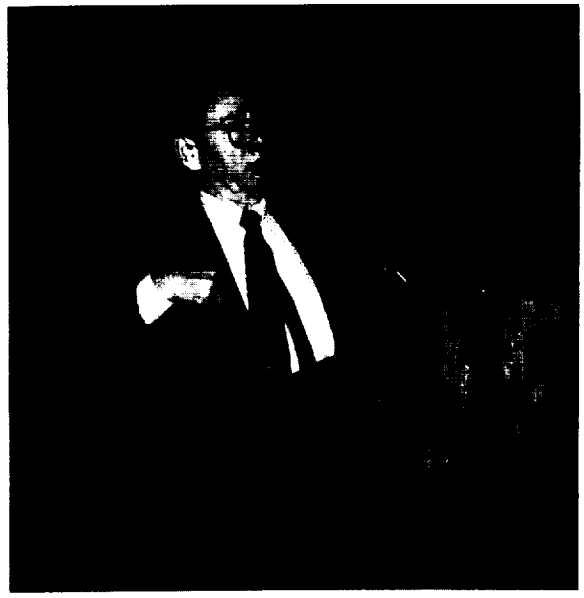
First, management style differs according to the nationality of the parent company. Each European country tends to have its own special characteristics. Japanese firms are well-known for their unique manner of managing which diverges markedly from U.S. firms. Relatively minor modifications occur when the parent company first establishes their affiliates in the U.S. Then, however, pressures start to build up for changes which would bring some aspects of management policies more in line with the predominant culture of U.S. workers, managers, suppliers, and customers. There is also great pressure on U.S. firms to change so that they can be more competitive with the Japanese-affiliates and with global competitors as well.

So we attempted to determine the degree of flexibility of the various management nationalities. The Japanese-affiliated firms are absolutely reluctant to change their management style. They have been successful in design, production, and marketing, but have problems being accepted as readily as the European and Canadian-affiliates. It is apparent that they have a pattern for the way they do things and they seem determined to maintain that pattern.

The managements of European-affiliates in the U.S. are very flexible. They seem to be actively seeking ways of bringing about managerial changes. As a matter of fact, as a group, they are the most venturesome firms that we encountered. Management of domestically-owned firms in the U.S. are willing to experiment if they are convinced that there is a good chance to become more competitive. But they are reluctant to change without incontrovertible evidence of superior performance. U.S. firms fall somewhere in the middle between the JAFs and the EAFs.

Second, there is a difference in the way that managers of each national affiliation seek and use information that might be competitively useful. JETRO, which is the Japanese Export and Trade Organization, has a very comprehensive system of collecting and reporting information among JAFs.

Various Japanese trade associations seem to share weather information as pilots do who fly on common routes. JAFs are serious collectors of reports about competitive conditions. They interchange information about such potentially sensitive topics as: manufacturing techniques, quality control systems, supplier characteristics, labor relations including union performance (e.g., Nissan in Smyrna, Tennessee, had developed guidelines to deal with unionization efforts of the U.A.W. These guidelines were based on information about the U.A.W.'s attempt to organize Honda of Marysville, Ohio).



Dr. Martin K. Starr

In comparison, neither the EAFs nor the U.S. firms are tied into networks for sharing information. These firms tend to be independent and feel that they are giving away more than they get whenever they share information. They do not provide anyone with technical or trade data readily. Japanese Keiretsu afford an ideal family system for interchanging information whereas U.S. consortia are arrangements between firms that are normally competitors. Also, the U.S. and Europe have a history of anti-trust strategies to block certain kinds of competition whereas, in Asia, governments have employed pro-trust strategies with great success.

Third, Japanese firms in the U.S. have been increasing the number of suppliers that they use. That is because they are being pressed to buy domestic content from suppliers who are not trusted to produce quality products and to deliver with reliability. The well-known Japanese management model touts the advantage of few suppliers and idealizes the single supplier. Ironically, in America, it is U.S. firms that are moving toward the single-supplier, whereas, Japanese firms are moving away from it. Ford is reducing the number of its suppliers using a strict certification process while Toshiba is striving to increase the number of suppliers in an effort to develop some kind of a network with American

suppliers. There is some confusion among EAFs concerning what to do.

Finally, people talk about the religious verve with which Japanese firms address quality issues. We did not address this issue in our surveys. Nevertheless, there is no evidence that the JAFs look upon quality as a religious issue. Instead, it seems accurate to say that the Japanese firms treat quality as a combination of science and art. The art part is based on the critical importance that is placed on doing things right (as in the Tea Ceremony). In the U.S., the closet management model might be with sports where it is understood that you keep on training to win, break speed records, etc. European firms are sympathetic to the art and the science as well as to the sports model for excellence. That is how one might describe the difference in perception of quality that exists in each culture. Religion and metaphysical factors do not seem to enter the picture. In Japan, we are looking at an attitude that stresses the long term. In the U.S. the time horizon is short. The Europeans are somewhere in between.

To sum up, there are surprising deviations from stereotypes that apply to foreign-affiliated firms in America. At the bottom line, JAFs have seen American firms improve productivity and quality. As a rough guess, the average U.S. firm in America has improved its quality between 50% and 100% in the past 10 years. JAFs, on average, have improved their quality by about 200%. But it is not enough to play "quality catch up." Best quality is taken for granted. The rules of the game have been changed. The moving target that matters is now innovation. Joint ventures and strategic alliances can provide an organizational cure: a means to recover from bureaucracy and leapfrog the competition.

6.3 Changing Work Force Demographics

The panel exposes and discusses the effects of a rapidly changing work force in the United States. Both Government and private sector perspectives will be presented.

6.3.1 Introduction

Bonnie W. Soodik, Vice President-General Manager, Quality Systems, McDonnell Douglas Space Systems Company, Chairperson

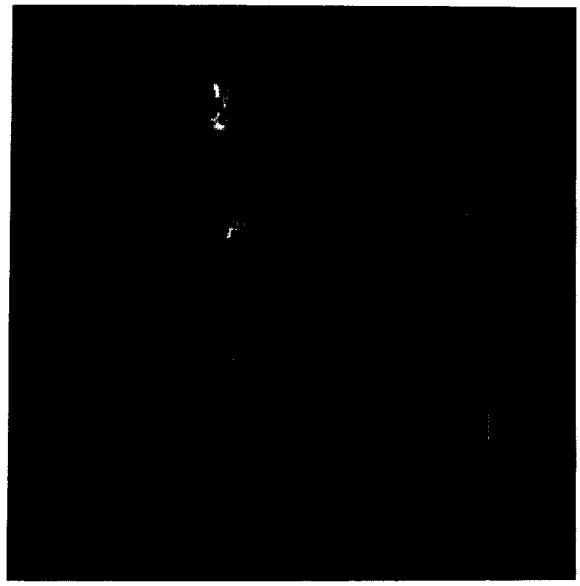
I'd like to share some predictions about the future workers of America. As we look toward the end of this century, we can forecast changes, both in our economy and the work force necessary to support that economic picture. Toward the end of this decade we expect increased U.S. exports and productivity, as well as a strong global economy. Manufacturing, however, as a percentage of our economy, will decline while the service industry forecasts strong growth.

It appears as though the new entrants to the work force might not be prepared for the challenges they face. Critical skills will retire, while workers with even higher skill levels will be required and will grow in increasingly shorter supply. In the economy in general, we expect joblessness to increase among the least skilled workers while the more-educated can expect to be employed.

Total work force growth will be slow at best. Towards the end of the century, our work force will have a much larger percentage of older, female, minority, and non-native workers. In 1985, the entrants to the work force were almost 50% white males, with white females comprising another third. People of color comprised 10% of the entrants while non-natives were the remaining 7%. However, since 1985 and continuing through the end of this decade, we see a major shift in this trend. White males, who were almost half of the entrants to the work force in 1985, will decrease to only 15% by the year 2000. At that time, white females will become the dominant entrant group.

In addition, people of color, who in 1985 were 10% of the new entrants, split equally between men and women, will double to 20% of the entrants, with females comprising almost two-thirds of that number. Non-native Americans will triple their representation in the work force, growing from 7% to almost 22% of the entrants.

No discussion, however, of the changing work force demographics would be complete without including the discussion on the crisis facing our education system. America faces a significant challenge, particularly in the areas of math and science education. American children show a decline in student performance compared to their international peers. Fewer students are pursuing scientific and technical curricula. In general, the level of scientific literacy among the American public has decreased significantly and is expected to continue to do so.



Bonnie W. Soodik

We must begin to recognize diversity as a business issue. The work force of tomorrow will look and think and act differently than the work force of today. Managing that work force will require different attitudes and behaviors than are deemed acceptable in today's business. A diverse work force is not something we ought to have; it's something we do have. Managing diversity is a business issue, not just a legal issue.

6.3.2 What NASA is Doing to Get More Minorities, Women, and Individuals with Disabilities into Science and Engineering Careers

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

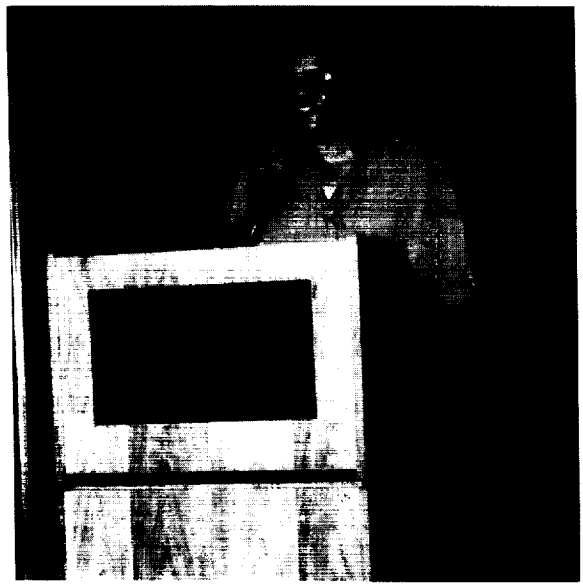
I want to share with you some of the things NASA is doing to get more minorities, women, and individuals with disabilities into science and engineering careers.

Traditionally, our nation has been less successful in helping to educate and prepare these groups, women, minorities, and the disabled, for viable economic survival. So federal agencies, including NASA, feel that it is in their interest and also in the public's interest to ensure that these emerging groups are well prepared for what we now know are going to be more highly-skilled jobs in the future, and we'd also like them to be prepared for science and engineering positions.

The National Science Foundation legislation in 1987 mandated that a task force on women, minorities, and the handicapped in science and technology be established. It had federal agencies on it, members of industry, other institutions, and professional associations. We recommended that the President of the United States should take the lead in developing specific national education goals, performance standards, and time-tables for meeting them.

We like to take pride in saying that we think that our work contributed to the America 2000 initiative. We also recommended that the President's Science Advisor establish a federal coordinating counsel for science, engineering, and technology. We call that a "fix-it committee." Furthermore, we recommended that it provide visibility and coordination of these federal agency plans to improve math and science education in this country, and also to strengthen the science and engineering work force.

We didn't stop there. We also made recommendations for governors, state legislators, school boards and parents, federal government, universities and colleges, pre-kindergarten and kindergarten through 12th grade, educators for professional societies, even for the media. And we did not leave out industry. We recommended that industry should help us sound the alarm for a need to improve education, to set up partnerships with departments of education, with school systems, and with federal agencies to provide scholarships, fellowships, summer work, internships, teacher assignments in industry kinds of jobs, and to encourage their employees to help teach in school systems — release them so they can do that during business hours, and encourage their retirees to participate as well.



Dr. Harriett G. Jenkins

NASA, being action oriented and results oriented, has initiated programs and strategies of its own to try to get more minorities, women, and individuals with disabilities into science and engineering careers. We count approximately 40 initiatives which have targeted special programs at the pre-college, undergraduate, and graduate levels, and for faculty and university research kinds of activities.

We have counted approximately 200 educational efforts at our various installations. Our Teacher Resource Centers provide teaching materials, loaded with ideas for improving and enriching classroom education. We have programs for minority universities where a substantial number of the minorities who go on to get graduate degrees are first trained and receive their first degrees. Historically Black Colleges and Universities comprise a very significant part of our university program at NASA. Now there is even a group of Hispanic-serving colleges and universities with whom we work.

You may have heard of the National Space Grant College and Fellowship Program, designated institutions which provide specialized training and education programs to maintain U.S. capability in aerospace and science and technology. And the last one, Minority University Space Interdisciplinary

Network (MUSPIN), is a project at our Goddard Space Flight Center which provides electronic linkages, network training, and resources information to minority universities to facilitate the development of their research capabilities.

We also sponsor programs for seventh and eight graders. It's hands on, math, science, and engineering concepts kinds of experience for students, using a professor of engineering from the University of Maryland and some of his students. The Saturday Summer Academy at the University of the District of Columbia, for ninth and tenth graders, also has an enrichment program in math, science, and computers.

Our Summer High School Apprenticeship Program takes 11th and 12th graders and assigns them to a NASA scientist or engineer during the summer. The youngster works on a technical project, prepares a report, and we've found that most of those students go on to universities to obtain their degrees.

The Cooperative Education program allows students to alternate study at their universities with work assignments at the NASA Installations in their career fields. The Federal Junior Fellowship provides support while the youngster's obtaining a college degree. We have a small model summer program for handicapped students at the college level at Gallaudet, which is a college for the deaf.

We have the Graduate Researchers Program for under-represented minorities, and we've just launched this year an undergraduate component of that. It provides fellowship support on research projects of mutual interest to the student, his advisor, and NASA. We also have Project Preserve, which is a very unique program at Xavier University in Louisiana where they capture and rehabilitate talented minority students who have stumbled at other universities. This program has compiled a phenomenal record.

The Space Life Science Training Program is a six-week residential program at the Kennedy Space Center. While we call it a targeted program, it is well integrated. They have hands-on experiences in laboratories there. They're building experiments which could fly on the Space Shuttle.

The Helen Carr Fellows is a NASA-assisted program which supports youngsters in obtaining their Doctorate degrees in engineering if they will promise to return and teach at a historical black college or university. Similarly, we have a few installations in the physical science consortium where fellowships are provided for minorities or women who are majoring in the physical sciences. We are very proud of an initiative at the Jet Propulsion Laboratory where we provide scholarships for Native Americans at Northern Arizona University.

NASA is committed to continuing its targeted and mainstream efforts and with working with other federal agencies, universities, industry, state, and other entities to help forge strategies which will work. NASA is also committed to data collection, tracking of students, and evaluation of its efforts. America is changing, so is NASA. We believe both can be well prepared for this change if we set our minds and hearts to stepping up to the challenge and to the opportunities that it affords us. We are certain that it is in all our best interests to develop and utilize the tremendous talents of all our diverse citizenry.

6.3.3 Valuing Diversity

Jay P. Cooper, Corporate Director, Materiel Policy and Socio-Economic Business Program, Supplier Relations, Northrop Corporation

Northrop employs 40,000 people in six major cites. Essentially, we're a DOD supplier, but we do some NASA business. We have about 14,000 active suppliers. About 800 of those suppliers are minority and women-owned business. We have a very diverse employee work force and certainly a very diverse supplier community.

We took a hard look at the demographics and we knew we had to do a number of things to meet the challenge of America's ever-more-diverse work force. So we set some goals. First of all, we want to create an environment where no one has disadvantages or advantages because of race, ethnic origin, age, gender, or disabilities. Now that's a very ambitious goal. We know that. It's an ideal environment, but we've got to move toward it.

Next, we accept and value this diversity as a company. We include diversity training as a part of our management development training. We recently implemented a family-leave-of-absence policy, recognizing the fact that women are going to be a very key segment in our work force from now on. We now allow our employees to take up to 12 months unpaid leave within any 36 month period to care for a new child or for a disabled immediate family member. The policy allows and encourages part-time work, flexible times, counseling through the employee-assistance program, and parenting semi-

nars.

We have made an enhanced commitment to personal development training. We are committing far more resources to corporate-wide training than ever before. We are trying to provide the tools for the advancement of women and minorities into higher-level positions. We have initiated an extensive corporate-wide leadership training program for all managers, and as a part of that training program we allow our employees to receive confidential feedback based on surveys completed by subordinates, associates, and suppliers.

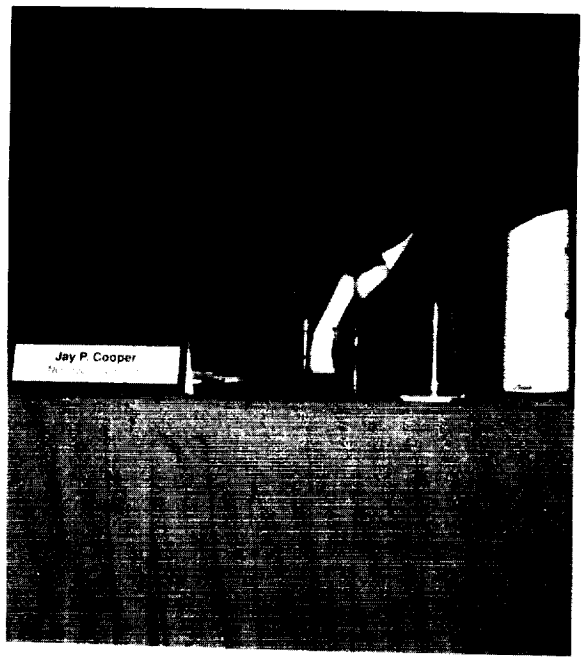
We recognize the fact that our work force is very diverse and we try to give everybody an opportunity to display their cultural objectives. One of the programs that we have initiated is corporate-wide observance of such events as Black History Month, Asian-American Heritage Month, and Hispanic Heritage Month.

Our CEO engages in an activity which is similar to the old management by walking around. He stops and discusses the concerns of both employees and management. He listens and then he does something about it. I've seen an employee stop our CEO, mention something, and a few days later it's taken care of. He remembers.

We've established a communication program to ensure that the diversity of Northrop employees is reflected in all of our company videos, annual reports, brochures, and graphic materials. In the past that hasn't always been so.

I believe the benefits derived from these programs are obvious, but perhaps they're not obvious to a lot of people. First of all, we need a positive public image in industry. Industry has long been a whipping boy, in many cases for Congress, and in many cases for the media, and we have got to establish a positive public image and prove that we are good citizens in the community. We believe this also enhances employee productivity, the organization climate, and team spirit.

There are a couple of initiatives that we are now implementing. We've put in a new performance appraisal system corporate wide. A specific component will appraise performance in the area of equal employment opportunity. Of course, that's what I call directive therapy. We've implemented a new employee survey to improve our human resource efforts. We continue to seek to increase representation of qualified women and minorities, not only in corporate management positions, but on the Board of Directors.



Jay P. Cooper

We also have a number of supplier programs that value diversity. First of all, we developed a theme. We called it "Building a World-Class Team." That's in the best tradition of total quality. Minority and women-owned businesses are key players on that team, and we know that a world-class team needs world-class suppliers.

As a result of that, we started out by implementing a corporate policy directive. We call it our "Minority Business Initiative." The objectives are four fold. First of all, to comply with statutory requirements. Secondly, we are responding to the Aerospace Industry Association resolution on dealing with diversity. Number three is we want to bring minority business fully into the economic mainstream, and we are training our personnel to deal with and value diversity.

What's our policy response to our minority business initiative? First of all, we involved executive management from the top down. Our CEO believes in the minority business initiative, he's very familiar with it, and he has directed us to carry it out. We have set internal goals for awards to small disadvantaged business or minority business at all sites and divisions. We have developed minority business set-aside programs, wherever we are not meeting our objectives.

We are implementing a minority business technical assistance program, and it's been very effective. We're developing a mentor/protegee project, and

that's a very complicated Department of Defense initiative that's currently being implemented. Basically, large business will be mentoring small minority business. And our first one, incidentally, will be on the reservation at Fort Burthold with a Native-American-owned company.

What's our ultimate objective? To develop capable, qualified, competitive minority suppliers and women-owned business and maintain them in the supplier base as capable, qualified, competitive suppliers. It's not enough just to bring suppliers into the supplier base. In a total quality environment, you have to nurture them. You have to set up programs that are working with your ongoing supplier base to make sure they are performing and to make sure they are working and melding with your objectives.

We, in my view, are at a crucial defining point in our nation's economic development. As a nation, we badly need the infusion of creative vitality, the enthusiasm, the energy, and the innovations that all of these diverse groups bring to our collective work effort and our society.

Diversity is a challenge. It's an opportunity, not a problem. Our prime mission for the next decade and beyond for all of us is to prove that diversity does work. Then, and only then, can we assure our nation's survival as a positive, viable, and growing economic and political force in a rapidly changing world.

7.0 Continuous Process Improvement - Success Stories

Success stories with demonstrated results are provided highlighting specific techniques in process analysis, measurement, and partnering. Individual panels will focus on products, services, and administrative processes.

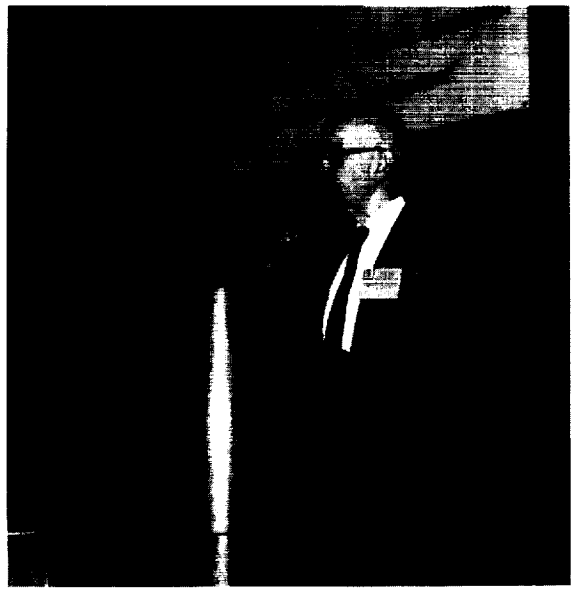
7.1 Continuous Process Improvement (CPI) Success Stories — Products.

Successful managers will describe the CPI methods employed to develop hardware and software products which brought dramatic improvements in quality and productivity.

7.1.1 Introduction

Marshall W. Novick, Vice President and Director-Quality, TRW Space and Technology Group, Space and Defense Sector, Chairman

Everyone here has a vital interest in TQM. What we're going to do today is cover success stories. The people that you'll be hearing from are those who have been into TQM for quite some time. Some are well renowned in the industry for the pioneering efforts and nothing succeeds like success.



Marshall W. Novick

7.1.2 Manned Space Flight Software Engineering TQM Process and Results

Gregory S. Trachta, Program Director, STSOC Program, Space Systems Division, Unisys Defense Systems, Inc.

I'd like to talk about the TQM process that we've been pursuing at Unysis on the STSOC Contract for about six years. We're part of a team which performs the ground operations functions at the Johnson Space Center for the Space Shuttle.

Our function on this team is to provide the software support for the ground-based systems that support Shuttle operations. This is a big job. This software runs into tens of millions of lines of code. There are a lot of different environments involved, a lot of different disciplines. We are receiving requirements in the form of discrepancy reports and change requirements for reconfiguring the software for each mission.

We like to look at this software engineering machine of ours like it is an engine. In the engine the kinds of things that we're interested in knowing are the minimal throttle setting — how much resource it takes to keep that engine going. We're also interested in flow gauge kinds of things. How is the work

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flowing through that engine? How fast is it coming in? How fast is it going out? And we're interested in dwell time kinds of measurements. How long do things stay in that machine before they come out?

Our continuous implementation policy is really based on three goals: operational excellence, doing things right; the idea of management engagement, that is, management's job is to make sure we're doing the right things; and customer engagement, making sure that we're in a partnership with our customers as we implement these continuous improvements. Those goals turn into strategic plans and plans of action, which then get deployed into the organization at all organizational levels. And we try to measure our progress in terms of how we're heading toward that long-term vision.

We have a conceptual model that helps us understand what we're doing. All of us in the organization are individuals, and we have an individual operational responsibility, but we all also have a management responsibility. The operational/individual responsibility we all have is to make sure we're doing things right. The management responsibility is to make sure that we're doing the right things. We try to establish our metrics so that they give us information about these two environments and about how we're doing in these two basic roles.

We're interested in work flow, understanding how things are flowing through our software engine. We're interested in productivity, that is to say the resource-to-work-item ratio. We're interested in the quality of the process, integrity of the process, the quality of the products, and team building.

A fundamental tool that we use and establish in our metrics is the Oregon Matrix. If you think of our process as an engine, the Oregon Matrix is an instrument hung on it to measure the performance of that engine. This is a tool that we use to calibrate those measurements and understand what's good and what's bad. The fundamental idea of the Oregon Matrix is that it gives you a real quick-look display to see how that engine is performing.

Now I'm going to give you examples of some of the kinds of measurements that we put into that Oregon Matrix. Remember that flow is very important to us so we keep track of how things are flowing through that machine in terms of the ratio of closure to openings. If we get discrepancy reports, are we closing them faster than we're opening them? And that's what this ratio is intended to show. If it's above one, we're doing good and if it's below one, work is accumulating on us. Recently, we've been closing them a lot faster than we get them.

Gregory S. Trachta

We also keep track of work item backlogs. Work flowing through the machine cannot be allowed to accumulate to too great an extent, so we're very interested in keeping those backlogs low, in particular, the high priority discrepancy reports.

We also watch resources very closely. We watch how we're allocating resources. We measure how many resources we allocate to change requests, discrepancy reports, and the test and release process which actually puts software into the operational baseline. When change requests go up, as they have in recent months, we increase resources to accommodate that.

Our results show that the backlogs for discrepancy reports and change requirements have dropped dramatically. We watch what we call the pipeline length in terms of flow rate. We measure what's in the pipeline right now and, at current closure rates, how long would it take to work that off. And we compare that to the average age of the work in pipeline. And if the length of the pipeline is shorter than the average age in the pipeline, that tells us that the flow rate is accelerating. And it is accelerating for both the discrepancy reports and the change requirements, and accelerating pretty dramatically.

Other gut-level issues have to do with problems with the software. Discrepancy reports per million lines of code have come down dramatically over the life of the contract. Another thing we look at is the amount of software that we're maintaining in terms of executable lines of code, and we look at the number of people that we have maintaining that software. So

we are looking at the difference between the growth in work and the growth in the people. There is a dramatic delta, an accelerating delta, growing between those two which is basically the productivity factor — that's the measure of how much additional work we are able to do with our people.

Where does all that leave us? Well, it leaves us running that never-ending marathon. We're headed toward the direction of doing more of the same. We believe that this TQM model gives us a good intellectual and conceptual basis for understanding what we're trying to do and how we need to go about deploying the resources to do it. We're certainly reaching a new level of maturity in our ability to develop goals and deploy those goals efficiently into the organization.

7.1.3 Supplier Partnership in TQM

Halbert M. Harris, Vice President and Chief Engineer, Development and Manufacturing, Xerox Corporation

In 1990, Xerox total revenue was about 18 billion dollars, with over 100,000 employees worldwide. We currently manufacture products at 11 sites located in North and South America, Europe, and the far East. This can present quite a challenge to ourselves and our suppliers, especially when dealing with different currencies, customs, logistics channels, national integration, and balance-of-trade requirements.

Xerox is a relatively young company. In 1959, we introduced the 914 which was called the most successful business product ever introduced. Following the introduction of the 914, Xerox had very rapid growth. We were the fastest company to reach one billion dollars revenue.

We were technology driven. We could sell all we could produce. We had little competition. Then, the competition arrived in the early 1970's. We no longer had the market to ourselves. Competition came chiefly from Japan. Our answer to this competitive challenge was to build volume and start at the low end, move up market.

Still, we began to lose market share. In 1979, we started benchmarking our competition. We found we weren't competitive in many ways. We found there was not just a five or ten percent difference; we were substantially off the benchmark. One study showed that the Xerox unit manufacturing cost was approximately equal to what the Japanese were selling their products for here. We went through that period of denial, anger, grief. And we did rebenchmarking. Unfortunately, that confirmed that there was a substantial gap.

Xerox spends approximately $3.3 billion annually on material. About half of this spending is for nonproduction material — supplies, services, and

Halbert M. Harris

transportation. Our purchase material represent 70-80% of our unit manufacturing cost. So you can see that suppliers are key members of the Xerox team.

In the 1960's and 1970's, Xerox operated as a classical functional operation — a matrix organization. We operated material management as a procurement organization. They had no involvement in source and decisions until just prior to production. We competitively bid our requirements to a supplier base of thousands, and the low bidders got the order. This technique certainly did not foster that cooperative relationship essential to TQM, and it proved very costly to us.

Our senior management acknowledged that we had a tremendous problem, and that we needed to get on with fixing the business. But how? Our answer was a corporate-wide change agenda — Leadership Through Quality. Leadership Through Quality has three objectives: to instill quality as the basic business principle in Xerox and to ensure that

quality improvement becomes the job of every Xerox person; to ensure that Xerox people, individually and collectively, provide our external and internal customers with innovative products and services that fully satisfy their requirements; and to establish work processees that enable all Xerox people to continuously pursue quality improvement in meeting the customer requirements.

In 1982, we reorganized our whole product delivery system into product delivery teams, and we developed a material management approach. We began material management involvement in the earlier design phases. We chose the supplier early and had them contribute to the design. We call this early supplier commitment. We cut our supplier base from 5,000 to just around 300. We provided each of these with training, a full day for general management type training, and two-and-a-half days of statistical quality control aimed at the production manager and the quality control manager. We did that at our cost because we understood and believed that this was fundamental to the partnership.

We also instituted commodity management, small cross-functional teams organized around seven commodity groups. We implemented the manufacture-and-resource team concept. That is, the direct assignment and co-location of a manufacturing team with each program to support concurrent and simultaneous engineering. Our vision for the 1990's is that materials management will provide a global supplier base that embraces the concepts of total quality and continuous improvement to provide benchmark components, products, and services that fully satisfy customer requirements and maximize corporate return. Because of our global nature, we must provide the capability to manufacture in the markets we serve. We must focus on the total supply chain, from supplier to customer, to minimize our inventory and maximize our flexibility to respond to customer needs.

Our sourcing strategies must allow us to source in the region we build; we call this Balanced Worldwide Sourcing. We will focus on the total acquisition cost rather than the direct material cost. For example, duty insurance for pipeline considerations will be used to determine the lowest total cost. Implementing Total Quality Management to meet customer requirements will continue to be our primary theme.

Our quality assurance approach has changed dramatically over the past 10 years through the evolution from part-and-lot inspection to part certification. We've made significant improvement in quality, yield, and major reductions in our own internal manpower. The key initiative for the 1990's is certifying our suppliers for their Total Quality Management system and to virtually extend our leadership through quality philosophy to our supplier partners.

Here we see that the demonstrated results of the implementation of process qualification and part certification are very convincing. As we increased certified parts, supplier parts per million rejections dropped from 12,000 in 1984 to less than 3,000 in 1990, contributing to our internal plant parts per million moving from 1,300 in 1984 to 361 in 1988 and down to 284 last year. We're currently achieving over 90% of process qualification on parts and our product launch.

As you know, a benefit of part certification is the reduction in number of people that are needed to inspect them internally. Here we made more than a factor-of-four reduction in our internal inspection. There are additional savings that have been realized from the initiative. Shipping and handling has moved from about 30% of our lots-direct-to-stock in 1981 to over 95% by 1988. Inventory and supplier scrap costs are substantially down. We calculate that these two categories alone represent a cost-of-quality savings of over $25 million annually. And, of course, factory automation is enabled.

To support early supplier commitment, a key strategy that we adapted in the middle 1980's was that of competitive costing. Our component commodity teams established worldwide cost benchmarks which they shared with our supplier base. Then, we encouraged and helped the suppliers to do their own benchmarking. With the additional knowledge learned through benchmarking, we could effectively target the cost of a part and work with a supplier to improve the design and their processing to move toward that benchmark. Emphasis has been on cost reduction by operations and improvements, not by eliminating profit margins.

To further improve our suppliers/partners performance, we knew we had to instill the Xerox quality principles with the suppliers' management. So we began to teach them the techniques of leadership through quality management behavior, quality principles, competitive benchmarking, cost of quality, customer relations, problem solving process, and quality tools. To foster this partnership, we defined the characteristics of a model supplier, and of course, with their help, we defined a model customer.

As our suppliers adopt total quality, we're able to move from part certification to supplier certification. This will give Xerox confidence that our suppliers' quality systems and performance and total quality

philosophy meet our joint business needs for the 1990's.

To date, supplier part quality has improved by two orders of magnitude over this period. Assembled product quality has improved by more than 10 times. We've reduced our inventory from almost 100 days of supply to under 30 days. Our component lead time has been worked down from 39 weeks to 8 weeks, that's our reorder lead time. Material overhead is reduced from 9% to 3%. We're still short of the benchmark objectives, but we're well on the way.

Now let's look at some customer-related measures. Our customers have told us that there are three things that are critical to their satisfaction with our products; copy quality, good clean and sharp copies; reliability — does the machine work when you need it; productivity — does the machine duplex, staple, etc., so that the operators' productivity is increased.

By all benchmarks, our customer satisfaction is not only improving, but the focus on quality has moved us into a leadership position in the critical area of product reliability. And, of course, the bottom line, satisfaction of our customers with Xerox products, has dramatically improved and continues to do so. An important element of this improvement has been our partnership with our suppliers and their enthusiastic adaptation of Total Quality Management.

7.1.4 Improving Quality Training Effectiveness

Larry D. Lambert, Senior Vice President, Center Services, American Productivity and Quality Center

What I want to talk about is how a training and education environment enhances Total Quality Management. In order to implement TQM, the people who manage various aspects of your business have to change the way that they do the things. That requires some new training, some new skills that they may or may not have.

In order to do that, we've got to change to a customer-driven education philosophy. The customers are the ones who should drive the development, the content, the length, and the topics. We've got to get away from the old education and training philosophy that you can have any training course as long as it comes in an orange notebook. We've got to start looking at training which meets the unique needs of that individual and that organization at that specific point in time.

Doing TQM requires a number of things. First of all, it requires an awareness that you need to change the way that you do things, and involved in that is some awareness training that must be developed for that organization. You can't take an off-the-shelf education program on total quality and say this is now yours. It won't fit every organization. There are some generic skills, of course, that are important. But the organization has unique words, acronyms, symbols, people, departments, concepts that must be incorporated. So as you're looking at education, you have to look at it from a quality education concept. Training must support the critical business issues that the organization has developed.

You must start at the very top. When you're defining your critical business issues, you then go into a strategic business planning session where you decide what actions will move your business forward. Then you design the training to support that. In short, make sure you provide the right training to the right people at the right time.

The other part of effective training and education is that you don't give employees 12 years of education, then expect them to remember it for the next 10 years before they put it to use. You provide them with the skills and knowledge as they need them. Therefore, as you provide it to them, they use it in the workplace. They learn it, they apply it, and they can transfer it to the person next to them.

An essential factor in education curriculum design is to find out what your people know already. You then look at what kind of a strategy you are going to employ in your organization to take the skills and knowledge that you need and push it throughout the organization. Are you going to go out and buy training? Are you going to develop it internally? Are you going to use an external resource to help develop it? Who's going to deliver it? How many times? If it's going to be an external source, that's O.K. If it's going to be internal, how do they get trained? What's the methodology for training internal people to deliver quality education throughout the organization?

When you design training, there are some very key elements that you must take into account. And I go back to three measurements that were used very widely at Motorola — cost, quality, and cycle time. If I can't measure those three in the design of training, then I'm not doing it right. I must be able to reduce

my design cycle time for training. Because if I've got to deliver it at the right time in order to be effective, than I have to have a much shorter lead time.

Let's design the training, the process, and the methodology all at the same time. All too frequently when we design something, I do a sketch, I put out a circulation list, and I send it out to the world, and everybody does their revue in serial. Why not do it in parallel in the same room at the same time? Then we can get all of the ideas from the organization at the same time. Wouldn't it be nice if most of the people in the organization understood what other people did so they could help each other? That's a part of this design process — getting them in the room so they can then find out what other people do while we're designing this. So you look at the development and the revue in parallel with each other. That reduces your cycle time.

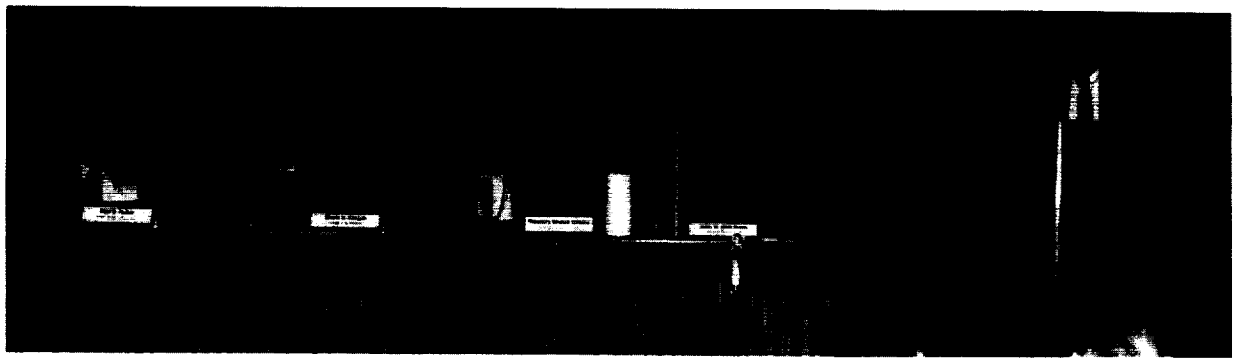
What about quality? How many of you have divisions and every division does its own thing when it comes to training? And everybody's got a little bit different focus, a little bit different twist. Some of them even have a totally different program. What about looking at a consistent message that gets delivered throughout the organization? If you're trying to get people to march to the same beat and to work in the same direction, why not deliver training in that way? So develop materials that will give a consistent message.

If you look at an overall design system that allows you the flexibility to modify that design within your various divisions, you can reduce cycle time in the development of training anywhere from 20-50%. It starts at about 20% because in the design of training, a lot of the time that's spent in the review and the development is queuing time. It's waiting time. It's waiting for somebody to make their input. It's waiting for somebody to print out a copy so I can review it. So by simply reducing a lot of the queuing time, you can immediately get rid of about 20% of the cycle time of the development. I've seen examples where it takes 20-80% of development time to produce one hour of training. If you can't get it down around 10 to one, then we're doing something wrong. We're doing things in serial instead of in parallel.

Please, please, please do not do training unless it supports the specific needs of the business. Otherwise, all you're doing is wasting your money.

7.2 Continuous Process Improvement in Providing Services

A broad spectrum of service-oriented organizations will share their success stories. Particular emphasis will be placed on their process analysis, continually improved services, and measurement techniques used to quantify their successes.



Panel E2 - Continuous Process Improvement in Providing Services (from left to right): Paul E. Huber, Technical Operations Manager, Space Dynamics Laboratory, Utah State University; Sheila H. Keegan, Manager, Logistics and Administrative Support Services, Quad S Company; Rosemary Windsor-Williams, Southwest Regional Customer Service Manager, United Parcel Service; Dr. John W. (Bill) Davis, Vice President and General Manager, Service Contracts Division - AEDC Operations, Calspan Corporation; (not pictured: Kenneth C. Hendershot, General Manager, Ames Operations, Service Contracts Division, Calspan Corporation)

7.2.1 Introduction

*Dr. John W. (Bill) Davis, Vice President and General Manager, Service Contracts Division - AEDC Operations, Calspan Corporation, **Chairman***

I'm working at the Arnold Engineering Development Center in Tulahoma, Tennessee. There, we are involved in the testing and evaluation of the various flight vehicles, space vehicles, most anything that flies will be tested and evaluated at one time or another at Arnold.

We have a major test facility, some 53 test units. Replacement cost is over a $1 billion. We have approximately 3500 employees spread over three contractor organizations and an Air Force organization. We use about $24 million a year in electric power. Our labor costs are in excess of $100 million. You could imagine that in such an environment there is ample room for continuous process improvement.

There are several other companies working at Arnold. We all are organized under TQM programs. We have a TQM council that is chaired by the commander of the base and each of the companies also has their own council. We have established good lines of communication.

We apply the same principles that we're going to hear about today, customer satisfaction, team work, and empowerment of the workers. In our first year of operation of a program, we saved our customers more than $7 million over the average cost that had existed through the four years prior to that.

7.2.2 The Internal/External Quality Connection

Rosemary Windsor-Williams, Southwest Regional Customer Service Manager, United Parcel Service

Your interest in our views on quality is a great compliment to our organization. And I will do my best to convey to you the essence of our formula for achieving quality in the service we provide, and something even more elusive, the ability to objectively measure it.

I don't have to tell this audience that quality is not

something that just automatically happens. It's the result of the process that involves everyone in an organization. Another key element of the total quality process is the ability to measure your results. We have found a number of elements in this process that work for our company.

UPS is a service company. We manufacture no product. So perhaps our experiences will be different than many of yours here today. However, we believe that the secret to providing a quality service or product rests internally with your people. Focus on your internal customers, your employees, and your external customers will truly benefit.

It may sound pretty simple but in reality it's not. Behind our basic ideas are a multitude of studies and surveys, policies and procedures, techniques and traditions, that have evolved at UPS over the past 84 years. All are based on the common-sense notion that the best way to keep our customers satisfied is to keep our employees involved and also satisfied.

UPS has a reputation for efficiency. Some people have called it an obsession. We measure everything that we do, and we are always looking for ways to improve those measurements. We apply as much attention to detail measuring the satisfaction of our internal clients, our employees, as we devote to measuring the level of customer service satisfaction.

At UPS we give our employees the very best tools which we can find. It begins on the day that the prospective employee is called in for his or her initial job interview with United Parcel Service. We go to great lengths during the very first meeting with the job candidates to describe in detail what they can expect from UPS and what the company in turn will expect from them.

Candidates know from the very start not just what the hours, wages, and the benefits will be, but also something of the company's values and traditions. As a result, the turnover rate among our full-time employees at UPS is less than 4%.

This is where Total Quality Management begins in a service organization. Getting good people into any organization is important, but keeping them involved in the company's mission is another story. UPS has two policies that help motivate our employees to do just that.

The first is our policy of promoting from within. UPS offers a person more than a job. We actually offer them a career. Our people know that if they demonstrate the desire and the ability to get ahead, nothing can stop them at UPS. When a new position opens up we look first to our employees to fill it. As a matter of fact, all of our members of our present management committee either started out in hourly positions or as front-line supervisors.

The other important policy is management ownership. We like to say our company is owned by its managers and managed by its owners. This policy gives our employees something to aspire to and it breeds intense loyalty.

We also strive to keep our employees motivated through constant training that reinforces values and pride in our company, and in themselves. All new employees participate in a 22-day period of intensive, one-on-one training by the new employee's immediate supervisor. This is graduated, results-oriented training in which the employee's performance is steadily raised until it reaches actual job requirements.

Equally important is the training of our management team. UPS managers attend numerous workshops and schools designed to help them work effectively with subordinates, and to provide them with encouragement and recognition. They learn how to effectively measure an employee's performance and assist the employee in achieving a high level of efficiency and job satisfaction.

Many companies would probably be content with programs that enable them to hire and retain good employees. At UPS we strive to involve our people totally in our business. The key to total involvement is good communications within the company. We have several programs that go beyond the traditional channels of communications found in most corporations.

One of these programs we call the Talk, Listen, and Act program. Once a year, UPS-ers meet privately with their manager or their supervisor. This is a time for employees to express their concerns, offer suggestions, and question matters affecting them and their work. It's not a time to discuss individual performance. It's an unhurried opportunity away from the hustle and bustle of the daily job for the employee and the supervisor to really get to know each other.

The employee does most of the talking. The manager listens, records the employee's concerns, and then commits in writing to follow up on each. This allows us to hold our people accountable and gives us the ability to measure the results of this critical quality program. Last year, more than 147,000 of these one-on-one meetings were held with our people.

The companion to our Talk, Listen, and Act is our job review discussion, also an annual one-on-one meeting between the employee and manager. In this

case, however, it is the manager who does most of the talking, letting the employee know how well he or she is performing on their job. The employee is given credit for what he or she has been doing, accomplishments are recognized and improvements are reinforced. The manager points out areas where further improvement is needed and together the manager and the employee devise a schedule to meet those goals.

A third direct communication program is our OJS or on-job supervision. On a scheduled basis the employee and manager spend time together, and that's usually the entire day while on the job. It allows the manager and the employee to work together on problems or procedures that affect job performance.

Other UPS communications programs address employees as a group. One of these forums is a PCM or pre-work communications meeting. Each morning or evening before the work shift begins supervisors spend three minutes with their employees telling them about new services, the competition, safety and anything else that might affect them or help them to do their job better. This three minutes represents an enormous amount of time. If you take it, it's three minutes a day spent by a quarter million people and it adds up to about 3 million hours a year.

So the primary question is, are the people we serve better off because the people we employ are satisfied in their work? We think that the answer is, yes. We routinely conduct internal measurements of service to ensure that we are meeting our customer expectations. For example, we measure the service performed on every package every day. Since we deliver 11 million packages a day and pick up the same amount, it's certainly a massive task. When we fail, which is fortunately not too often, we know about it and we know why on every package. Was it picked up properly? Was it sorted properly? Delivered properly? Recorded properly? And if not, we know it.

On-time delivery is a critical service measurement in our business. We constantly audit our performance, particularly in our air services. Our most recent results show that we are 99.9% effective for our next-day air deliveries and 99% on our second-day.

There are other areas of our business which are 99% effective, but even 99.9%, is not good enough. Sorting packages is an example. It is critical to our operation. However, if we accepted a 99% industry standard, nearly 110,000 packages a day would be mis-sorted or delayed. Therefore, the UPS standard is 99.96%. You cannot expect this kind of quality without qualified, motivated people with the controls in place to measure their performance.

At UPS, we work to satisfy our employees because they are essential to the overall success of our company. Because the people of UPS are personally involved in every aspect of the business, our customers are afforded the highest possible level of service, respect, and gratitude. That's why our company keeps growing and we keep prospering. We have built our business on a rock-solid foundation that enables us to continually expand our offerings, embrace new technologies, open new markets all over the world, and help lead the United States into the era of global competitiveness.

7.2.3 Teaching Our Elephant To Dance

***Sheila H. Keegan**, Manager, Logistics and Administrative Support Services, Quad S Company*

As Dr. James Balasco in his book, *Teaching the Elephant to Dance, A Manager's Guide to Empowering Change*, says about organizations, they are like elephants; they learn through conditioning and they are very slow to change.

The Quad S Company, like UPS, is a service organization. We are the prime contractor for the logistics and the administrative support services provided to the Ames Research Center and we do a variety of activities: supply transportation, equipment management, mail services, word processing, quick copy, manuscript preparation, human resources, graphics library, audiovisual, teacher resource, and tours.

To give you a little bit of background, when we took over the support services contract in August of 1988, we started with three goals which Ames gave us as contractual guidance. First, to promote productivity improvement; second, to enhance quality of service; and third, to improve customer satisfaction. These goals comprise our base line, and we periodically review to make sure we are progressing.

Contract evaluation guidelines were also established. The first was that we had to provide cash awards to reward productivity improvements. This has provided tremendous incentive that would not have been possible otherwise. Secondly, we had to

submit improvements which originated in our work force to the NASA Performance Evaluation Board as specific productivity initiatives. These SPI's, as we call them, were to be evaluated by the board, and a value established. And third, NASA approval was required before changes recommended by initiatives were implemented.

We faced a number of challenges in getting our program started. First of all, we were a new contractor with no productivity program in place. Secondly, our contract consolidated services which were previously provided by four separate companies. This brought together diverse functional areas as well as diverse work force cultures, including two unions.

We have a full-time person dedicated to coordinating productivity program efforts. This is an important factor in the success of our program. Without dedicated support, given the many operational priorities that the functional areas managers must balance, coordinating all of the activities involved in first developing and then maintaining a successful quality-improvement effort would be much more difficult.

We started with four elements at the beginning of the program: the Performance Objectives Matrix; quality teams; an employee-suggestion program; and the specific productivity initiatives. The performance objectives matrix, or POM, which was developed by the University of Oregon Productivity Center, was our measurement tool. Implementation of the matrix in the logistics supply department helped bring about productivity gains in an area which had been targeted by NASA for improvement.

Quality teams were started in numerous areas to provide formal training for both leaders and members in order to more effectively meet our goals. Employee suggestions which had been heavy at first, decreased when timely follow-up did not occur and resulted in some loss of credibility in this part of the program. The SPI's provided the vehicle to submit productivity improvements to our contract performance evaluation board.

During the first year-and-a-half, limited numbers of SPI's were submitted which obviously resulted in limited awards. We recognized, however, that the basic design of the program was solid. During this same period of time, NASA was embracing the Total Quality Management concept. So we made a commitment to integrate the individual elements of our program under one umbrella using the total quality philosophy.

We formed a management steering committee to provide an environment which encouraged innovation throughout the work force and supported full participation. The 10 members of the steering committee included all our prime and subcontract managers. We all have a high degree of commitment to the program and to creating a climate where everyone participates in the process and quality shows in attitude and the way the tasks are performed.

This required a cultural change from the traditional approach where managers control, to one where everyone is empowered to contribute. Our productivity manager can only be a coordinator and a facilitator for that change. The functional area managers must support and encourage this effort on a daily basis.

In the fall of 1990, the committee developed a mission statement, as well as goals and objectives. We also established policies and procedures for all four parts of the program. A booklet containing this information was distributed to all members of the work force. We also made the decision to use the word "associate" rather than "employee" when referring to our personnel.

As far as results go, initially, the rework rate was running as high as 15%. Within 12 months, our associates met their goal of a 0% rework rate. Now that the suggestion program has been improved, our associates, both as individuals and as teams, again submit good ideas. Suggestions with cost savings of less than $5,000 are evaluated by a suggestion award board, while those with greater savings are developed directly into SPI's. To this point in time, we have had about 62 suggestions submitted, 36 of which have been adopted, with a cost savings to NASA of $57,000. Cost savings and service improvements have occurred in all of the functional areas. And to date the value of those savings to NASA in both costs and time saved is approximately $800,000.

A major effort undertaken to educate associates on how to submit their improvements as an SPI resulted in a significant increase in the number submitted. In the last six-month period alone we saw an increase of 136% in SPI's.

The work force takes justifiable pride in their achievements, and the program has come a long way. We recognize that TQM is a long-term commitment, and that by encouraging continuous improvement, by providing associates with training geared to benefit them for the long term, and by expanding team participation with our NASA partners, we look forward to sustaining our momentum.

7.2.4 Technical Services Modernization: Concept to Implementation Made Easy Through a University Setting

Paul E. Huber, Technical Operations Manager, Space Dynamics Laboratory, Utah State University

The Space Dynamics Laboratory officially began in 1959 as an atmospheric research, infrared sensor development lab at the Utah State University. In 1982, the upper air research lab at the University of Utah at Salt Lake City, which had developed the sensor that was used in post-WWII V-2 rocket research, merged with SDL at Utah State. Today SDL is an independent research lab. It is a wholly-owned entity of Utah State University.

We develop from concept to flight, precision instruments that gather scientific information from the earth's atmosphere and record this information for future analysis. We also provide calibration services and other data analysis.

The lab has three functional divisions and employs about 325 people. This includes 130 students and 25 engineering and physics professors on a shared-time arrangement with the University.

The academic involvement, inherent in the association with the university environment, has been an important factor in the lab's innovative success in the aerospace community. Not only does the University provide a resource for scientific and technical expertise and management, but it has created an environment for free exchange of ideas and opinions about technology and lab management.

An example of the synergy which results from this environment can be seen in the design and fabrication process, an important part of our atmospheric instrument development operation. About six years ago, design and fabrication started with a designer working with the drafter or detailer using a drawing board, pencils, erasers, T-squares, parallel rulers, compasses, french curves, and scales ... all those really fun things which are really not very efficient or precise. Completed drawings were then carried over to the machine shop where the machinist would fabricate the part using the drawing as the reference.

Then computer-aided design software systems came along and revolutionized the design community. Now, designing was done with a computer with its capability of electronic storage and archiving, correcting, printing or plotting and drawing with previously-unobtainable precision. With such accurate and precise drawings available, it soon became apparent that the old manual machines were a limitation in the precision fabrication process.

We then acquired numerically-controlled, computerized milling machines that enabled the designer to directly input the drawing into the milling machine computer, and, with some detailing, complete the machining process by computer. That still required the drawing to be stored on the floppy disk and then carried along with the drawing to the machine shop.

One of our mechanical design and analysis engineers then suggested that we continue this process improvement to include solid-modeling software and computer local area networks. Our machine shop is in a separate building about 500 yards away from the designers' building so a computer network would really be a time-saver.

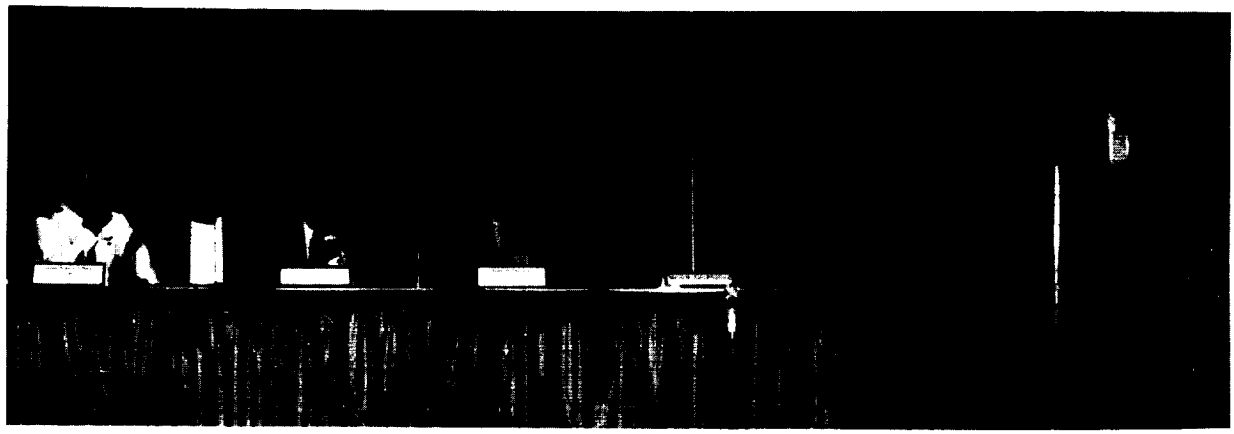
Is this the newest way? Most likely not. Probably newer is a better adjective. We think this evolution in process technology at SDL was possible because at SDL we really believe in the team concept. It is very important in our laboratory that the team concept be real. The entire lab is made up of teams and subteams where people work and talk together, including supervisors, program engineers, managers, and directors at all levels.

Once on a team, we feel that it is vital that we remain associated as a team with the program until the project flies and the program is complete. We realize that at a production lab this would be impossible. But at a research lab like ours, it is vital. Then you get a very real and important pride of ownership feeling among the members of the team.

This participative aspect of management teamwork is certainly not unique at the Space Dynamics Laboratory. But being associated with a university has helped to emphasize it. Traditionally, teamwork has always been a part of university research. We've found that using a TQM approach can indeed increase efficiency, productivity, pride, and morale. Being part of a university has stimulated all parties toward the benefits of continuing process improvement through Total Quality Management.

7.3 Continuously Improving Administrative Processes.

This panel highlights specific techniques in process analysis, measurement, and partnering in internal administrative and staff support functions.



Panel E3 - Continuously Improving Administrative Processes (from left to right): Colonel Robert J. Hager, USAF, Director, Programs and Productivity, Air Force Logistics Command; Odail Thorns, Jr., Director of Quality Network and Synchronous Organization, Automotive Components Group, General Motors Corporation; Allen R. Dressler, Quality Assurance Supervisor, 3M Environmental Engineering and Pollution Control; Spence (Sam) Armstrong, Associate Administrator for Human Resources and Education, NASA Headquarters; (not pictured: Thomas O. Maijala, Manager, Quality Services, Corporate Quality Services, 3M Company.

7.3.1 Introduction

Lieutenant General Spence M. (Sam) Armstrong, USAF (Ret.), Associate Administrator for Human Resources and Education, NASA Headquarters, Chairman

I'm an advocate of Total Quality Management. My own definition for TQM (and everybody's entitled to have one as long as it's within certain bounds) is it's a philosophy that enables an organization to improve from where it is today, to where it would like to be.

What's the difference between Total Quality Management and all the other things that have come along: management by objectives, quality circles, and all these other things? Many people, when they hear about TQM treat it like broccoli, something that has been forced down their throat, but they swear they will never develop a taste for, even though intellectually they know that it's good for them.

A couple years ago when I was thinking about how to explain Total Quality Management, the thing that really sets it apart in my mind is the fact that you've got to start with a vision, something that's out there far enough that you can't reach it on your watch but that's where you'd like to go.

Well, if the vision is out there, then the next thing on the decreasing-time scale is an objective, and that's something that you can reach within your tour-of-duty. You can assign somebody to do it, you can measure it, progress towards it, and so forth. And then, of course, there's the task, and that's the thing you do on a continual basis.

What are we doing in NASA Headquarters? Code F, that's what we call it. It stands for friendly, full-service human resources. We're in the process of helping the whole NASA community in terms of personnel training and education in developing the visions that we need to support the NASA vision. A vision is something you can't issue to people. It has to be developed by the people who are going to carry it out. Our job in Headquarters is to facilitate that. TQM is a long, arduous process, and we've all got to work at it if we're going to make things happen.

7.3.2 3M Total Quality Environmental Management System

Allen R. Dressler, Quality Assurance Supervisor, 3M Environmental Engineering and Pollution Control

I'd like to tell you a little bit about the 3M process and how we've developed and incorporated the Malcolm Baldrige criteria in developing our total quality environmental management programs.

I'd like to just briefly give you some 3M facts so you can help understand what the 3M Company and the environmental management program is up against in this marathon. We have world-wide sales of $13 billion. And just recently we reached $10 billion and we got a free day off. The whole company got a free day off. So we're real anxious to get to $20 billion to get two days off.

Our R&D expenditures are about 7% of the total budget. We have roughly 90,000 employees. In terms of the Fortune 500 ranking, we're 32 in sales and 16 in net income. We have some 60,000 products. We have about 50 product divisions. Internationally, we're situated in 53 countries. Total, we have about maybe 250-to-350 facilities that we're responsible for. At least 25% of our sales come from new products.

Any quality management program worth its salt has to have top management support. 3M has developed and adopted the Malcolm Baldrige criteria as their own to ensure that we have quality processes throughout 3M. This is an attitude that our CEO has, and really, it's an attitude in terms of winning customers, not so much in winning awards.

Our procedure in this whole process has been that each of the 50 divisions are responsible for conducting a self-assessment, an audit if you will. The self-assessment also includes gap analysis, that is, put gaps into a priority, empower teams to close the gaps, measure and report these results, to recognize good, and reward people who participate, and then the continuous improvement process. That is our procedure.

In the environmental area, our division is the Environmental Engineering and Pollution Control. Our main mission is to protect the corporation in terms of environmental issues. In 1975 we wrote a policy which was based essentially on what we know as TQM principles today. Basically, we initiated TQM principles simply to resolve our own environmental problems, to prevent pollution at its source, over fifteen years ago.

Since 1975 we've had something like $500 million in savings from this program. We are determined to develop safe products, green products, if you would, conserve natural resources, assure that all of our facilities are in compliance with the regulatory requirements and corporate guidelines, and assist governmental agencies wherever possible.

In 1980, we developed the policy to phase out PCBs. In 1981 we developed an air-emission-reduction program, and a corporate safety and health committee was formed in 1988 in an effort to ban CFCs.

Also, along the way, companies have recognized 3M as a leader in benchmarking. We've had some visitors through the years and months. These are people who have come in to visit and benchmark some of our various programs.

So the real effort for our group has been trying to understand all of the various federal, state, and local regulations and stay in compliance, stay in step with those regulations, and in some cases go beyond the regulations to protect the corporation. Along the way we developed a continuous improvement plan, and this has been our model to keep things on track.

To wrap up, environmental issues are everywhere. I think that one of the areas that is becoming very big is this idea about sustainable development, meeting the needs of the present without compromising the ability of future generations to meet their own needs. That is a real balancing act and the only way we can handle it effectively is through our continuous improvement process.

7.3.3 Quality Management in an Office Environment

Odail Thorn, Jr., Director of Quality Network and Synchronous Organization, Automotive Components Group, General Motors Corporation

The Delco-Remy Product Division has about 14,000 people world-wide and it makes things like batteries, generators, motors, switching systems, basically the electrical equipment that's under the hood of the automobile.

Customers must have products and services which meet their requirements the first time, every time. Why work the quality process in a non-manufacturing environment? After looking at Dr. Deming and the training we had using statistical process control in the plants, the question to me ended up being why not. This whole customer-centered concept, both

internal and external, definitely involved a cultural change in this particular group.

We had what I call a factory-floor mentality. As we looked at the organization, the people in the organization felt that the quality improvement process belonged on the factory floor. It had to do with product. It had essentially nothing to do with us.

So with that particular background, we set out to establish a quality plan which eliminates waste. In our particular case in a non-manufacturing area we implemented the Crosby process. The next thing we put together was a training plan where we identified and developed detailed training modules for every employee in this group — all 155 people.

The first step is management commitment. Management commitment to me goes a lot deeper than giving a 10-minute opening presentation at a training workshop. It means that you are fully trained in the process, and that you participate in the process to the extent of actually teaching a part of the coursework that goes with it. That commitment has to be demonstrated by action. So, we sent all of our leadership to the Crosby quality college.

As a result, we began to implement their program, immediately. We developed several subcommittees, including a measurement subcommittee to help the areas with the details of measurement, a corrective-action(CA) subcommittee, and even a subcommittee to help groups as they get into the corrective action process. When they can't find out what the root causes are and get at the irreversible corrective action, we have a team that goes in, works with them, and helps them.

We have an awareness subcommittee. I can't emphasize enough the importance of having that group because that's the group that tells your story. It keeps it before them. It keeps the publications out there, the video tapes and all of those things, the quality message on the bulletin boards all over the place, and is a very important group.

And then finally, your training group, the educational subcommittee. We put together an employee orientation model. We often take for granted that as a new employee comes in we kind of show them where the office is, where the desk is, where the phones are, the copying machine, the fax machine. But what about a detailed process for orientation which might involve several days of training?

You've got to teach these people about the whole issue of error-free. The leadership has got to talk about being error-free all the time. Then you've got to teach them about being customer responsive. Once you get the idea that that person that you're delivering a service to is your customer, you've got to drive home the point that you've got to be responsive to him and deliver error-free service to him the first time, every time.

Recognition is a very important part of the successful quality-management mix. We recognized employees and teams for practically anything that they did. We threw one team a breakfast. You can give out certificates. You can give out awards. There are a lot of things that you can do that don't cost a lot of money. Plaques don't cost a lot of money. When something big is done by a team, we send out teams along with their spouses to dinner and so forth.

Understanding the customer's requirements. We call this the voice of the customer. We coined an expression, "being knee-to-knee with the customer." Go sit down with them and ask them questions about the services that you deliver. What's that customer telling you? We found we were handling paperwork a certain way. We were handling benefits a certain way. We were handling workmen's compensation a certain way. The customer was not always satisfied. Go to them and talk to them about it. It might hurt your feelings the first time but you're going to be better off for it.

What type of improvements have we measured? Since we implemented quality management, we've cut our budget by 10%. We've cut employees from 155 to 45. We've detailed over 300 processes. Now, when someone is sick, someone else can do their job just by looking at the process document and basically performing most of their work that day without any help. That's the level of detail that we got into.

Crosby says that if you look at a manufacturing area, 20% of sales is in waste. And in a non-manufacturing area, up to 40% of its budget is in waste. So the opportunity is really there.

The big disappointment was that some people didn't realize that the process doesn't end. You send people to workshops, they get a certificate and they put it on the wall and say I've been, and the process is all over. The thing about this process is that it just starts all over again because the focus is on continuous improvement. And it's management's responsibility to see that the process is continuous. As the leader of that organization, I can't cop out and get off that team. As long as I'm there I've got to be there modeling the behavior, developing new costs of non-conformance.

In other words, revisit your processes. Have surveys in every organization that you look at from the customer point-of-view. Validate the customers'

requirements. Go to them saying, "Now, is this indeed what your requirements are," and have him give the stamp of approval and say, "That's what I want from you, and I want it done right the first time, every time."

The process works. It requires an enormous amount of commitment and involvement from the top. I'd say every employee needs a minimum of 30 hours of training to get them ready to move forward with continuous improvement.

7.3.4 Quality Awards — A Guaranteed Formula for Winning

Colonel Robert J. Hager, USAF, Director, Programs and Productivity, Air Force Logistics Command

The Air Force Logistics Command has about 8,000 airplanes in the Air Force that we support, and around 12,000 in 83 different countries. We have 22 sites at 10 locations, with approximately 90,000 people and $158 billion in assets. We manage about $50 billion a year. I guess that would put us about number two behind GM on the Fortune 500 if we made a profit.

Our key processes are of course determining requirements; buying and acquiring; storing and distributing the parts; doing depot repair; and also the long-term logistics support. We've essentially been doing it the same way for 20 or 30 years. Why change? Why implement TQM? In Dr. Deming's book, *Out of the Crisis* , we see that the reason most people change is because they are having a crisis.

We've got two big challenges. Due to the peace dividend, we've got a fairly large budget reduction coming in terms of logistic support. They are taking about cutting more out of our area than they are out of some of the others. So we've got to figure out how to satisfy the customer in light of reduced resources. And that's really the number one challenge.

Our second challenge is something called Command Integration Merger. They have taken two large organizations, Air Force Logistics Command at 90,000 people, and Systems Command at about 40,000, and smashed them together. And that's what we're doing right now, and we're using TQM to manage change.

We have had tremendous success using TQM to accomplish our merger. We've been using TQM not only to do the vision and mission goals, but on all of our key processes. We've totally reorganized 90,000 people. Now, when a customer comes to us asking about F-15 fighter aircraft they get the whole fighter team.

Let me tell you, I come from a manufacturing background, and TQM works on the production floor great, but if you're going to only look at your manufacturing areas to achieve quality, you're overlooking some of the greatest opportunities. We have found that the greatest leverage within TQM is in the administrative practices because they affect everything else that goes on. They cut across all organizations, and they are extremely powerful.

And it all starts at the top. The top brass has got to be committed to total quality and continuous improvement. You know, right in the middle of Desert Storm, our Chief of Staff got all of the four-stars in the whole United States Air Force together in Washington and spent four hours talking about one thing ... quality. That's the kind of leadership that helps make it happen, and it happens from the top.

Now, how can going for awards help your organization? In the private sector a lot of people are using the Baldrige criteria for other than going for the award. IBM and McDonnell Douglas are even basing the salaries of their executives on their ability to make progress against the Baldrige criteria.

The criteria for the NASA George M. Low Trophy, the President's Award, and the Baldrige award are very similar. I don't think you should look at the criteria elements as separate things. They work together like a process, with strategic planning as the driver of the process, the rest of the criteria elements as the process itself, and the results are what you do in your business. If you can integrate your business planning and your quality planning, then you are looking at what you do to achieve your mission.

Assessing your organization against award criteria allows you to measure your progress against your goals and assess your progress in each step. We are doing this internally in the Air Force Logistics Command, just like Motorola and McDonnell Douglass and others. We've put together a 10-step process on self-assessments, we've been able to pinpoint the areas that we need to work on to achieve our quality and business goals.

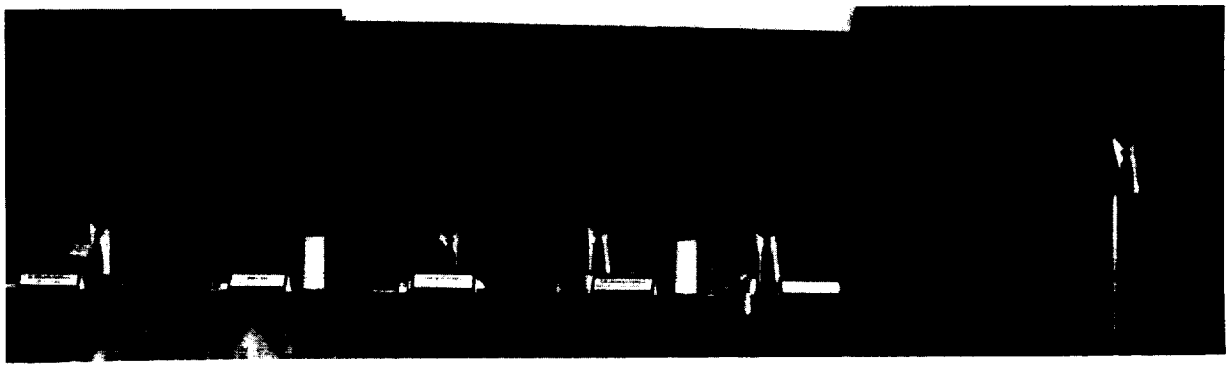
We feel good about ourselves but we know that continuous improvement is a marathon. But most importantly, here is the formula for winning. It's in competing that you have won.

8.0 Empowerment and Teamwork

Explores the practical experiences of organizations with empowerment and teamwork. The successful experiences, problems encountered, and lessons learned are explored from the "trenches" to the Board Room. Panels emphasize start-up, intermediate/advanced, and futuristic aspects of empowerment and teamwork.

8.1 Initiating Programs for Empowerment and Teamwork

Initiating successful programs for empowering individuals and teams requires changes in roles, work processes, training programs, and attitudes toward individual responsibility and productivity. This panel will present examples based on actual experience which show how this culture change has been successfully initiated and how start-up problems can be avoided.



Panel F1 - Initiating Programs for Empowerment and Teamwork (from left to right): G. William Kuhfuss, Product Assurance Manager, Ground Systems Program Department, GE Aerospace; George Robson, Program Manager - Continuous Improvement Programs, GE Aircraft Engines; T.M. (Mickey) Clemons, Manager - Integrated Resource Planning, Martin Marietta Astronautics Group; William F. Huseonica, Director of Science and Technology, John C. Stennis Space Center; Earl L. Lee, Manager - Space Shuttle Software Verification, IBM Federal Sector Division.

8.1.1 Introduction

Dr. William E. Huseonica, Director of the Science and Technology Laboratory, John C. Stennis Space Center, Chairman

Our program title today is "Initiating Programs for Empowerment and Teamwork." If you are in the productivity and TQM world, that particular phraseology of employee empowerment is a hot topic.

Empowering employees means that the employees are going to accept the corporate or organizational goals that we have, and they are going to make them their personal challenges. That's very powerful.

We expect that when we empower these employees they are going to strive to meet these challenges. Sounds great. Sounds wonderful. But, can we do it? It's easier said sometimes than done.

There is a lot of skepticism about empowering employees. Being in senior management, I know what happens to your middle management when an organization begins talking about empowering employees. In probably 50 percent of the cases I've experienced, barriers start going up.

So we have two sets of barriers, I believe, in empowering employees; one is in the area of management, and the other is in how we prepare our employees for this empowerment.

Does your management style permit empowering employees? Are you receptive to that? Are you threatened by that? Is our role changing relative to management if we empower employees? Have we gone from this controlling, dominating, directing manager to more of a facilitator, an enabler, a coach, a cheerleader? Should we change our roles, or is the role different if we empower employees?

We need to find out if we are a champion of employee empowerment, or merely giving it lip service, and I believe our panel is going to give us some insight into this.

The other thing is, have we prepared our employees for empowerment? Let me give you an example. In Southern Mississippi, new management came in to this textile factory. They were having a great deal of problems. The bottom line was down, productivity was down. The management came in and said, we've got to get the employees involved. We've got to fix all of these problems.

So they called all the employees in the organization together and had this meeting and said, "Ladies and gentlemen, we want you to identify and fix the problems in this organization." So after a few weeks they saw more and more of the people quitting. People were leaving.

The management said, "What's wrong?" So they stopped one of the employees and said, "Why is it that everybody seems to be leaving? People are quitting." The employee said to him, "Boss, you came down here and told us you didn't know what the problems were, and you wanted us to find out what the problems were and fix them. If you don't know, we're getting out of here."

So, that's the kind of reaction you might get. Do you prepare your employees with empowerment? I think there has to be a preparation.

8.1.2 New Visions Beyond Old Barriers

T.M. (Mickey) Clemons, Manager — Integrated Resource Planning, Martin Marietta Astronautics Group

In the end of 1988, our Astronautics Group president recognized it was time for a change, and decided that it was time to perform an assessment on how we were doing business in production operations. In looking at that assessment we concluded that our style of management was as dated as the Titan program itself. We had poor communications, and we weren't working well as a team within production operations. As a result, we had a moral problem.

This initial assessment proved to be the framework that allowed us to begin to take some immediate steps to begin a transformation of the organization and to start the culture change. We committed in a big way to high-performance work groups, and developed a strategic plan.

In the past, our management style was that of a cheerleader, encouraging our people to row faster, row harder, get stronger, get some better oars, and that type of thing. But in reality, what we needed was a leader to step forward and recognize that we weren't yet in the water.

There were three basic steps for us to get started. The first step was to develop the case for change and to convince people that change was needed. And that was something that needed to be developed by strong leadership. At Martin, we believe that leaders have to lead by example.

As management leaders, we recognized that the defense budgets were shrinking, and there was foreign competition, and we wanted to utilize TQM to stem that tide. This convinced the entire team that we needed to change the way we did business.

The second step was to provide a vision of where we wanted to go, where we wanted to be, what we wanted the company to look like in the future. Our vision is that in 1993 we expect to be a world-class producer of launch vehicles, and of associated hardware and services. It also talks about providing our employees a challenging and healthy work environment. So, vision is very, very important. In fact, as Joel Barker puts it. "Action without a vision just passes the time."

The third step was setting strategic objectives. What were our goals as an organization? What were our goals as an astronautics group?

We started our high-performance work team

evolution in 1989. We took a team of 54 people from our wire harness fabrication area and trained them in what high-performance work teams were about. That worked so well, we trained another 1,200 that year in the concept.

We've also provided some better tools for our teams in the form of modernizing our factory and basically adopted a premise that we would undertake quality in everything that we do, not just in the actual manufacturing of hardware, but in supporting that process from the start through the finish.

As a result, we've seen improvements in terms of the work actually done on the factory floor. In terms of our stage-one harness assembly, the savings here went from 1,313 hours down to 406 hours. For the engine heat shield on the Titan core vehicle, we've gone from 2,570 hours on assembly down to 550 hours.

Here are some tips on how we've implemented TQM. Number one, continuous improvement needs to be shared by all employees, and be part of all the organizations. Secondly, if you see a problem, you own it. That's not something that you just expect somebody else to pick up at some point in time. Everybody is vested in improving the way we do business and improving our environment.

And third, training. We've internalized the training. We now employ a concept that managers are trainers. We don't employ outside trainers and we don't employ central trainers as much as we employ training each other in new ways of doing our business. Also, we focus our training just in time to the need. We do it as we require to improve our processes.

Lastly, I wanted to warn you about some difficulties that we encountered along the way towards high-performance work teams and changing our culture in production operations. The first problem we encountered was that we need to focus on allowing top management to take the time necessary to participate in the process. High-performance work teams and empowering your employees is not necessarily equatable to a complete hands-off approach in terms of being a leader. It actually requires more leadership, not less.

Another key lesson learned is that we need to keep a constant focus and attention to the fact that the teams and the people in the process need a lot of care and feeding. It's not a matter of sending them to training for a couple of days and then hoping when they come back everything works well. It's a matter of constant attention and constant work and it's not an easy process.

And lastly, and probably one of the most important factors, is that production operations alone can't change the way we do business as a whole. We chose production as a place to start, but recognize that culture change can only happen if you have total involvement across all functions in your organization.

A couple of additional suggestions for implementation. First, you need to take a big dose of reality. Do an assessment to see how well you're really doing and get an idea of what things are strong and where things are weak, and then take some ownership in the change. And, don't lose focus on your strengths during this period of time either, otherwise they will become weaknesses.

And then, lastly, one of the key elements is to make sure that we're inventing the future rather than redesigning the past. Take a step out and look at new directions on how to do business.

I'd like to conclude with this quote from Aristotle, which says, "we are what we repeatedly do." Excellence then is not an act, it's not a one-time event, but it's a habit of doing the right things over and over again.

8.1.3 Continuous Process Improvement

George D. Robson, Program Manager - Continuous Improvement Programs, GE Aircraft Engines

Continuous Process Improvement (CPI) is a change activity. We talk an awful lot about the world and the world economy, and we try to get people involved with this change activity. Why? Why change? I sum up the reasons into three areas.

First, the world is changing as a function of increasing technology. Certainly management technology should keep pace. Secondly, our customer expectations are increasing. They never go down. When was the last time you went to buy something and your expectations were lower about the product than the last time you bought it?

Third, to be competitive, our concept of the marketplace has to shift from merely a national one, to one which is truly global. We have to take the same view which the Japanese took several years ago. Theirs was totally an international market. Ours was

domestic. Our target was only local, while, the entire time, we were their target.

The essence of CPI is that management, today, has to know when to lead, when to follow, and how to get out of the way when we empower our people.

I'm going to share proven methodology that will help management understand how to lead and operate a business in what I refer to as a process-oriented manner which will empower and reinforce natural teamwork so that people cannot only do what we ask them to do, but can innovate without direction.

Most of us managers have gotten where we are because of our individual ability. But is that good enough to proceed into the future? The answer to that, from my perspective, is no. Clearly the results show something has to change. Therefore, from a management perspective, we must lead and manage differently, and I use the word lead first because it's important that we are leaders and not just managers, because basically anybody can manage and maintain. Now, the question is, what do we have to do, and how do we have to do it?

We can't rely on the traditional problem solving techniques which are the "ready, fire, aim" approach. You can't be a John Wayne. You can't just go out and start firing your gun without aiming. You've got to make sure you understand what you're going after, you're got to take aim at it, and then you've got to execute the activity.

Task forces. We can't operate with task forces. Why? Task forces are nothing more than a group of people going out to do what should have been done right in the first place. Swat teams. Same kind of activity. We have to stop reacting. We have to be able to perform up front. Think about what we are doing first, share the vision of our business, and then help people to understand what and how they need to do things differently.

We have to stop searching for who did it. We have to stop shooting the messenger. It's a very easy thing to go out and do. So, these are some of the things we need to stop doing. What do we need to start doing?

We need to, first of all, begin by sharing the business with all team members. We have to insure that the business is truly customer-focused. We also have to be able to define critical business processes that are necessary to succeed.

Then, we have to empower the natural teams to simplify and improve these critical processes. I use the terms "simplify and then improve" in that order because we don't want somebody to go out and improve a process that's no good. We need to get rid of the junk, the bureaucratic things that don't need to be done any more, that don't add value to the process, that don't support customer needs.

So, let's talk about the individual steps to Continuous Process Improvement. First, we need to share the business mission. We need to determine the customer's needs, plans, and goals and then define the critical processes. Once that's done, we need to identify the stakeholders, the managers, the customers and suppliers, the people who are involved in the process steps.

Once we know who they are, and how that process is bounded, then we can assemble the team. Once the team is assembled that team establishes the goals for the process. Once the team identifies their goals and once they identify the critical-to-quality elements, then, and only then, will we be able to satisfy the customer in today's global marketplace.

Next, we have to determine the data needs, what we've got to measure to determine if we are improving. We collect and analyze the data and determine whether or not what we are doing today can fulfill the needs of the customer.

From the data we determine if our process is capable. If it's capable, are we in control. If not, we need to analyze, then apply the simple tools and techniques that we have to bring it into control. You eliminate the root causes, and you stay in that analysis loop until you're satisfied that the process is in control.

The next thing, the team has to determine whether or not the process meets the goals the team set. If the goals are not met, you analyze why not. If your changes were, in fact, implemented, then you develop a new plan to control the process.

Then, finally, you monitor the results. You go back and you check your critical to quality elements. You go back at the end of your process and you ask, have we fulfilled the customer needs and expectations, and the best way to do that is to invite the customer in. Once that's completed, you establish new goals with the team.

During the first two years of implementation the businesses that we had worked with in General Electric have showed approximately $35 million saved by a handful of natural work teams. This was with absolutely no capital expenditure. If you compare the amount saved to the amount spent on training the people, it's a return on the investment of about 80 to 1.

In summary, there is nothing new here. These

ideas have been around for years. The thing that we have been able to do is put the logic and the pieces together in a sequential methodology and prove that it works and let people actually use it and do it.

I'd like to challenge the managers here to think about this. Put your ego in your back pocket, don't care about who gets credit, and then translate that into the work teams and participate with them so that they understand that they, too, can operate in an environment where they don't care who gets credit and absolutely amazing things happen.

8.1.4 Process Evaluation Teams

Earl L. Lee, Manager - Space Shuttle Software Verification, IBM Federal Sector Division

What I'm going to give you this morning is an example of a grass-roots kind of empowerment we call PET, which is working very well for us.

We first delivered software for the Space Shuttle in 1981, after ten years of development, and we've been improving on it ever since. So you can see that this project is very old. We've had a long period of time to develop the methods that we use to produce the software.

We employ 250 to 300 people to do this. We generate the basic capabilities and deliver the software to Rockwell International, which reconfigures the software for each flight. The software, itself, is absolutely critical for flight of the Space Shuttle. The shuttle is a fly-by-wire vehicle, as probably a lot of you know, which means that all the critical commands to fly the vehicle go through the computer system. Even when the astronauts are flying this thing manually the commands from their hand controllers and everything go through the computers.

Consequently, the hardware and the software in that data processing system are absolutely essential to the safe operation of the shuttle. The software and hardware have to work perfectly. We've got redundancy built into the hardware. We've got four general-purpose computers which run the primary avionics system, and if any one of those general-purpose computers fail, we've got a back-up we can go to. But we've never had to go to the back-up system. In fact, we never want to. We feel that the primary avionics system has to be perfect.

Because of those kind of drivers, we've developed methods that have allowed us to produce software which is arguably the best in industry and the highest quality. We've found no one to compare ourselves with that even comes close.

In the past, the process we have used to achieve this kind of quality has been similar to others. We do requirements analysis and software development, we design and code inspections, and then we do some development testing, performance testing, and detailed independent verification. Those things are common to large aerospace projects, so there should be no surprises. But we had some fear that if we let those processes degrade somehow through inattention, we would start reducing the quality of the product we were delivering.

I wish I could say that we started out to empower our employees, but in fact we didn't. We started out to control our processes, configuration control, and that was directed from above. But a very empowered team of employees came up with a different implementation which mixed configuration control and empowerment together.

What we came up with is something called process evaluation. The core to this method is a team which we call the Process Evaluation Team, or PET. It's made up of a group of people who are the process owners, that is, the people who actually do the work. Also on that team is a senior engineer who acts as the leader, the facilitator of the team, as well as somebody there from our quality organization who keeps us honest.

The PET's role really is to evaluate each individual process and to give it a rating, and this isn't real novel. There are a lot of methods of doing that. Primarily, the one that comes to mind, is one from Carnegie-Mellon's Software Engineering Institute where they evaluate the maturity level of software processes, and that's partly where we got the idea but we also used some IBM internal processes, and even used the Baldrige application to come up with the criteria that we were going to use to evaluate our processes.

Our idea was to have some generic criteria that we could use for every process, so that the process owners had a lot of flexibility to change and improve on their processes. And, the reason we wanted that was because we were afraid when we put configuration control in place on our processes, that they would stagnate.

The PET team actually establishes a rating level for each process. They negotiate what rating level a particular process should strive for, and the idea is

that once you attain that goal, you are going to reset it and go higher. The idea is to also make that goal credible. That you don't set such high goal that it's not credible to the people who have to achieve it.

What are the criteria on each level? Just to give you an example, on level one, our basic criteria for quality would be that a process has measurements in place and goals established, and you're collecting data to really look at those measurements. Level two shows that we've got positive trends established with those measurements. Level three says you've sustained them ... it isn't just an aberration ... that you have a positive trend. Level four says products are defect free.

Now, we've got these criteria on all our processes. We have goals on productivity, customer satisfaction, education, and the configuration control, the thing that we really started out to get originally, is now one of the criteria. In fact it's a level-one criteria. A process has to have some kind of configuration control mechanism in place. So now configuration control is administered by the ownership teams themselves, the empowered employees.

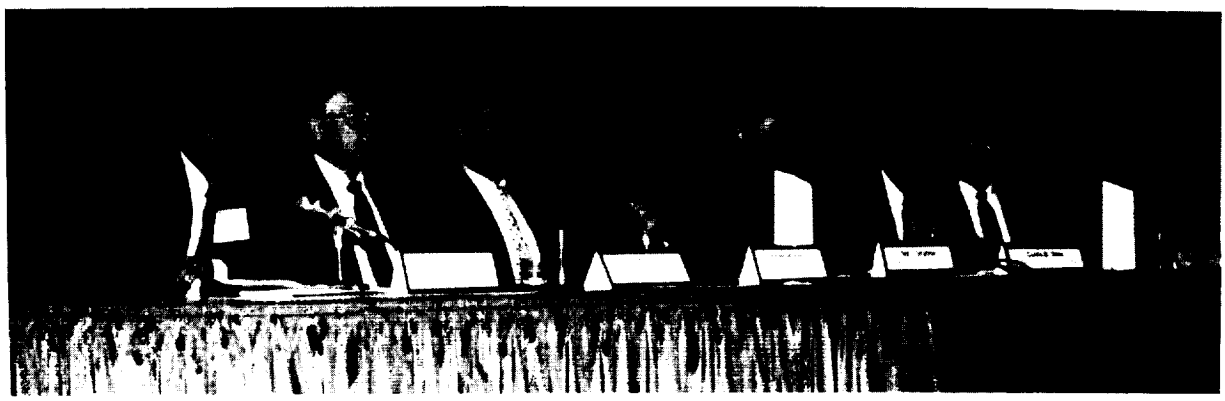
Results? We've found that our criteria have been very good. We quickly identified weaknesses and processes just by preparing for evaluation. Those have been addressed. Successes that processes have had have been copied by other processes. With the goal of having to be evaluated, those good ideas are picked up and propagated into other processes. We've had general and immediate improvement in how we formalized our processes and documented them because that is a level-one criteria.

We've received many employee suggestions for process improvement because of this. The numbers, as of a few days ago, were somewhere around 300 in the year that we've been fully operational on this. And, whether we wanted it or not, we've got a competitive atmosphere established between our processes. They all want to be top-rated.

In summary, we feel that this PET concept has really given us what we wanted--employee empowerment. It keeps us all striving towards the goals of our project, knowing that we can use our combined talents and knowledge to achieve those goals. It's been great for addressing our weaknesses and propagating our strengths, and has moved us toward the primary goals: defect elimination, employee participation, and improved productivity.

8.2 Empowerment with a Track Record

The on-going process of empowerment and teamwork requires continuous nurturing. The panel addresses how to measure the success of the process, how to make changes as required, and how to address many practical problems as they arise.



Panel F2 - Empowerment with a Track Record (from left to right): Robert P. Hessler, Staff Manager Performance Improvement, Kennedy Space Center Division, McDonnell Douglas Space Systems Company; Virgil Muilenburg, General Dynamics Space Systems, Resident Engineering Representative at Pratt & Whitney; Haven M. Eaton, II, Operations Quality Assurance Manager, Government Engines and Space Propulsion, Pratt & Whitney; Ted L. Shaffner, Manager, KSC Operations Support; Curtis B. Wise, Supervisor, Final Assembly and Test Inspection, Thiokol Space Operations; Gerald T. Oppliger, President, Lockheed Space Operations Company, Inc.

8.2.1 Introduction

*Gerald T. Oppliger, President, Lockheed Space Operations Company, **Chairman***

Lockheed is the prime contractor for NASA at the Kennedy Space Center. We process and launch the shuttle fleet, and Lockheed together with our team members, Grumman, Thiokol, and Johnson Controls, make up the Shuttle Processing Contractor team at the Center.

Lockheed's Continuous Process Improvement Program is well underway and has been underway, for about a year, and we have realized what we think are some really significant results.

One of those things I want to talk about is what we call our Integrated Task Leader Implementation Team. This team was formed for the purpose of improving the process flow through the facility and to resolve the problems at the lowest possible level. This is the floor-level, where the people really know what is going on, and what the problem really is.

As you know, in most big operations almost anybody can stop an operation, but it takes a lot of people to get it going again. So our objective here was to move that responsibility and empowerment down to the people who are doing the job, give them the responsibility and authority to make the decisions, and keep the operation moving in a safe and reliable manner.

Several things have come out of this that are very advantageous. You get very clearly-defined responsibility and authority within those teams, and that starts from the planning of the job, through completion of the job. However, the major improvement has been a significant reduction in the processing flow times through the facilities from launch to launch. We have set records this year in the flow times through each of the facilities. We have bettered the goals we set for ourselves, and have shortened the time significantly since return-to-flight operations.

So, since the name of the game is continuous improvement, we now have new goals, and new records set that we are working towards, and these same teams are working to further improve the

processes, and further enhance all those operations.

Basically, our objective in the operations area is to just continuously do what we do a little bit better every time we do it. The basic effectiveness of this team, the measurement criteria set out, was completion of the jobs as scheduled. But we also wanted an assessment of the quality of each of the jobs as they were completed. We think this has been tremendously successful and we are very proud of this team. By the way, they are very proud of themselves, and the things that they have done.

8.2.2 Problem Report Elimination Team

Curtis B. Wise, Supervisor, Final Assembly and Test Inspection, Problem Report Elimination Team, Thiokol Corporation, Space Operations and Ted L. Shaffner, Manager, KSC Operations Support, Problem Report Elimination Team, Thiokol Corporation, Space Operations

Thiokol is the largest producer of solid propellants in the United States, and we supply the solid rocket motors for the Space Shuttle program. We are headquartered in Northern Utah with a work force of 12,000. Space Operations consists of approximately 4,200 employees, the majority of whom are engaged in NASA activities.

The solid rocket motors used to power the Space Shuttle are big and impressive. Each motor is just over 126 feet long and 12 feet in diameter. From ignition to end-burn, each motor generates an average thrust of two-and-a-half million pounds.

By the time the twin solid rocket motors have completed their task, the Space Shuttle will have reached an altitude of 24 nautical miles travelling in excess of 3,000 miles per hour. Minutes later, splash down occurs, and the motors are retrieved and refurbished for another mission.

Thiokol established our TEAM program in 1985. TEAM means Total Employee Action Meeting. The training provided for the teams consisted of problem-solving techniques and group-process skills.

In 1988, our Continuous Improvement and Total Quality Management policy was formalized, followed in 1990 by 24 TQM centers which were created within each functional department. This included 24 guidance teams established to build upon the team experience and provide the necessary guidance through these formal centers.

Our return to flight in 1988 brought more than just the end of a major redesign effort, and the start-up of production, it also brought a newly-designed product with new problems, new people, new processes, and new initiatives to be resolved with the Kennedy Space Center inspection criteria 2,500 miles away.

The 470 problem reports generated against first-flight testify to the learning curve we experienced, and the lack of communication that existed between Utah and Florida, as well as between organizations within Utah's Space Operations.

Our team today consists of 12 voluntary members, including one NASA representative, five Thiokol-Utah members, and six from Thiokol-Florida. Our efforts, to date, have resulted in significant measurable progress, and our focus has expanded to include the elimination of all problem reports.

With this background information in mind, let's take a closer look at our employee empowerment project and how we are measuring the success of our project, how we are making changes to our manufacturing processes, and how we are addressing problems as they arise.

We are measuring the success of our employee-empowerment project in four key areas: problem-report-reduction trends, customer satisfaction, schedule and contract compliance, and increased quality and reduced cost.

A problem report is used by Kennedy Space Center to document non-conformances on our solid rocket motors upon receipt, and during processing. The reduction in problem reports is a solid indicator of our success thus far in the project.

To further measure our success, we created a matrix to identify all problem reports generated to date, and the frequency with which they occurred. The matrix helped us concentrate a massive amount of effort for those problems with a high frequency, while at the same time putting into place minor efforts for less frequent problems.

Customer satisfaction has been another clear indicator of our success. Customer input and suggestions have proved very valuable to the overall goals of the project. NASA's praise and encouragement have stirred the team to excel.

Schedule and contract compliance are also major drivers toward measuring improvement. Reductions in the required rework and non-conformance documentation have allowed us to more consistently meet time-line objectives, and more effec-

tively comply with contractual requirements.

As a result of the heightened awareness of defect reduction, we have significantly reduced waivers for flight hardware non-conformances. This reduction of waivers follows the same downward trend as the problem reports.

Finally, as you enhance quality, reductions in cost follow. These reductions in problem reports and waivers on the hardware have helped shorten our booster assembly times to the point where an assembly record was set on flight set 19.

By analyzing the successes of our efforts, the Problem Report Elimination Team learned to make changes to our manufacturing processes by following this four-step model. The steps are: Management trust and empowerment, effective communication, engineering consistency, and on-line team coordination.

Management trust is the first if not the most critical step to success of any employee empowerment team. We have learned that management's on-going trust in its employees is the only consistent way to attract and maintain a highly effective, highly involved work force. The key thing management did was to empower our team to go out and try to reduce problem reports. In quite a few instances, we had the support of management to implement some of the corrective actions to reduce the problems which we were seeing at Kennedy.

When Mr. Garrison, our Chief Executive Officer, at the 1990 NASA/Contractors Conference, expressed his commitment to continuous improvement in Total Quality Management, he opened the door for empowerment to flow down through all levels of management, thus allowing team members to achieve as we have.

Effective communication concerning problem report defects was virtually non-existent between Thiokol-Florida and Thiokol-Utah. This was a major hurdle for team members to overcome. The first big step toward overcoming this problem was to hold face-to-face discussions at Kennedy Space Center between the Utah and Florida team members.

In these mid-1990 meetings many differences were aired, and resolved. When these meetings were over, the team had agreed upon a unified course of action and had adopted a Problem Report Elimination Plan. Telecommunications and face-to-face meetings are contributing to the team's further successes.

Many felt that differences between Utah's engineering and Florida's requirements were major causes for many of the problem reports being written. As a result, we identified and eliminated differences between the two requirements. The major focus now is consistency in interpreting existing engineering where successes have been achieved only through the aforementioned face-to-face discussions and telecommunications.

Today we continue to address problems as they arise through the application of employee empowerment and our four-step model. Additional precautions are also being taken to ensure that continued success is realized. Employee cross-training is underway between line personnel at Florida and Utah. This is providing both groups with a better understanding of the processes and inspection techniques at these sister facilities. Consistency, of the process and of inspection techniques, is being rigorously pursued.

Providing information on the hardware prior to receipt at Kennedy Space Center is also helping us eliminate concerns regarding the acceptability of specific anomalies. This information is provided through metal surface mapping, and the creation of a record revision change notice.

Metal surface mapping provides a detailed description of all visible anomalies on all metal surfaces, including joint seal and non-seal surfaces, pinholes, leak check and vent ports, nozzle flanges, and exit cone surfaces.

Our record revision change notice is giving us a description and prior-approval of all discrepancies previously documented which violate inspection requirements at Kennedy Space Center. As a result of our efforts, 28 additional specific inspections are being completed at Utah prior to shipment by railcar to Florida's Kennedy Space Center. These inspections, called pre-shipment inspection points, are implemented based on problem report history.

As a result, using the four-step model we have reduced problem reports from 470 to 20 since 1988. Through effective leadership, commitment to continuous improvement and Total Quality Management, and willingness to trust and empower employees, we are confident that your empowerment teams can experience the success that we have achieved, and will continue to achieve.

8.2.3 Pratt & Whitney/General Dynamics Joint Process Team

Haven Eaton, III, Operations Quality-Assurance Manager, Government Engines and Space Propulsion, Pratt & Whitney; and Virgil Muilenburg, Resident Engineering Representative at Pratt & Whitney, General Dynamics Space Systems Division.

MR. EATON: Pratt & Whitney is the single largest operating entity of United Technologies Corporation. Our facility is located in Florida. We are on the edge of the Florida Everglades, about 22 miles northwest of West Palm Beach.

We are responsible for program management, design, development, testing and marketing for all of Pratt & Whitney's military engines, and also for the liquid and solid-fuel space propulsion systems and launch services that we provide.

The RL-10 engine was developed and produced in Florida. It powers General Dynamics Centaur upper-stage. We are also working on an alternate turbo-pump design for the Space Shuttle Main Engine that is presently being developed and tested in Florida as well as at the Stennis Space Center, and we are a team member on the National Aerospace Plane and the national launch system.

MR. MUILENBURG: General Dynamics Space Systems Division is located in San Diego, California, and we are the producers of a family of Atlas and Atlas Centaur vehicles, and also a provider of launch services from Cape Canaveral Complexes 36 A and B for both commercial and government payloads.

MR. EATON: Pratt & Whitney's TQM efforts are called Q-Plus or Quality-Plus, and they are patterned after a process developed by Armco Steel Company. We looked at a number of programs before we decided on Armco back in the 1985 time frame.

In 1986, many of our managers were sent to Middletown, Ohio, for awareness training and an understanding of how Armco ran their Q-Plus process. It is based on seven principles, which won't surprise any of you, conformance to requirements, prevention, do it right the first time, measurement, customer-supplier partnerships, etc.

Our process is managed by Q-Plus teams. At the Florida facility there are 22 of them, approximately one for every 300 employees in the functional areas. They receive four days of training in quality improvement theory and quality management systems, and they are the administrators of the process for us.

We also have, at the moment, approximately 20 corrective action teams. They are problem-solving teams, and as we evolve from problem solving to process improvement, naturally the number of corrective action teams are decreasing. They receive just-in-time training, and they are facilitated by trained CAT leaders.

We have approximately 200 process-improvement teams. They are increasing throughout the organization as we move from problem solving to process improvement. They receive one day of off-site training, and just-in-time training in the areas of process improvement.

Those two teams focus primarily on systems. The integrated-product-development-and-management teams are more hardware oriented, but they certainly apply the principles of Q-Plus. There are 140 integrated-product teams. They are responsible for bringing together the various functional organizations to get them involved throughout the design, development, and manufacturing process to be sure that every functional organization is represented. Their training is similar to the process-improvement teams.

Lastly, we have joint customer-process action teams. We presently have three of those. They receive two to three days of off-site training with some emphasis on team building, and then as we go along, we get just-in-time training.

MR. MUILENBURG: In San Diego, we have about 600 employees involved with our process action teams, and there are about 61 teams at present. These teams are from the Atlas program office, Titan program offices, all the way through quality assurance.

For example, there are four teams in the Atlas program office, there are ten teams in engineering, and twelve teams in quality assurance. Each of the employees that participates in a team gets four days of training, again, on a just-in-time sort of philosophy.

MR. EATON: Executives from Pratt & Whitney and General Dynamics recognized the need for teamwork between our two companies, and they considered a list of opportunities. We decided to begin teamwork implementation to reduce the time that it took us to deliver our engine once we had completed acceptance testing to the point where we actually turned it over to General Dynamics and they signed on the shipping paperwork accepting it. So, our mission was to develop an improved RL-10 accep-

tance process that meets all customer requirements in a more efficient manner, and ensures delivery of a high quality product.

Prior to the team being formed, it took us anywhere from 40 days to in excess of 100 days to deliver our engines from the time they completed test, to the time that General Dynamics accepted delivery. After we put in place what we learned from our team, we reduced delivery time to an average of roughly 20 days. That is not to say that 20 days is an acceptable number, but it is certainly an improvement over what we had in the past.

MR. MUILENBURG: When General Dynamics started out purchasing these engines, we would send an entourage from San Diego to West Palm. It may have been seven, eight, nine folks in the various disciplines to look over the paperwork and look over the hardware for acceptance of that engine.

So the travel cost per engine and the travel manhours per engine was pretty high, but after our team implemented improvements, these numbers dropped significantly.

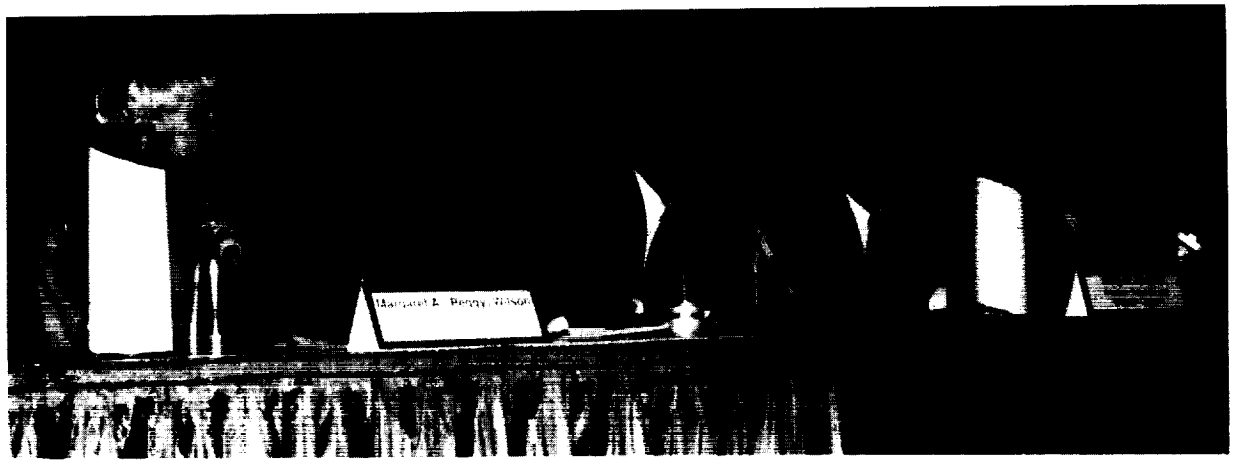
MR. EATON: Now let's look at some of the softer things that you get out of a project like this. Stakeholders are the people who do the work, and are affected by the process. We took a survey early on so that we could establish some baselines. We looked at what their perception was of delays and bottlenecks in the process relative to what they did, whether it be at General Dynamics or Pratt & Whitney.

Some of the points addressed were, for example, did they feel that they got adequate support from the other functional organizations to do their job? Was overtime required? Was the required overtime excessive? And lastly, did they feel that we were responsive to their suggestions? After all, we all know that the people doing the job generally know the best way of doing the job, and we occasionally get in their way as managers.

As a result, we made improvements in some of these things, because we have clearly reduced the bottlenecks. But, we have run another survey to determine whether or not the stakeholders' perception is that we have improved the process.

8.3 What's Next in Empowerment?

The panel provides visions of the future through a discussion of current and innovative empowerment practices.



Panel F3 - What's Next in Empowerment? (from left to right): Margaret A. (Peggy) Wilson, Productivity Program Specialist, John F. Kennedy Space Center; Joseph W. Dickey, Senior Vice President, Fossil Hydro Power, Tennessee Valley Authority; Philip W. Hartman, Vice President of Corporate Resources, American Transtech, American Telephone and Telegraph Company; James (Gene) A. Thomas, Deputy Director, John F. Kennedy Space Center.

8.3.1 Introduction

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

What is next for empowerment? One of the basic tenets of TQM is employee empowerment, and I sincerely believe that whatever we let the employees do, or permit teams to do, will be a powerful influence on how successful we are.

You have all seen articles about the Year 2000 and what it is going to look like, as far as demographics go. There are a couple of good books I would recommend, *Workforce 2000* and *Workplace 2000*. Both of them are recent studies on that subject.

I would like to just tell you, in a few sentences, what I think those reports say. Some of it is not easy to accept. You may even take exception to some of the things they are saying, but they are the experts, and this is what they are predicting.

The population, and therefore the work force, will grow more slowly than it has over the last two or three decades. The average age of the population and the work force will rise. The number of young people in the pool of workers will decrease. More women and minorities will enter the work force, and immigrants will represent the largest increase in both the population and the work force.

In order to empower the people who are going to be available in that work force by the Year 2000, and it will consist of 68 percent women and minorities, we have to understand their culture, their special needs, and the diversity of that work force.

One recent study warned us as managers that we must be ready to face the future, because there will be no more time clocks, no more hourly workers, no supervisors or job classifications, and everyone at work will be involved in the major decisions, even as to whom you hire and what kind of training you give them.

These experts also say that the middle manager is going to go away, and that will not be easy for a lot of people to swallow. The reason is, I think, is because control is what makes a middle manager tick, that is the meat-and-potatoes of his job, and control just will not exist any more.

These same people go on to predict that you will be

paid for what you know, and therefore it will behoove you to understand and educate yourself as best you can. You will be paid for the benefits which you bring to the company and therefore, if you are multi-faceted in talent, then you will get more benefit from it.

Everyone will be salaried, and merit raises will disappear. You will not get promotions any more, and a worker might have twenty or thirty jobs with fifteen or so companies over a career.

Workers will finally have pure autonomy on the job. People will be paid for their performance, and hopefully productivity will increase. A bonus might be equal to a year's pay. Many employees will draw more money than their boss.

I do not think I will be around. I will probably retire before we get to the real summit of all this, but a lot of younger managers today are going to have to face that. But I think the key is awareness and training and understanding and acceptance. If we really are going to empower employees, we have got to change our way of thinking.

Our panel today is going to address that subject. I think in all these seminars it is very interesting to hear from someone outside the aerospace business. A lot of times we learn good lessons from these folks, although they are close to what we are doing, I would say they are not directly involved in aerospace as much as most of us are.

8.3.2 Employee Empowerment at AT&T American Transtech: The 'Engineering' Behind the Intentions.

Philip W. Hartman, Vice President of Corporate Resources, American Transtech, American Telephone and Telegraph Company

I take it by your presence here you share some of the same enthusiasm I do about empowering workers, and that is what I want to share with you today, is essentially not a speech, but a Transtech story about what we have done in our workplace.

I want to steal shamelessly from one of the speakers at an AT&T quality-sharing rally I attended last week, Tom Malone, President of Milliken. He said something that I think is very applicable in this presentation today. What Tom said was this. "The hard stuff is easy. The soft stuff is hard."

Now he is involved in a very technical business at Milliken, a lot of the engineering, but he is saying that the engineering is the easy stuff, because you can benchmark it. The hard stuff involves the employees.

So what I am going to share with you today is not something that was easy. It was hard work, and if you ever venture on this journey with employee empowerment, it is going to be a long, hard journey.

I would venture to say that many of you do not know about American Transtech. We were a company formed in 1983 to handle the divestiture of the regional holding companies from AT&T. We are in the service industry. We service the financial, employee, and consumer marketplaces. Our revenue is about $250 million, with about five thousand employees. Before 1983, we were a department of AT&T. At that time, we moved to Jacksonville, Florida, and became a subsidiary.

We have attained some notoriety. In September 1989, Florida recognized Transtech as one of the ten best companies in Florida to work for. We have frequently been visited by companies such as Solomon Brothers, Corning Glass, and G.E.

Even while we were still part of AT&T, employee involvement and participation were very important. We claimed that we had values such as customer focus, excellence, trust, teamwork, sharing, growth, and social responsibility. But when we set up the new operation, we did not do everything right. We were very product-focused, so consequently, the customers began to complain that we were not treating them as individuals.

Our customers told us we were great at fixing problems. When we saw a problem, boy, did we attack it and fix it, and our customers loved us for doing that. But they also said, why not do it right the first time, every time, on time? So we were put in a situation where we had to go to a total quality system in 1988. That is when we began our quality journey.

At that time, we were doing $110 million in mail volume. We produce more mail in Jacksonville than the rest of the city combined. We were dealing with about two hundred thousand interactions a day. We had thirty teams in our shareowner request processing, and we had fifteen teams in our computer operations. You can just imagine all the hand-offs that were taking place, and all the boundary issues that we were encountering, and the lack of focus on customers. We had no reason to work together. The teams were too isolated.

So, what happened? After we implemented a total quality system in shareowner service we went from thirty teams to nine teams. The computer operations went from fifteen teams to four teams. What this did was bring teams together, and refocus on the customers.

Consequently, we did not need as many middle managers. As the number of teams grew smaller, the size of the teams grew larger. The team consisted of about thirty to thirty-five members, so you are in a situation where you cannot act and behave the same way in dealing with the team. That control issue is not there, because you cannot control thirty to thirty-five people.

We also changed the role of managers. The manager was to provide resources, to protect boundaries. Again, we reduced the number of boundaries, but they were still there to do boundary management, to clarify goals, and to integrate activities.

Now, the role of the team was to be concerned about quantity, quality, timeliness, and cost. Essentially, the team took responsibility for the work process, the technical process, that it is done the best way. The team has responsibility for selecting, assimilating, and training the members of the team.

They are also involved in conducting formal performance appraisals. You can imagine what you are doing to an employee when you ask him to evaluate his peer, and give feedback. That is not easy. Teams can even approve or veto merit increases. Talk about performance, how about not giving someone their increase that they are looking for? But that was part of the team's decision. Teams can even recommend disciplinary action or firing.

We have designed a profit-sharing plan called Team-Share, that all the employees participate in. If a team contributes to the financial success of the company, they share in that. What that means for our employees is about one-third of every dollar of profit goes back to the employees in some type of profitsharing.

What have we learned? It is not all a bed of roses, but customer satisfaction was never higher. They love us. Productivity improvements skyrocketed and continue to improve each year, so that our costs continue to go down. The team feels like they own the outcomes. They owned the success of the service they provide. We provide daily information about the business, including profitability.

The main roadblock is the middle managers. They are the ones who have the most difficulty going through an empowerment because they are the ones that are disempowered. They are not controlling any more. They are supposed to be coaches, and it takes a totally different type of manager.

I would like to close with a quote by Charles Kingsley that I think summarizes what I was trying to say to you today. "We act as though comfort and luxury were the chief requirements of life, when all that we need to make us really happy is something to be enthusiastic about." Are you happy as a manager? What about your employees? Do you have a passion for what you are doing, or are you just tired? Remember, the soft stuff is hard to do.

8.3.3 Employee Empowerment: Lessons Learned

Joseph W. Dickey, Senior Vice President, Fossil and Hydro Power, Tennessee Valley Authority

I heard a definition that I like for total quality. We all have definitions, but a very simple one is, "a systematic and disciplined application of common sense."

I have only been with TVA for a short time. We are implementing a total quality program, and in doing that, we are trying to steal/borrow all of the lessons from every other organization that we can so that we can shorten the cycle time of how long it is going to take us to implement the program and to begin to achieve some significant results.

TVA is the largest generating utility in the United States, it is almost sixty years old, and what comes with that is a considerable amount of inertia and tradition that is rooted back in the 1930's, and so there is a tremendous amount of history that we are trying to change as we go forward.

Before I went to TVA, I was with Florida Power and Light where we had a lot of team participation. By 1990, we had over 50 percent of our employees on teams at any given time. In addition to that, we had a very good evaluation process for the individual team activities, so we were able to judge between teams that did very well, and teams which were struggling.

So we began to ask some questions. How do you ensure success for teams? We asked two other questions. What works well, encourages teams, and makes them successful, and what hinders teams from producing up to their capacity?

To do this, we did not send out surveys, but we actually sat down with individuals teams and discussed with them the things that went on as they were developing as a team, to see if there were any factors which made some successful and others not so successful.

In doing that, we found a number of factors which make a team successful. Interest from senior management. Very important. This is the top-down commitment that everyone talks about, but it is important even at individual locations. The workers know if someone is really interested, or if they are not interested, in what their activities are.

Support from the immediate supervisor. Again, the middle-management individual, the person who really can make or break any kind of a program within your location. People that can help a team to work through the problem-solving process, to get information for them when they need it.

Recognition for good work. People want their peers and their superiors to at least know when they do well, and to have some type of recognition and feedback that they have done a good job. A very powerful motivator.

Understanding how their work impacts important indicators for the organization. Everyone wants to help the organization that they work for. Whatever can be done to link what the employee is doing with the major and important indicators of that organization will allow them and will focus them on more and more tasks that will improve that organization.

What are some of the things that hinder a team? Too much bureaucracy within the process. They understand very clearly what is useful and what is not useful, and those things that are bureaucratic and not very useful immediately become a barrier for them from performing to their capacity.

Inadequate education and training. Many times we have heard here over the last two days that this is the foundation for any total quality program, and it is certainly true in team activities and even participation by team members. A team can become very discouraged if one or two people are carrying the load, or hogging the load, and not allowing other people to participate within the team.

So, what have we done at TVA? First of all we have modified the mechanics of teams themselves, and secondly, we have examined the philosophy for teams.

Why do you have teams? To solve problems, is one reason, but they are also used as a vehicle to communicate the mission and goals of your organization, and a key way that you communicate with employees.

I really think that solving problems, and the solution that a team comes up with, is probably the gravy. It is not the real benefit that you get for having teams. If you look through your organization, you'll find many other reasons why teams can be important for your organization.

We no longer have any formal team leaders. In the process that we are implementing, everyone gets a chance to be a team leader. At every meeting, you have a secretary and a team leader. At the next meeting, the secretary from the previous meeting, who kept all the notes and what all the activities are that they are supposed to accomplish, becomes the team leader, and that is rotated around throughout the entire team.

Frequent presentations to senior management. We have a six-step process and at the conclusion of each step, the team presents to senior management, so that they have a chance to interact with the team, they have a chance to ask questions that the team may or may not have thought about, and so at the conclusion of the project, there are certainly no surprises as to what the recommendations are going to be.

We boil successful team management down to a six-step process. The first step is the reason for improvement, which is to identify a problem area, and the reason for working on the problem. The second step is problem definition to select a specific problem within that area and set a target for improvement. The third step is analysis, which is to identify the root cause of that specific problem. The fourth step is solutions, which is to identify and select a solution that will fix the root cause of the problem, and to verify that it will in fact do that. Fifth, results. Have you correctly identified the root causes? Have they been diminished? And has the target for improvement has been met?

An important thing is, we try to keep it down so that the five steps to solve a problem, you all get on one hand. It is easy for people, surprisingly, to remember that, and where they are in the process.

The sixth step is process improvement. Here you have correctly identified the root causes and you take steps to prevent them from reoccurring.

One final thought that I would like to leave you with, that I find is very appropriate to this topic, is that every one of our employees comes completely equipped with a brain at no additional charge, and we just need to learn how to use it.

9.0 Training and Recognition in the World of TQM

Methods, issues, and experiences in the start-up and maturing phases of total quality training as well as tools and state-of-the-art technology which enhance the continuous development of employees in future-oriented organizations. Prior to the conference, field research on current and innovative recognition efforts employed by aerospace organizations was conducted. Results are summarized and discussed.

9.1 Beginning Total Quality Training — Moving Out Smartly

The do's and don't's of designing and implementing training for total quality. The topics faced by organizations as they move toward a total quality environment: Who should receive how much training? How should the training be paced? What TQM concepts and tools are a "must"?

9.1.1 Introduction

Carl L. Vignali, Group Vice President, Space Systems Group, Honeywell Inc., Chairman

I am sure this panel on quality training is of great interest to everybody who is thinking about, or trying to operate a total quality system in their organization. The first question is how are we going to train all these people to know how to do it. So, we have some experts here today to help you with that issue.

9.1.2 Training for Quality in the Internal Revenue Service

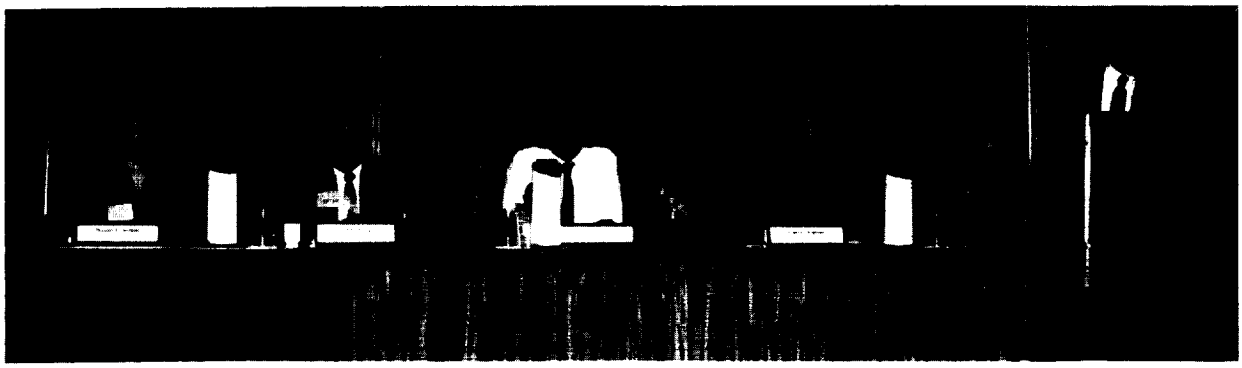
Donald McPartland, Quality Analyst, The Internal Revenue Service

One of our problems in the IRS is that it is very difficult to change an organization of 120,000 people. So, despite the fact that I moved into quality about five years ago, I cannot guarantee that everyone in the organization has. I can say that for the last four years we have had consistently better results in the processing of tax returns, we have had consistently better results in the issuing of refund checks, and we have had consistently better results in the answering of tax questions.

I am here to talk about how we got started in training people in quality management. We made a lot of mistakes, so those of you who are just getting started can really benefit from our experience, because we screwed up a lot.

We started in late 1984. We set up the Commissioner's Quality Council and started doing some research about how we should bring in quality principles into the IRS. We began to ask other people for advice on what we should be doing differently. We did some research and selected Dr. Juran to help us get started. Since then, we have had a long-standing association with the Juran Institute.

He suggested to us that we start with quality improvement. Juran divides the process of quality into three parts, which he calls the Juran Trilogy; planning, control, and improvement. He suggested that we start with improvement. That made sense to us, because we thought we already had quality control, we thought we already knew what our problems were. We thought we'd just start on improvement and work planning later.



Panel G1 - Beginning Total Quality Training - Moving Out Smartly (from left to right): Susan Crandall, Manager of Productivity, Bendix Field Engineering Corporation; Emmett B. Ferguson, M.D., Director of Medical Services, EG&G Florida, Inc.; Don McPartland, Quality Analyst, The Internal Revenue Service; Carl L. Vignali, Group Vice President, Space Systems Group, Honeywell Inc. (not pictured: Edward U. Gascon, Deputy Program Manager, Houston Operations, Bendix Field Engineering Corporation).

The fact of the matter is we had no clue to what our mission was, had no clue as to what our business was, and we did all our review on the back end. But he suggested we start with improvement. So, we set up five quality principles. Quality is the first principle. Next came dealing with systemic flaws, then improving responsiveness, then installing a quality process in every office, and last to change the evaluation systems. Now, those principles are actually included in our manual, and I think they have been lived up to by top management.

So, Dr. Juran came in and trained all of our executives. When I say all of our executives, I mean all 250 of them. He came in for a two or three day session with all of them. He did much of it himself, personally. I think that's really critical. We continue to do that with incoming executives. We have had three Commissioners of IRS who have taken Dr. Juran's training.

We now have developed our own quality leadership training, and we've used that to train all 10,000 middle managers. This has two components to it. The first component is the sort of soft-sided stuff, which deals with teamwork and communication, the role of managers, etc. The second component is the hard-sided stuff, which is the seven tools, and what we call the eight-step problem-solving process.

At the same time we were developing quality leadership training, we also developed quality improvement training for team leaders and facilitators. We used the Florida Power model. It has grown to 13 days, that's one of our mistakes. It's too long. There are three components to that, group dynamics, quality tools, and the problem-solving process, which incorporates statistics.

In October of 1987 the union became involved. So now, we have involved all of our employees, and we use consensus decision making within the confines of quality improvement. Consensus in our frame of reference means that you have veto powers, essentially, from going forward. The group makes the decision. If they all support it, it goes forward. If one person cannot support it, it stops. We're wrestling with how that works in government.

One error we made was we created an expectation among our employees of immediate change, which we could not support. We couldn't really follow through. So, there are some lessons to be learned in that arena.

Once we had completed our initial training we brought in the Juran Institute to do a review, and we also did a formal needs assessment. We did a survey of 1,600 people, and we analyzed the data.

What we found out was that the facilitators were unhappy with the role. In IRS we hire people that are very action-oriented and very aggressive. We found that the facilitators felt they were sitting on the wall and observing, but they were not really happy with that.

We found role-confusion between team leaders, and team members, and team facilitators, and we found we needed more training particularly in terms of statistics, and sampling, and those kinds of issues. We also found that the administration was very uneven. People were being trained very late, they were being trained too early, etc.

So, as a result of that, we hired an outside consultant to do some additional facilitation-skills training,

and we've been very, very happy with that. We've also revised our team leader/facilitator training. We've provided additional training for joint Quality Councils.

We also identified some new training needs, such as for process analysis training, which, to us, involves flow charting, setting up process measures, results measures where they are not already established, doing statistical analysis of the data that is gathered, and then making improvements from that.

Finally, we have a group of people who are identifying additional needs, who are working on a deployment strategy for added training, and we're working on additional course development.

So, that's essentially the history of training in the IRS. We developed training for executives, for managers, for union people, for team leaders, and for team members, and now we are developing training on process management for a wide group of people.

To conclude the message, I have to say that quality is only one of five things that the IRS is really trying to work on. Some people say that the commissioner of the IRS, Fred Goldberg, only has five words, and he mentions these all the time. They are related, and I think it's very important that you all hear them.

The first is quality, and that's his first message, quality. His second message is tax system modernization. We're going to spend about $8 billion over the next five years on that.

The third thing is diversity. We must value diversity. He says that people of different cultures, and different races, and different genders add to the process.

The fourth thing is ethics, and that has to do with our ability not only to obey the law, but to apply principles to our employees that say we're going to respect and value the way you do your business, and we're going to respect and value taxpayers.

The fifth thing is we're not going to treat all of you all the same way in the future. The fishermen in Oregon and the stockbroker on Wall Street are different people, and they have different needs, and we're going to try to meet those needs in individual ways.

I might point out that we could not have had executives come to that conclusion unless we had taught the quality principles to begin with. So, you're going to see not only your refund check get there quicker, but you're going to see the way we treat you differently. That doesn't mean that you're not going to be subject to a criminal investigation, or that you're not going to be subject to a form, but you're going to see us treat you differently as individuals and as part of market segments just the way that private industry does, and that is a part of this education process.

9.1.3 Quality Training Must Include the Customer

Emmett B. Ferguson, M.D., Director of Medical Services, EG&G Florida, Inc.

I believe that many of the tenets of total quality leadership have been used in the health care industry for many years. Experts have said that at least 85 percent of people in most organizations want to perform to the best of their ability. People in the health care industry tell us that it is actually a far greater percentage, perhaps approaching 100 percent.

One of the factors that prevents employees from achieving total quality is the lack of effective training. Most of us have recognized that there is a traditional approach to training. It starts with identifying a world-class resource, and having him train your senior management and senior leadership.

The second step, traditionally, is that those managers, those organizational leaders, and that consulting support must provide a certain level of generic training to everyone in an organization, to establish the definitions, to establish the groundwork to build upon as the effort is made to institutionalize total quality.

Now, most of us have been involved in teams for a long time, so teams are nothing new. However, the need to train facilitators in the TQM method is of extreme importance. But early in the process it's essential to make sure that teams are not forgotten because they provide the worker with empowerment.

The fourth part of the traditional approach to training is reinforcement training, both for managers and for the people in the work force, because the process needs incentivization and needs motivation.

When it comes to training, what many of us forget is we have to train the customer, or, at least his expectations. In the health care industry, we have taken surveys and we find that most hospital patients expect certain things: everyone expects to be

healthy when they leave the hospital; everyone expects the hospital to be clean; everyone expects to receive a bill that is so confusing that it's almost uninterpretable; everyone expects the food to be cold and not very good; and everyone expects to be awakened by the nurse to be given their sleeping pill. What happens if, in fact, you take those negatives in expectation and turn them around? What happens if, in fact, you train that customer to expect something differently?

Once you have identified a customer's needs, once you have identified that customer's expectation, how do you alter it? Don't forget to train the customer.

Now, you may say, how do you do that? Well, you are all victims of being trained by the health care industry. Fifteen years ago you would go to a social event in the evening, you would hear people discussing their grandchildren, or their golf scores, or their handicaps, now you hear people talking about their cholesterol levels.

The national cholesterol education program started an effort in 1987, both directed at consumers and directed at the health care industry, to inform people that if your cholesterol level is over 240 that you needed special studies, and probably special treatment, at least dietary treatment, and follow-up, and if your cholesterol is between 200 and 240, and you have certain other risk factors, you are a smoker, you have high blood pressure, you have a powerful family history for early heart attacks, then that group needs to be further investigated and perhaps treated, at least by diet, and possibly by more extensive treatment.

That educational program has greatly influenced the consumers' expectation in the health care industry. How many of you know that once you are on high blood pressure medicine, you are probably going to need to stay on that medicine for life? That has been a major part of our educational effort.

We run continuing education videos in our waiting room in the health care services of the Kennedy Space Center. We have about 25,000 employees at KSC and Cape Canaveral Air Force Station, and our organization provides comprehensive occupational, environmental, and emergency medical services for that group. Comprehensive means patient education. It means health care education and risk modification.

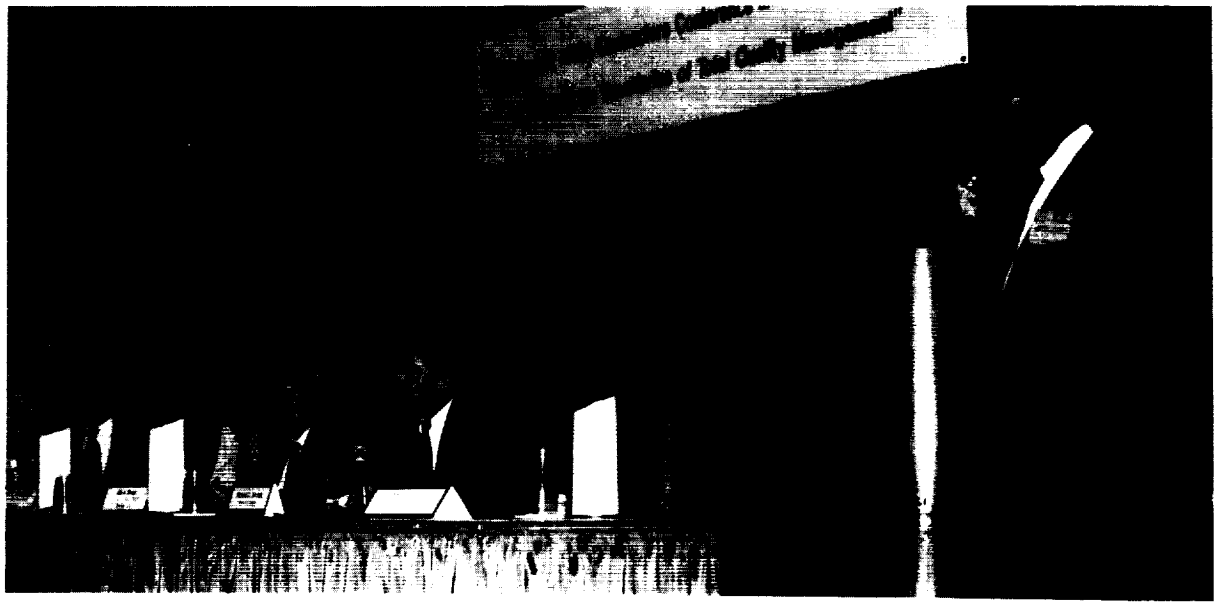
There is one other aspect of training that I would like to touch on just briefly, because it is probably something that is relevant from health care to your particular area of management. What happens when you ask physicians, "What could happen in this institution to make your practice easier, your life better?" Almost invariably they point a lot of fingers. We could have the lab work back on the charts when we make rounds, we could have the patients in the room when we show up, etc. In other words, they are blaming someone else, some other department.

The point is that it may be necessary to involve them in the team approach to solving those problems, to get them to recognize that their areas of responsibility affect the overall quality of the organization, and to identify areas that they also can bring about improvement in. Once you can get them to see that their team effort has brought about an improvement, not just in their own area, but in the overall organization, you usually have a powerful convert.

So, you have to, in fact, make sure that in your educational system you have that ultimate goal in mind. How you train your leaders and how you train your facilitators has a lot to do with that goal orientation, and it is of vital importance in institutionalizing the process.

9.2 "After the Initial Excitement" — Continued Improvement in Training

The challenges the presenters' organizations have faced and the methodology they have used to develop the high-performance work force required in a maturing TQM environment. They provide "lessons learned" on such employee-development topics as cost effectiveness, using training specialists versus line personnel as instructors, and sustaining the TQM momentum.



Panel G2 - "After the Initial Excitement" - Continued Improvements in Training (from left to right): Robert L. Moore, Jr., Business Development Specialist, BAMSI, Inc.; Robert R. Wooderson, Division Manager, Applications Support, Technical Service, Facilities Operations and Support Services Project, Johnson Controls World Services Inc.; Leo A. Braun, Manager, Support Services, Facility Operations and Support Services Project, Johnson Controls World Services Inc.; Richard G. Tancreto, Director of Quality, Black and Decker; James I. Chatman, Chairman/Chief Executive Officer, Technology Applications Incorporated.

9.2.1 Breaking Down the Paradigms Surrounding TQM Training

Richard G. Tancreto, Vice President, Total Quality for the U.S. Power Tool Group at Black & Decker

Black and Decker has been around for about 80 years. We have a proud heritage. In 1971 we were involved in the lunar space mission. We designed and developed the drill that took core samples from the surface of the moon. Every time we recruit new employees into our organization we are sure to mention that.

Although there is no perfect prescription for companies that excel, the research that has been conducted on excellent companies shows that their success results from a number of things: excellent management and management practices, management with vision, purpose, and a roadmap to get them there. It is really not technology, not geography, not labor pools, not government intervention, or any other external factor that makes the significant long-term difference; it is the performance of management and the management philosophies which they subscribe to.

If you look at it from the perspective of the individual managers within an organization, it is their one-on-one interactions and their roles as group and

team leaders which lead to success. It is their defining and transmitting their values and their vision which help shape a successful organization. It is also clear in these excellent companies that sustained good management does not just happen. It is a product of planning, and of developing, and most importantly, training.

Have you noticed that education and training have begun to receive a lot of focus lately. We have all read in magazines, and in newspapers, and seen on T.V. that our schools, for whatever reasons, are not turning out the level of students we hope for. Of this country's 3.8 million 18 year old's, 37 percent are educational failures. One out of five high school graduates cannot read a restaurant menu.

We are no longer ranked as the highest country in the world in math and science. Where Japanese companies spend next-to-nothing reteaching basic skills in the work place, companies like Ford, and Motorola are spending millions and millions of dollars teaching their employees, among other things, simply to read and to write.

The focus our education and training are receiving is healthy. It is just too important to sweep it under the rug. Dr. Deming said, "People are our most important asset, education the most important supplier." Successful companies have realized that it is no longer enough to train just managers within an organization. Every employee must be given equal opportunity to be trained.

A successful quality process is extremely dependent on having a synergistic work force focused on continuous improvement. One of the key ingredients to accomplish this is training, and training that permeates every department in every functional area of an organization.

My organization has been researching and planning, and then finally implementing total quality over the past three-and-a-half years. During that time we have learned a number of excellent lessons, as they pertain to TQM training. Each of these lessons has helped my organization not only solidify training, but sustain the TQM momentum. Each time the quality process seems to be slowing down, it's training that rejuvenates the process and puts it back on track.

What are some of our lessons learned? The first lesson is that you have to set a clear vision of your training goal as it pertains to the TQM effort. You have to ask yourself what are the individual and organizational results that the training is intended to achieve. Will these results, when achieved, be congruent with the TQM's goals and missions? If they are not going to be, you probably need to go back and revisit your training goal.

If your training is not aligned with the goals of an organization, you may have entertained, but you probably did not train. It is a sure-fire way to lose the interest and the support of an organization.

Also, a TQM training plan must be developed to take into account the immediate as well as the long-range goals of an organization. In other words, the training plan you put together must be a continuum. It must address the needs for today while preparing for tomorrow's needs. Don't fall into the trap, like we did, of just looking out over the next nine to twelve months. You have to keep your eye on the long-term goals of the company in order to develop the right short-term training curriculum.

Next, we quickly discovered the importance of getting line management committed and involved, not only in TQM, but in the TQM training. While many organizations talk of management involvement and support, I suspect most training programs receive permission rather than support.

We've done a number of things to turn that around. First and foremost, the training is delivered by line management. We have 160 managers who train for about two to three days a month. With that, however, it is incumbent upon the organization to provide these managers with the proper training and the proper tools. They need a training program and training materials that are facilitator-friendly. They themselves need to be trained and even certified in the training material, so that they feel comfortable and appear professional to their audience. They should possess a positive can-do attitude, and they must be self-confident.

The other major advantage in using your own managers is the instant credibility and receptivity on the part of the organization that is generated by having their own manager get up there and present the material, and take the time and interest to conduct these training sessions.

Another key lesson learned in getting management involved was to have all managers, including senior management, not only participate in the training, but as importantly, model those skills. Senior management or management of any level cannot just let a TQM effort happen. They just can't watch it happen, they must make it happen.

Always, where possible, try to have a training session kicked off or closed by a senior executive. This not only tells the participants that this training is important, but believe it or not, it reinforces that same message for that executive.

So, how do you know if you have changed behavior for the better? That question leads me to the last lesson we learned; you must continuously evaluate the results of your training. The absolute greatest mistake an organization can make in training is to ask someone to attend a training session and then not provide the reinforcement and the measurement of that training back on the job.

It is incumbent on the manager to establish an environment of trial and error for using the new skills, to establish himself or herself as a coach to help reinforce the application of these skills, and to establish himself or herself as a cheerleader to recognize the behavioral changes that are brought about by the new skills on the part of the employee.

My final closing comments deal with resistance to change. Not everyone, whether you are a manager or an employee, is going to want to buy into TQM or into TQM training. There are always going to be those that are skeptical and others that are going to be cynical of your motives. This is normal in any organization trying to change their culture.

Don't try to win over everyone all at the same time. Look for those pockets of support in your organization and begin working with them first, begin to build your critical mass. Don't overlook your skeptics, however. We found that if you can get them to change and be supportive of the change initiative, they are worth a hundred employees who believed all along. How do you get them to change? You get them involved. You ask them to conduct your training classes. You ask them to lead problem-solving teams. You ask them to become involved in any way that interests them.

9.2.2 The Johnson Controls Manager Certification Program

Leo A. Braun, Manager, Support Services, Johnson Controls World Services Inc.

Johnson Controls has developed and implemented a new training program which focuses on developing leaders at all levels. Any individual who is responsible for the performance of another is trained within our management training program.

We provide managers with the skills to communicate effectively, to identify wasteful practices, to deal with adversity and confrontation, and to create an environment so that all employees can successfully contribute to the performance of a team.

Our training program is structured essentially, but not distinctly, for two levels. We have an organizational development portion and an individual or leadership development portion. The course of instruction is approximately 64 hours, and it is conducted in either workshop or instructional lecture method.

At the start, we break off into teams of about 20 persons each, and each team prepares three plans. They will develop a strategic plan. They will develop an annual Excellence In Customer Satisfaction plan, and they will develop departmental and divisional operations plans.

These plans build upon each other. Our strategic plan would include some criteria from the Malcolm Baldrige National Quality Award, and some from the George M. Low Trophy: NASA's Quality and Excellence Award. We have experience with the NASA award. We were finalists in 1987. We also include contract requirements and barriers to teamwork.

Our Excellence In Customer Satisfaction plan includes measurements of previous performance, necessary barriers to performance, and other identification of things that we need to improve in our work practices. This is sixteen hours for all managers, eight hours for all other employees. We had 100 percent training in FY91.

The Divisional Operational Plan is developed from the bottom up and is assembled by a crew consisting of 2-25 people. It contains customer expectations developed from interviews with internal and external customers. We do an internal customer needs assessment. Each individual that is being trained must read Tom Peters' *Driving on Chaos*, and then must develop recommended improvements using the prescriptions he develops within each chapter.

Something that I think is an excellent innovation in our program is that for the operational plan we develop job performance standards for each individual. Our general manager implemented this last year for all his managers, and we are taking this down now to the lowest level. Every individual within the company will have a job performance standard that not only tells him what he needs to be doing as far as accuracy, timeliness, quality, and performance goes, but additionally these will be reviewed with each individual quarterly.

We also have a negotiated, continuing education plan for each employee, such as EMT training for firemen or medical services training. It would include tuition assistance, formal education, and things

that would be nice to have if we could get them. But it's negotiated with each individual.

Another program that we have is a Leadership Council. This is composed of seven hourly collective-bargaining persons and seven management non-collective persons. They work with committees within each division. These committees have taken on a needs assessment and made interviews of all individuals within the organization, and identified items that are barriers to quality and productivity. These are provided to the teams in training so that they can be worked.

To summarize, what we have tried to do with our training is bring it to the lowest level in the organization, so that each team can understand and contribute to the total quality program.

In the past, we tended to look to management skills. Now, we are looking to develop a customer focus, improving the way we work, and total employee involvement.

9.2.3 The Impact of the Manager Certification and Work Force Training Programs

Robert R. Wooderson, Division Manager, Applications Support, Technical Service, Facility Operations and Support Services Project, Johnson Controls World Services,Inc.

The Technical Service Division (TSD) at Johnson Controls finds it very important to train everyone and get even the lowest-level person involved. We are committed to training all of our people, not just the managers, not just the shop leaders, but all of them. By doing that, we feel like we lay the foundation for continuous improvement.

The main thrust by TSD is to implement Excellence in Customer Satisfaction to make sure that each of our division employees understands the need to do it right the first time every time. We preach that in our training, we talk to them about it, we get them involved.

Customer satisfaction is, and must be our primary goal, because it is vital to our continued success. In both the government and the commercial arenas, a contractor's reputation for excellence, integrity, and on-time delivery of a quality service or product is paramount in both his performance evaluation and in the selection process. Our recent and continuous emphasis on customer satisfaction has allowed us to improve ourselves, our systems, and our relationships with others.

Technical Services Division was organized in late 1988 to improve productivity using a business approach, driven by a strong engineering department, with technological advances in processing, machining, and welding, to redevelop the shops to a mode which would handle increased engine activity in any new engine testing programs that came along in the 1990's.

The operation of TSD, unlike some of our sister divisions, is funded in excess of 90 percent by customer demand. The degree to which those customers are satisfied determines the survival of our division. We feel that the improvements made in our organizational structure have one goal in mind, customer satisfaction. Customer satisfaction will ensure our survival.

Throughout the Johnson Controls organization at Stennis the Total Quality Management style of operations has taken root and is producing measurable improvements. For example, in 1988, the Fluid Components group had one of the poorest records in the project. But TQM improvements have transformed that group, and enabled them to recently win the coveted Johnson Controls' merit award for the second quarter of 1991.

Today, all of our employees have completed the Excellence in Customer Satisfaction Training. We have a division-wide training effort which emphasizes cross-training and professional certification. Also, we encourage team members to participate in on-site and off-site educational activities. We have developed a performance standard for each employee in the division. Each employee is accountable and responsible for his own performance. He is given guidelines, and these are reviewed quarterly, so that he knows where he stands.

Results? In one of our groups, during the period 1989-90, we had a reduction in the number of technicians it took to do the same volume of work from 26.5 to 16.7. In 1991 this number is slightly lower, and it is still continuing to go down. Another measure is the number of components processed per technician. This number went from 4.34 up to 6.2.

Inherent with productivity, and quality, and good workmanship has been the safety record. During 1985-88, OSHA-reported accidents in one of our shops were a problem. During 1989 this was reduced, and in 1991, to date, this particular group has not had a lost-time accident.

Increased productivity, updated equipment, optimization of labor, equipment, and facilities have increased safety and led to over $1.1 million in cost savings from 1988 through 1990.

The Component Processing Group is not resting on past success. Analysis will show that equivalent cost savings will be realized in 1991, and we intend to continuously improve. Some of the ways improvements will be attained are by developing fully self-managed teams. We will develop better benchmarks and measurement techniques so that the other crews will be able to compare their performance against what is planned for the future. We will identify and establish criteria for elimination of waste by improvement, cost savings, and quality enhancement.

We also intend to develop a customer service team, which will assign a responsible team member to track and deliver a critical delivery item. If a customer has a concern for a particular component or job in process, he can be given a minute-by-minute location and condition as applicable to his job.

We will continue to stress and support the need for continuous training. The more we know, the better we perform. We will continue to encourage our employees to advise us of their needs and make every effort to try to implement these actions.

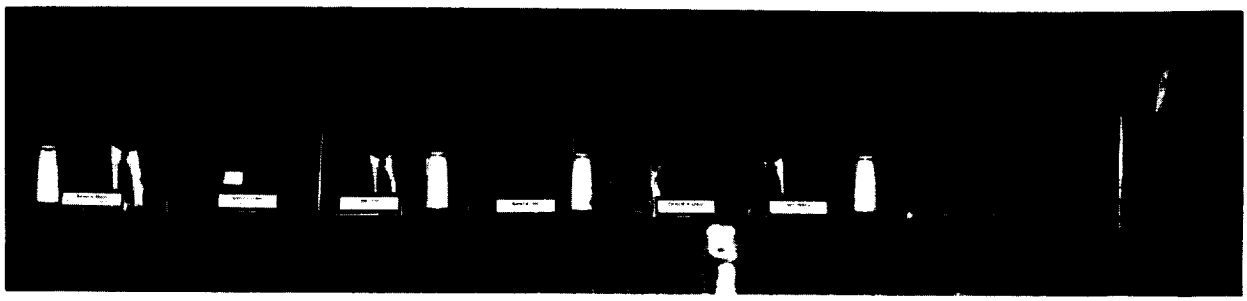
9.3 Recognition Methods - What Turns People On?

A pre-conference survey has been conducted to learn how organizations recognize their employees. Data will be summarized, and current recognition efforts examined for their effectiveness in the fast-changing work place. Panelists will discuss the changing values of today's work force, and will explore innovative recognition systems being developed by companies with a 21st century focus.

9.3.1 Introduction

Donald E. Smith, Vice President and General Manager, Bendix Field Engineering Corporation-Houston, Chairman

As chairman of this panel, I've taken the position that I'm just going to be a facilitator, because this group is truly one which was built using group skills, group analysis, and all of the tools that we are supposed to be working with in TQM.



Panel G3 - Recognition Methods - What Turns People On? (from left to right): Kevin H. Dunn, Environmental Control and Life Systems Design Engineer, Boeing Aerospace and Electronics Division; Althea Gamble, Executive Secretary, ILC Space Systems; Joe Cruz, Tunnel Operations Leadman and Union Steward, Ames Operations, Calspan Corporation; Darlene Cole, Buyer, Intermetrics, Inc.; Cindy M. Krehbiel, Lead Engineer, Harris Space Systems; John Hillins, Vice President of Corporate Compensation, Honeywell Inc., and Chairman of the Productivity and Alternative Awards Committee, American Compensation Association; Donald E. Smith, Vice President and General Manager, Bendix Field Engineering Corporation - Houston (not pictured: Dennis M. Carvalho, Director, Quality Systems, Space Station Division, McDonnell Douglas Space Systems Company, and Otto G. Coldiron, Director, Product Assurance, Honeywell Space and Strategic Systems Operation).

9.3.2 *Cinsy M. Krehbiel, Lead Engineer, Hardware Systems Department, Harris Space Systems*

The first thing we did was distribute a survey to ten percent of our employees. This survey asked the employees to rank on a scale of one-to-ten the effectiveness of the 35 most-frequently-used methods of recognition. They were to rank how effective these methods were at motivating.

Although we found that many of the commonly-used methods of recognition are of minimal impact, something which was very important was a personal thank you from upper management. But this was only effective, however, if the management clearly understood what was being recognized, and if there was a sincere appreciation for that contribution. It was very important that the recognition be earned for something which was truly significant. People can see through it if they are getting white-washed.

A recent survey done by Otto Coldiron and Dennis Carvalho looked at the top-ten methods of recog-

nition used by management and compared those to the top-ten methods favored by employees. It found that the most commonly-used recognition methods were performance appraisals, cash awards, newsletter recognition, small gifts, and thank you letters.

The survey found that the top three most-frequently-used methods also made the employee's top-ten list. Then, after that, it gets spread out. Several of the most-frequently used methods did not make the top-ten for the employees. In fact, special projects and assignments, ranked in the top-ten by the employees, were not very frequently used at all.

Another thing that came out is that it is very important for employees to feel that their peers recognize them as valuable contributors. They want their peers to see that management values them.

There are several ways accomplish that. One is to stand up at an all-hands meeting and give individual recognition to somebody, again, calling the person by name, pronounced correctly, and explaining what the contribution was. That is important. It is not enough to just say this is a good employee, but to say this is a good employee for this reason, and we are specifically acknowledging this contribution. That needs to be done in front of the peers. It doesn't necessarily have to be the whole company, but it does need to be in public.

Another example is when somebody does excellent work, that person gets a promotion. That was actually listed as a method of recognition. Many people I talked to said I want that recognition to show up in my title.

Another facet is not only recognition by management in front of peers, but recognition by peers, peer-nominated awards. People really value what their peers think. I guess that makes sense. Most of us want to think that we truly are valued all around. So, if you have the opportunity to give an employee recognition among his or her peers, you will get a whole lot of mileage out of it, a lot more than you would if you just privately gave the recognition.

9.3.3 *Kevin H. Dunn, Environmental Control & Life Systems Design Engineer, Aerospace and Electronics Division, Boeing Defense and Space Group*

One of the key points we saw is that there is a general lack of understanding of the awards programs. People don't know what is available, people don't know what is out there, they don't know how to nominate somebody, they don't know what the criteria for selection are, they don't understand the selection process. These points, if not worked out, basically make your program useless. So, what we need to do as companies is to educate the employees on what programs are available, how you use them, who can nominate who.

Just a case in point, one of the things that we saw throughout several companies is most employees thought that only managers can nominate them for employee-of-the-month, or other programs. I know at Boeing, at least, this isn't the case. Co-workers can nominate other workers, and people just don't understand that.

If we tell employees what is out there and explain to them very carefully the selection criteria and process, I think we will see more nominations coming in. Remember, even nomination is a recognition. You may not win that award, but you were nominated, and that means a lot to the employees.

I think we can educate the employees in a fairly easy process. You could use the company newsletter, you could use all-hands meeting, you can use staff meetings. It is very critical and important that we get the word out, otherwise, the awards programs we have in place just won't work.

Another comment we frequently saw was to the effect of putting your money where your mouth is. Employees didn't see consistency among awards. What they mean by this is that it's good to hear some words, it's good to hear you're doing a good job, but let's see it on the performance appraisal, let's see it carried out in a commensurate salary adjustment.

9.3.4 *Althea Gamble, Executive Secretary, ILC Space Systems*

We are dealing today with recognition and what turns people on. I am going to just take the word "recognition" and let's see what it means. Recognition means an acknowledgement, a favorable notice, it also means to be aware of, to appreciate.

In order for you to get total quality, you have to get to know the people that work for you. In order to know me, you have to know of me. Many of the managers don't know the people who work for them, and by that, I mean they don't know them by

first name and they don't know where they are from.

We are dealing with a time and an era where the work force is changing. You are having a wide variety of cultures in your work force. Do you know the different cultures that you are dealing with? If you do know of them, then you would be able to motivate them properly.

This has to be done genuinely. I think that managers should have a strategic plan, how are they going to know their employees, and this is from the top down, the president, the vice-presidents, the project managers, the program managers. They need to know the people who work for them.

I could assure you that if you get to know those people, and they feel that they are a part of a team, and they know they are part of this end product, and they are as important as the other person, I think, production would increase. Managers could start today, they could go back after attending this conference and decide that they are going to make a difference. I could assure you also that if you go back and you decide that you want to get to know your people, you would see a difference in your environment.

If the manager wants to make a point to one of his employees he doesn't necessarily have to do it in a meeting. He can talk to him in the hall, he can go to him if he heard his wife was ill. That gives the employee the feeling of this man or this woman really is concerned about me.

I would use a little example of a situation that happened with me about two or three weeks ago. I have been blessed to have a real great boss. We had to put some 70 folders together for a big meeting. They could find nobody to do it, so I volunteered. I was downstairs. He was leaving his office at about six-thirty and he saw my things on my desk, and he went around the building looking for me. He found me, helping to put these binders together.

When he left he was appreciative and said he trusted me to the job. The feeling I had is that there was a man who was concerned about me, and, therefore, there is nothing morally right that I would not do to help him to accomplish his goals, because he was concerned about me.

So often we forget about those hourly workers in the shop, those guys who are actually putting the tools together, but a project manager gets a plaque that says thank you for making this happen.

I close by saying that today is the first day of the rest of your life, and you could begin today by committing to know the people who work for you, to communicate, to be genuinely concerned for them, and you just watch the results.

9.3.5 *Joe Cruz, Tunnel Operations Leadman and Union Steward, Calspan Corporation, Ames Operations*

I have been in the union all my employment life. What I find to be a problem in the union management is that the union people feel there is a line dividing management from union, they don't feel like they are part of the company. They need to be taken in and made to feel like they are part of it. It just makes it very difficult for them to be motivated by when they do not feel like they are a part of the company.

Hourly employees frequently feel they have no incentives. They have negotiated raises, and in some cases, incentive raises, but that's not enough to make them really feel they are a part of the process. Hourly employees don't want a whole lot, they just want recognition for the job that they are doing as long as they are doing it well.

Unfortunately, many times, the only recognition an hourly employee gets is when they do something wrong, and that's negative. I think management would be surprised if they realized how much more effort they can get from hourly employees with a little more positive recognition so that they can show their peers that they are doing a good job.

9.3.6 *Darlene Cole, Buyer, Intermetrics, Inc.*

My area of discussion this afternoon is one of the most popular forms of recognition, simply an immediate or direct thank-you from the manager. This is considered more personable, because it is generally done on a one-on-one basis.

How can you be sure this form of recognition has maximum impact? There are four factors to an effective direct thank-you from the manager. The first is credibility. Did the employee really deserve a pat on the back? To know that, managers need to know their employees' jobs. You can't measure the employee's ability to do a good job if you don't know

what that job is. You need to be able to set a reasonable expectation for your employee. That way, work that is above and beyond expectations can be rewarded as it should be.

Secondly, the recognition must be timely. That doesn't necessarily mean immediate, but it should not be delayed too long. If you wait too long your reward loses its credibility as a motivator to your employee. For instance, work put into preparing proposals sometimes can go unrecognized until the proposal is finished. This can take months, or years, and that is too long to wait.

Thirdly, the manager needs to be sincere in their recognition. A thank-you should not be given as an afterthought. If you are talking with your employee in a group of people, and the subject of their last effort comes up, and you say, "Oh, by the way, I want to thank you for the work you did, you really put in a good effort." That's not generally considered a sincere thank-you.

In addition, the recognition should not necessarily be expected. It could be a surprise recognition. That is generally well received. Gestures such as a handshake or a pat on the back usually denote sincerity, and are usually well received, both publicly and privately.

Eye contact is another important factor to sincerity. An employee isn't going to think you are sincere if you say thank-you as you are passing in the hallway.

Group thank-you's are not generally personal enough to be considered significant, unless they are accompanied by some form of sincere gesture. For example, when you are thanking a person or a group of persons, for an individual or a group effort, distinguish them from the larger group. Ask them to stand, call them by name, and even walk over and shake their hand to show sincerity. If you do call them by name, please be careful to pronounce that name correctly.

Form letters from upper management have little sincerity. They don't seem to carry as much weight as hand-written ones.

Fourthly, recognition needs to be consistent. Recognition or rewards should have an end result in order to be useful. In other words, they should lead up to something, otherwise, they are considered useless. If someone's efforts or abilities are deserving of thanks, they likewise are deserving of documentation. Don't be appreciative of them all year long with good words and gestures, and then forget them at raise time.

Notations or copies of letters should be documented in the employee's personnel file, to be reflected in their evaluation. This keeps good efforts from being overlooked. People tend to remember things that we do wrong much more often than the things we do right.

In summary, I just want to say that this form of recognition requires some time invested on the part of the manager, but according to most employees the reward is worth the investment.

9.3.7 ***John Hillins****, Vice President of Corporate Compensation, Honeywell Inc., and Chairman of the Productivity and Alternate Awards Committee, American Compensation Association.*

The real question is, are our people merely commodities that we use up and throw away, or are they really assets that we invest in?

In the past, organizations have been structured with the executives at the top, and they make all the decisions. In the middle we will hire some middle managers to actually watch these workers, the people who actually do the work. So, our organizations have been structured like a megaphone. At the top is knowledge, power, decision making, and freedom to act. By the time you get to the work station, scientist or production worker, there is very little knowledge of process, power, freedom to act, and yet, that is where most of the knowledge about how to best do the job exists.

The organization of the future is one that will be an enabling organization, it will be a facilitating organization. Leadership will shift minute-by-minute within the organization, and people who know best about the decision are the ones who will make the decision. So, we need to take the megaphone and turn it into somewhat of a wastebasket, where at the bottom there is much greater power, knowledge, and freedom to act. We call that empowerment, or delegation.

Most of us read with great interest what is happening in the Eastern Bloc. The biggest change in democracy, in my opinion, is not in Europe. The biggest change in democracy is within our organizations, right where we work, because democracy is entering the work station. Each person wants a say, they want to contribute, they want freedom to act.

Now, let's look at the history of U.S. business.

First of all, we competed with the world in technology and we said, "Take our technology, because it's the only place you can go to get it, we're the only ones that have it." Then, other people got our technology, and we said, "Ah-ha, but we've got good manufacturing processes and good quality." Well, they caught us in manufacturing processes, and jumped ahead of us in quality.

Then, we said, "Oh, but look at our costs." But now, everyone is beating us on costs. In tomorrow's business environment, technology, process, manufacturing, quality and cost will all be even across the world. Everybody will have them. What will be the basis for competitive advantage or disadvantage? Time. We will compete in a time dimension.

Now, if I want to talk about cycle times I want to talk about employees performing work efficiently. So, I need efficient execution and time-based competition. I need efficient resource utilization. I believe that all the major challenges to organizations today in the United States are human resource issues, and that gets us to a discussion of recognition programs.

Recognition programs are awards, they are not rewards. Let me tell you what I mean as the difference between an award and a reward. An award is something I give you as a gift after the fact. A reward is something I know all the rules ahead of time. I know what I have to do and I know what the consequences of my behavior are if I do it, or not do it. Lawler's Expectancy Theory says if I want money to motivate in the rewards area, the person must believe that they personally can impact what you are measuring, line-of-sight. I can touch it, I can feel it, it is within my influence sphere.

Recognition programs must be meaningful. We had a recognition program, which initially worked well, and we stretched it out for three years. But our awards were trinkets, junk. The junk worked for a while, but it got awful demeaning after a while. So, you have to have fresh ideas for recognition.

The key statement is that recognition programs are primarily communication, not remuneration. They are a way of saying to people, "I really appreciate what you did." Sixteen years ago I was working in the compensation department of our computer division. It was December and we were having a problem with double bid errors in the memories cabinets, and the systems were crashing. We worked all night, and in the morning we found out it was a change in supplier delay lines. I got a $500 bonus. I cashed it on the way home. I had a five year old and a two year old. My wife was on my back for getting an MBA at night and working 60 hours a week, and trying to succeed in life, and all I got was crap for it.

I cashed the check. I got it in fives, tens, and ones, put it in an old shoebox, tied a string around it and went home and gave it to my wife. When she opened the box she thought I robbed a bank. Ladies and gentlemen, I will tell you that we have pictures in our album of our kids on our bed with money floating down out of the sky that they were throwing up in the air. I will tell you what that spot award did for me. It wasn't the money, it was the message, "You see, dear, you're wrong, they do care. I am okay, I know what I'm doing, and somebody is seeing me do it." There's that recognition, and I believe rewards like this are allowing people to feel important about themselves. The only way you can do it is for the supervisor to really know what's going to make the employee feel very important about himself.

I have two secretaries in Minneapolis. They can't possibly do all the work we give them. I was afraid one of them is going to quit. A management letter came out the other day saying, "Honeywell has Viking tickets, here are the games that we have Viking tickets for, which of you execs would like some. We'll charge your budget."

I thought, well, there's an idea. I gave the letter to the two secretaries and said I would like you and a guest, possibly your husband, to pick whatever game you want to go to.

Recognition programs should reach to your outside suppliers, as well. I keep 12 certificates in my secretary's desk, four $25 certificates to Red Lobster, four $35 tickets to T-Wright's, the best salad bar in the twin cities, and four $50 dinner certificates at the Old Log Theater. Anyone in my organization is free to give those certificates to anyone outside the organization that does something for us, works the whole weekend because our computer went down, and did not go home from noon on Friday until Monday morning.

I agree 100 percent with the panel that we ought to have an open nomination process. It shouldn't be just managers that can recommend. Anybody can recommend anybody. The more management insists on deciding on who gets them, the more management is subjecting itself to a problem. Let the peer group decide who gets them, based on criteria that you have established and communicated.

I also believe in tiered awards. I believe that some recognition is at the $5,000 level, and other recognition is at the $100 level. I believe, also, you ought to have different kinds of awards. We give an award for technical excellence. They get a trip, and money,

and recognition of being the best engineers from a patent standpoint at Honeywell. We have another award which recognizes those people in the company who are the best developers of people. We have the President's Club, the best sales people. They go to Puerto Rico for a week, with all senior management and spouses.

You're always going to have recognition programs. You're going to have to make them bigger to get peoples' attention. They are going to be more team-based, there is going to be increased peer involvement, and they are going to reflect the empowered organizations that we're talking about.

10.0 Community Partnerships: Reports from the Field

A discussion with Houston community leaders and interactive discussions via satellite from Baltimore and Denver pursuing community solutions to seemingly evasive quality and performance challenges.

10.1 Focus on Total Quality in Education

No system is more critical to sustained U.S. competitiveness than the educational system. Total Quality offers a management model that can be used to transform education as it is transforming American industry. This session will examine two models for applying Total Quality in Education. One is state-wide for public education (K-12); the second is a model of Total Quality in a major state university. The critical role played by industry partnerships in both of these models is also explored.

10.1.1 Introduction

Dr. John M. Klineberg, Director, Goddard Space Flight Center, Chairman

Achieving excellence in education is an issue that is very important to all of us, and is one of extreme national concern. Concern for excellence in education is not a new concern for NASA. The mission of the Goddard Space Flight Center, for example, is to expand human knowledge of the earth and its environment, the solar system, and the universe through observation from space.

We are committed to excellence in scientific investigations as well as in advancing essential technologies for developing instruments, spacecraft and data systems. To achieve our mission we are therefore committed also to excellence in education from grade school right through graduate school. We know that we must nurture an interest in our young people to strive for excellence in such fields as mathematics, science, and engineering. And to do this we must continue to build on the strong foundation of outreach programs that NASA has done for years such as the Aerospace Education Services Program where a lecturer goes to a high school assemblies or teacher workshops. This program reaches nearly 1,000,000 people every year.

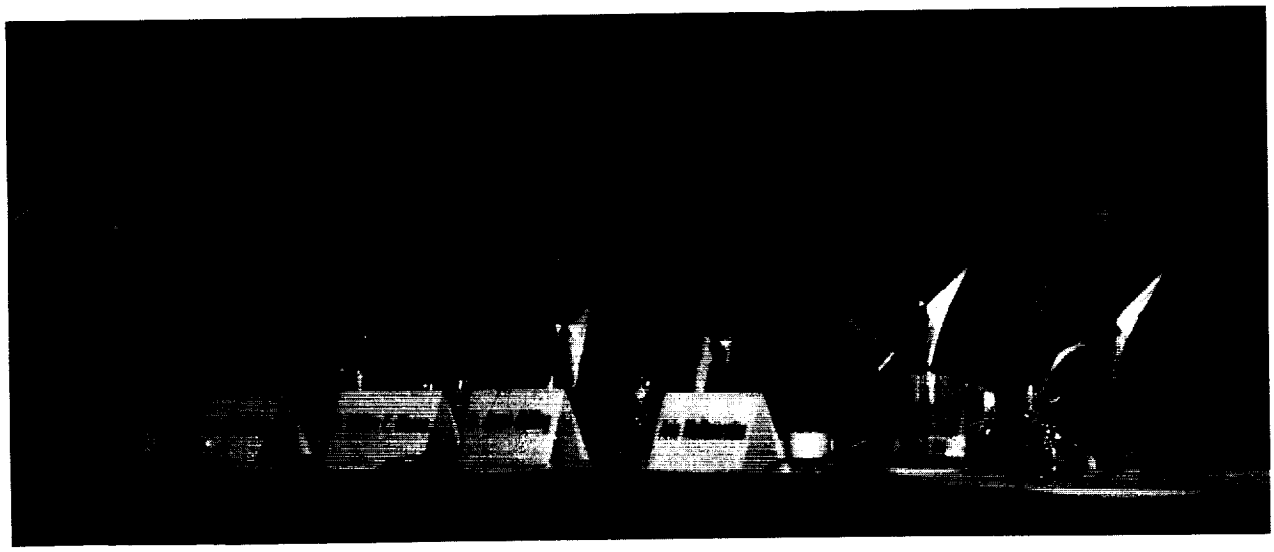
All components of NASA participate in the community involvement programs, in developing teacher resource centers, in judging science fairs, and in providing student, teacher, and facility internships in our centers. The list goes on, but it's important to recognize that we can all do better if we can develop a broad community commitment to excellence in our schools.

Total Quality Management offers a model for us which suggests that our educational establishment should really reexamine what it is we do in education from the viewpoint of the student as the customer. Now although this sounds straight-forward, it's probably revolutionary.

Suppose, for example, that we look at the school classroom as a system. Since students are part of that system, they have to be treated as customers or as stakeholders, not as a group that teaching is done to. The students themselves have to realize that they're an important component of that system, and that part of their job is to work with the managers to create a better system. So in essence, the task is to have students realize that they can make a difference in their education, if they themselves take responsibility for it.

Making that shift will take time, but in Maryland as in other states the journey has begun. It's for this

purpose, to help us examine what our educational leaders are doing in this area and participation with industry, that we've assembled this panel of exceptionally qualified individuals.



Panel H1 - Focus on Total Quality In Education (from left to right): Dr. Thomas C. Tuttle, Director, Maryland Center of Productivity and Quality of Work Life, University of Maryland; Dr. John M. Klineberg, Director, Goddard Space Flight Center; William (Brit) Kirwan, President, University of Maryland, College Park; Dr. Joseph Shilling, State Superintendent of Schools, Maryland State Department of Education; Aris Mellissarotis, Vice President of Productivity and Quality, Westinghouse (not picturod: Imants (Monte) Krauze, Director, Quality and Productivity, Bendix Field Engineering Corporation; John P. Scully, Deputy Director, Management Operations Directorate, Goddard Space Flight Center).

10.1.2 *Dr. Thomas C. Tuttle, Director, Maryland Center for Quality and Productivity, University of Maryland; Moderator*

The total quality process in education is being conducted with the support and active involvement of business leaders. Therefore, business is a supplier to education. Furthermore, the panelists themselves represent customer/supplier relationships. This panel will address total quality in education, how it is being conducted, and the need for partnerships to increasingly affect the total quality implementation.

Centers like the Center for Quality and Productivity (which is part of the Maryland Business School) represent efforts of universities to provide service to their state and their region. There is a well-established tradition of this service in the agricultural arena, in the agricultural extension service, and perhaps a growing tradition in the technology extension area. But we're trying to launch a similar tradition in providing assistance in the quality and productivity arena.

This is particularly important if we believe experts like Peter Drucker, who was recently quoted as saying, "The single greatest challenge facing managers in the developed countries of the world is to raise the productivity of knowledge and service workers." This challenge, which will dominate the management agenda for the next several decades, will ultimately determine the competitive performance of companies. Even more important, it will determine the fabric of society and the quality of life in industrial nations.

Through its centers, universities have a responsibility to assist managers and leaders to respond to this vital challenge through programs of information, training, education, technical assistance and research. We have learned over the years that quality is the fundamental driver of that productivity improvement.

Therefore, we have adopted total quality as the best mechanism for responding to the challenge raised by Peter Drucker. Perhaps the most important element in our ability to respond as a nation to this challenge is the performance of our education systems. It is especially appropriate that NASA, which has contributed so much through the years to improvement in education, would choose to spotlight this session entitled "Total Quality in Education."

10.1.3 ***Dr. William (Brit) E. Kirwan**, President, University of Maryland, College Park.*

Total quality is a concept that is well developed in the private sector, but surprisingly, it is not well understood in higher education, nor has it been widely discussed or implemented.

My first exposure to this concept came through our corporate contacts and research and development projects with Xerox, Ford, Westinghouse, and some other companies who have been leaders in the implementation of total quality. They encouraged me to visit their headquarters to observe total quality at work in the private sector and I must admit that I had a certain amount of skepticism about what this might mean for a university but I did respond to these invitations for visits.

I was impressed by what I saw. There was a visible difference, a responsiveness, a sense of pride in the place that, quite frankly, one doesn't see to the same extent on most college campuses. And so, it occurred to me from those experiences that there might be a role for total quality in the higher education setting.

Initially it seemed to be more appropriate in the administrative functions of the university. After all, we are in large part a service industry and our admissions process, records, registration, and procurement, could benefit from the concepts of total quality. However, as I've explored this concept further I've come to realize that there are many other benefits to the university. For one thing, I see it as a means of empowering people in the work place to control what they do, and to make their work more efficient. I also see it as a means to eliminating unneeded bureaucracy. But more than that, I now believe it must be extended beyond the administrative functions of the university and into our classroom and research laboratories.

I think there is a very important reason why this concept of total quality must be embraced by higher education which goes beyond just our concern for internal matters. Universities are coming into a period of increased accountability on the part of the public and private sector. Quite frankly, university images have been tarnished in recent years by expenditures on overhead, some instances of fraud in research, and a general sense of lack of achievement along the educational pipeline. That's why we see Apple University, Motorala University, other examples where corporations have felt the need to begin the educational process themselves because of dissatisfaction of what they get from universities. So, in a time of fiscal constraints, with everyone sensitive to, and conscious of the way money is being spent, I think we are going to see, of necessity, universities across the country embracing the concepts of total quality.

And what is our objective at the University of Maryland at College Park? What have we embarked upon? Over the next five years, it is our intention to bring total quality into all administrative operations at the University. Over a somewhat-more-extended time period, we will bring total quality into the classroom completely in the College of Engineering, Business, Management and several other colleges across the campus.

I have appointed a steering committee chaired by the Dean of the College of Engineering, involving faculty, students, administrators, and staff to develop an implementation plan to accomplish these objectives. The implementation plan is being field-tested with focus groups, focus groups of faculty, staff, students, and alumni.

We're also trying to bring an awareness of total quality into the curriculum. We sponsored a major conference, with David Kearns as the keynote speaker. We brought in higher education leaders from the region and gave a day-long session on the concepts of total quality. In our internal publications on the campus, we have had a steady stream of articles written about total quality concepts and what they can mean for a university.

We've also embarked upon a number of pilot projects. Our graduate school, the President's office, financial aid, the library, and the computer center, have all taken on some pilot projects in total quality so that we can demonstrate the success of this effort. And finally, and I think this is most important, it is essential that the President of the University be very visible, and be very committed to this concept. It is an enormous task to bring about this cultural change in any organization, and in particular in a university, and without the high visibility of the President and the strong commitment of the President, it cannot work. And I have made that commitment.

And what are some of the special barriers that we face in higher education in bringing about the concepts of total quality? I think we recognize that it's a different environment, there is no model to follow. We're breaking new ground, and to some extent the concepts seem to be foreign to the members of our community. Universities are based upon concepts of academic freedom, tenure, shared governance, in fact, even the language of total quality is not language that faculty and some members of the community feel comfortable with.

I think higher education faces some very special

challenges. We need help from industry. You are experts in this area. We need your encouragement. We need your support, and quite frankly, I've been very impressed by the way industry has responded to what we are doing at College Park. Several corporations have provided us with loaner executives who have spent long periods of time on our campus helping us to bring in the concepts of total quality. We wouldn't be as far along as we are without this support. Xerox, IBM, and Westinghouse have all been very supportive of what we are doing.

I believe that this is an investment well worth making because if we are successful in implementing these concepts we will provide the private sector with a better-trained product, which will be to the benefit of all.

10.1.4 ***Dr. Joseph Shilling****, Superintendent for Schools, Queen Anne's County*

As we look at the condition of elementary and secondary education in the State of Maryland on a comparative basis, we're in pretty good shape. Our third graders on standardized achievement tests scored about three-to-six months ahead of the national norm, our 5th graders about six-to-nine months ahead of the national norm, our 8th graders almost a year-and-a-half ahead of the national norm. Three years ago we ranked third in the country in SAT scores, last year we moved up to second among those states where over 50% of the kids take SAT's. So we have a fairly good school system.

The question clearly has become for us, "Is that good enough?" When we look at the global economy, when we look at the shrinking social/economic environment that our youngsters are going to enter, I think the answer becomes overwhelmingly clear. What we are doing today is not nearly good enough. So our mission became pretty simple, to put Maryland in a national leadership position educationally.

To do that we developed a set of ten goals, and I'm not going to share with you all ten of those goals but to give you a sample of the kind of goals that we're talking about. One, Maryland will rank in the top five states of the nation on national and international comparisons of student achievement and other measures of student success. Two, 100% of our students will graduate functionally literate and will be able to demonstrate that by the time they enter the ninth grade.

Three, 95% percent of our students will achieve satisfactory levels in mathematics, science, reading, social studies and writing language usage on state developed assessment measures that in fact emphasize problem solving and critical thinking skills. The number of students pursuing post-secondary studies in mathematics and science will increase by 50%.

Unfortunately, after we looked at the data we found that a 50% increase wasn't enough. We discovered that only 1% of our high school graduates were entering our college and university system and majoring in mathematics, and only 4% were majoring in all the sciences combined. Now here we are a state with Westinghouse, Martin Marietta, and all kinds of technologically-based industries, and we've got 5% of our youngsters leaving our high schools and majoring in the subjects that are going to support those industries.

Another problem area is that in Maryland, only 75% of our youngsters who enter the 9th grade graduate from high school. Quite frankly, we don't have jobs for the 25% who don't graduate from high school. Bethlehem Steel has long passed the point where they have entry level jobs in labor. Those firms that we once had dotting the countryside in the State of Maryland are now housing developments. So these entry-level jobs no longer exist.

Of those who did graduate from high school, 22% of them were not preparing to go on to post-secondary education and were not in a technology-education program that would prepare them for meaningful employment. Quite frankly what they were doing is picking the easiest English course they could find, the easiest social studies, math, and science. They were picking their way through our system. We handed them a high school diploma at the end of grade 12, but they really weren't prepared to do much. And by the way, they're the folks who are knocking on your doors for some of your entry level jobs. They're the folks that are going to C&P Telephone, Baltimore Gas and Electric and applying for those entry level jobs.

After we set those goals, we put in place an assessment tool we called the Maryland School Performance Program. It establishes a very high set of standards that are geared to five years from now, 1996, on our way to achieving those goals by the year 2000. We then developed assessment measures to determine our progress toward meeting those standards on an annual basis.

Last year we published our first state-wide report card on how well Maryland is doing in meeting those standards. This year, we will issue a report card that

tells people in each community in this state how well their school system and how well their individual school is doing in meeting those state standards. If it sounds familiar I guess we were about a year ahead of America 2000 in deciding that in fact we needed those standards, we needed to assess our progress towards those standards, and we needed to tell everybody in our communities throughout the state how well we were doing in meeting those standards.

As far as answers go, we think we need to do a great deal more with our early childhood education program. We have a lot of youngsters who don't come to school in the first grade prepared to learn. They come from social/economic backgrounds that are severe impediments to them coming to school with the kind of skills that are going to allow them to succeed. With the help of a very energetic government, we have expanded greatly our pre-kindergarten program throughout the state with the goal of having every youngster who is a chapter-one-eligible child in a preschool program prior to entering our kindergarten program.

Next, we needed to look at restructuring our process. We think some of the most important decisions need to get made by teachers and principals at the building site if, in fact, we're going to hold them accountable for the results. And that's where we saw a tremendous opportunity when we began to look with Westinghouse at total quality. We formed a partnership with Westinghouse about three years ago at the state level to develop a management focus on the customer.

And let me tell you, that's tough for us, because we don't know who the customer is yet. We thought the customer was the student, but we're not on target folks. The customer is you, and we've got to figure out how we produce a product as a supplier to business and industry, to our higher education system that is acceptable to you.

I conclude by saying our goal is pretty simple. We want world-class school system, we want success for all of our students. Total quality is a process which we think will help us get there, and finally I say to you, we need your help. If you look at it realistically, we're your farm system. You're the major leagues, we have to get our students out of the farm system into the major leagues.

10.1.5 *Aris Mellissarotis, Vice President of Productivity and Quality, Westinghouse*

Total quality in the education arena is certainly an idea whose time came a long time ago. And it's a great thing to see so much momentum building on this whole objective nationally.

We were fortunate in Westinghouse to have visionary leaders who set up exactly ten years ago the first corporate facilities dedicated to productivity and product improvement. Our challenge is to seek the total quality management culture throughout every one of our operating units. We started out with an emphasis on productivity, but by the mid-eighties we saw the light and changed the emphasis towards quality and productivity.

TQM is more than a management model which addresses our factories and the industrial environment. As we perfected our TQM model, we discovered its applicability in every enterprise, profit or nonprofit, educational or otherwise. Our TQM model has four imperatives: customer orientation; human resource excellence; product/process leadership; and management leadership. Within those four imperatives, I'm going to try to outline the potential linkages that exist between industry and the educational system.

In the customer orientation area, most of us in industry discovered that it is very important to listen to our customer. We only exist for that customer, and we must focus all our energies to satisfy, in fact overwhelm and delight that customer, so the customer will never want to do business with anyone else. Who is the customer for the education system? Certainly we in industry are their customer, every enterprise in this nation is their customer, and the student is the customer. But the most important customer is society as a whole.

By product/process leadership, I mean innovation. In the case of the industrial environment, that means focusing on process as opposed to technology, as well as focusing on producing a quality product. In the education arena, it means streamlining the delivery systems of education by simplifying and balancing the resources that get devoted to the bureaucracy of education as opposed to the delivery of education.

In management leadership, we recognize that it is important to empower all of our people in the enterprise to take part in improvement. Empowering schools at the local level is very important, but I think extending that empowerment to the teacher in the classroom is important, too.

We have now successfully applied this management model to not only our own industrial enter-

prise, but to many non-profit organizations throughout the nation. But the linkages we have helped to forge with the education system have probably been the most gratifying for me personally, and for my corporation.

It is important for us as a nation as we recognize that we have let our education system deteriorate, particularly in the pre-K through 12 levels. Yes, we still have the very best higher education system in the world, but in our metropolitan areas in particular, we've let the pre-K through 12 no longer be world-class. And we must fix that.

Many of us in industry have done our share through Adopt-A-School programs. We've encouraged our executives to get involved as volunteers in the school system, and that's great, but we need more of that. My company essentially adopted the entire Maryland State Department of Education, and through a joint partnership taught them the principles of total quality. I think we had a couple of bus loads of Joe Shilling's administrative staff visit our Quality and Productivity Center in Pittsburgh and spend a week learning the elements of total quality.

As we strive to regain our economic leadership in the world, education will play the most important role. This is a great time for us. In order to compete on a global basis with Japan and the European Community, we must strengthen our education system.

The responsibility for the education system cannot be left with the elected officials. We, in corporate America, need to help them. Working with academic partnerships such as the Maryland Center for Productivity and the State Department of Schools, has provided us with the opportunity to synergistically leverage our resources. American industry is getting tired of being merely asked for money from the education systems and from the non-profits, but one place where we can do more is we can contribute the intellect of our people. And that, I think, is the model that we set in our involvement with the Maryland Department of Education.

I'm pleased to tell you that this an idea is gaining a lot of momentum nationally. Duquesne University is putting in place in its business school a great total quality program. Pitt, Carnegie-Mellon, and universities around the country are doing the same thing. It is important and imperative that we structure our curriculum to address the principles of Total Quality Management. I don't think it is essential to create total-quality curricula, per se. I think the notion is so basic that we need to inculcate those values into every one of our students in every curriculum.

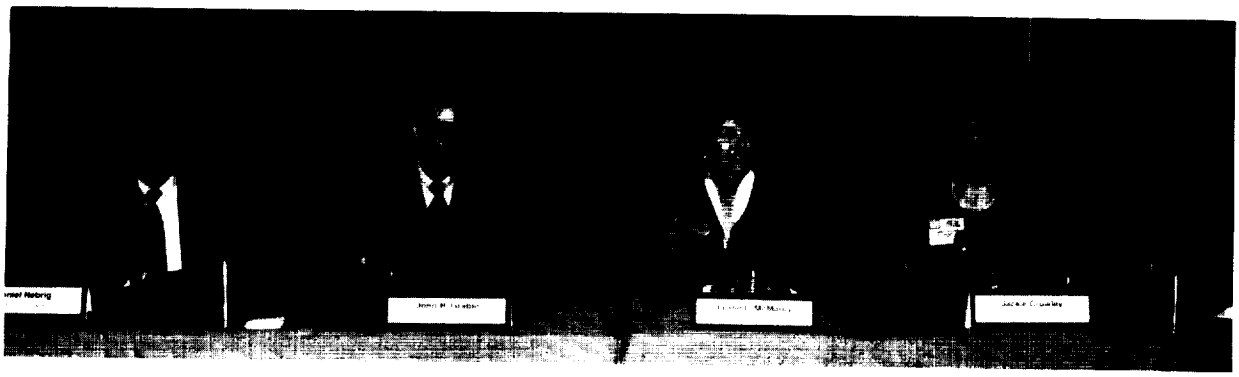
And, of course, we certainly need to address the math and science issue, because regardless of what current labor statistics indicate, as this economy starts to pick up, and it will, we will have a work force shortage. We will be importing engineering and scientific talent from the Soviet Union that has been, over the last decade, significantly outpacing us in the awarding of degrees in engineering and science. So we've got some very significant challenges that the education system must, in working with industry, address.

In June of 1990 at West Virginia University about 400 educators got together to address the challenge of education and total quality. Just this past July in Southern California the Second National Symposium on Total Quality in Education took place. And that symposium attracted many, many national leaders in total quality and about 600 educators.

So the idea of total quality is getting accepted throughout the nation. I think those of us in industry need to continue to let our expertise, our professionals, our employees at all levels, empower our local educational systems. We need to continue to form partnerships and Adopt-A-School programs. If large American corporations follow the example set by Westinghouse, by Xerox, by IBM, by all of the great American companies, in doing our share by encouraging our people to volunteer in enhancing local educational systems, I think we will achieve a total quality culture in all of our communities, in all of our endeavors, and in so doing enhance our society and retain America's leadership on all parameters of superpower performance.

10.2 Partnering to Work Quality Issues in the Houston Community

The panel explores from three different perspectives the process and "lessons learned" in initiating a coalition of organizations formed to work with the business community, educational community, and governmental and civil organizations in using a Total Quality approach to addressing important community issues, especially those relating to educating a quality work force.



Panel H2 - Partnering to Work Quality Issues in the Houston Community (from left to right): Daniel A. Nebrig, Associate Director, Lyndon B. Johnson Space Center; Dr. John R. Grable, President, Brazosport College; Leslie L. McManis, (Vice President, Texas Commerce Bank), Greater Houston Quality Group; Jackie Crowley, Director, Quality Academy, Houston Community College (not pictured: Leslie J. Sullivan, Chief, Management Analysis Office, Lyndon B. Johnson Space Center.

10.2.1 Building a Partnership to Enhance Science and Mathematics for Grades K-12

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

The Johnson Space Center is very interested in improving the quality of education of math and science students in our community. The reasons for JSC's interest and involvement are obvious: the majority of our people are scientists, mathematicians or engineers. The future of JSC's programs is heavily dependent upon the availability of a well-educated and trained work force.

We are also dedicated to America 2000, the President's long-range strategy to improve the quality of education in America. The goals slated for accomplishment by the year 2000 involve student readiness to learn, improved graduation rates, competency in the work place, adult education, and a drug-free environment. The top goal for us is to make U.S. students first in the world in science and mathematics by the year 2000.

I don't have time to discuss all the educational initiatives that we are involved in, so I have selected three areas: in-house opportunities, community partnerships, and outreach, as illustrative of the types of things that we do.

With our Education Working Group we produce written material and videos. The kinds of video tapes we produce are somewhat humorous and very interesting. The two that we have released so far, *Space Basics*, and *Goal for EVA*, are aimed at middle schools as are the planned ones, *Newton's Laws in Space*, which will be out this month, and two others which are in production, *All Systems Are Go*, and *The Gamma Ray Spectrum*.

We also produced publications. The first of those is called *Mission Watch*, which is done before a mission is launched. After the mission we produce *Mission Highlights*. In the *Mission Watch*, done for STS 48, which was the upper atmosphere research satellite, we provided a mission overview, which talked about the scientific and technological experiments that were going to be performed on the mission. We also provided some classroom activities and questions for further exploration, and provided

references so anyone could obtain additional information.

The requestors are given reproducible masters. You can get on the mailing list simply by requesting them on your school letterhead, if you so desire. The distribution is through a network that we've established called NASA Teacher Resources Centers. There are 11 in the United States. One at each NASA center.

One of our videos is called *Goal for EVA*. It's about space walking. It's less than 14 minutes long and aimed at the middle school group. It describes the reasons you wear space suits, how they work, and what's being done while you're wearing them. The resource guide that's provided along with it gives the background on the mission, what the environment of outer space is like, what the components of the space suit are, definitions of those components, and provides classroom activities that can go on in conjunction with the video. It provides references, and interestingly, a feedback form that hopefully will allow us to produce enhanced, continuous improvement in those videos. The distribution is very similar to what I mentioned for the *Space Watch* publications and all one has to do to obtain a copy of these videos is to supply us a blank tape and we will give you a copy of the video.

I'm going to shift gears a little bit and talk about two community partnerships we have. The first one is the Aerospace Operations Technician. This is a program to develop a new educational field in aerospace technicians. In our Mission Control Center, right now, we staff those positions largely with bachelor and advanced-degree people. That's fine for what we're doing right now. But, we anticipate that when we get into continuous activities like the Space Station Freedom, where it will be seven days a week, 24 hours a day, all days of the year, that we could get by with technicians to monitor the problems and trends that they noticed.

No curriculm currently exists to train aerospace technicians. We anticipate that by the year 1995, 200 of these jobs will be necessary, and approximately 100 or so a year additionally thereafter could easily be employed. Our solution is to work with our local community colleges. We're trying to establish faculty development and retraining programs. We are defining the curriculum that we will need in preparing course modules and we're looking at developing new courses as needed. This develops an educational framework for a new space technology.

Another community partnership activity is a non-profit organization called Partners In Space. This is a non-profit 501-C3 corporation registered in Texas. The purpose of the project that we are undertaking is to improve and enhance science and mathematics in grades K-12 through strengthening the relationships among JSC, our contractors, businesses and research and technology in Texas.

The approach we're using is to try to build on the belief that space and space-related topics are exciting to young people. And we hope to use that to motivate elementary and secondary students through the process of teaching them a little bit more about space. The flagship of Partners In Space is Project Space, a three-year project to develop space-related curriculum in grades 4-8, especially math and science courses. We have five industry/teacher groups. We plan to develop the curriculum during this school year, we hope to have it tested next year, and then disseminated throughout the state in 1993 and 1994.

10.2.2 Interception of Entropy

Dr. John R. Grable, President, Brazosport College

There are three things to consider in the relationship between higher education and the total quality process: the major forces for change which are impacting our institutions of higher education and those of us who work there; the implications of these changes for our colleges and universities; and a strategy for facilitating change.

The first major force for change in higher education are the economic demands. First, I think in developed countries, and this is particularly true of the United States, increased affluence within the population has reached the point where the demand for quality products and services has replaced price as the primary criteria in the decision to purchase. In my opinion, the Japanese auto makers are exactly right when they introduced automobiles such as the Lexus and Infinity with higher perceived value, and a higher price.

There are significant implications for those of us in colleges and universities where quality has traditionally been measured in terms of inputs, such as the average SAT scores of the entering Freshman class, the size of the institutional endowment, or the number of volumes in the institutional library. Isn't it interesting that we never ask what happens with all those volumes in the library, but simply count them. This is particularly important for two-year colleges

because these institutions have historically emphasized two features - low cost and ease-of-access. The quality issue has been largely ignored, and I think we can continue to do that only at the peril of our institutions. We must pay more attention to the quality issue in higher education.

The second economic demand are demands from taxpayers. Public funds pay more than two-thirds of the cost of higher education in this country. And I think the public outcry for accountability and quality in higher education is increasing substantially. What does the public want from us? I think four things in this order of importance. First, assurances of educational quality. Second, demonstration that we operate our institutions efficiently. Third, reinforcement of society's values, and fourth, the three things listed above at a fair price tag. When there is evidence that we are delivering these the public would cheerfully support us. When there is evidence to the contrary, however, we run the risk of increased state intervention.

The second major force for change in our institutions I put under the heading of replenishing an aging teaching force. Here I want to use the word "replenishing" in two aspects, first in terms of replacing. As an institution, Brazosport College, for example, is only 24 years old. The average age of our faculty, however, is 46. In the next ten to fifteen years we will experience a large number of retirements. Replacements for these faculty members are already difficult for us to locate, and they will become increasingly difficult in the years ahead.

My second use of the word "replenishing" is in terms of renewing. I think the primary issue we have to address is whether or not we have provided an environment for our employees which rewards risk-taking, growth, or whether we've employed a reward system which emphasis security, comfort, and what we at the college have come to call "the way we have always done it."

The next major force impinging on our institutions are concerns about student performance. Across the entire spectrum of higher education we're being called upon to educate an increasingly under-prepared student clientele. More and more we are required to offer remedial programs to ensure even minimal levels of student success.

Let me illustrate with an example. At Brazosport College, every entering student who wishes to obtain a degree is tested for skills in reading, writing, and mathematics. Those who do not demonstrate college-level skills in those areas go into remedial, that is non-college-credit courses until they do demonstrate those skills. Of our entering freshman last fall, only 33% needed no remediation, 18% needed writing and reading remediation, 21% mathematics remediation, and 28% needed both reading, writing, and mathematics. Sixty-seven percent of the entering freshman class required remediation.

What would the future of your organization be if 67% of the product or service you provided was defective? These are implications for change for our colleges and universities. I think the most obvious implication is that we must change to respond to these challenges. We have no option.

Two questions then arise in my mind. First, is our organization receptive to the changes which have to be made; and second, are we structured in ways which encourage and facilitate change. Since this is a NASA-sponsored program, and since I assume we have a large number of engineers, I thought I would use an example today dear to the heart of engineers. And this comes from a little booklet called *Leadership as an Art* by Max DuPre. DuPre is chairman of the board of the Herriman-Miller furniture company and this is one of the finest books on leadership you could find.

The second law of thermodynamics, for those of you who have been out of school awhile, says the entropy of a system increases as that system operates over time. If we substitute the word disorder we could say that the disorder of a system increases as that system operates over time. Now for the non-engineers among us perhaps Arnold Toynbee expressed it a little better. He described the rise and fall of nations in terms of challenge and response. A young nation, he said, is confronted with a challenge, it finds a successful response which enables it to grow and prosper, but as time passes the nature of the challenge changes, and if the nation continues to make the same once-successful response, it inevitably suffers a decline, and eventual failure.

The same is true of our organizations. People who study organization have developed a concept called organizational life-cycle. In organizational-life-cycle theory, every organization goes through four distinct and automatic phases. There is a birth period for an organization, there is period of rapid growth, after which there is a leveling off. And there is a fourth automatic phase, which is decline. There is a fifth optional phase in organizational-life-cycle theory which is called renewal, but that only happens because of some action taken by people within the organization.

We developed what we call our vision of the future. We call this Direction 2000. We think this expresses very well where we plan to be by the year 2000. We're committed to certain key ideas. Among

these, make an unshakable commitment to improving quality across the entire organization. The primary focus of the organization must be on the following: 1. serving the customer; 2. increase the use of data and analysis in decision making; 3. respect, support and listen to all people who work in the organization and help people do their jobs. Sounds simple.

I would submit to you that for any organization trying to implement the total quality process there is one absolutely essential element, that's the concept of organizational leadership as servant leadership. In the concept of servant leadership, the leader is defined as one who serves. There are certain responsibilities which leaders share to the organizations: 1. they must leave the organizations with assets in the legacy, and the most important asset is the people; and, 2. leaders are responsible for organization momentum. They cannot escape that responsibility. And another way of putting it, a leader must intercept entropy in the organization. Leaders are responsible for effectiveness of the organization. As Peter Drucker so aptly stated, "efficiency is doing the thing right, effectiveness is doing the right thing."

Leaders must lead in developing the values of the organization, and certainly one of those values must be what is the quality of the product or service we must produce. Leaders have the opportunity to make a difference in the lives of those they serve. It is my conviction no organization will be successful with the total quality process unless the leadership embraces these concepts.

I leave you today with one thought. He who hesitates is lunch. I think this is very true. If there is any way to guarantee your survival these days it's this, make yourself indispensable to your customer, and here's another hint, better do it quickly. Instead of waiting for customers to come to you with problems, go to them with solutions.

10.2.3 Strategy for Building Community Partnerships for Quality

Leslie L. McManis, (Vice President, Texas Commerce Bank), Greater Houston Quality Group

In Houston, Texas, we are in the process of broadening the quality movement. The Greater Houston Quality Group was the vision of a local businessman and his sister. They contacted Houston's American Productivity and Quality Center to organize a community effort to service an ever-increasing demand for information about the quality process, especially from companies that are new to the process.

What exactly is the purpose of this new group? I don't know if many of you have ever developed a mission statement, but if you have you understand the amount of negotiation, the amount of careful consideration, and the time required to agree on a charter, and especially if you are brainstorming with a group of 75 people. This particular mission statement is the result of over 200 man-hours of effort. The mission of the Greater Houston Quality Group is to foster and drive quality awareness, quality practices, products, and services for the greater Houston communities in order to improve competitiveness and positively impact the quality of life, resulting in Houston being recognized as a world-class community.

In order to support this mission, certain objectives and activities were immediately identified. The first objective of the Greater Houston Quality Group is to coordinate information about existing quality groups in order to provide a clearinghouse of networking resources. The second objective in support of our mission is to raise and support quality awareness. An activity in support of this objective is to obtain media interest and support. Our Marketing Team has furnished press releases to the media, both newspaper and broadcast media, and will continue to release information as it unfolds. A third objective is to influence our customer base to utilize quality practices to build cooperative educational opportunities for our customers.

Well, who are our customers? Our customers are, in many cases, our members. They are the businesses, large businesses and small businesses, educational institutions, government agencies, and civic organizations that comprise the greater Houston community. Our customers are also national and international businesses and concerns that are interested in the Houston community and its environment. A third set of customers are the Houston membership of established quality associations such as the American Society for Training and Development, the Greater Houston Section of the American Society for Quality Control, Houston Association of Quality and Participation, Houston Business Round Table, Southwest Quality Group, and so on.

How are we currently servicing our customers? There are several products that we have already produced this last year. First is a calendar of events. This calendar lists local TQM events such as semi-

nars, conferences and meetings. A second one is a resource guide which is a directory of all the organizations and associations in the Houston community that are dedicated to continuous improvement through quality processes. This resource guide gives the mission of the organization, the services it provides, the membership criteria, any monthly publications, meeting times, and a point of contact for every organization that is listed in the resource guide.

The third product is a how-to-get-started pamphlet for organizations which are investigating the quality process. It answers the questions of what is total quality, why is it important to me, how do I find out more about it.

We have also designed a market research survey with three purposes in mind. First is to understand our customers by determining the current level of involvement in the TQM process. The second is to determine our customer's needs and requirements. Third is to provide the data that's required to develop the strategic plan for the Greater Houston Quality Group so that we can continuously improve.

The Greater Houston Quality Group through its pooling of talented and committed people and through the survey information provided by its customers will attempt to address some of the total quality needs that assure Houston's standing as a world class community. Dr. W. Edwards Deming has said, "In Japan they have nothing, no natural resources, but they have people. We have some natural resources and we have people." Let us say that no community need be poor if it has people.

10.3 Community Partnerships for Our Environment — A Rocky Mountain Region Report.

Community partners, meeting in Denver, Colorado, report the results of initiatives for doing their part for the global environment, including reports from Government, Academia, and Industry community partners who produce our nation's space and defense products.

10.3.1 *James Scherer, Regional Administrator, Environmental Protection Agency Region VIII*

Let me give a few examples of some of the partnerships which EPA is encouraging at this time. One of these is the Green Lights program. This is a program which prevents pollution by substituting efficiency in the use of lighting for the heavy use of fossil fuels.

By voluntarily joining this program, industry, communities, governments, and utilities are reducing pollution and finding tremendous cost savings. Our estimate is that with full participation by all of the commercial-industrial sectors of this nation, the Green Lights concept could eliminate the emission of 235,000,000 tons of pollutants per year, and could save the consumers of this country approximately $19,000,000,000 a year.

EPA's 33/50 program operates under the same principles. It challenges the 6000 companies which have to report chemicals they are releasing under the Toxic Release Inventory to reduce the wastes they are generating by 33% by the year 1992, and by 50% by the year 1995. So far, 250 companies have risen to this challenge. One of those is Martin Marietta which has committed to a reduction of 76% overall by 1995, which is truly a very admirable goal.

Because of the win/win nature of this pollution prevention effort, all kinds of partnerships are springing up. The American Institute of Architecture is working with EPA to produce an environmental resource guide. This will help improve the quality of the indoor environment and since this is where we spend about 90% of our time, it's really very critical. Improving the indoor environment has been identified by our prioritzing, as one of the more significant areas where we can really affect human heath.

The American Institution for Pollution Prevention brings together leaders from some of the country's most energetic trade associations and government agencies and helps them to map out a strategy for spreading the word, getting out more education about what can be done in pollution prevention. We have funded two western states with pollution-prevention state incentive grants, and building on that, the states are working with their universities to set up pollution-prevention centers, to set up waste exchanges and also data bases.

EPA also is administrating the Pollution Prevention Information Center. This is a compilation of all the case studies on pollution prevention, currently about 600 case studies. Anyone with a computer modem can access this data base.

So these are some of the examples we feel have been highly successful in this region. I think that what we really need to realize is that pollution prevention is not a fad that's going to go away, and the reason it's not is because it's based on sound economics. We are making cost savings in process, and in the amount of raw materials being used, and we are really helping the economy and the economic vitality of the individual company at the same time that the environmental concerns are being met.

10.3.2 *James W. Spensley, Co-Chairman, Colorado Center for Environmental Management*

It is a pleasure to give you an idea of the activity here in Colorado, where we are attempting to think locally, and act locally, in terms of a partner-in-project.

I would like to talk a little bit about something called the Colorado Center for Environmental Management. This is a newly-created center here in Colorado which brings together a diverse group of interests including the private sector, large companies, like Martin Marietta, along with smaller entrepreneurial businesses that want to become involved in the environ-

mental area. We have non-profit organizations involved as well, several here in Colorado that have been very active on environmental issues. We have also a number of governmental agencies. We also involved another very important sector in this effort, which is our academic sector in Colorado.

I would like to go back for a moment and tell you just a little bit about how this initiative started because I think people would be interested in this case example because it might apply to other communities. The Colorado Center for Environmental Management is focused on hazardous waste. We do not deal with all problems, just with hazardous waste. The governor of Colorado put together an effort, initially within his own policy office, to look at what Colorado could do in terms of cleaning up its own hazardous waste problems, utilizing the resources of this state, the academic, the private sector, and the non-profit resources.

His policy office put together some ideas, they called a series of meetings, and from that stemmed a volunteer effort of about 25 individuals who were asked by the governor to take this idea and develop some sort of ongoing organization to deal with hazardous waste problems. This resulted, a year later, in the incorporation of a non-profit organization called the Colorado Center for Hazardous Waste Management. The governor has been a very active supporter of this effort and has been involved in helping select the people who would participate in guiding this organization.

The focus of the center is hazardous waste, and it really has four program areas that it is attempting to address. The first is research and development, which of course is a very important aspect of hazardous waste problems or clean-up problems as well as prevention problems. The research and development effort has been headed by one of our university vice-presidents for research who has formed a volunteer committee here in Colorado, and they have been working over the last six-to-eight months in identifying areas where research needs to be done. And we are hoping that by putting together this program we appeal to some of the federal funding sources, as well as state and local sources, again, in a joint effort to address some of these issues.

The second area is what we call business and technical services. This deals with working principally with our private-sector representatives in addressing either their problems, or other industry problems where the Center can bring to the table some expertise from the academic sector and some experience and some ongoing guidance from the governmental sector. We're actively working now to put together some ideas in this area. Clearly one of the feelings of the Center members is that we need to find some new innovative approaches, for example, mediation or negotiation, as ways of dealing with some of these kinds of hazardous problems.

The third area that we're involved in is education and training. And, of course, that's a very important component of dealing with not only preventing problems but also in teaching a labor force to deal with the clean-up side. We have been working very actively, again, with our academic partners in structuring some programs that deal specifically with the public participation and regulatory side.

Finally, the fourth element of the Center which was just added recently by our Board is to focus on how to get better public involvement in the hazardous waste decision-making process. I think since we have had some very strong federal laws in the last ten years we've had to learn about making sure that the public who are affected by not only the hazardous waste problems, but also by the decisions about how those problems are solved, are important players in that decision-making process. So that is one of the focuses of the Center.

Simultaneously with the organization of the Center, we were approached by the Department of Energy in Washington and asked to assist in a new program of theirs which focuses on incorporating innovative clean up technologies into a normal clean-up process.

They were particularly interested in asking the Center to become involved in helping to focus on public involvement, as well as early consideration of environmental requirements. Much of the technology development in this area in the past has not focused on environmental aspects but more on the technological and economic aspects. So the Center put together a proposal, and in July of this year was awarded a multi-million dollar grant from the Department of Energy to work with them at two levels.

We are working with various partners around the country that are involved in this program to find better ways to involve the public in the technology development process, and similarly, to look at some of the environmental requirements. The other part of that is on the national side where we are looking at the entire decision-making process.

Well, this is the beginning of what we hope will be an effort to focus on those two aspects of public involvement in environmental regulation. We are participating now in many forums and being asked to give support in many other areas dealing with those two subjects. I'm hoping this Colorado effort will

bring special focus to Colorado as a place which has something to contribute to this area and we're looking forward to the Center playing a very major role in that effort.

10.3.3 ***Laura Belsten****, Director, Environmental Policy and Management Division, University of Denver*

The environmental field has been a very exciting one for me. It can be characterized as a dynamic and very diverse field. It's young and it's rapidly growing, with new laws and technologies coming on board every year, even every other month.

The field is being driven by environmental laws and regulations. Much of what we're doing is prompted by Congressional enactment of specific laws governing air quality, water quality, and solid and hazardous waste. The laws are numerous and highly complex and many people working in the field are starting to draw comparisons between the environmental code and the tax code, for example. This can lead to a substantial amount of conflict, and one of the things we are focusing on in the University of Denver is conflict resolution, conflict management, negotiation, and mediation.

The field is also diverse in terms of the people who come into it. There are people who come in from the law, there are people who come in from the fields of engineering and the physical and natural sciences. There are people who come into the field from business, from marketing, and from public relations.

It's also diverse in terms of the numbers of different kinds of players who are actively involved in environmental management. You have people from the non-profit sector. You have the environmental groups, who at times don't feel that businesses and industries are doing enough to protect the environment. Sometimes the environmental groups don't feel that the government agencies, the public sector, is doing enough to enforce the environmental laws and regulations, and this can lead to conflict.

The government agencies that are charged with the responsibility of enforcing the environmental laws and regulations do come under pressure from the environmental groups, but they also come under pressure from the businesses and industries who feel that we're moving too quickly, too fast some times, and that we're spending a little too much money to try to clean up the environment.

The question is, what we can do as academic institutions to foster more bridging and more partnering among these different sectors, the public sector, the private sector and the non-profit sector. About a year ago the University of Denver embarked upon a new Master's degree program in environmental policy and management. It is a program for working adults. About 65% of our students come into the program already working in the environmental field. The average age of our students is about 37. Our courses are taught at night and on weekends to accommodate working professionals.

The concept for the course of study and for the curriculum was actually developed by some of the top environmental players here in Colorado and in the Denver metropolitan area. We convened a group of working professionals, corporate environmental affairs directors from Martin Marietta, Coors, from public service companies, from Hewlett-Packard, and we also invited some people in from the Environmental Protection Agency, our state Department of Health and also from some of the non-profit and environmental-advocacy groups.

We asked these individuals what they were looking for when they were intending to hire people into responsible positions in the environmental field. We based the development of our curriculum directly on their input. What they told us is that they needed people who had a thorough understanding of the laws and regulations which are driving the field. They told us they needed people with good management skills who can develop and implement programs to bring companies and corporations into compliance, they told us they needed people with good communications skills.

Our program is a little different at the University of Denver because it is not an environmental engineering program or an environmental sciences program but strictly an environmental policy and management program. Many of the people who come into the program already have technical backgrounds in engineering and natural sciences. In a sense, this approach, the community-advisory committee that we convened, approximates the Total Quality Management approach. We view our students and their employers as our customers, and we work very carefully and closely with them to tailor a program that's going to meet their needs.

We developed courses which promote the concept of partnering. Our curriculum not only offers courses in air quality management, water quality management, solid and hazardous waste management, but also offers courses in environmental law, environ-

mental economics and finance so our students can figure out how they're going to budget for and finance environmental clean-up projects.

We also offer courses in environmental negotiations, mediation, and conflict resolution. We offer courses in leadership, environmental values and ethics, sustainability, public affairs, community relations, and environmental risk communication. Our courses teach practical, hands-on partnering skills.

The courses themselves are taught by a variety of people who work in the field. Students take courses from practitioners representing government agencies, from the private sector, industries and businesses, and also individuals representing the environmental community. This diversity of faculty fosters a greater understanding of different points of view.

Finally, our students are required to complete a capstone course in lieu of a Master's thesis. This is a project whereby students actually go out into the community and work on an environmental problem and write up their experience. They are strongly encouraged to work in a different type of organization than the one in which they are currently employed. For example, our students who are working for private industries and private businesses are encouraged to do their capstone project with a government agency or with non-profit environmental groups. Our students who work for government are encouraged to go into private industry and see the perspective from private industry. This bridging fosters a partnership, fosters almost a walk-a-mile-in-your-shoes kind of approach to environmental management.

In conclusion, academic institutions can play a role in fostering cooperation among the various constituencies interested in environmental protection and management. First of all we can teach courses that emphasis practical skills in partnering. Second, we can bring in faculty with wide-ranging backgrounds and diverse points of view, faculty who are trained in group facilitation and group discussion. And third, we can encourage our students to do internships in other projects with organizations with different points of view than the one the student might have.

Finally, I would just like to add that academic institutions must take a Total Quality Management approach to providing educational services, the educational product. The TQM approach to providing academic instruction fosters partnering between academic institutions and the community as well as within the various sectors of the community.

10.3.4 *William Owen, Manager, Environmental Safety and Health, Lockheed Engineering and Sciences Company*

Lockheed Corporation began its partnering efforts in the environmental area a few years ago by appointing four corporate vice presidents to a corporate Environmental Safety and Health (ESH) board. This board oversees the environmental issues that confront our operations. Lockheed established a corporate ESH director and our corporate ESH department which is housed in Las Vegas.

The corporation has elected to partner with government in improving the environment by participating in several voluntary programs such as the Green Lights program and the 33/50 program. All these are aimed at continuously improving the quality of our environment.

Each of our Lockheed operating companies is individually managed and has its own professional ESH staff. And these companies are partnering with communities in which they live to involve them with educational institutions, emergency management organizations and with state, county and local governments. I want to show how some of these partnerships might be formed in your organization by providing you with some examples of some of the things we have done within our Lockheed companies.

The Antelope Valley College Curriculum Board asked our Palmdale, California, company to participate in addressing the requirements to provide the community with technicians, hazardous materials people, and emergency response people. Our Lockheed Missiles and Space Company in Sunnyvale, California, is providing instructors at both the University of California/Davis, and UC/Santa Cruz, for certification-training programs for environmental managers and hazardous materials managers. At Las Vegas, the environmental programs office was asked to review and comment on a new curriculum developed by the University of Nevada, Las Vegas, in environmental sciences. Our Corporate Department sponsors a student co-op education program with the University of Cincinnati which is a renowned leader in environmental engineering programs.

The objectives of these interactions, these partnerships with academia, are obviously to provide an operations perspective to academic programs and to provide additional on-site training for the students

who are entering into the environmental career fields. Both goals reflect our efforts towards continuous quality improvement which is our company's program of Total Quality Management.

Hazardous materials used in industry operations represent a considerable concern to our community neighbors. I think this is probably an understatement. Lockheed has developed an extensive emergency response program within the various companies which unfortunately has been tested and proven effective in real time events such as the earthquake in 1989 in San Francisco, Hurricane Hugo in South Carolina, and a tornado in Huntsville, Alabama.

The state of Nevada asked us to participate with them by conducting the joint FEMA, EPA, and DOT hazardous-materials contingency- planning course in Las Vegas for state, local, and industry emergency planners. On very short notice we had 50 participants in this course which testifies to their interest in planning activities and to their faith that planning mitigates the effects of hazardous materials contingency. Other Lockheed companies are involved in mutual-aide agreements with their local first-responders for chemical incidents as well as providing input to city and county governments for their hazardous materials management plans.

Our department represents Lockheed/Las Vegas operations on Hazardous Waste Recycling Coalition, which was sponsored by the University of Nevada extension services. This community group was instrumental in implementation of the Las Vegas city-wide recycling of glass, plastic, and aluminum waste.

Several Lockheed companies which are located in California are joining with governments and regional agencies to meet California's very stringent air emission requirements. In Palmdale, for example, we are spending very large amounts of money to provide environmental controls on new facilities to ensure a zero degradation in the Antelope Valley air quality.

All these illustrations show how partnerships may be formed between industry, academia, and governments to improve our environment. And although these may not be grandiose efforts, they are efforts, and they represent progress in partnering to clean up and to improve our environment situation.

10.3.5 ***Robert M. McMullen****, Director, Environmental Management, Martin Marietta Astronautics Group*

We're going to close this panel discussion with a description of the public/private partnership that Jim Scherer of the EPA briefly mentioned in his opening remarks. The Colorado Pollution Prevention Partnership is a coalition of industry, regulatory agencies, and public interest groups organized around the idea that pollution prevention is a subject of mutual interest to business, the public, and the environment.

To understand this partnership I need to take you a little bit in to the concept of pollution prevention. For most of the history of the environmental movement in the United States, which is approaching probably 25 years old now, the role and the activity of business and industry has been almost exclusively reactive. Government creates laws and regulations, industry reacts to get into compliance with the requirements. Most of that compliance effort consists of end-of-the-pipe kinds of installations of equipment, such as control systems that transfer pollution from one medium to another.

For example, scrubbers take things out of the air and put them in water forms or in solid forms. As you might recognize, this form of reaction to regulations has been very capital-intensive. It doesn't add much value to the industry that is spending the money, and it frequently results in adversarial kinds of proceedings. Moreover, the fact that it merely transfers pollution from one medium to another consistently has lead to new additional regulations.

For example, removing pollutants from the air led to collection in water and ultimately to more water regulations. Removal of pollutants from water led to generation and subsequent regulation of contaminated solids, solid waster regulations, hazardous waste regulations. So, the proliferation to more stringent requirements seems to be endless. In recent years this spiral of never-ending-and-increasing costs has led to the development of new thinking on pollution prevention rather than merely pollution control. Pollution prevention is the idea that one can break the cycle of ever-increasing costs by cutting off the generation of pollutants at their source rather than at the tail end of processes as in the traditional fashion.

Now, why is this a popular idea? One reason is cost savings. If you don't generate a waste, you don't pay for collection, you don't pay for treatment, you don't pay for disposal. If you don't use a chemical, you don't pay for the purchase of that chemical, and you don't pay for the collection, treatment, disposal.

Another reason is regulatory exposure and liability. Avoiding the creation of waste also avoids the

regulatory requirements, the attendant costs of inspection, of monitoring, of reporting and the potential fines and penalties as well as the liability for hazardous waste. If you generated it you're responsible for it forever. That's come back to be a very significant cost to business.

Worker protection is another incentive. Lack of chemical use avoids the need for protective clothing and equipment, it reduces employee exposure to chemicals, it makes even happier, more productive workers in some circumstances. So in addition to these cost savings, there are a number of less tangible but very real benefits as well for pollution prevention such as improved public relations. The public benefits, public relations benefits occur because the public recognizes that eliminating the generation of pollutants has a real benefit to the environment and to the quality of life.

Now, I'll come back to the Pollution Prevention Partnership. The partnership is a coalition of five Colorado companies, Martin Marietta, my company, Coors, Hewlett Packard, Public Service of Colorado, and Geritty & Miller Inc., which is an environmental service firm. In addition, two regulatory agencies, EPA and the Colorado Department of Health, are members of the partnership, and two public interests and citizen-type organizations, the League of Woman Voters and the Colorado Public Interest Research Group, are members.

The partnership is formed as a non-profit corporation, has a board of directors, has an advisory council that's made up of representatives from each entity that formed the partnership. Its purpose is to accomplish the following goals. We want first to promote the concepts and benefits of pollution prevention, primarily to the business and the industrial community. We don't think there is really adequate recognition of the cost savings, of the minimized exposure to the regulations, the reduced liability, all those things that are meaningful to business.

Second, the partnership intends to demonstrate pollution prevention through projects, practices, and technology. The companies which are involved have already made very significant changes in their processes to eliminate the use of chemicals and developed technology to substitute polluting processes with nonpolluting processes. So, the partnership is a mechanism for continuing those demonstrations.

A third important goal is to strengthen the working relationships between the private and the public sectors. We want to eliminate this adversarial kind of relationship we've had in the past, and the concept of pollution prevention is one that we can all very much agree on. It's favorable to industry, it's favorable to the agencies, and it's favorable to the environment.

And finally, the partnership exists to exchange information and expertise on pollution prevention practices, and more importantly, to transfer it to small and medium size companies, and to the general public. So we function as, in some ways, as not a clearinghouse, but as a conduit to talk to industry and business on these techniques. Membership is open to corporations, companies, public interest groups, educational institutions, and anyone who has an interest in supporting the purposes of the partnership.

Companies who join the partnership are expected to be committed to the principles of pollution prevention and to the goals of the partnership. Most importantly, companies who join agree to be accountable to measurable reductions in use of chemicals and measurable reductions in the generation of waste or pollution and be able to stand up and be counted on an annual basis and say this is what we've done in a measurable way. And finally, they agree to share in the partnership's expenses in some equitable manner based on their means and the expenses of the group.

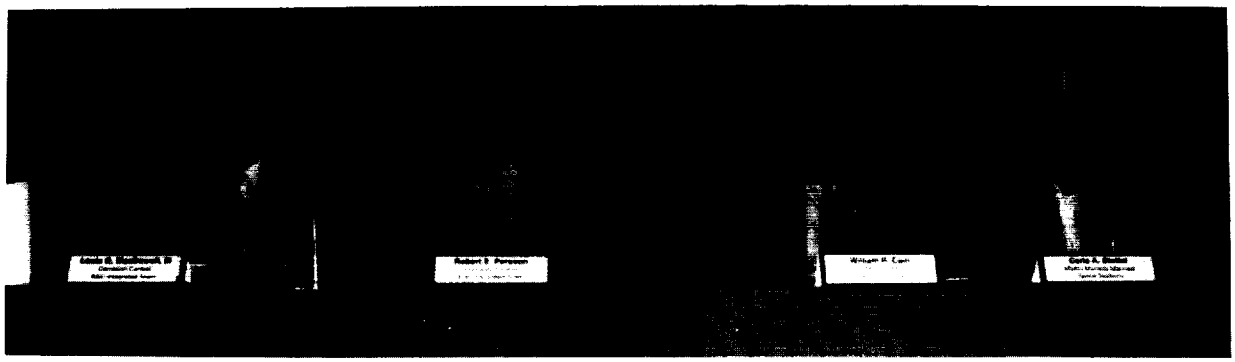
It's been in existence as a partnership for about two years now. Its first project was, and is called, the SolveNet Project. Its aim is to promote the reduction and the use of chlorinated, ozone-depleting solvents in Colorado. Members of the partnership have agreed to reduce the use of 111 trichloroethane ,which is a very common solvent, by about 70% over a two-year period and to try to reduce it in general in industry by about 50% in that same time frame. And we're doing very well in that with measurable data. We're very close to that goal now.

Overall we've employed the spirit and principles of Total Quality Management and we think it's created a mutual benefit for Colorado business and Colorado environment.

11.0 Teams in Action

Teamwork in action is demonstrated as both standard and non-standard types of teams present the process they employ and the product they produce.

11.1 Corrosion Control Kennedy Space Center Integrated Team



Teams in Action Panel 1 (from left to right): Louis G. MacDowell, III, Senior Materials Engineer, John F Kennedy Space Center; Robert E. Persson, Senior Engineer, EG&G Florida, Inc.; William R. Cain, Financial Analyst, Martin Marietta Manned Space Systems; Carla A. Diettel, Associate Analyst, Martin Marietta Manned Space Systems (not pictured: R. Ross Bowman, Vice President and Assistant Director Operations, Space Operations, Thiokol Corporation).

11.1.1 *Louis G. MacDowell, III, Senior Materials Engineer, John F. Kennedy Space Center*

The corrosion control team was formed at KSC in 1985 as an integrated team composed of both NASA and KSC contractors associated with the corrosion program. This integration was something new at the time and may have been the first such team ever formed within NASA. The environment at Kennedy Space Center is very unique in that several conditions combine to form a very hostile and highly-corrosive situation for our steel structures and related hardware. Protecting these facilities from corrosion is a continuing effort to provide safe and reliable launch facilities.

First, we have acidic residues formed during the combustion of the solid rocket boosters and the heat generated during launch which combine to form a very hostile environment for the protective coatings used to control corrosion at the launch facilities. The acidic cloud can be seen permeating the launch structure and depositing the residues on the coated metallic surfaces.

In addition to the conditions produced directly by the launch of the Space Shuttle, the location of the facilities provides other hostile influences. Located directly on the Atlantic Ocean on Florida's east coast, the launch facilities must withstand attack created by high concentrations of wind blown salt and sand. The Florida sun also provides intense ultraviolet radiation to degrade the performance of the applied protective coatings. At the time of the team formation, many of the protective coating applications were not providing the corrosion protection for the facilities that the coatings were designed to produce.

To address these perceived problems, a Kennedy Integrated Team or KIT was voluntarily formed of both NASA and contractor personnel actively involved in corrosion control at the Center. Before this time these personnel were not united to work toward the common goal of improving the corrosion control process on all KSC launch structures, facilities and

ground support equipment. Each organization was struggling within the system to provide protection to their individual responsibilities. In many areas these individual efforts did not fully address the scope of the problem leading to marginal protection of many facilities.

The first team meeting quickly led to identification of problems through brainstorming and other TQM techniques. Subsequent weekly meetings have produced a list of problems to be worked by the team. Upon analysis of the list of problems, the team discovered that the major reason for premature failure of many of the coating systems was improper application of the coatings. From this analysis the team decided that properly training coating inspectors in the field would improve the quality of these applications substantially and therefore reduce the costly failures.

In 1985, we started with only six members. Those six members were composed of NASA, EG&G, and Lockheed personnel. Active membership is now approximately 75 people with team representatives from NASA, EG&G, Lockheed, McDonnell Douglas, USBI, the United States Air Force, Johnson Controls, General Dynamics, and several outside agencies. The common goal of this team is still to improve the quality and effectiveness of the corrosion control program at the Center.

As a continuing effort, the team uses the following tools for improving the corrosion program at KSC. A majority of the testing of the protective coatings for KSC's structures takes place in close proximity to the launch facilities. This proximity provides valuable data of coating performance that the team uses to produce and revise corrosion-control design standards.

The testing site is also close to the Atlantic Ocean. Again this provides realistic performance data for use by the team for incorporation of coating standards and specifications. What we learn is incorporated into the main corrosion control design standard for use by engineering and other personnel in the preparation of coating specifications for the facilities and equipment at KSC. The team works to update this document regularly to achieve continuous improvement of the materials and procedures. This document is where the requirement for coating inspection was incorporated by the team for improved quality of the applied coatings. Further, this document includes an approved products list generated with data from the beach testing facility that is continuously updated by the team to ensure only fully-acceptable materials are used at KSC facilities.

In response to the requirement for coating inspection, the team contacted the National Association of Corrosion Engineers (NACE) in 1986 to inquire about training for personnel. This organization provides intensive, internationally-recognized certificated coating inspection training for the corrosion industry. At that time, the only location for the coating inspection training in Houston, Texas. The team negotiated with NACE to bring this training to KSC to save travel and accommodation expenses for the inspector candidates.

After this successful training at KSC, the team trained 21 personnel in 1986. This training included rigorous classroom work to familiarize personnel with the requirements and tools of inspection work. As part of this inspector training, personnel are required to participate in field exercises to help them understand field procedures. After completion of the classroom and field training, final examinations are given in both written and hands-on practical tests. Only personnel that pass both of these exams are allowed to inspect coatings application at the Kennedy Space Center.

To date nearly 500 personnel have received various levels of inspector training as part of the team's efforts. Personnel receiving training have come from many different organizations at Kennedy Space Center and Cape Canaveral. These include design engineering, quality assurance, contract monitoring, construction management, and coatings applicators. By conducting the training on-site, over $2,000,000 has been saved on inspector training to date. These cost savings have resulted in enormous pride and sense of accomplishment to team members.

As another result of the team's efforts, a course was developed to further train engineering on the correct methods of specifying coating requirements. Personnel included design engineers, A&E firms that contract with KSC, Air Force design engineers and quality engineers who check the coating specification for compliance. Over 300 personnel have participated in this program and improvement to coating specifications produced at KSC has been significant. Response to this program has been very positive and the team anticipates sponsoring more of this training in the future.

11.1.2 ***Robert Persson**, Senior Engineer, EG&G Florida, Inc.*

The corrosion wheel represents all the necessary requirements to properly execute and maintain a comprehensive corrosion control program. The wheel has eight spokes and each spoke must be present for the wheel to turn. When the team was formed, there were at best about two or three spokes and the wheel was definitely not turning. Today we have all the spokes at Kennedy, however, some are weaker than others. The team is continuing to work on these spokes.

The first spoke of the corrosion wheel is organizational support. That simply means that the team members must attend our weekly meetings and to get involved in the team's efforts. The next spoke is materials testing. The materials-testing program at KSC is probably the best long-running program in America. Data gathered there is being used in industry on a continuing basis.

The next spoke is field procedures. Generally, this involves such functions as scheduling, paper work flow, design reviews, hazardous waste procedure, and environmental health regulations. The next spoke is conditions survey. That simply means inspecting the condition of the equipment and facilities, and using the data derived to formulate and drive our respective annual and long range plans.

The productive equipment spoke represents three things: what type of equipment, how much equipment, and what is the condition of the equipment. Here the team relies on the knowledge of the personnel in the field and in the shops to support our program. The specifications and standards spoke is where the law comes in. You must have good laws that can be enforced by the inspectors and contractor administrators. Engineers from NASA and contractor organizations at KSC are presently active members of the team.

The next spoke is ensuring trained applicators. When applying high-performance coatings, team members regularly solicit coating and equipment manufacturers for seminars and demonstrations. We have experienced applicators who are active team members. The final spoke is inspection, qualified inspection. I would like to point out to you that these high-performance coatings are excellent when applied properly. However, they are very unforgiving when they are not applied properly and will fail miserably.

Now I'm going to discuss some of the equipment and conditions surrounding qualified inspectors. A typical inspection tool kit includes a sling hydrometer, charts for dew point calculations, surface preparation comparitors, thickness measuring devices and calibration shims, just to name a few. The kits also include a simple mirror that lets the inspectors see those hard-to-get and hard-to-access places that sometimes are missed by the applicator.

Inspectors also use an electronic coatings-thickness measuring tool that has the capability to store coating thickness data for later analysis. They alse use a magnetic gauge to read total coating thickness on carbon steel.

How about results? When we have qualified inspection the failure rate drops dramatically. Since implementing qualified inspection, $20,000,000 in coatings have been applied at KSC with no reported failures. Previously expensive coating failures were commonplace prior to qualified inspection. I say qualified inspection because it has been proven that unqualified inspection is exactly the same as no inspection.

So let's summarize. We have saved over $2,000,000 in training inspectors, over $20,000,000 in coatings have been applied without failures reported, over 400 inspectors trained and qualified, 300 design engineers trained in specification writing and continuous updating of the KSC design standard. We also have continuous problem-solving with coating applications.

Teams in Action Panel 2 (from left to right): Dimas G. Pascua, Jr., Electronics Technician, TRW Electronic Systems Group; Beverly A. Tricomi, Manufacturing Engineer Supervisor, TRW Electronic Systems Group; Damon A. Hooten, Principal Engineer, Flight Hardware and Laboratory Systems, Lockheed Engineering and Sciences Company; A. A. "Al" Tauler, Procurement Supervisor, Lockheed Engineering and Sciences Company; (not pictured: Leo A. Braun, Manager, Support Services, Johnson Controls World Services Inc.).

11.2 **Profiteer's Team,** Martin Marietta Manned Space Systems

11.2.1 *William Cain, Financial Analyst, Martin Marietta Manned Space Systems*

Martin Marietta is the prime contractor to NASA to build the Space Shuttle's external fuel tank. At Martin Marietta, company-wide TQM teams were established in 1990 and 1991. Membership can be either voluntary or mandatory. Leadership is chosen either by team or management. Facilitation includes full-time professional and part-time departmental facilitation.

TQM training comes from the Human Resource Department and covers the TQM philosophies, techniques, and process improvement. This training is available to all teams and individuals. Currently there are over 200 teams with 346 projects in work. Since the early 1980's, 1,046 projects have been completed.

Our TQM team, the Profiteers, assembled in October of 1989. It is composed of at least one member from each section within our estimating department. Membership is on a voluntary basis. Once our team was formed we came up with a mission statement, and this was to improve the pricing system process used at Manned Space Systems for external change orders, external tank major proposals, and new business proposals. Also, once the initial improvements were completed, we were to implement a new process to provide continuous improvement and configuration control for pricing systems.

Pricing is a sensitive issue in this day and age. We at Manned Space Systems are proud of our excellent track record when it comes to pricing accuracy. We would like to emphasis that our motivation for tackling this project was not to correct any existing problems with pricing inaccuracies. Instead we chose this project to prevent any future problems, especially those caused by lack of configuration control due to advancements in computer technology.

To do all of the above we went through a TQM process which included the following seven basic techniques. Brainstorming, customer/supplier analysis, clarifying points, organizing information, multi-voting, planning the work, and documenting the results.

Brainstorming was used to utilize the team members' technical skills to come up with a diversity of ideas. Customer supplier analysis was performed to determine the needs of both NASA and the user. We went through the process of clarifying and understanding the project's concerns and objectives before proceeding to the next steps.

We organized and assembled any information that was gathered for previous steps. We used multi-voting to list numerous project concerns. We

categorized these concerns and then selected the number one project. This was the computer pricing system improvements. We did what was called planning-the- work, where we constructed milestone charts along with having regular reviews, both internal and external, with the customer and management to ensure success.

The last process is documenting the results where we complied all requirements for system improvements. We also used our results to help construct, plan the work, and plot milestone charts.

Using these TQM processes we were able to define our process benefits. We now have a standardized pricing system, resulting in a streamlined process which enhanced our quality control, and leads to customer satisfaction.

11.2.2 *Carla Diettel, Associate Analyst, Martin Marietta Manned Space Systems*

I'll begin with a brief history of our estimating pricing systems. Over the past years pricing operations have transitioned from mainframe, to the IBM PC, and most recently to the Macintosh. In the past, we had 23 pricing systems on our floor, using several different combinations of computer and software systems.

We recognized the need for streamlining. We defined four areas that required improvements. The first area is configuration control. These 23 versions of the pricing systems created various software and hardware configuration problems, maintenance problems, and quality and training difficulties.

The second area is quality control. There was no quality control process in place. Instead, errors had to be detected through checking after the pricing had been completed.

The third area is written documentation. There was limited documentation on some models, obsolete documentation on others. This created roadblocks to adequate operation and maintenance of our systems. The fourth area is training. The unavailability of trained personnel hampered quick proposal turnaround along with a greater potential for error.

We took each of the four areas and defined how to improve them. These improvements have been implemented as processes. Our first process is configuration control. Our primary development was the uniform pricing concept. This model was developed on the Macintosh and tailored slightly to meet each section's requirements while still using one basic programming theory. With this we also created the position of Business Systems Coordinator to control and monitor all pricing system periodic changes. The coordinator is also supported by a representative from each section to help determine when changes are necessary and possibly assist the coordinator. This leads to continuous improvements.

Our second improvement is quality control. Included in this is a monthly validation process for all pricing models and coordination of proposal schedule requirements.

Our last implementation includes documentation and training packages. The first one is a pricing systems operation manual, which is a step-by-step users manual on how to get through. The second one is a pricing system maintenance manual, which defines all programming aspects in case macros need to be altered. The last one is the implementation of the employee training program.

So, in the beginning we had 23 models to maintain on three different computer platforms. Through the uniform pricing concept, we were able to consolidate the 23 models into one uniform pricing system resulting in only five maintainable models all written on the Macintosh. Because of this uniform model, it has enhanced the cross-training, maintenance, and all operations associated with pricing activities.

This brings us to our cost-avoidance benefits. We estimate that these measures have saved us $74,000 per year. This can be identified in the 20% decrease in our overtime over the past 12 months. Our customers may also experience cost benefits due to their decreased audit, fact finding, and negotiations time.

Lessons learned. We learned many things as the TQM group, however, I think the most important lesson we learned was training and team dynamics. When the team first started, we were very disorganized and argumentative. After we received some proper training and constant facilitation, the team was able to concentrate on the development of the project. We feel we would not have achieved this goal without the support and guidance we received.

11.3 Acquisition TQM Team

A.A. "Al" Tauler, Supervisor, Procurement, AND ***Damon A. Hooten****, Principle Engineer, Flight Hardware and Laboratory Systems, Lockheed Engineering and Sciences Company.*

The Lockheed Engineering and Sciences Company (LESC) provides high technology support services in the engineering and scientific areas on such programs as Space Shuttle, Space Station Freedom, and space exploration initiatives at the Johnson Space Center.

In February 1990, LESC established a pilot program of 4 TQM-related teams: Human Resources, Quality, Finance, and Procurement. The Procurement TQM team was later redefined at the Acquisition TQM team to better reflect the scope of the activities of the team, and comprises members from management, engineering, science, and business administration to create a cross-functional team. Our primary focus was to devise and implement a system of continuous improvement to the acquisition process and to identify and eliminate work that added no real value to the services we provided.

First we had to develop an in-depth understanding on how the entire acquisition process functioned. Multiple flowcharts were developed for the process, each with a different viewpoint. We combined and consolidated these flowcharts to determine the one that best reflected the process. The team members were empowered to interview informed process participants who could provide insight into areas we were not familiar with. Then, we had to establish quantifiable statistics on the process. Without being able to measure we could not confirm improvements to the system.

In our very first conversations, we concluded that applying TQM concepts to our analysis meant that we must fully understand the process and we had to understand the history and the data behind the process in order to determine where the improvements should be made. We had at our disposal procurement data for FY89 and FY90, so we set out to identify numerical parameters with which we could measure process behavior.

Our objectives were first of all to group procurements in terms of their common attributes. We wanted to know if we could find several procurements to the same vendor and how many PR's (procurement requests) fit in each dollar category. We also wanted to quantify PR's in terms of traffic, paper volume, and percentage of total dollars spent for the years. We found that the larger percent of volume was taken up by the lowest dollar class of PR; class A. Class A represents less than 9% of the total dollar volume. This led us to examine the focus of our efforts in two categories—the class of PR where most of the effort is spent and the class of PR where most of the money is spent. We realized improvements in both areas.

We also wanted to track process flow times. We found that we could break the process into three distinct time intervals: Initiation to Approval; Approval to Placement; and Placement to Delivery. We also applied statistical process control theory to assess overall process behavior. We did not take the classical approach of sampling; we had available over 10,000 real data points for FY89 and FY90, which made the math application straight forward.

Our most important objective was to develop an ongoing "near real time" process measurement system so that the processes can be evaluated and problems can be addressed in a timely manner as they show up in the data. The tools at our disposal are our Management Information System PR Data Base, which tracks all pertinent procurement data, and statistical theory. We also manually generated audit data for a portion of the data base to validate our results.

We plotted all the PR data from FY90 as cost versus time-to-place in days. The upper control limit lines in this analysis showed that the means were acceptable, but we found some large variance in some of the data. We found that the reasons for these variances were in the very nature of our business. We use the same system to buy personal computer software and printer paper as we do to procure very complex, one of a kind custom-made flight items for the Shuttle program.

When we categorized PR data into product categories, we found that over half of our procurements were for computer hardware, both large and small systems. The smallest category represents flight hardware, less that 4% of all procurements over $2500; but also the one area which consumes a lot of

effort and requires the most customer visibility and emphasis. However, we found that over 96% of all PR's over $2500 can be placed into only 6 commodity categories. We also looked at the rate of initiation throughout the Fiscal Year.

Although our procurement traffic has increased by about 12% with about 10% fewer manhours, and the total dollars spent increased by about 26%, we have been able to maintain a near real time system monitoring capability. By adding some fields to the procurement forms we were able to collect some additional measurements and better assess the process. And a number of experiments were initiated to eliminate waste by revising procedures where a gain in productivity was evident.

Using these multiple statistical evaluations uncovered data which led to team recommendations for improvement.

We discovered a diverse system of unique acquisitions innate in a research and development type of environment. We were able to identify some natural groupings of acquisitions, and this led to the concept of negotiating Blanket Purchasing Agreements with numerous vendors to shorten the time of obtaining product upon definition of the requirement. We found that specific buyers could also be trained and assigned to the purchase of specific items without nullifying buyer rotation control requirements.

A second finding was the numerous originators currently requesting the acquisition of goods or services. The top 20% of these originators could be given advanced training in procurement practices and requirements. For the remaining originators, we recommended a designated procurement advocate to assist in the generation of requisitions.

A complete approval cycle that required multiple signatures to authorize expenditures was also found to be a detriment to effective operations. The solution was as simple as recommending that the existing electronic approval system for small dollar purchases be expanded to a new threshold. The statistics indicated that approximately 85% of the purchases over the original $1000 threshold would be expedited by increasing the threshold to $2,500.

Through this process we discovered certain elements about the team building process necessary for effective operations. We found that support and involvement by management was crucial to legitimize the activities of the team and enabled the team members to be empowered to investigate and recommend ideas outside the scope of current philosophy without the risk of reprisal. Without the members' commitment to release preconceived ideas and personal agendas to apply themselves to the refining of a system for the benefit of all, the team could not have continued. Also, the team had to remain focused, as well as committed, on the TQM mission in order to assure progress. We found that the perception of the value of the team's activities, by management, the team members themselves, and by the peer employees, was necessary for establishing a productive environment. And finally, we realized that you need to need to be able to quantify and measure the attributes of a project in order to be able to control and manage that project.

11.4 Kanban Team

Beverly A. Tricomi, Manufacturing Engineering Supervisor, AND, Dimas G. Pascua, Electronic Technician, TRW Electronic Systems Group

TRW's Advanced Microelectronics Lab assembles and tests microwave integrated circuits and microwave assemblies. Assembly and test involves more that 20 separate processes; chip packages must be carefully cleaned, assembly steps include precision bonding of electrical lead wires to the circuit; and packaged chips undergo electrical, thermocycling, and performance tests.

Our TQM team, the Kanban Team, developed and implemented a process-driven work flow for the assembly and test area by using a dispatch board that displays the status of all work in assembly and test. The system for using this board, the Kanban system, functions to provide up-to-the-minute status on lots and inventory. The board is interactive and it lets the technicians manage the flow of work through the area. By following the rules established and using the board, we achieve maximum coordination between the lab's engineers and technicians.

Each column, or queue, on our Kanban board represents an operation or a process that a device must go through during assembly and test. Each technician is responsible for one process and thus must manage the work in their queue by using magnetic Kanban cards, which are displayed on large boards throughout the area, to track the progress of each device their individual queue, and transfer the device to the next queue (the next step in the assembly and test process) once they have completed work on the device.

The Kanban concept came from the Japanese, who used the system in World War II as a quick and effective way to get messages out to the people in the towns. They clipped the message on a board and each family read the message and then passed the board on to the next family. This message system is still used in some small towns today. The literal translation of Kanban is "Kan," which means look and "Ban," which means wooden block. In Japanese, kanban also means "sign on the front of the store."

Our Kanban is more than just a display board. It has become a very important tool that makes sure that the right information gets to the right people at the right time, and this information helps everyone involved to make the decisions that move work efficiently through the area. Before, technicians had to go through other people to get the information they needed to do their jobs; now, everyone can get the information they need directly off the board. This ability to manage the work flow in real time gives us greater control over it, helping us move toward a just-in-time delivery system.

The benefits of the Kanban system are many. Previously, technicians were responsible for taking a batch of parts through all stages of assembly and testing. The switch to process ownership, where each technician is responsible for one process, has enabled our technicians to become specialists. They now keep data on process performance and measure improvements. As a result, in 8 weeks, the process time required for wire bonding was shortened by 37%.

The Kanban system also places the responsibility for routine process decisions on the person who knows most about it, the technicians. When you spread responsibility in this way, you reduce the burden of managers to supervise and free their time for planning and problem solving. You also create a shared sense of responsibility and dedication among everyone in the system. The ownership that this system encourages is the key to achieving improvement in all your processes.

We did not really understand the full implication of empowerment until we actually implemented the Kanban system. As we delegated more responsibility for our processes, we found a few managers who did not trust the technician's ability to make decisions that would guarantee continuous improvements. However, we've proven the system by results; Kanban and our technicians have shown continuous improvement over three quarters in yields, cost, and cycle time.

To be effective, the Kanban system must be flexible and continue to adjust and improve the mechanics and methods used to manage the process. You must also manage the momentum of the system by getting and keeping your people involve. You do that by granting them real power to manage the processes and work flow.

The empowerment that has resulted from the Kanban system has led to improvement. We've seen productivity improvement and cost savings and we've freed managers from routine supervisory tasks and enabled them to spend more time planning and finding the best resources to support production. Our Kanban system has shown that empowering employees empowers everyone in the organization.

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

12.1 Presentation

Robert V. Caine, President, American Society for Quality Control

The driver for competitive dominance in world markets has become increasingly difficult as more and more players bring higher and higher levels of quality to the market place. Victor Hugo, writing in 19th century France, could well have been speaking for us when he wrote, "The challenge is urgent, the task is difficult, the time is now!" Retaining markets and market share is no longer a given and the aerospace industry is no exception. That's why your commitment, efforts, and achievements, and especially your technology exchange, are more important today than ever before.

Now as the economy gathers itself from recession, as markets across the world increasingly demand quality and excellence, as our aerospace industry asserts itself as the world leader, the George M. Low Trophy continues to gain in stature in the eyes of the world. As this country's first national quality award, the George M. Low Trophy lends prominence to those organizations which would gladly carry the banner of continuous improvement, with or without the recognition provided by this award. This commitment is demonstrated by those organizations putting forth the effort to perform the day to day tasks required to satisfy their customers and still willingly generating the extra effort to prepare an application for this competition. This willingness demonstrates the pride your companies have in the work you perform, reflected in the desire to analyze your own performance and undergo the intense scrutiny of objective observers, and effort to find and capitalize on every avenue of improvement. Above all, your participation is testimony to your determination to be satisfied with nothing short of excellence.

I point with pride to the unselfishness at which award finalists and recipients share both their success and their failures, even with their competitors. This technology exchange has become the linchpin to the continuous improvement we witness through the industry. These organizations and all of us gathered here for this conference have given voice and heart and meaning to the quality movement. We can take pride in knowing that we are giving value to the meaning of the words "Made in America." NASA, at the forefront of American achievement in ingenuity, is continuing its leading role in developing this national awareness.

We at the ASQC salute NASA and its contractors honored here tonight. In the broadest sense, this award benefits us all in raising our ideals and providing benchmarks for all sectors of the economy. Our challenge is clear, our commitment as witnessed here tonight is strong, and the course set by NASA with this award program is true.

12.2 Presentation

G. David Low, NASA Astronaut

I'd like to start out by saying congratulations to all the finalists; all of you are being honored here tonight. You've all done some outstanding work, you are all to be commended for that, and I would like to personally urge all of you to continue.

Quality is very important to astronauts. But my personal feeling is that astronauts are just a very small part of a very large team with the same goals. Quality should be equally important and very important to every single member of that team. We must all ensure that is the case.

My father spoke about quality quite often; in fact, I think it was one of his favorite topics. Quality was something that he was talking about long before TQM became a national buzzword. In one speech in Florida in 1981 he talked about the human aspects of quality when he said, "Quality is a very human

thing. It depends upon people, and their attitudes, and how well they are motivated" Nowhere is this more true than in the space program today. In the space program quality is not just important, in my mind it is critically important.

To the workers I would like to say, please continue to do the good work. It is you all that take the great ideas from management and turn them into the great realities of the space program of the past 30 years. Managers can talk until they're blue in the face, but if the workers don't do quality work, we are not going to be successful. The space program is flying on your quality work.

And to the managers I say it is your job to keep the workers properly motivated to do the quality work. That can be a tough job sometimes, but you must always send the right signals. What you do, what you say, the actions you take, and how you lead send very important messages to the workers and affect their motivation. Your actions are at least as important as your words.

NASA Astronaut G. David Low describes the importance of excellence as a prelude to the announcement of the 1991 George M. Low Trophy recipients.

In looking back I'm sure I learned as much from my father by watching the way he lived, his honesty, his integrity, the way he treated his fellow human beings, than by anything he ever said to me.

To the finalists tonight, I'm very proud of all of you, but please don't let this be your quality pinnacle. You are very good, but we can all be even better. The folks in this room represent some of the very best in America. No one else has the capability to do what we do in space, and of that we can be very, very proud. Your quality work helps us accomplish some very important national goals, and in so doing instills national pride and enhances our national prestige. But we know that with systems as complex as those with which we deal, and in an environment as harsh as that in which we operate, if we lessen our attention to detail even a little, all of this can be stopped very, very quickly.

Unfortunately, quality does not have an end. We can't achieve quality and then quit. But we must keep pushing. I hope you view this award tonight, not as a measure of a goal accomplished, but as a catalyst to do even better.

On the personal side, I can't tell you how extremely proud my family and I are that NASA's highest award for quality and excellence has been named for my father. Anyone who ever knew or worked with him knows that he was driven by quality and excellence, and accepted nothing less from himself or from those with whom he worked. I can't think of a higher compliment to my father and all that he stood for in his life, than to have his name forever linked to the terms quality and excellence through this trophy. From an admittedly biased view point I think that the trophy is very appropriately named. Whoever receives it should be very, very proud indeed.

12.3 Announcement of the 1991 George M. Low Trophy: NASA's Quality and Excellence Award Recipients

Admiral Richard H. Truly, NASA Administrator

On behalf of every person and every organization within NASA, I am personally very pleased and very proud of the achievements of all the finalists in continuous improvement and in TQM. I'm also particularly proud to be joined here on the podium this evening with my good friend, astronaut David Low, son of George M. Low, for whom this trophy was named by me. George Low was a great American who represented to me and to NASA and to America true excellence. Each finalist for the 1991 award is one of the very best of NASA's many contractors. They have risen to the top, outperforming others in quality achievements. They have each elected to have their processes, products, and services closely scrutinized, and I mean closely, by the NASA and ASQC award evaluation team.

Those achievements serve as examples by which others can pattern their work and themselves. For all the applicants, it is an arduous journey, since it requires at least 3 years of sustained continuous improvement to be eligible to reach the finalist status. We recognize your efforts, because you have earned the right to be considered among the very best. You have shown a firm commitment to teaming efforts, with your customers, with your employees, with your suppliers, and with your vendors. Where necessary, you have harnessed technology and put it to work to benefit yourselves, and NASA and America's space program. Your organizations have made customer satisfaction a company wide goal. You care about your people, your customers and your organization, and you've embarked on that never ending quality journey which is vital for continued success. All of you share one thing in common, no matter who receives the 1991 George M. Low Trophy, you have shown that among NASA's contractors, you are the very best, and I am delighted to join you here tonight.

This has been a very unusual year in determining the recipient of the 1991 George M. Low Trophy. The evaluation process is not really so much a competition between one company and another, but rather a tough measurement of how an organization stacks up against itself, in a never ending quest for excellence. This year's recipients have set extremely high goals and in most cases have achieved them. So tonight we acknowledge that effort and encourage them and the other finalists to set even higher goals in the future.

The first recipient is the Grumman Technical Services Division, a subcontractor to Lockheed Space Operations Company on the Shuttle Processing Contract. Subcontractors and support service contractors have special challenges and Grumman has met them. Their role is every bit as essential as building, testing and flying aircraft and space craft. Grumman set six tough goals for itself: emphasis on the customer; active leadership; do things right the first time; streamline wherever possible; enhance communications; and encourage participation. Grumman's progress in meeting these goals justifies their receipt of this award.

The second recipient of the George M. Low Trophy is a recipient that I think will send a ringing message across America about quality to contractors in many businesses and particularly in the aerospace business. That is the Thiokol Corporation Space Operations.

I can tell you that I personally know a lot about Thiokol's journey to this trophy. Thiokol's contribution to the space program is evident in every single launch when the redesigned solid rocket motors kick in and prove the tremendous thrust required to leave this earth and soar into space.

Thiokol has improved steadily for a number of years and has reached a level warranting recognition as a quality operation. Their focus during their progress has been on culture, on skills, on teamwork strategy, and on rewards.

NASA's vision is nothing less than to be an inspiration to America through the achievement and execution of our aeronautics and space program. The finalists that are here on this stage are all winners. They have shown me what quality in the space business is all about. Thank you all for participating in this two-day event.

12.4 Grumman Technical Services Division

Jarvis L. Olson, Program Vice President, Grumman Technical Services Division

I've been but a small part of what the Grumman workers have achieved. We entered the program not because we had to but because we wanted to. Our people encouraged us to continue, and they deserve this recognition for being the best of the best. This is also proof that a subcontractor can win this award, so hopefully all of you subcontractors will take a go at it.

Javis L. (Skip) Olson, Grumman Technical Services Division, signals congratulations to his organization as Admiral Richard H. Truly announces Grumman as a George M. Low Trophy recipient.

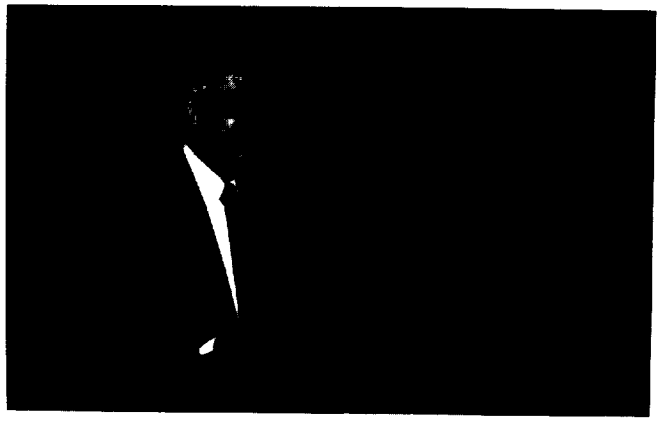
12.5 Thiokol Corporation, Space Operations

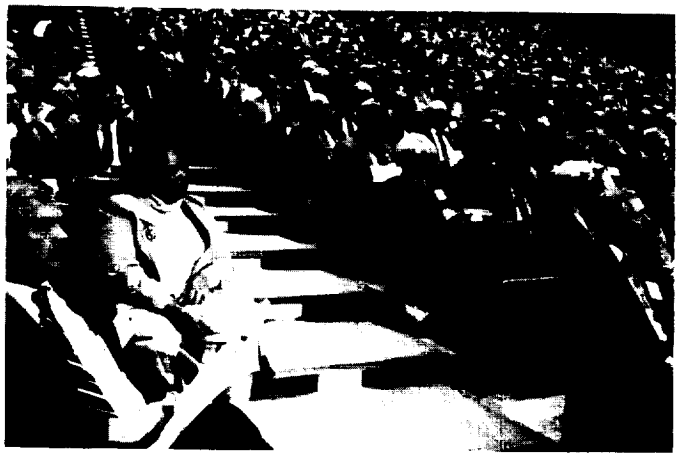
Robert E. Lindstrom, Senior Vice President and General Manager, Thiokol Corporation, Space Operations

I am really very happy to accept this award on behalf of the many dedicated people at Thiokol, our subcontractors, and the many NASA people at the Marshall Space Flight Center and other centers who've supported us very much. We look forward to the award ceremony when we can share this award with all the people who worked to achieve this level of excellence.

Admiral Richard H. Truly congratulates Robert E. Lindstrom, Thiokol Corporation, a 1991 George M. Low Trophy recipient.

Aaron Cohen, Director, Lyndon B. Johnson Space Center, welcomes the attendees.





More than 1,100 representatives from government, industry, academia, professional societies, and the international community attended the two-day event.

Charles S. Harlan, Director, Safety, Reliability and Quality Assurance, Lyndon B. Johnson Space Center.

Attendees discussed continuous improvement strategies between panels.

The Greater Houston Quality Group surveyed attendees on quality initiatives and practices.

The George M. Low Trophy Banquet Reception provided an opportunity to exchange success stories and lessons learned in an informal environment.

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

Panels sessions provided insight into the theories and applications of continuous improvement.

(from left to right): Roy Estess, Director, John C. Stennis Space Center, Linley K. Ward, Sverdrup Technology, Inc., Aaron Cohen, Director, Lyndon B. Johnson Space Center, and Mrs. Cohen.

Robert V. Caine, President, American Society for Quality Control

Computer Sciences Corporation, Applied Technology Division

Cray Research, Inc., Manufacturing Division

EG&G Florida, Inc.

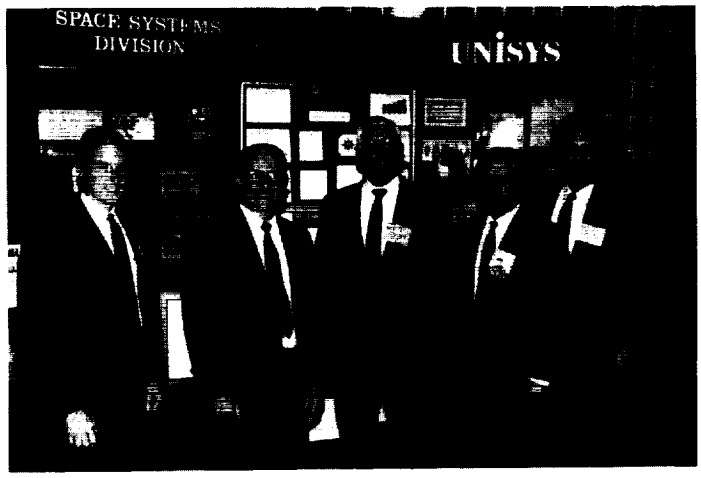
Grumman Technical Services Division

Honeywell Inc., Space Systems Group

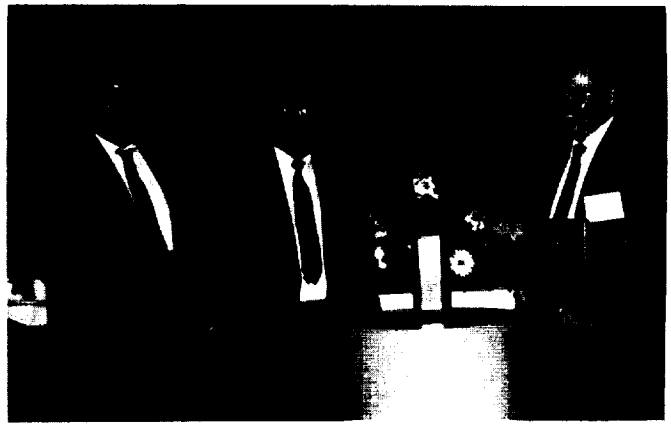
Thiokol Corporation, Space Operations

TRW Space and Technology Group

Unisys Defense Systems, Space Systems Division



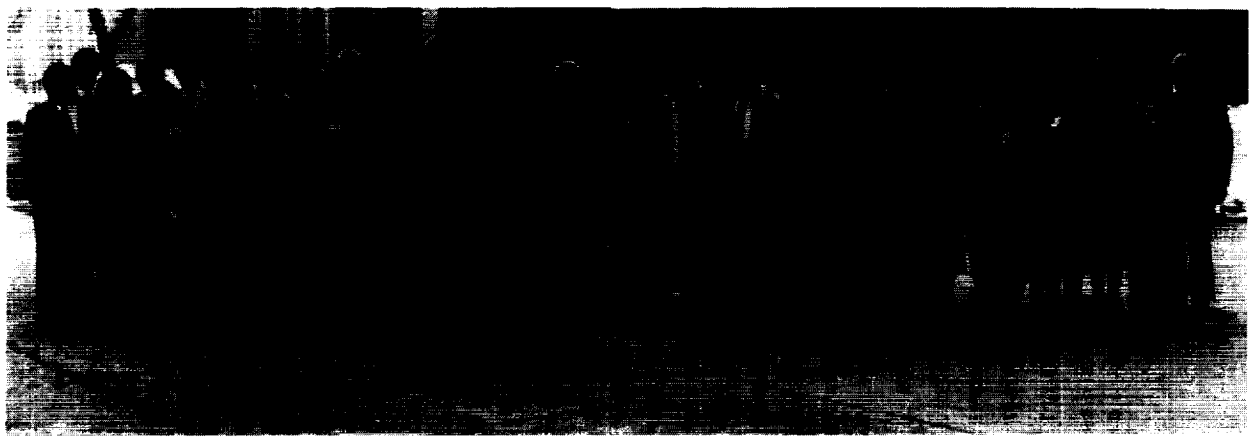
Robert E. Lindstrom (l),
Admiral Richard H. Truly, and
Jarvis L. Olson.



The 1991 George M. Low Trophy Finalists (from left to right): John Munson, Unisys; Daniel Goldin, TRW; Richard L. Davis, Thiokol Corporation; Carl Vignali, Honeywell Inc.; George A. Rodney, Associate Administrator for Safety and Mission Quality; Admiral Richard H. Truly, NASA Administrator, Robert V. Caine, President, American Society for Quality Control; G. David Low, NASA Astronaut; Jarvis L. Olson, Grumman Technical Services Division; James R. Dubay, EG&G Florida, Inc.; Louis Saye, Cray Research, Inc.; Bill F. Barry, Computer Sciences Corporation.

The University of Houston Military Sciences Department provided the Color Guard Ceremony to kick off the George M. Low Trophy Banquet.

Carl G. Thor, Vice-Chairman, American Productivity and Quality Center (left) and William E. Hart, Producer, NASA Select, Bendix Field Engineering Corporation, provided commentary for the live two-day NASA Select broadcast.



The Eighth Annual NASA/Contractors Conference and 1991 National Symposium Planning Committee

Appendix A - Conference Agenda

Eighth Annual NASA/Contractors Conference and 1991 National Symposium on Quality and Productivity "Extending the Boundaries of Total Quality Management"

George R. Brown Convention Center
Houston, Texas
November 6-7, 1991
Hosted by the **Lyndon B. Johnson Space Center**

Wednesday, November 6, 1991

7:00 - 7:50 a.m.	Buffet Breakfast and Registration at the George R. Brown Convention Center.
8:00 - 8:10	Welcome - **Aaron Cohen**, Director, Lyndon B. Johnson Space Center.
8:10 - 8:30	Keynote - **Admiral Richard H. Truly**, Administrator, National Aeronautics and Space Administration.
8:30 - 8:40	Conference Overview - **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvement Programs Division, Symposium Chairperson, NASA Headquarters.
8:40-8:50	Remarks - **Darleen A. Druyun**, Assistant Administrator for Procurement, NASA Headquarters.
8:50 - 9:05	Break.
9:05 - 10:30	**"TOP LEADERSHIP" PANEL.**

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

Arthur R. Taylor, Dean, Graduate School of Business, Fordham University.

Dr. Bob G. Gower, President and Chief Executive Officer, Lyondell Petrochemical Company.

Manager: **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvement Programs Division, NASA Headquarters.

Four Concurrent Panels: 10:45-12:00 noon.

Four Concurrent Panels highlighting the **GEORGE M. LOW TROPHY: NASA'S QUALITY AND EXCELLENCE AWARD - 1990 Recipients Marotta Scientific Controls, Inc., and Rockwell Space Systems Division, and the eight 1991 Finalists.**

Session Director: **Geoffrey B. Templeton**, NASA George M. Low Trophy Program Manager, NASA Headquarters.

Panel 1 **1990 George M. Low Trophy Recipients.**

Darleen A. Druyun, Assistant Administrator for Procurement, NASA Headquarters, **Chairperson.**

Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc., **"Total Quality Management - The Foundation for Continuous Improvement."**

Robert G. Minor, President, Rockwell Space Systems Division, **"Sustaining Commitment to Excellence - Our Ultimate Customer."**

Manager: **Robert Medina**, Office of Aeronautics and Space Technology, NASA Headquarters.

Panel 2 **1991 George M. Low Trophy Finalists - Manufacturing.**

Aaron Cohen, Director, Lyndon B. Johnson Space Center, **Chairman.**

Daniel S. Goldin, Vice President and General Manager, TRW Space and Technology Group, **"TQM: How the Best Get Better."**

Carl L. Vignali, Vice President and Group Executive, Space Systems Group, Honeywell Inc., **"TQM-Lessons Learned by Management."**

Robert E. Lindstrom, Senior Vice President and General Manager, Thiokol Corporation, Space Operations, **"Total Quality at Thiokol Space Operations."**

Manager: **David P. Heimann,** Presidential Management Intern, NASA Headquarters.

Panel 3 **1991 George M. Low Trophy Finalists - Mission Support.**

Charles S. Harlan, Director, Safety, Reliability and Quality Assurance, Lyndon B. Johnson Space Center, **Chairman.**

Bill F. Barry, Vice President, Applied Technology Division, Computer Sciences Corporation, **"People: Stakeholders in Quality."**

John B. Munson, Vice President and General Manager, Space Systems Division, Unisys Defense Systems, **"TQM Tools and Techniques for Manned Spaceflight Mission Support."**

Louis A. Saye, Vice President of Manufacturing, Manufacturing Division, Cray Research, Inc., **"Evolution of a Quality Icon."**

Manager: **Paul E. Cate**, NASA Quality and Productivity Improvement Programs Division, NASA Headquarters.

Four Concurrent Panels: 10:45-12:00 noon (continued)

Panel 4 **1991 George M. Low Trophy Finalists - Service Support.**

Margaret G. Finarelli, Associate Administrator for Policy Coordination and International Relations, NASA Headquarters, **Chairperson.**

James R. Dubay, President and General Manager, EG&G Florida, Inc., **"Achieving Excellence - The "Grassroots" Approach."**

Jarvis L. Olson, Program Vice President, Grumman Technical Services Division, **"Superior Customer Service at KSC."**

Manager: **Candace D. Livingston**, Office of Commercial Programs, NASA Headquarters.

12:00 - 1:30 p.m. Lunch/Keynote Speaker: **Dr. Renso L. Caporali**, Chairman of the Board and Chief Executive Officer, Grumman Corporation, **"Without a Finish Line."**

Overview of Concurrent Sessions: 1:30-5:30 p.m.

FOUR CONCURRENT SESSIONS. Generic sessions will be presented vertically, one after the other, to permit participants to follow a series or attend other panels, if so desired.

SESSION A **The Development, Implementation, and Evolution of a Quality-Driven Strategic Plan.** This session will provide a focus on the infusion of quality principles into the strategic planning process; investigate successful implementation of quality-driven strategic plans; and discuss the evolution of partnerships with our stakeholders.

Session Directors: **Thomas H. Forbes**, Quality Manager, Government Services Division, Electronic Data Systems Corporation, and **Irwin J. Schauer**, Manager, Quality and Productivity Improvement Programs, Langley Research Center.

SESSION B **World Class Quality - Tools for Survival.** This session will focus on the use of three assessment tools which are critical for the survival of the organization today: Benchmarking, Supplier Certification, and Quality Standards for Services.

Session Directors: **Tina M. Doty**, Corporate Vice President, Quality Assurance, Leach Corporation, and **Charles S. Harlan**, Director, Safety, Reliability and Quality Assurance, Lyndon B. Johnson Space Center.

Overview of Concurrent Sessions: 1:30-5:30 p.m. (continued)

SESSION C

It Takes Two-The Customer and You. This session will explore successful methodologies for identifying customer needs and expectations, and forming unique and effective partnerships.

Session Directors: **Marc C. Bridgham**, Manager, Organizational Development and Continuous Quality Improvement, Missiles and Space Division, Boeing Defense and Space Group, and **Larry E. Lechner**, Productivity Improvement Office, George C. Marshall Space Flight Center.

SESSION D

Community Partnerships: TQM Applied to Systemic Organizational Performance. This session will provide successful experiences of community/cooperative action dealing with deep, pervasive "outside" issues stymieing organizational performance and competitiveness.

Session Directors: **David R. Braunstein**, General Manager, Quality, Business and Technology Development, Douglas Aircraft Company, McDonnell Douglas Corporation, and **Carl G. Thor**, Vice-Chairman, American Productivity and Quality Center.

Four Concurrent Panels: 1:30-2:40 p.m.

Panel A1

The Process of Strategic Planning. This panel will focus on the "process" of strategic planning while infusing the principles of Total Quality.

Robert B. Young, Jr., President and Chief Executive Officer, Lockheed Engineering and Sciences Company, **Chairman.**

Thomas R. Curry, Manager of Business Planning, Electronic Data Systems Corporation **"Strategic Planning: A Quality Perspective."**

Manager: **Richard M. Simon**, TQM Program Manager, Harris Space Systems, Corporation.

Panel B1

Benchmarking: Competitiveness, Survival and Territoriality. This panel will explore techniques for assessing the quality level of internal processes with the moving target of a worldwide competitive environment. The implementation issues in handling sensitive benchmark data will also be discussed.

Dr. Robert M. Krone, Chairman, Systems Management Department, University of Southern California, **Chairman.**

Wallace J. Luther, Vice President of Quality Assurance, North American Aircraft Division, Rockwell International Corporation, **"Quality Benchmarking."**

Ken Potashner, Corporate Quality and Technology-Staff, Digital Equipment Corporation, **"Total Quality Management."**

Charlotte R. Scroggins, Senior Vice President, American Productivity and Quality Center, **"APQC Benchmarking Clearinghouse."**

Managers: **Kenneth R. Shipe**, Product Assurance-Staff, Martin Marietta Astronautics Group, and **Leslie J. Sullivan**, Chief, Management Analysis Office, Lyndon B. Johnson Space Center.

Four Concurrent Panels: 1:30-2:40 p.m. (continued)

Panel C1

It's 10 O'Clock, Do You Know Where Your Customer Is? Identifying a customer's real expectations may require unique approaches which must ultimately be integrated into responsive actions. This panel will explore techniques for obtaining these data and review case history successes.

Richard D. Clapper, Chief, Office of Human Resources Development, Lewis Research Center, **Chairman.**

Gerald H. Sandler, President, Grumman Data Systems, **"Identifying Customer's Real Expectations..."**

Judy K. Landrum, Development Specialist, Coors Brewing Company, **"Customer Satisfaction Builds Our Future."**

Larry L. Parker, President and Chief Executive Officer, Leach Corporation, **"Customer Focused World Class Manufacturing."**

Managers: **James F. Holloway**, Program Development, Space Propulsion, Pratt & Whitney, United Technologies Corporation, and **Jessica R. Wilke**, Assistant to the Director, Total Quality Process, Grumman Corporation.

Panel D1

TQM Partnerships with Education. This panel will present successful models of business/education TQM partnerships.

Dr. James Stoner, Professor of Management Systems, Graduate School of Business, Fordham University, **"Herding Cats - Observations on Implementing Quality Management in Academe and Beyond," Chairman.**

Dr. H. E. (Rusty) Marr, Quality/Productivity Manager, Operations Systems Business Unit, American Telephone and Telegraph Company, **"Quality New Jersey - The Role of Volunteers in a Business/Education Partnership."**

Jess Arnold, Manager, Community Interface Programs, Space Systems Division, Rockwell International Corporation, **"Partnerships for Progress."**

Managers: **Ned Hamson**, Editor, The Journal for Quality and Participation, Association for Quality and Participation, and **Nora G. Williams**, Director, Program Excellence, Space Systems Division, Unisys Defense Systems.

2:40 - 2:55 Break.

Four Concurrent Panels: 2:55-4:05 p.m.

Panel A2

The Continuing Role of Strategic Planning. How to maintain strategic quality-driven viability and flexibility while responding to organizational and cultural transitions.

Dr. Robert A. Emry, Associate Dean and Professor, School of Communication, California State University, Fullerton, **Chairman.**

Ian L. Rushby, Chief of Staff, Western Hemisphere, British Petroleum Exploration, **"British Petroleum Project 1990."**

Dr. James E. Ashton, Division Vice President and General Manager, Naval Systems Division, FMC Corporation, **"A Practitioner's Approach to Implementing Continuous Improvement."**

Managers: **Dr. Cecile C. Blake**, President, STATWATCH, and **David L. Stoner**, Manager, SRM&QA Technical Support, Loral Space Information Systems.

Four Concurrent Panels: 2:55-4:05 p.m. (continued)

Panel B2

Exploring Quality Assurance Standards in a Services Environment. This panel will explore the definition and measurement of meaningful quality standards in non-traditional areas, such as, research and development, engineering services, and white-collar work. The use of requirements, definition tools, process analysis, peer reviews, and other innovative approaches will be discussed.

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

James W. A. Cearns, Vice President-Aerospace, LRE, Munich, Germany, **"Quality Standards in Service Environments."**

Dr. Robert R. Spear, Manager of Quality, The M. W. Kellogg Company, **"Building Quality into Project Execution."**

Richard B. Bhend, Senior Reliability Engineer, Application Business Systems, IBM Corporation, **"Rochester Excellence...Customer Satisfaction-The Quality Journey Continues."**

Manager: **Sherry H. Prud'homme**, Project Manager, TQM Office, Lockheed Engineering and Sciences Company.

Panel C2

Let's Get Together! Successful partnerships result from establishing trust and eliminating barriers. This panel will focus on how to build collaborative relationships that integrate customers and suppliers into all phases of operations, from planning through implementation, to ensure common alignment and ownership of goals.

Thomas J. (Jack) Lee, Director, George C. Marshall Space Flight Center, **Chairman.**

Dr. F. Max Croft, Director, Information Systems Office, George C. Marshall Space Flight Center, AND **Paul J. Holyoak**, Program Manager, Integrated Information Services, Boeing Computer Support Services, **"Service Excellence Through Partnership."**

Colonel Loren J. Shriver, Astronaut, Lyndon B. Johnson Space Center.

Managers: **Leroy A. Mendenhall**, Manager, Management and Organization Development, Unisys Defense Systems, and **Jeffrey K. Evans**, Manager, Total Quality Management, Safety, Reliability and Quality Assurance Directorate, Lyndon B. Johnson Space Center.

Four Concurrent Panels: 2:55-4:05 p.m. (continued)

Panel D2

Partnerships in the International Community. This panel will explore the formation of partnerships in Europe and Japan that address quality and productivity issues in a rapidly changing global economic environment. Comparisons with the United States' efforts will be presented based on a study performed by Columbia University's Center for Operations.

Dr. William B. Lenoir, Associate Administrator for Space Flight, NASA Headquarters, **Chairman.**

Masayuki Shimodaira, Director, Reliability Assurance Department, National Space Development Agency of Japan, **"Quality Control Activity in Japan and Relationship of International Cooperation Activity."**

Fabio Corno, Scientific Coordinator, Center of Entrepreneurial Studies, Valmadrera, Italy, **"Cultural Decoding: A Must for Cooperating in Europe."**

Dr. Martin K. Starr, Professor, Center for Operations, Graduate School of Business, Columbia University, **"Comparative Performance of Foreign Affiliate and U.S. Firms in America."**

Managers: **Sally L. Stohler**, Manager, Space Shuttle Main Engine Marketing, Rocketdyne Division, Rockwell International Corporation, and **G. Ted Ankrum**, Special Assistant to the Administrator, NASA Headquarters.

4:05 - 4:20 Break.

Four Concurrent Panels: 4:20-5:30 p.m.

Panel A3

Planning for Evolving Partnerships. In this panel you will learn how Rockwell International and the United Aerospace Workers committed to a joint partnership to achieve competitive advantage and how company and union officials reached a landmark contract agreement by "issue" bargaining instead of "position" bargaining. Additionally, you will learn how USAA built a world-class service organization through quality driven strategic planning and business partnerships.

Eileen T. Crowley, President and Chief Operating Officer, Chamber of Commerce Division, Greater Houston Partnership, **Chairperson.**

Ernest Shelton,International Representative, United Aerospace Workers Region 6, AND **Frank L. Chabre**, Vice President, Human Resources and Communications, Space Systems Division, Rockwell International Corporation, **"New Beginnings: United Aerospace Workers'/Rockwell International's Breakthrough Approach to Contract Negotiations."**

M. Staser Holcomb, Executive Vice President and Chief Financial Officer, United Services Automobile Association, **"Partnerships: A Strategy for Success."**

Managers: **Robin S. Lineberger**, Manager, Space, Aerospace and Defense Consulting, KPMG Peat Marwick, and **Geneviene R. Emry**, Director, Organizational Excellence and Communications, Space Systems Division, Rockwell International Corporation.

Four Concurrent Panels: 4:20-5:30 p.m. (continued)

Panel B3

World-Class Suppliers: Making Sense of Supplier Certification. This panel will examine various supplier certification programs and provide recommendations for implementation and/or participation in supplier's certification.

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

Dr. Lawrence M. Malinowski, President, Advanced Quality Systems, **"Cultivating a Supplier/Customer Partnership."**

Lynne G. Kunster, Director, Supplier Development Program, Leach Corporation.

Joseph N. Buzzelli, Director of Quality Assurance, Magellan Systems Corporation, **"Supplier Certification."**

Managers: **Tina M. Doty**, Corporate Vice President, Quality Assurance, Leach Corporation, and **Donald O. Atkins**, Director Product Assurance, ILC Space Systems, ILC Dover, Inc.

Panel C3

Consider Yourself One of Us! Panelists representing the Space Station Freedom and National Aerospace Plane programs will present breakthrough approaches to continually meet evolving customer expectations in an interactive community, both domestic and international.

Arnold D. Aldrich, Associate Administrator for Space Systems Development, NASA Headquarters, **Chairman.**

Richard L. Grant, Vice President, Space Station Freedom Program, Missiles and Space Division, Boeing Defense and Space Group, **"International Working Agreements and Partnerships on Space Station Freedom."**

Dr. Robert R. Barthelemy, Program Director, NASP Joint Program Office, Wright-Patterson Air Force Base, AND **Joseph P. Zimonis**, Executive Vice President and General Manager, USBI Company Inc., United Technologies Corporation. **"Government/Industry Partnerships on the National Aerospace Plane."**

Managers: **Marsha L. Dollarhide**, Executive Advisor, Huntsville Operations, Space Systems Division, Rockwell International Corporation, and **Nancy H. Fussell**, Product Integrity Manager, Space Station Freedom Program, Missiles and Space Division, Boeing Defense and Space Group.

Four Concurrent Panels: 4:20-5:30 p.m. (continued)

Panel D3

Changing Work Force Demographics. The purpose of this panel is to expose and discuss the effects of a rapidly changing work force in the United States. Both Government and private sector perspectives will be presented.

Bonnie W. Soodik, Vice President-General Manager, Quality Systems, McDonnell Douglas Space Systems Company, **Chairperson.**

Dr. Harriett G. Jenkins, Assistant Administrator for Equal Opportunity Programs, NASA Headquarters, **"What NASA is Doing to Get More Minorities, Women, and Individuals with Disabilities into Science and Engineering Careers."**

Jay P. Cooper, Corporate Director, Materiel Policy and Socio-Economic Business Programs, Supplier Relations, Northrop Corporation, **"Valuing Diversity."**

Managers: **Willis E. Chapman,** Administrator, Total Quality Management, Jet Propulsion Laboratory, and **Thomas W. Parkinson,** Deputy General Manager, Houston Division, McDonnell Douglas Space Systems Company.

5:30 - 6:30 Free Time.

6:30 - 7:15 Reception at the George R. Brown Convention Center featuring the George M. Low Trophy: NASA's Quality and Excellence Award Finalists and **G. David Low,** NASA Astronaut.

7:30 - 9:30 George M. Low Trophy: NASA's Quality and Excellence Award Banquet (George R. Brown Convention Center). Presentation of the 1991 Finalist plaques by **Admiral Truly** and **Robert V. Caine,** President, American Society for Quality Control. **Announcement of 1991 Award Recipient(s) - Admiral Richard H. Truly, NASA Administrator.**

Thursday, November 7, 1991

7:15 - 8:30 a.m. Breakfast. Keynote Speakers: **Dr. Tor Dahl**, President, Tor Dahl and Associates, AND **Candy Johnson Rausch**, Executive Secretary, World Confederation of Productivity Sciences, **"How Much More Productive Can Education Become? 100%? 200%?"**

Overview of Concurrent Sessions: 8:40-11:30 a.m.

SESSION E

Continuous Process Improvement - Success Stories. Success stories with demonstrated results will be provided highlighting specific techniques in process analysis, measurement, and partnering. Individual panels will focus on products, services, and administrative processes.

Session Directors: **Dr. Dean R. Lee**, Director, Quality/Productivity, Systems Services Group. Unisys Defense Systems, and **Timothy M. Sullivan**, Director, Planning and Resources Management Division, NASA Headquarters.

SESSION F

Empowerment and Teamwork. This session explores the practical experiences of organizations with empowerment and teamwork. The successful experiences, problems encountered, and lessons learned are explored from the "trenches" to the Board Room. Panels will emphasize start-up, intermediate/advanced, and futuristic aspects of empowerment and teamwork.

Session Directors: **Ralph J. Tortorich**, Manager, Performance Enhancement Programs, Martin Marietta Manned Space Systems, and **John L. Reiss**, Chief, Management Programs Office, Ames Research Center.

SESSION G

Training and Recognition in the World of TQM. These panels will present methods, issues, and experiences in the start-up and maturing phases of total quality training. They will offer tools and state-of-the-art technology which enhance the continuous development of employees in future-oriented organizations. Prior to the conference, field research on current and innovative recognition efforts employed by aerospace organizations was conducted. Results will be summarized and discussed by members of Panel G3.

Session Directors: **Dr. Karen K. Whitney**, Manager, Productivity, Rockwell Space Operations Company, and **Richard D. Clapper**, Chief, Human Resources Development, Lewis Research Center.

SESSION H

Community Partnerships: Reports from the Field. This session will provide discussions with Houston community leaders and interactive discussions via satellite from Baltimore and Denver to pursue community solutions to seemingly evasive quality and performance challenges.

Session Directors: **David R. Braunstein**, General Manager, Quality, Business and Technology Development, Douglas Aircraft Company, McDonnell Douglas Corporation, and **Carl G. Thor**, Vice-Chairman, American Productivity and Quality Center.

Four Concurrent Panels: 8:40 - 9:55 a.m.

Panel E1

Continuous Process Improvement (CPI) Success Stories - Products. Successful managers will describe the CPI methods employed to develop hardware and software products. Featured will be dramatic improvements in quality and productivity.

Marshall W. Novick, Vice President and Director-Quality, TRW Space and Technology Group, Space and Defense Sector, **Chairman**.

Gregory S. Trachta, Program Director, STSOC Program, Space Systems Division, Unisys Defense Systems, Inc., "**Manned Space Flight Software Engineering TQM Process and Results.**"

Halbert M. Harris, Vice President and Chief Engineer, Development and Manufacturing, Xerox Corporation. "**Supplier Partnership in TQM.**"

Larry D. Lambert, Senior Vice President, Center Services, American Productivity and Quality Center.

Manager: **Marshall W. Novick**, Vice President and Director-Quality, TRW Space and Technology Group, Space and Defense Sector.

Panel F1

Initiating Programs for Empowerment and Teamwork. Initiating successful programs for empowering individuals and teams requires changes in roles, work processes, training programs, and attitudes toward individual responsibility and productivity. This panel will present examples based on actual experience which show how this culture change has been successfully initiated and how start-up problems can be avoided.

Dr. William E. Huseonica, Director of Science and Technology, John C. Stennis Space Center, **Chairman**.

T. M. (Mickey) Clemons, Manager - Integrated Resource Planning, Martin Marietta Astronautics Group, "**New Visions Beyond Old Barriers.**"

George D. Robson, Program Manager - Continuous Improvement Programs, GE Aircraft Engines, "**Continuous Process Improvement.**"

Earl L. Lee, Manager - Space Shuttle Software Verification, IBM Federal Sector Division, "**Process Evaluation Teams.**"

Manager: **G. William Kuhfuss**, Product Assurance Manager, Ground Systems Program Department, GE Aerospace.

Four Concurrent Panels: 8:40 - 9:55 a.m. (continued)

Panel G1

Beginning Total Quality Training - Moving Out Smartly. This session offers the practical do's and don't's of designing and implementing training for total quality. The panelists will address those topics faced by organizations as they move toward a total quality environment: Who should receive how much training? How should the training be paced? What TQM concepts and tools are a "must"?

Carl L. Vignali, Group Vice President, Space Systems Group, Honeywell Inc. **Chairman.**

Donald McPartland, Quality Analyst, Quality, The Internal Revenue Service, **"Training for Quality in the Internal Revenue Service."**

Emmett B. Ferguson, M.D., Director of Medical Services, EG&G Florida, Inc., **"Quality Training Must Include the Customer."**

Managers: **Susan Crandall**, Manager of Productivity, and **Edward U. Gascon**, Deputy Program Manager, Houston Operations, Bendix Field Engineering Corporation.

SATELLITE UP/DOWN LINK HOUSTON/GODDARD SPACE FLIGHT CENTER

Panel H1

Focus On Total Quality In Education. No system is more critical to sustained U.S. competitiveness than the educational system. Total Quality offers a management model that can be used to transform education as it is transforming American industry. This session will examine two models for applying Total Quality in Education. One is state-wide for public education (K-12); the second is a model of Total Quality in a major state university. The critical role played by industry partnerships in both of these models will also be explored.

Dr. John M. Klineberg, Director, Goddard Space Flight Center, **Chairman.**

Dr. Thomas C. Tuttle, Director, Maryland Center for Quality and Productivity, University of Maryland, **Moderator.**

Dr. William (Brit) E. Kirwan, President, University of Maryland, College Park.

Dr. Joseph Shilling, Superintendent for Schools, Queen Anne's County.

Aris Mellissarotis, Vice President of Productivity and Quality, Westinghouse.

Managers: **Imants (Monte) Krauze**, Director, Quality and Productivity, Bendix Field Engineering Corporation, and **John P. Scully**, Deputy Director, Management Operations Directorate, Goddard Space Flight Center.

9:55 - 10:15 Break.

Four Concurrent Panels: 10:15 - 11:30 a.m.

Panel E2

Continuous Process Improvement in Providing Services. A broad spectrum of service-oriented organizations will share their success stories. Particular emphasis will be placed on their process analysis, continually improved services, and measurement techniques used to quantify their successes.

Dr. John W. (Bill) Davis, Vice President and General Manager, Service Contracts Division - AEDC Operations, Calspan Corporation, **Chairman.**

Rosemary Windsor-Williams, Southwest Regional Customer Service Manager, United Parcel Service, **"The Internal/External Quality Connection."**

Sheila H. Keegan, Manager, Logistics and Administrative Support Services, Quad S Company, **"Teaching Our Elephant To Dance."**

Paul E. Huber, Technical Operations Manager, Space Dynamics Laboratory, Utah State University, **"Technical Services Modernization-Concept to Implementation Made Easy Through a University Setting."**

Manager: **Kenneth C. Hendershot**, General Manager, Ames Operations, Service Contracts Division, Calspan Corporation.

Panel F2

Empowerment with a Track Record. On-going process of empowerment and teamwork requires continuous nurturing. This panel addresses how to measure the success of the process, how to make changes as required, and how to address many practical problems as they arise.

Gerald T. Oppliger, President, Lockheed Space Operations Company, **Chairman.**

Pratt & Whitney/General Dynamics Joint Process Team.

Haven M. Eaton, II, Operations Quality Assurance Manager, Government Engines and Space Propulsion, Pratt & Whitney.

Virgil Muilenburg, Resident Engineering Representative at Pratt & Whitney, General Dynamics Space Systems Division.

Problem Report Elimination Team, Thiokol Corporation, Space Operations.

Curtis B. Wise, Supervisor, Final Assembly and Test Inspection

Ted L. Shaffner, Manager, KSC Operations Support

Manager: **Robert P. Hessler**, Staff Manager, Performance Improvement, Kennedy Space Center Division, McDonnell Douglas Space Systems Company.

Four Concurrent Panels: 10:15-11:30 a.m. (continued)

Panel G2

"After the Initial Excitement" - Continued Improvement in Training. These presenters will describe the challenges their organizations have faced and the methodology they have used to develop the high-performance work force required in a maturing TQM environment. They will provide "lessons learned" on such employee development topics as cost effectiveness, using training specialists vs. line personnel as instructors, and sustaining the TQM momentum.

James I. Chatman, Chairman/Chief Executive Officer, Technology Applications Incorporated, **Chairman.**

Richard G. Tancreto, Vice President, Total Quality for the U.S. Power Tool Group at Black & Decker, **"Breaking Down the Paradigms Surrounding TQM Training."**

Leo A. Braun, Manager, Support Services, **"The Johnson Controls Manager Certification Program,"** AND **Robert R. Wooderson**, Division Manager, Applications Support, Technical Service, Facility Operations and Support Services Project, Johnson Controls World Services Inc., **"The Impact of the Manager Certification and Work Force Training Programs."**

Managers: **Philip W. Snyder**, Director, Training and Development, Technology Applications, Inc., and **Robert L. Moore, Jr.**, Business Development Specialist, Brown and Associates Management Services, Inc. (BAMSI).

Panel H2

Partnering to Work Quality Issues in the Houston Community. This panel explores from three different perspectives the process and "lessons learned" in initiating a coalition of organizations formed to work with the business community, educational community, and governmental and civil organizations in using a Total Quality approach to addressing important community issues, especially those relating to educating a quality work force.

Daniel Nebrig, Associate Director, Lyndon B. Johnson Space Center, **"Building a Partnership to Enhance Science and Mathematics for Grades K-12," Chairman.**

Dr. John R. Grable, President, Brazosport College, **"Interception of Entropy."**

Leslie L. McManis, (Vice President, Texas Commerce Bank), Greater Houston Quality Group, **"Strategy for Building Community Partnerships for Quality."**

Managers: **Leslie J. Sullivan**, Chief, Management Analysis Office, Lyndon B. Johnson Space Center, and **Jackie Crowley**, Director, Quality Academy, Houston Community College.

11:30 - 12:25 p.m.

Lunch/Luncheon Keynote Speaker: **Jim "Mac" McIngvale**, President, Gallery Furniture Company. **"Total Quality Customer Service."**

12:25-12:45

Conference Acknowledgements/Remarks. **Joyce R. Jarrett**, Director, NASA Quality and Productivity Improvement Programs, NASA Headquarters.

Four Concurrent Panels: 1:00-2:15 p.m.

Panel E3

Continuously Improving Administrative Processes. This panel highlights specific techniques in process analysis, measurement, and partnering in internal administrative and staff support functions.

Lieutenant General Spence M. (Sam) Armstrong, USAF (Ret.), Associate Administrator for Human Resources and Education, NASA Headquarters, **Chairman.**

Allen R. Dressler, Quality Assurance Supervisor, 3M Environmental Engineering and Pollution Control, **"3M Total Quality Environmental Management System."**

Odail Thorns, Jr., Director of Quality Network and Synchronous Organization, Automotive Components Group, General Motors Corporation **"Quality Management in an Office Environment."**

Colonel Robert J. Hager, USAF, Director, Programs and Productivity, Air Force Logistics Command, **"Quality Awards - A Guaranteed Formula for Winning."**

Manager: **Thomas O. Maijala,** Manager, Quality Services, Corporate Quality Services, 3M Company.

Panel F3

What's Next in Empowerment? This panel will provide visions of the future through a discussion of current and innovative empowerment practices.

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

Philip W. Hartman, Vice President of Corporate Resources, American Transtech, American Telephone and Telegraph Company, **"Employee Empowerment at AT&T American Transtech: The "Engineering" Behind the Intentions."**

Joseph W. Dickey, Senior Vice President, Fossil and Hydro Power, Tennessee Valley Authority, **"Employee Empowerment: Lessons Learned."**

Manager: **Margaret A. (Peggy) Wilson,** Productivity Program Specialist, John F. Kennedy Space Center.

Panel G3

Recognition Methods - What Turns People On? A pre-conference survey has been conducted to learn how organizations recognize their employees. Data will be summarized, and current recognition efforts examined for their effectiveness in the fast-changing work place. Panelists will discuss the changing values of today's work force, and will explore innovative recognition systems being developed by companies with a 21st century focus.

After the formal presentations, a response group comprised of five non-management personnel will give their reactions to the survey report, and will share their own ideas on recognition in their work environment.

Donald E. Smith, Vice President and General Manager, Bendix Field Engineering Corporation-Houston, **Chairman.**

John Hillins, Vice President of Corporate Compensation, Honeywell Inc., and Chairman of the Productivity and Alternative Awards Committee, American Compensation Association.

Althea Gamble, Executive Secretary, ILC Space Systems.

Cinsy M. Krehbiel, Lead Engineer, Hardware Systems Department, Harris Space Systems.

Kevin H. Dunn, Environmental Control & Life Systems Design Engineer, Aerospace and Electronics Division, Boeing Defense and Space Group.

Darlene Cole, Buyer, Intermetrics, Inc.

Joe Cruz, Tunnel Operations Leadman and Union Steward, Calspan Corporation, Ames Operations.

Managers: **Dennis M. Carvalho**, Director, Quality Systems, Space Station Division, McDonnell Douglas Space Systems Company, and **Otto G. Coldiron**, Director, Product Assurance, Honeywell Space and Strategic Systems Operation.

Four Concurrent Panels: 1:00-2:15 p.m. (continued)

SATELLITE UP/DOWN LINK HOUSTON/DENVER

Panel H3

Community Partnerships for Our Environment - A Rocky Mountain Region Report. This forum of community partners meeting in Denver, Colorado, will report the results of initiatives for doing their part for the global environment. The forum will report on who, how, and results from the Rocky Mountain Region. These reports will be from partnerships with Government, Academia, and Industrial community partners who produce our Nation's space and defense products. This regional report on results will be reported via a national (NASA) satellite link.

Dr. Steven A. Hawley, Associate Director, Ames Research Center.

Robert M. McMullen, Director, Environmental Management, Martin Marietta Astronautics Group.

James Scherer, Regional Administrator, Environmental Protection Agency Region VIII.

James W. Spensley, Co-Chairman, Colorado Center for Environmental Management.

Laura Belsten, Director, Environmental Policy and Management Division, University of Denver.

William Owen, Manager, Environmental Safety and Health, Lockheed Engineering and Sciences Company.

Dr. Noel Hinners, Vice President and Chief Scientist, Civil Space and Communications Company, Martin Marietta Astronautics Group.

Manager: **Kenneth R. Shipe**, Product Assurance-Staff, Martin Marietta Astronautics Group.

2:15 - 2:30 Break.

Two Concurrent Panels: 2:30 - 3:30 p.m.

TEAMS IN ACTION. See teamwork in action as both standard and non-standard types of teams present the process they employ and the product they produce.

Panel 1

Corrosion Control Kennedy Space Center Integrated Team, John F. Kennedy Space Center.

Louis G. MacDowell, III, Senior Materials Engineer, John F. Kennedy Space Center.

Robert E. Persson, Senior Engineer, EG&G Florida, Inc.

Profiteers Team, Martin Marietta Manned Space Systems.

William R. Cain, Financial Analyst, Martin Marietta Manned Space Systems.

Carla A. Diettel, Associate Analyst, Martin Marietta Manned Space Systems.

Manager: **R. Ross Bowman,** Vice President and Assistant Director Operations, Space Operations, Thiokol Corporation.

Panel 2

Acquisition TQM Team, Lockheed Engineering and Sciences Company.

A. A. "Al" Tauler, Supervisor, Procurement, Lockheed Engineering and Sciences Company.

Damon A. Hooten, Principal Engineer, Flight Hardware and Laboratory Systems, Lockheed Engineering and Sciences Company.

Kanban Team, TRW Electronic Systems Group.

Beverly A. Tricomi, Manufacturing Engineering Supervisor, TRW Electonic Systems Group.

Dimas G. Pascua, Jr., Electronics Technician, TRW Electronic Systems Group.

Manager: **Leo A. Braun,** Manager, Support Services, Johnson Controls World Services Inc.

VIP Tour of Lyndon B. Johnson Space Center: 2:30-6:00 p.m.

NASA/Contractors Conference Planning Committee

Session Directors

David R. Braunstein
Douglas Aircraft Company

Marc C. Bridgham
Boeing Aerospace and Electronics Company

Richard D. Clapper
Lewis Research Center

Tina M. Doty
Leach Corporation

Thomas H. Forbes
Electronic Data Systems Corporation

Charles S. Harlan
Lyndon B. Johnson Space Center

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Irwin J. Schauer
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Geoffrey B. Templeton
NASA Headquarters

Carl G. Thor
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Ralph J. Tortorich
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Rockwell Space Operations Company

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Susan Crandall
Bendix Field Engineering Corporation

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G. William Kuhfuss
GE Aerospace

Robin S. Lineberger
KPMG Peat Marwick

Candace Livingston
NASA Headquarters

Thomas O. Maijala
3M Company

Robert Medina
NASA Headquarters

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Unisys Defense Systems

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BAMSI, Incorporated

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TRW Space and Technology Group

Thomas W. Parkinson
McDonnell Douglas Space Systems Company

Sherry H. Prud'homme
Lockheed Engineering and Sciences Company

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Technology Applications, Inc.

Sally L. Stohler
Rocketdyne

David L. Stoner
Loral Space Information Systems

Leslie J. Sullivan
Lyndon B. Johnson Space Center

Jessica R. Wilke
Grumman Corporation

Nora G. Williams
Unisys Defense Systems

Margaret A. (Peggy) Wilson
John F. Kennedy Space Center

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Appendix C - Acknowledgments

The papers, graphics, and audio presentations from the conference were used as the basis for writing this report.

Many individuals deserve recognition for their work in organizing the Eighth Annual NASA/Contractors Conference and 1991 National Symposium:

Geoffrey B. Templeton, NASA Headquarters, Conference Director; **Lynne M. Stewart**, NASA Headquarters, Associate Conference Director; **Jeffrey K. Evans** and **Marie A. Prebilsky**, Assistant Conference Directors; and **Leslie J. Sullivan**, Johnson Space Center, Conference Liaison Officer.

The Conference Session Directors:

Geoffrey B. Templeton, NASA Headquarters *(George M. Low Trophy: NASA's Quality and Excellence Award Session)*;

Thomas H. Forbes, Electronic Data Systems Corporation, and **Irwin J. Schauer**, Langley Research Center *(Session A - The Development, Implementation and Evolution of a Quality-Driven Strategic Plan)*;

Tina M. Doty, Leach Corporation, and **Charles S. Harlan**, Lyndon B. Johnson Space Center *(Session B - World Class Quality - Tools for Survival)*;

Marc C. Bridgham, Boeing Defense and Space Group, and **Larry E. Lechner**, George C. Marshall Space Flight Center *(Session C - It Takes Two-The Customer and You)*;

David R. Braunstein, Douglas Aircraft Company, and **Carl G. Thor**, American Productivity and Quality Center *(Session D - Community Partnerships: TQM Applied to Systemic Organizational Performance and Session H (Community Partnerships: Reports from the Field)*;

Dr. Dean R. Lee, Unisys Defense Systems, and **Timothy M. Sullivan**, NASA Headquarters *(Session E - Continuous Process Improvement - Success Stories)*;

Ralph J. Tortorich, Martin Marietta Manned Space Systems, and **John L. Reiss**, Ames Research Center *(Session F - Empowerment and Teamwork)*;

Dr. Karen K. Whitney, Rockwell Space Operations Company, and **Richard D. Clapper**, Lewis Research Center *(Session G - Training and Recognition in the World of TQM)*.

The Panel Managers:

Robert Medina, NASA Headquarters *(Panel 1 - 1990 George M. Low Trophy Recipients)*;

David P. Heimann, Goddard Space Flight Center *(Panel 2 - 1991 George M. Low Trophy Finalists - Manufacturing)*;

Paul E. Cate, NASA Headquarters *(Panel 3 - 1991 George M. Low Trophy Finalists - Mission Support)*;

Candace D. Livingston, NASA Headquarters *(Panel 4 - 1991 George M. Low Trophy Finalists - Service Support)*;

Richard M. Simon, Harris Space Systems Corporation *(Panel A1- The Process of Strategic Planning)*;

Dr. Cecile C. Blake, STATWATCH, and **David L. Stoner**, Loral Space Information Systems *(Panel A2 - The Continuing Role of Strategic Planning)*;

Robin S. Lineberger, KPMG Peat Marwick, and **Geneviene R. Emry**, Space Systems Division, Rockwell International Corporation *(Panel A3 - Planning for Evolving Partnerships)*;

Kenneth R. Shipe, Martin Marietta Astronautics Group, and **Leslie J. Sullivan**, Lyndon B. Johnson Space Center *(Panel B1 - Benchmarking: Competitiveness, Survival and Territoriality)*;

Sherry H. Prud'homme, Lockheed Engineering and Sciences Company *(Panel B2 - Exploring Quality Assurance Standards in a Services Environment)*;

Tina M. Doty, Leach Corporation, and **Donald O. Atkins**, ILC Dover, Inc.; *(Panel B3 - World-Class Suppliers: Making Sense of Supplier Certification)*;

James F. Holloway, Pratt & Whitney, United Technologies Corporation, and **Jessica R. Wilke**, Grumman Corporation *(Panel C1 - It's 10 O'Clock, Do You Know Where Your Customer Is?)*;

Leroy A. Mendenhall, Unisys Defense Systems, and **Jeffrey K. Evans**, Manager, Lyndon B. Johnson Space Center *(Panel C2 - Let's Get Together!)*;

Marsha L. Dollarhide, Space Systems Division, Rockwell International Corporation, and **Nancy H. Fussell**, Boeing Defense and Space Group *(Panel C3 - Consider Yourself One of Us!)*;

Ned Hamson, Association for Quality and Participation, and **Nora G. Williams**, Unisys Defense Systems *(Panel D1 - TQM Partnerships with Education)*;

Sally L. Stohler, Rocketdyne Division, Rockwell International Corporation, and **G. Ted Ankrum**, NASA Headquarters *(Panel D2 - Partnerships in the International Community)*;

Willis E. Chapman, Jet Propulsion Laboratory, and **Thomas W. Parkinson**, McDonnell Douglas Space Systems Company *(Panel D3 - Changing Work Force Demographics)*;

Marshall W. Novick, TRW Space and Technology Group *(Panel E1 - Continuous Process Improvement (CPI) Success Stories - Products)*;

Kenneth C. Hendershot, Calspan Corporation *(Panel E2 - Continuous Process Improvement in Providing Services)*;

Thomas O. Maijala, 3M Company *(Panel E3 - Continuously Improving Administrative Processes)*;

G. William Kuhfuss, GE Aerospace *(Panel F1 - Initiating Programs for Empowerment and Teamwork)*;

Robert P. Hessler, McDonnell Douglas Space Systems Company *(Panel F2 - Empowerment with a Track Record)*;

Margaret A. (Peggy) Wilson, John F. Kennedy Space Center *(Panel F3 - What's Next in Empowerment?)*;

Susan Crandall and **Edward U. Gascon**, Bendix Field Engineering Corporation *(Panel G1 - Beginning Total Quality Training -Moving Out Smartly)*;

Philip W. Snyder, Technology Applications, Inc., and **Robert L. Moore, Jr.**, BAMSI, Inc. *(Panel G2 - "After the Initial Excitement" - Continued Improvement in Training)*;

Dennis M. Carvalho, and **Otto G. Coldiron**, Honeywell Space and Strategic Systems Operation *(Panel G3 - Recognition Methods - What Turns People On?)*;

Imants (Monte) Krauze, Bendix Field Engineering Corporation, and **John P. Scully**, Goddard Space Flight Center *(Panel H1 - Focus On Total Quality In Education)*;

Leslie J. Sullivan, Lyndon B. Johnson Space Center, and **Jackie Crowley**, Houston Community College *(Panel H2 - Partnering to Work Quality Issues in the Houston Community)*;

Kenneth R. Shipe, Martin Marietta Astronautics Group *(Panel H3 - Community Partnerships for Our Environment - A Rocky Mountain Region Report)*;

R. Ross Bowman, Thiokol Corporation *(Teams in Action Panel 1)*;

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