NASA Johnson Space Center
Total Quality Partnership

Charlie Harlan - NASA JSC SR&QA
Sam Boyd - Loral Space Information Systems
This presentation traces the development of and benefits realized from a joint NASA, support contractor continuous improvement process at the Johnson Space Center (JSC). The joint effort described is the Safety, Reliability and Quality Assurance Directorate relationship with its three support contractors which began in early 1990.

The Continuous Improvement effort started in early 1990 with an initiative to document and simplify numerous engineering change evaluation processes. This effort quickly grew in scope and intensity to include process improvement teams, improvement methodologies, awareness and training. By early 1991, the support contractor had teams in place and functioning, program goals established and a cultural change effort underway. In mid-1991 it became apparent that a major redirection was needed to counter a growing sense of frustration and dissatisfaction from teams and managers. Sources of frustration were isolated to insufficient joint participation on teams, and to a poorly defined vision.

Over the next year, the effort was transformed to a truly joint process. The presentation covers the steps taken to define vision, values, goals and priorities and to form a joint Steering Committee and joint process improvement teams. The most recent assessment against the President's award criteria is presented as a summary of progress. Small, but important improvement results have already demonstrated the value of the joint effort.

Mr. Charlie Harlan is the Director of Safety, Reliability and Quality Assurance at the Johnson Space Center, and Mr. Alfred A. "Sam" Boyd is Program Manager and Vice President for the major support contractor, Loral Space Information Systems.
Space Shuttle Program

STS-50 JUNE 25 - JULY 9
- MANNED VEHICLE
- LONG DURATION MISSION
- EXTREMELY NARROW MARGINS
- HAZARDOUS FLUIDS
- EXTREME LOADS
- COMPLEX SYSTEMS

Space Station Freedom Program

SPACE STATION FREEDOM
- PLANNED 1995 FIRST LAUNCH
- PERMANENTLY MANNED
- 30 YEAR LIFE
- COMPLEX, SOFTWARE INTENSIVE SYSTEMS
- LOW MARGIN LIFE SUPPORT
- RESUPPLY DEPENDENT
Safety, Reliability, and Quality Assurance Role

- PROVIDE ASSESSMENTS AND RECOMMENDATIONS TO SENIOR NASA MANAGERS

Where We Started

- STRANDED BY PAPER
- COMPLEX PROCESSES, NOT WELL UNDERSTOOD
- INSUFFICIENT ENGINEERING ANALYSIS

WE WERE PROCESSING TOO MUCH PAPER THAT TOOK UP TOO MUCH TIME
Evolution of Loral Total Quality
1990 to Mid 1991

- BEGINNINGS
  - CUSTOMER DEMAND FOR PROCESS DOCUMENTATION AND SIMPLIFICATION
  - FEE BASED ON CONTINUOUS IMPROVEMENT
- LORAL TQ RESPONSE
  - DOCUMENTATION – 40 PROCESSES
  - EDUCATION AND AWARENESS BEGINS JULY 1990
  - TQ PLAN AUGUST 1990
  - TQ STEERING COMMITTEE SEPTEMBER 1990
  - TEAMS NOVEMBER 1990
  - GOALS AND MANAGEMENT TEAM BUILDING JANUARY 1991
  - CULTURE SURVEY MARCH 1991
  - RECOGNITION PROGRAM MAY 1991

Problems

- NO STRATEGIC DIRECTION
- NASA INVOLVEMENT WAS NOT ADEQUATE
  - ON TEAMS AND IN STRUCTURING THE PROCESS
  - JOINT PROCESSES BUT CONTRACTOR-ONLY PROGRAM
- A HOST OF PERIPHERAL PROBLEMS
  - COMPETITION FOR EMPLOYEES TIME
  - BUY-IN FROM SUPERVISORS
  - UNFOCUSED TRAINING
  - PRESSURE FOR EARLY SUCCESS
  - INATTENTION TO CULTURE
Joint Total Quality
Mid 1991 to Present

- RECOGNITION OF GENERAL FRUSTRATION
- JSC STRATEGIC PLANNING AND TQ INITIATIVE MARCH 1991
- JOINT TQ ACTIVITIES
  - JSC SR&QA/CONTRACTOR JOINT RETREATS MARCH - OCTOBER 1991
  - JOINT TEAMS JUNE 1991
  - PATHFINDER TEAMS AUGUST 1991
  - JOINT STEERING COMMITTEE AUGUST 1991
  - JOINT MISSION STATEMENT, GOALS, VALUES OCTOBER 1991
  - IMPROVEMENT OBJECTIVES DECEMBER 1991
  - JOINT RECOGNITION PROGRAM IN WORK
  - EMPOWERMENT INITIATIVES APRIL 1992
  - TQ ASSESSMENT CAPABILITY MAY 1992

Typical Teams

- PARTS APPROVAL PROCESS NASA LEAD, JOINT MEMBERSHIP
- WORK PLANNING LORAL LEAD, JOINT MEMBERSHIP
- FMEA/CIL LORAL LEAD, JOINT MEMBERSHIP
- OPERATIONS REQUIREMENTS LORAL LEAD, JOINT MEMBERSHIP
- CHANGE REQUEST PROCESS LORAL LEAD, JOINT MEMBERSHIP
- ADP SUPPORT LORAL LEAD, JOINT MEMBERSHIP
- SAFETY SUPPORT LORAL LEAD, JOINT MEMBERSHIP
Q+ Team Membership

- COCHAIRS - NASA SR&QA AND LORAL
- MEMBERSHIP
  - NASA SR&QA 8
  - LORAL 6
  - BARRIOS 1
  - WEBB MURRAY 1

Joint Steering Committee

- COCHAIRS - CHARLIE HARLAN AND SAM BOYD
- MEMBERSHIP
  - NASA SR&QA 7
  - LORAL 3
  - SIMCO 1
  - WEBB MURRAY 1
Where Are We Now

- MISSION AND VALUES
- STRATEGIC GOALS
- DIVISION/DEPARTMENT IMPROVEMENT OBJECTIVES
## TQ Benchmark

<table>
<thead>
<tr>
<th>TQ Element</th>
<th>A: Management Leadership and Support</th>
<th>B: Strategic Planning</th>
<th>C: Focus on the Customer and Partner</th>
<th>D: Employee Training and Recognition</th>
<th>E: Employee Empowerment and Teamwork</th>
<th>F: Continuous Improvement Measurement and Analysis</th>
<th>G: Continuous QA Activity</th>
<th>H: Quality and Productivity Improvement Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status Level</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Top Executives Directly Involved in Quality Activities</td>
<td>Short-Term and Long-Term Goals Established</td>
<td>Innovative Methods for Obtaining Customer Feedback</td>
<td>All Personnel Trained in TQ</td>
<td>Innovative, Effective Leadership Approaches</td>
<td>Continuous Improvement Progress Tracked in Most Areas</td>
<td>All Products Reviewed To Meet Customer Needs</td>
<td>Most Significant Indicators Demonstrate Exceptional Results</td>
</tr>
<tr>
<td>4</td>
<td>Top Executives Participate in Quality Councils and Other Leadership Activities</td>
<td>Short-Term and Long-Term Goals Established</td>
<td>Effective Feedback System for Obtaining Customer Information and Improving Services</td>
<td>Training Plan Being Implemented and Evaluated for Effectiveness</td>
<td>Some Innovative Improvement Process Tracked in Most Areas</td>
<td>Continuous Improvement Progress Tracked in Most Areas</td>
<td>Majority of Products Reviewed To Meet Customer Needs</td>
<td>Most Significant Indicators Demonstrate Excellent Results</td>
</tr>
<tr>
<td>3</td>
<td>Most Top Executives and Managers Support TQ</td>
<td>Short-Term Goals Established in Key Parts of Organization</td>
<td>Customer Feedback Regularly Solicited and Management Action</td>
<td>Training Plan Being Implemented and Recognized by Most of Organization</td>
<td>Majority of Managers Recognized for Improvements</td>
<td>Quality Information Collected from Internal Surveys</td>
<td>Key Products Reviewed to Meet Customer Needs</td>
<td>Most Significant Indicators Demonstrate Good Results</td>
</tr>
<tr>
<td>2</td>
<td>May Top Executives and Managers Support TQ</td>
<td>Improvement Goals Established</td>
<td>Most External and Some Internal Customer Feedback</td>
<td>Training Plan Under Development</td>
<td>Many Managers Support Teams</td>
<td>Quality Information Collected from Customers</td>
<td>Few Products for External Customers Reviewed and Approved</td>
<td>Most Significant Indicators Demonstrate Improving Results, Including Supplier Satisfaction</td>
</tr>
<tr>
<td>1</td>
<td>Top Executives Beginning To Support TQ Activities</td>
<td>General Goals Established</td>
<td>Customer Complaints Are Primary Method of Feedback</td>
<td>Many Managers Attended TQ Awareness</td>
<td>Some Managers Support Employees Improvement</td>
<td>Feedback Systems Providing Information on Quality</td>
<td>Products for Customers Reviewed/Controlled to Meet Internally Developed Specifications</td>
<td>Some Results in One or More Market Areas</td>
</tr>
</tbody>
</table>

*Figure E-3. TOTAL QUALITY BENCHMARK—We Assess Our TQ Culture Every 6 Months To Our Status Level in Eight TQ Elements. These Elements Are Used To Select the Recipient of the President’s*
SR&QA Mission Statement

We as the SR&QA Team in partnership with our customers, assure the success of NASA programs through both technical expertise and innovation.

**PEOPLE**

**PRODUCTS**
Our products and services are the end result of our efforts, and they should be the best to serving our customers. As our products and services are proved, so are we valued.

**ENVIRONMENT**
We value a stimulating environment that supports maximum personal effectiveness through empowerment, teamwork, and continuous improvement.
# Strategic Goals and Division/Department Improvement Objectives

## Strategic Goal Categories

<table>
<thead>
<tr>
<th>Environment (People)</th>
<th>Technical Quality of Products/Services</th>
<th>Timeliness of Products/Services</th>
<th>Cost of Products/Services</th>
<th>Innovation of Products/Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. Evans</td>
<td>G. Johnson</td>
<td>K. Walls</td>
<td>S. Boyd</td>
<td>C. Harlan</td>
</tr>
</tbody>
</table>

### Goals

- **Environment (People)**: Continually improve toward a total quality culture
- **Technical Quality of Products/Services**: Improve the quality of all products and services
- **Timeliness of Products/Services**: Continually increase on-time delivery of all products and services, and improve response time
- **Cost of Products/Services**: Continue to effectively decrease costs of providing products and services while maintaining quality
- **Innovation of Products/Services**: Achieve recognition as the center of excellence for safety, reliability, maintainability, and quality assurance support and assessments

### Directorate Areas of Emphasis

**Management Leadership and Support**
- Strategic Planning
- Focus on the Customer and Partners
- Employee Training and Recognition
- Employee Empowerment and Teamwork
- Measurement and Analysis
- Quality Assurance
- Quality and Productivity Improvement Results
- Organizational Analysis

**Software Assurance**
- Reliability and Maintainability Analysis
- JATL

**Risk Assessment, Analysis, and Management**
- Application of Concurrent Engineering
- Non-Destructive Evaluation
- Hardware Manufacturing "Environment"

**Opportunities for Improvement (OFI) System**

### Indicator Examples

**Directorate**
- Customer Evaluation of Product and Service Quality
- Internal Evaluation of Process and Product
- % of "Expedite" On Time Delivery
- Cycle Time
- Cost per Unit Man Hours
- # of Non-Conformances in JSC Products
- Implementation of SW Assurance Program (Milestones)
- Requests for Assistance
- Papers Presented/Published
- Participation on National Committees and Societies
- Being Used as a Benchmark by Others

### Participation
- # of Suggestions
- % Implementation

### Targets

- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement

## Division/Department Improvement Objectives

- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
- Show Some Level of Improvement
First Successes

FMEA/CIL Process Modifications

- THE SOLUTION ELIMINATES PAPER CHANGES WHICH TRANSLATES INTO

  | REPRODUCTION | ANNUAL REDUCTION |
  | 369,890 PAGES |  |

  | MAN-HOURS | 17,000 |

- THE POTENTIAL TOTAL COST AVOIDANCE IS ESTIMATED TO BE $688,000 ANNUALLY
NSPAR Process Modifications
Estimated Savings

- VOLUME OF REQUESTS 2183
- MANHOURS 15135
- COST $545K OVER PROJECT LIFE

- SCHEDULE - NONSTANDARD PART APPROVAL CYCLE REDUCED 18 MONTHS
  - CURRENT PROCESS – 24 MONTHS
  - NEW PROCESS – 6 MONTHS

NSPAR Approval Rate

% OF TOTAL NSPARS

F2.1-13
Space Shuttle
Summary for Processing as of 04/09/92

Suggestions

- LAST 10 MONTHS – 233
- PREVIOUS 6 MONTHS – 10
Where Are We Going

- CULTURE
- TEAMS
- TRAINING
- MANAGERS
- IMPROVEMENT OBJECTIVES

JSC Vision
Pioneering Space Exploration

"AT JSC WE ARE ALL PIONEERS CHARGED WITH THE ENViable TASK OF IMPLEMENTING THE DREAMS THAT NOT TOO LONG AGO EXISTED ONLY IN THE WORLD OF SCIENCE FICTION."
A Shared Vision:
Partnership of NASA and Rockwell International
In Cost Effectiveness Enhancements (CEE) for
The Space Shuttle System Integration Program

Ninth Annual NASA/Contractors Conference
on Quality and Productivity

Presented by:
Larry Williams, NASA
and
Bohdan Bejmuk, Rockwell International