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
  - MANNEV 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

- STRANGLED BY PAPER
- COMPLEX PROCESSES, NOT WELL UNDERSTOOD
- INSUFFICIENT ENGINEERING ANALYSIS
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 JULY 1990
  - EDUCATION AND AWARENESS BEGINS AUGUST 1990
  - TQ PLAN SEPTEMBER 1990
  - TQ STEERING COMMITTEE NOVEMBER 1990
  - TEAMS JANUARY 1991
  - GOALS AND MANAGEMENT TEAM BUILDING MARCH 1991
  - CULTURE SURVEY MAY 1991
  - RECOGNITION PROGRAM

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>Status Level</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MANAGEMENT, LEADERSHIP AND SUPPORT</strong></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top Executives Directly Involved in TQ Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TG is a Number 1 Priority</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-Term Top Management Commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Everyone Held Accountable for Improving Processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STRATEGIC PLANNING</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-Term and Long-Term Goals for TG Established Across Organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer and Supplier Issues Incorporated into TG Plans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benchmark Data Used Extensively</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FOCUS ON THE CUSTOMER AND RECOGNITION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovative Methods for Obtaining Customer Feedback</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective System Links Feedback with Goals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>That Can Act on Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Contacts Fully Empowered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EMPLOYEE TRAINING AND RECOGNITION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Personnel Trained in TG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plans Fully Integrated into Strategic Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal Processes Exist to Recognize Employee Emphases, Emphasis on Teamwork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONTINUOUS IMPROVEMENT AND MEASUREMENT AND ANALYSIS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous Improvement Progress Tracked in All Areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Available to All Users</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Collected in Complete Data Accuracy Checks Routinely Made</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employee Use Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CONTINUOUS QA ACTIVITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Products Reviewed to Meet Customer Needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Optimization Methods Used Routinely</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods Emphasize Prevention, Not Detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>QUALITY AND PRODUCTIVITY IMPROVEMENT RESULTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Most Significant Indicators Demonstrate Excellent Results</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superior to Competitors in All Areas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Customer Satisfaction Over the Past 3 Years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results Clearly Related to TG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results Sustained at High Levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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.
## Strategic Goals and Division/Department Improvement Objectives

### Strategic Goal Categories
- **Environment (People)**
  - Continually improve toward a total quality culture
  - J. Evans
- **Technical Quality of Products/Services**
  - Improve the quality of all products and services
  - G. Johnson
- **Timeliness of Products/Services**
  - Continually increase on time delivery of all products and services, and improve response time
  - K. Walls
- **Cost of Products/Services**
  - Continue to effectively decrease costs of providing products and services while maintaining quality
  - S. Boyd
- **Innovation of Products/Services**
  - Achieve recognition as the center of excellence for safety, reliability, maintainability, and quality assurance support and assessments
  - C. Harlan

### 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
- **Depth of Technical Knowledge**
  - Depth of technical content of products
  - Problem Closeout (CAPS)
  - Change Paper
  - PRA
  - PPR Process
- **Negotiation of Deadlines**
  - Work Planning and Management Process
  - Change Paper
  - Problem Closeout (CAPS)
  - Verbal Requests/Actions at Boards
  - Technical Requirement Documents
- **Cost Drivers Within Specifications and Standards E.G., NHB 5300 and 50,000 Parts Program**
  - Supplier Defects E.G., NSR/Parts and CAPS
  - Work Planning and Management
- **Software Assurance - Reliability and Maintainability Analysis**
  - JATL
- **Risk Assessment, Analysis, and Management**
  - Application of Concurrent Engineering
  - Non-Destructive Evaluation
  - Hardware Manufacturing Environment

### Directorate Indicators (Examples)
- **To Benchmark Indicators**
  - Customer Evaluation of Product and Service Quality
  - Internal Evaluation of Process and Product
- **% of “Expedites” 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**

### Directorate 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
First Successes

FMEA/CIL Process Modifications

- THE SOLUTION ELIMINATES PAPER CHANGES WHICH TRANSLATES INTO

ANNUAL REDUCTION

REPRODUCTION: 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
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 ENVIALE TASK OF IMPLEMENTING THE DREAMS THAT NOT TOO LONG AGO EXISTED ONLY IN THE WORLD OF SCIENCE FICTION."

F2.1-15
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