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**NASA Johnson Space Center
Total Quality Partnership**

Charlie Harlan - NASA JSC SR&QA
Sam Boyd - Loral Space Information Systems

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PR2265

Abstract

NASA JOHNSON SPACE CENTER

CONTINUOUS IMPROVEMENT PARTNERSHIP

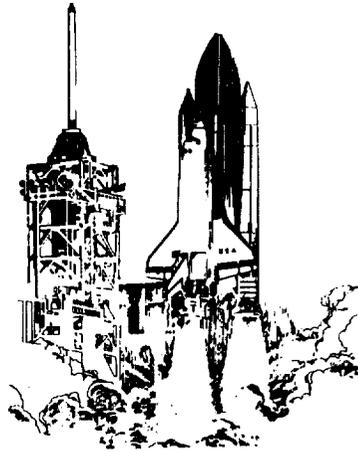
This presentation traces the development of and benefits realized from a joint NASA, support contractor continuous improvement process at the Johnson Space Center (JSC). The joint effort described is the Safety, Reliability and Quality Assurance Directorate relationship with its three support contractors 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. *MO*

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



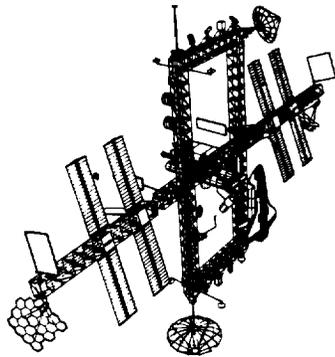
STS-50 JUNE 25 - JULY 9

- MANNED VEHICLE
- LONG DURATION MISSION
- EXTREMELY NARROW MARGINS
- HAZARDOUS FLUIDS
- EXTREME LOADS
- COMPLEX SYSTEMS

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Space Station Freedom Program



SPACE STATION FREEDOM

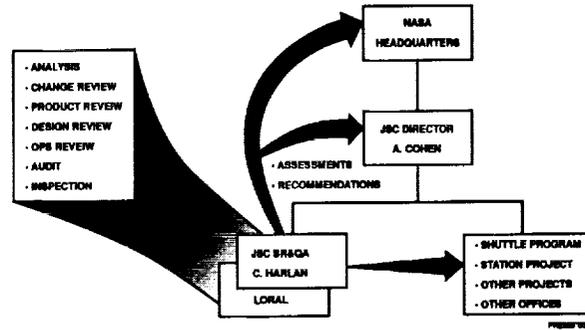
- PLANNED 1995 FIRST LAUNCH
- PERMANENTLY MANNED
- 30 YEAR LIFE
- COMPLEX, SOFTWARE INTENSIVE SYSTEMS
- LOW MARGIN LIFE SUPPORT
- RESUPPLY DEPENDENT

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Safety, Reliability, and Quality Assurance Role

- PROVIDE ASSESSMENTS AND RECOMMENDATIONS TO SENIOR NASA MANAGERS

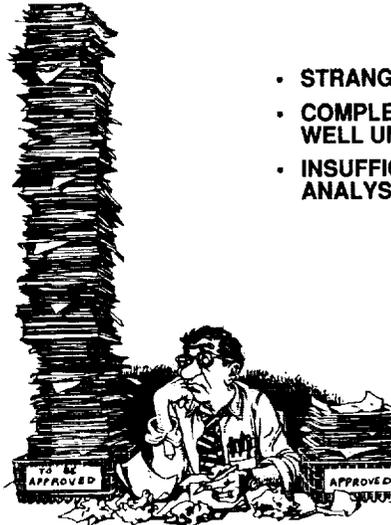


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Where We Started

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



WE WERE PROCESSING *TOO*
MUCH PAPER THAT TOOK UP
TOO MUCH TIME

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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
 - TQ PLAN
 - TQ STEERING COMMITTEE
 - TEAMS
 - GOALS AND MANAGEMENT TEAM BUILDING
 - CULTURE SURVEY
 - RECOGNITION PROGRAM



JULY 1990
AUGUST 1990
SEPTEMBER 1990
NOVEMBER 1990
JANUARY 1991
MARCH 1991
MAY 1991

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Problems

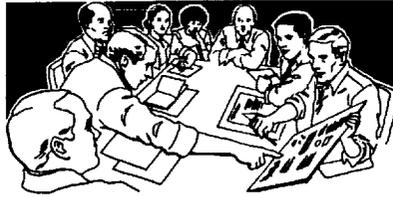
- NO STRATEGIC DIRECTION
- NASA INVOLVEMENT WAS NOT ADEQUATE
 - ON TEAMS AND IN STRUCTURING THE PROCESS
 - JOINT PROCESSES BUT CONTRACTOR-ONLY PROGRAM
- A HOST OF PERIPHERAL PROBLEMS
 - COMPETITION FOR EMPLOYEES TIME
 - BUY-IN FROM SUPERVISORS
 - UNFOCUSED TRAINING
 - PRESSURE FOR EARLY SUCCESS
 - INATTENTION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



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**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



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Joint Steering Committee

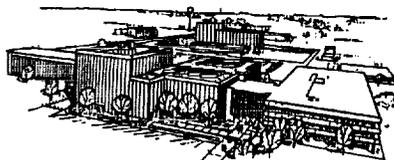
- COCHAIRS – CHARLIE HARLAN AND SAM BOYD
- MEMBERSHIP
 - NASA SR&QA 7
 - LORAL 3
 - SIMCO 1
 - WEBB MURRAY 1



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Where Are We Now



- MISSION AND VALUES
- STRATEGIC GOALS
- DIVISION/DEPARTMENT IMPROVEMENT OBJECTIVES

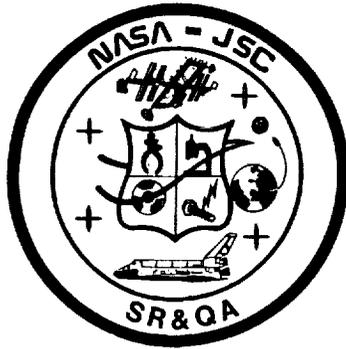
TQ BENCHMARK

TQ Element Status Level	D E G R E E O F I M P R O V E M E N T							
	A	B	C	D	E	F	G	H
	MANAGEMENT LEADERSHIP AND SUPPORT	STRATEGIC PLANNING	FOCUS ON THE CUSTOMER AND PARTNERS	EMPLOYEE TRAINING AND RECOGNITION	EMPLOYEE EMPLOYMENT AND TEAMWORK	CONTINUOUS IMPROVEMENT MEASUREMENT AND ANALYSIS	CONTINUOUS Q/A ACTIVITY	QUALITY AND PRODUCTIVITY IMPROVEMENT RESULTS
5	<ul style="list-style-type: none"> Top Executives Directly Involved in Quality-Related Activities Quality is Number 1 Priority Long-Term Top Management Commitment Everyone Held Accountable for Improving Processes 	<ul style="list-style-type: none"> Short-Term and Long-Term Goals for TQ Established Across Organization Customer/Supplier Issues Incorporated into TQ Plans Benchmark Data Used Extensively 	<ul style="list-style-type: none"> Innovative Methods for Obtaining Customer Feedback Effective System Links Feedback with Groups That Can Act on Data Customer Contacts Fully Empowered 	<ul style="list-style-type: none"> All Personnel Trained in TQ Plans Fully Integrated into Strategic Plans Feedback Processes Exist To Recognize Employees with Emphasis on Teamwork 	<ul style="list-style-type: none"> Innovative, Effective Employee Involvement Approaches Cross-Functional Team Cooperation Occurs Positive Suggestion Trends Worklife Quality Improving Strong Employee Empowerments 	<ul style="list-style-type: none"> Continuous Improvement Progress Tracked in All Areas Data Available to All Users Information Collected is Complete Data Validity Checks Routinely Made Employees Routinely Use Measures 	<ul style="list-style-type: none"> All Products Reviewed To Meet Customer Needs Process Optimization Methods Are Used Routinely Methods Emphasize Prevention, Not Detection 	<ul style="list-style-type: none"> Most Significant Indicators Demonstrate Exceptional Results Superior to Competitors in All Areas Customer Satisfaction over Past 5 Years Results Carry Over to TQ Results Sustained at High Levels
4	<ul style="list-style-type: none"> Top Executives Participate in Quality Councils and Other Leadership Activities TQ is a Number 1 Priority of Most Groups Adequate Resources Invested in TQ Communication is Two-Way 	<ul style="list-style-type: none"> Short-Term and Long-Term Goals for TQ Established Throughout Most of Organization Customer and Supplier Issues Are Factors in TQ Planning Benchmark Data Used 	<ul style="list-style-type: none"> Effective Feedback System for Obtaining Customer Information Systems Linked to Groups That Can Act on Data 	<ul style="list-style-type: none"> Training Plan Being Implemented and Evaluated for Effectiveness Nearly Everyone Trained in TQ Extensive Management and Peer Recognition 	<ul style="list-style-type: none"> Some Innovative Involvement Some Cross-Functional Employee Suggestions Teamwork Increasing Most Workers Empowered Periodic Survey Process Team Contributions Evident 	<ul style="list-style-type: none"> Continuous Improvement Progress Tracked in Most Areas Data Available to Most Users Most Information Collected is Complete Data Validity Checks Made Most Employees Use Measures 	<ul style="list-style-type: none"> Majority of Products Reviewed To Meet Customer Needs Methods Emphasize Prevention, Not Detection 	<ul style="list-style-type: none"> Most Significant Indicators Demonstrate Excellent Results Competitive in All Areas Customer Satisfaction Rating Results Related to TQ Resulting Improving Results Contribute to Organization's Mission
3	<ul style="list-style-type: none"> Most Top Executives and Managers Support TQ Which is a Significant Priority for Many Groups Some Resources Invested Communication is Sometimes Two-Way Top Management Committed to Long-Term TQ 	<ul style="list-style-type: none"> Short-Term Goals for TQ Established in Key Parts of Organization Customer/Supplier Issues Influence TQ Planning Benchmark Data Readily Available 	<ul style="list-style-type: none"> Customer Feedback Regularly Solicited for Management Action Supplier Quality Monitored Most Groups Aware of Customer Needs 	<ul style="list-style-type: none"> Training Plan Being Implemented on Schedule Most of Organization Trained in TQ Individuals and Teams Recognized for Improvements 	<ul style="list-style-type: none"> Majority of Managers Support Employee Involvement Several Cross-Functional Teams Empowered Some Employees Evidence of Improvements Informal Surveys Plans To Expand Employee Involvement 	<ul style="list-style-type: none"> Quality Information Collected from Major Customers Data Available to Senior Managers Many Work Units Use Measures Information Collected is Usually Complete 	<ul style="list-style-type: none"> Key Products Reviewed To Meet Customer Needs Methods of Process Optimization Used Product Standards Set for Some Internal Support Areas 	<ul style="list-style-type: none"> Most Significant Indicators Demonstrate Good Results Competitive in Many Areas Customer Satisfaction Exists Results Generally Improving over Past 3 Years Performance Improving over Past 2 Years
2	<ul style="list-style-type: none"> Many Top Executives and Managers Support TQ Some Resources Allocated to TQ TQ Projects Underway Most Aimed at Short-Term Payoff Communication is Usually Top-Down (Sometimes Two-Way) 	<ul style="list-style-type: none"> Improvement Goals Established by Management Customer Needs Generally Known for Key Products Considered in TQ Planning Process 	<ul style="list-style-type: none"> Most External and Some Internal Customers Identified Needs Identified ad hoc Rather Than Systematic Methods Feedback Systems Report on General Satisfaction/ Dissatisfaction 	<ul style="list-style-type: none"> Training Plan Under Development Many Units Trained in Group Problem Solving Recognition in Many Units Number of Awards Increasing 	<ul style="list-style-type: none"> Many Managers Support Teams Established Some Teams Growing "Ownership" of Improvement Growing Number of Involved Employees Growing Employees Overlooked Regarding Overall Satisfaction 	<ul style="list-style-type: none"> Quality Information Collected from Some Customers Limited Data on Quality Some Work Units Use Quality Measures Information May Not Be Complete 	<ul style="list-style-type: none"> Few Products for External Customers Reviewed and Controlled To Meet Customer Needs Methods Used Emphasize Detection Not Prevention 	<ul style="list-style-type: none"> Most Significant Indicators Demonstrate Improving Results, Including Customer Satisfaction Improvements Achieved in One or More Dimensions/ Areas Quality of Suppliers Generally Improving
1	<ul style="list-style-type: none"> Top Executives Beginning To Support TQ Activities Support Tentative Few Resources Allocated to TQ Few TQ Projects Underway Communication is Primarily Top-Down 	<ul style="list-style-type: none"> General Goals Contain Elements of TQ Quality Planning Not Yet Integrated with Overall Strategic Planning Customers' Needs May Not Be Routinely Considered 	<ul style="list-style-type: none"> Customer Complaints Are Primary Method of Feedback and Not Systematically Used To Improve Processes Many Work Units Have Identified Customers and Their Needs 	<ul style="list-style-type: none"> Many Managers Attended TQ Awareness Training To Increase TQ Minimal TQ Training Resources Recognition Primarily for Individual Effort May Not Be Focused on TQ 	<ul style="list-style-type: none"> Some Managers Support Employee Involvement Small Percent of Employees Participating in Traditional Suggestion System Improvements Result from Complaints Only General, Nonspecific Improvement Plans 	<ul style="list-style-type: none"> Feedback Systems Providing Information on Quality Quality Data Generally Not Available Data Used for Reporting, Not Improvement Few Work Units Use Measurement Quality Information Collected on ad hoc Basis 	<ul style="list-style-type: none"> Products for Customers Reviewed/Controlled To Meet Internally-Developed Specifications Quality May Not Be a Priority for Suppliers 	<ul style="list-style-type: none"> Some Results in One or More Areas Results Achieved in One or More Dimensions/Area Little Evidence of Improvement Trends

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 in serving our customers. As our products and services are viewed, so are we viewed.

ENVIRONMENT



We value a stimulating environment that supports maximum personal effectiveness through empowerment, teamwork, and continuous improvement.

**ORIGINAL PAGE IS
OF POOR QUALITY**

First Successes



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FMEA/CIL Process Modifications

- THE SOLUTION ELIMINATES PAPER CHANGES WHICH TRANSLATES INTO

REPRODUCTION

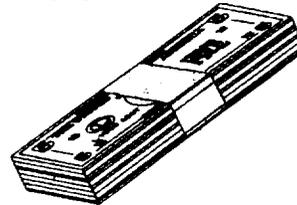
MAN-HOURS



ANNUAL
REDUCTION

369,890 PAGES

17,000



- THE POTENTIAL TOTAL COST AVOIDANCE IS ESTIMATED TO BE \$688,000 ANNUALLY

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NSPAR Process Modifications Estimated Savings

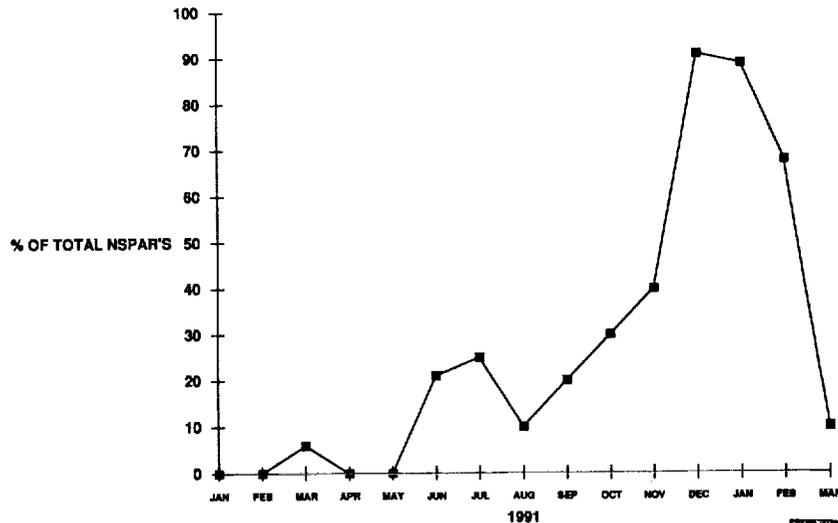
- VOLUME OF REQUESTS 2183
 - MANHOURS 15135
 - COST \$545K OVER PROJECT LIFE
-
- SCHEDULE - NONSTANDARD PART APPROVAL CYCLE REDUCED 18 MONTHS
 - CURRENT PROCESS - 24 MONTHS
 - NEW PROCESS - 6 MONTHS



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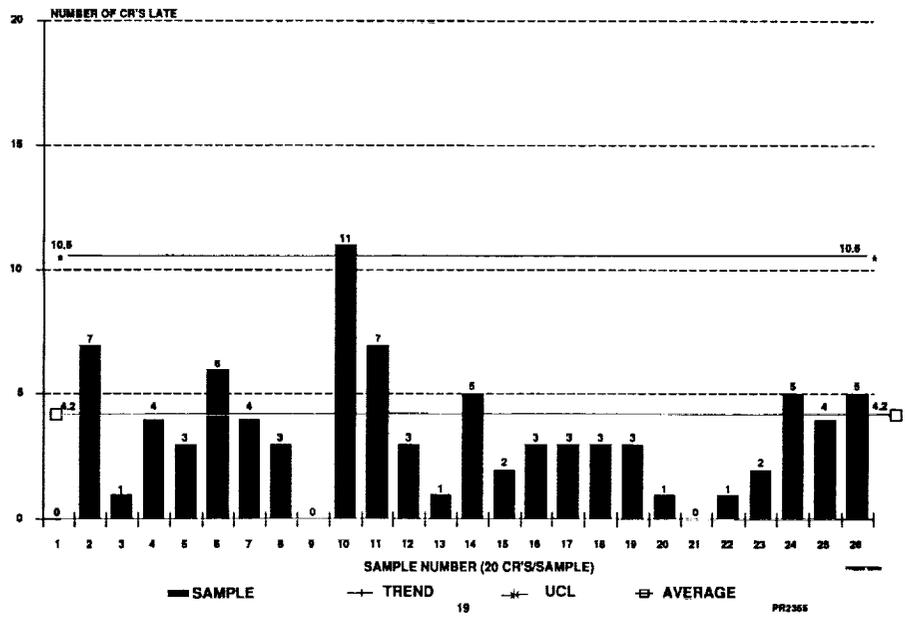
NSPAR Approval Rate



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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

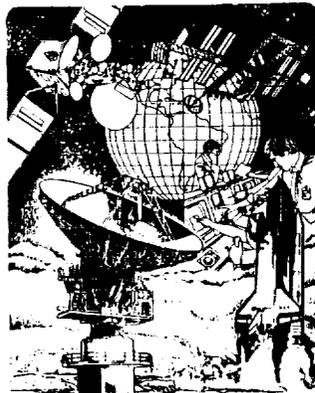


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JSC Vision Pioneering Space Exploration

"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."

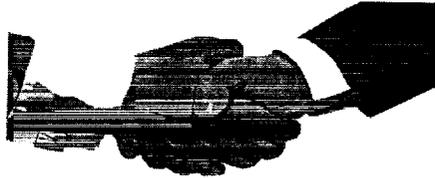


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A Shared Vision:

**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**