Welcome to the NASA John C. Stennis Space Center Propulsion Test Customer Day 2002
Tuesday Morning Agenda

- Agenda/Logistics
  Gary Taylor/Propulsion Test Directorate

- Welcome/Opening Comments
  Mark Craig/Deputy Director, Stennis Space Center

- Stennis Space Center (SSC) Video Tape

- SSC Overview
  Robert Lightfoot/Director, Propulsion Test Directorate

- Overview of A/B Test Complex
  Gary Taylor/Propulsion Test Directorate

- Overview of E Complex
  Bartt Hebert/Propulsion Test Directorate

- Overview of Test Support Services
  Stan Gill/Propulsion Test Directorate

- Engineering and Test Technology
  Shamim Rahman/Propulsion Test Directorate

- Rocket Propulsion Test Management Board (RPTMB)
  Mike Dawson/Manager, Propulsion Test Program Office

4/16/02
Welcome
to the
NASA John C. Stennis Space Center
Propulsion Test
Customer Day 2002
John C. Stennis Space Center

Unique Environment
- 30 Federal and State Agencies for Synergy and Cost-Sharing
- Government Managed, Contractor Operated
- DoD/NASA Working Relationship
- Commercial Customer Experience from Propulsion Test and Remote Sensing

Proven Capability
- Business Systems, Service Providers and Infrastructure in Place
- Experienced Work Force
- 125,000 Acre Buffer Zone
- Environmental Relationship with State

Strong Community Support
- A Recognized Contributor to Two States’ Well Being
- Mississippi and Louisiana State Agency Presence on Site
- “Partners for Stennis” Local Support

4/16/02
NASA Activity at Stennis

Implement NASA’s Strategic Enterprises
- Propulsion Testing
- Earth Science Applications

Manage and Develop the “City”
- Infrastructure
- Services
- Marketing

Enrich the Community
- Technology
- Education System Support
- Public Information Dissemination

4/16/02
Stennis Space Center Workforce/History

- First Saturn V Test (1/68)
- Apollo Fire (11/67)
- Challenger (1/86)
- Earth Resources Laboratory (ERL) Transfer (1974)
- Last Apollo Test (10/70)
- SSME Test Responsibility (5/84)
- Resident Agencies

NASA Programs

NASA Civil Servants

Mississippi Test Facility

National Space Technology Laboratory

Stennis Space Center

New Direction
- Shared facility infrastructure-resident agencies

Expanded Responsibility
# Stennis Space Center Workforce

## 2001 Workforce at John C. Stennis Space Center

- **NASA and Contractors**: 1,730
  - SSC Federal Civil Servants: 287
  - Contractor and Other: 1,443
- **Department of Defense and Contractors**: 1,279
  - Department of Navy: 1,205
  - Department of Army: 74
- **Department of Commerce and Contractors**: 180
- **Other Resident Agencies**: 1,311

**Total**: 4,500
SSC Test Stands

Stennis Space Center

A-1
A-2
E-1
E-2
E-3
B-1/B-2

4/16/02
## Test Stand Utilization Schedule

### CALENDAR YEARS

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- **Occupied**
- **Project Pending**
- **Available**
- **Construction/Activation**

**4/16/02**
NASA Programs

Today: Space Shuttle
1st Generation RLV
- Orbital Scientific Platform
- Satellite Retrieval and Repair
- Satellite Deployment

2010: 2nd Generation RLV
- Space Transportation
- Rendezvous, Docking, Crew Transfer
- Other on-orbit operations
- ISS, Orbital Scientific Platform
- 10x Cheaper
- 100x Safer

2025: 3rd Generation RLV
- New Markets Enabled
- Multiple Platforms / Destinations
- 100x Cheaper
- 10,000x Safer

2040: 4th Generation RLV
- Routine Passenger Space Travel
- 1,000x Cheaper
- 20,000x Safer

4/16/02
A and B Test Complexes

Gary O. Taylor
Propulsion Test Directorate
NASA, Stennis Space Center

A-1  A-2  B-1/B-2

4/16/02
A and B Test Complex

Stennis Space Center

4/16/02
History of A/B Complex

- Early 1960s – Early 1970s
  - National Rocket Testing Center
  - Support Flight Certification of 1st and 2nd stages of the Saturn V “Moon Rocket”
- Mid 1970s – Present
  - Support Space Shuttle Main Engine (SSME) development and certification test
  - Sea level, simulated altitude, and main propulsion cluster system (MPTA)
- Mid 1990s – Present
  - Continue SSME development and flight certification testing
  - Support government/government, agency/agency, and commercial programs
    - X-33 Program: Aerospike Engine Testing
    - NASA Research: MC-1 Engine/Assembly Testing
    - Commercial: RS-68 Engine/Stage Testing
Apollo Saturn V:
- Second Stage (S-II) Testing
- First Stage Test in April 1966
- Stage:
  - Five J-2 engines
  - 1.15 M-lb thrust at altitude
  - LOX/LH₂
  - 15 acceptance tests
  - 27 total static firings

Saturn V Second Stage is Lifted Into The A-2 Test Stand
History of A Complex (A-1 & A-2)

- Space Shuttle Main Engine (SSME):
  - Single engine testing
  - Sea level and simulated altitude test
  - First static firing in May 1975
  - SSME:
    - 375 K-lb thrust at sea-level (100% RPL)
    - LOX/LH
History of A Complex (A-1 & A-2)

Stennis Space Center

- X-33/RLV Program
  - Linear Aerospike Engine Test
  - Testing initiated in 1998
  - Powerpack testing
  - Single and dual engine test
  - Completion in 2001
  - Engine:
    - 250K thrust
    - LOX/LH
History of B Complex (B-1 & B-2)

- **Apollo Saturn V:**
  - 1\textsuperscript{st} Stage (S-IC) Testing
  - First stage test in March 1967
  - Utilized the B-2 test position
  - Stage:
    - Five F-1 Engines
    - 7.5 M-lb thrust at sea level
    - RP-1/LOX
    - 15 total static firings

*Saturn V First Stage is Lifted Into B-2 Test Stand*
History of B Complex (B-1 & B-2)

- Space Shuttle Main Engine (SSME):
  - Single engine / Altitude simulated test
  - Utilized the B-1 test position

- Main Propulsion Test Article in B-2
  - 3 SSMEs
  - April 1978 through January 1981
  - 1.125 M-lb thrust at sea level
  - 18 total static test firing
History of B Complex (B-1 & B-2)

- MC-1 (Fastrac Engine):
  - Low Cost Booster R & D
  - X-34 Technology Demonstrator Program
  - First test Dec. 1998 (B-2 upper deck)
  - Continued testing through Oct. 1999
- Engine:
  - 60K Thrust
  - LOX/RP-1
History of B Complex (B-1 & B-2)

- Combined Booster Core:
  - Delta IV Program
  - RS-68 Engine
    - 650K thrust
    - LOX/LH$_2$
A Complex Capabilities

A-1

- A-1 & A-2 test stands similar in design
- Gimbal capability at A-1 (Sea level testing)
- Diffuser at A-2 (Simulated altitude testing)
- Designed for maximum dynamic load of 1.1 M lb thrust
- Supported by a dual capability test control center (TCC)

A-2

- Propellant run tanks
  - LH₂: Water volume of 110K gallons, certified pressure of 50 psig
  - LO₂: Water volume of 40K gallons, certified pressure of 250 psig
- Propellant barge docking stations
  - LH₂: two (2)
  - LO₂: two (2)

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B Complex Capabilities

B-1/B-2

- B-1/B-2 is a dual-position test stand
- Sea level and simulated altitude testing
- Designed for maximum dynamic load of 11 M-lb thrust
- Shared Test Control Center (TCC)
- Propellant run tanks
  - LH₂: Water volume of 90K gallons, certified pressure of 66 psig
  - LO₂: Water volume of 49.5K gallons, certified pressure of 110 psig
- Propellant barge docking stations
  - LH₂: three (3)
  - LO₂: three (3)
Current Programs at A/B Complex
Space Shuttle Main Engine

Location
- Transitioning to A-1 during A-2 modifications

Scope
- Acceptance Testing for Flight Program
- Demonstrated Reliability Testing for Block II Engines
- Anomaly Resolution
- Engine Assembly/Maintenance

Status
- Engine installation into A-1
- A-2 maintenance/modifications
RS-68

Stennis Space Center

- Location
  - B-1 Test Position

- Scope
  - Development, Certification and Production Acceptance Testing
  - World-Class Assembly Facility at SSC
  - Two-position Test Stand

- Status
  - B-1 Dual Position Operational
  - 1st test on Position “B” - 9/8/99
  - 1st test on Position “A” - 11/6/99
  - 74 tests to date
  - Engine installation into position B in work
E-Complex

- E Complex Comprised of Three Test Stands
  - E-1 Having Three (3) Test Cells
  - E-2 Having Two (2) Test Cells
  - E-3 Having Two (2) Test Cells

- Versatile Test Complex
  - Thrust Chambers
    (sub-scale to full scale)
  - Turbopump Assemblies
  - Preburners
  - Engine Systems

- Multiple Propellants
- High Flow Rate Capabilities
- High Delivery Pressure Capabilities

4/16/02
E-Complex History

- Late 1980s/Early 1990s
  - DoD/NASA Advanced Launch System and National Launch System
  - National Aerospace Plane

- Construction Starts
  - E-1 1989
  - E-2 1991
  - E-3 1995

- First Test
  - E-1 1999
  - E-2 1994
  - E-3 1995

4/16/02
E-1 Test Stand Capabilities

- **E-1 Cell 1**
  - Pressure-Fed LO$_2$/LH$_2$ & Hybrid-Based Test Articles
  - Thrust Loads up to 750K lb$_f$
    (horizontal)
- **E-1 Cell 2**
  - LH$_2$ Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb$_f$
- **E-1 Cell 3**
  - LO$_2$ Turbopump & Preburner Assembly Testing
  - Thrust Loads up to 60K lb$_f$

**General Pressure Capabilities**
- LO$_2$/LH$_2$ ~ 8,500 psia
- Support Fluids ~ 15,000 psia
- Support Systems: GHe, GN, GOX, Hydraulics, TEA/TEB

4/16/02
E-1 Test Stand Activities

250K Hybrid Motor Program

- Conducted (4) Hotfire Test at E-1 Cell 1
- LO₂ Propellants
- Thrust ~ 250K lb₉
- Phase 1 Testing Completed Late 1999 (3 tests)
- Phase 2 Testing Completed Early 2002 (1 test)
- Achieved 35 second Duration Steady State Test at Full Thrust
Ultra Low Cost Engine (ULCE) Program

- Conducted (15) Hotfire Tests at E-1 Cell 1
- Tested TRW, Inc. Pintle-Based ULCE at E1 Cell 1
- LO₂/LH₂ Propellants
- Thrust ~ 650K lbₙ
- Testing Completed Late-2000
- Achieved 8 second Duration Steady State Test at Full Thrust

Integrated Powerhead Demonstration (IPD) Program

- Joint NASA/Air Force Program
- Tested IPD LOX Turbopump at E-1 Cell 3
- HP GN Turbine Drive
- LP LN Feed
- Phase 1 Testing Completed Late-2001
- Achieved Steady State Test at 75% RPL

4/16/02
E-1 Test Stand Upcoming Programs

- Cell 1
  - Boeing RS-83 LOX/LH Preburner
  - Aerojet/P&W COBRA LOX/LH Preburner

- Cell 2
  - IPD LH Turbopump Test
  - IPD LH Turbopump Hotfire
  - IPD LH Fuel Rich Preburner

- Cell 3
  - IPD Ox-rich Preburner Test
  - IPD LOX Turbopump Hotfire
  - IPD Integrated System Test

4/16/02
E-2 Test Stand Capabilities

- **E2 Cell 1**
  - Pressure-Fed LO$_2$/RP-1 Based Test Articles
  - Thrust Loads up to 100K lb$_f$
    (horizontal)
  - LO$_2$/RP-1 ~ 8,500 psia
  - GN/GH ~ 15,000 psia
  - Hot GH (1,300 F @ 6,000 psi)

- **E2 Cell 2**
  - LO$_2$/RP-1 Engine/Stage Test Articles
  - Loads up to 150K lb$_f$

- **Support Systems**
  - GHe, GN, Hydraulics
E-2 Test Stand Activities

RS-76 LOX Rich Preburner Program

- Conducted Several Hotfire Test at E-2 Cell 1
- 7,000 psi LO$_2$/RP-1 pressure fed
- Thrust ~ 30K lb$_f$
- Testing Completed Early 1999
- Achieved 12 second Duration Steady State Test at Full Thrust

4/16/02
E-2 Test Stand Upcoming Programs

Cell 1
- Air Force LR-89 LOX/RP Pressure Fed 75 k-lb Thrust Chamber
- Boeing RS-84 LOX/RP Sub-Scale Preburner and TCA

Cell 2
- Air Force/Orbital Upper Stage Flight Experiment ($H_2O_2$/JP-8)
E-3 Test Stand Capabilities

- E3 Test Stand Capabilities
  - Rocket Engine Component & Sub-Scale Engine Development
  - Comprised of Two (2) Test Cells

- E3 Cell 1
  - Horizontal Testing
  - Propellants: LO₂, GOX, Hydrocarbons, GH₂
  - Support Systems: LN₂, GN₂, GHe
  - Thrust Loads up to 60K lb_f

- E3 Cell 2
  - Vertical Testing
  - Propellants: LO₂, H₂O₂, Hydrocarbons
  - Support Systems: LN₂, GN₂, GHe
  - Thrust Loads up to 25K lb_f

4/16/02
E-3 Cell 1 Test Stand Activities

Hybrid Sounding Rocket (HYSR)

- Tested Lockheed Martin Michoud Space Systems HYSR at E-3 Cell 1
- HYSR Designed For Sub-Orbital & Atmospheric Science Missions
- LOX Fed Hybrid-Based Test Article
- Thrust ~ 60K lb_t
- Achieved Steady State Test at Full Thrust

4/16/02
E-3 Cell 2 Test Stand Activities

Hydrogen Peroxide Programs (85% to 98%)

• Tested Several $\text{H}_2\text{O}_2$ Test Articles
  - Boeing AR2-3
  - Orbital Sciences Corporation TCA
  - Pratt & Whitney and Boeing Catalyst Bed Testing Programs
E3 Test Stand Upcoming Programs

- Cell 1
  - $\text{H}_2\text{O}_2$/JP Turbopump Development

- Cell 2
  - $\text{H}_2\text{O}_2$/JP Thrust Chamber Development
E-Complex Control Rooms

E-1 Control Room

E-2 Control Room

E-3 Control Room

4/16/02
E-4 Future Test Stand

- Designed for Testing of RBCC Engine Systems and Powerpack Assemblies
  - 50 K Thrust Capability
  - Low Pressure JP-7 and H2O2 Propellant Supply

- Single-Cell Test Stand

- Facility Construction Complete 6/04/04

- Facility Activation/Checkout Complete 2/07/05
Stan Gill
Propulsion Test Directorate
NASA, Stennis Space Center

4/16/02
SSC Test Support Services

- SSC has all the required functions along with some unique support facilities to support propulsion testing.
  - High Pressure Gas Facility
  - High Pressure Industrial Water
  - Cryogenic Propellant Storage/Transfer Facility
  - Laboratories
  - Shops
  - Utilities
  - Other Services

4/16/02
High Pressure Gas Facility (HPGF)

- Helium System
  - Max Pressure 4,500 psig
  - 2 Storage Vessels - each 10,000 ft³
  - Max hydrocarbon content - 10 ppm

- Hydrogen System
  - Max Pressure 3,000 psig
  - 1 Storage Vessel - 20,000 gal

- High Pressure Air System
  - Max Pressure 2,800 psig
  - Missile grade air

- Nitrogen System
  - Max Pressure 4,400 psig
  - 2 Storage Vessels - 63,250 gal and 27,000 gal

- Auxiliary Tube Bank Storage
  - 7 Helium Trailers
  - 7 Nitrogen Trailers
  - 2 Hydrogen Trailers
Cryogenic Propellant Storage Facility

- Six LOX Barges – 97,500 gallons each
- Three LH₂ Barges – 250,000 gallons each
- Propellant storage/transfer facility (trailers and barge)
- Integrated canal system for barge traffic
- Control panels for barge systems checkout
- Real-time transfer capability on vertical test stands
High Pressure Industrial Water (HPIW)

- 66,000,000-gal reservoir with industrial wells
- Ten diesel-driven pumps with a total capacity of 330,000 gal/min for a duration of 40 min.
- Piping and foundation to expand to 13 pumps
- Deluge and cooling water is provided to A-1, A-2, and B-1/B-2
Bascule Bridge & Lock

Stennis Space Center

4/16/02
Laboratories

- Environmental
- Gas and Material Analysis
- Measurement Standards and Calibration
Shops

- Carpentry Shop
- Mechanical/Plumbing Shop
- Electric Shop
- Heating, Ventilation, and Air-Conditioning Shop
- Paint Shop
- Weld/Fabrication Shop
- Machine Shop
- Component Support
- Nondestructive Test and Evaluation Laboratory
Utilities

- Electric
  - (2) 13.8 kilovolt feeds to SSC
  - Emergency generators
  - (4) 1,875 KVA, diesel-driven generators
  - Located in the HPIW Facility
  - Supports A/B Complex activities

Four Diesel-Driven Generators at HPIW
Other Services

- Medical Clinic/Emergency Response Team
- Wellness/Fitness Facility
- Food Services
- Recreational Association
- Fire Department
- Security Services
- IT Support
Engineering and Test Technology

S. A. Rahman
Engineering Division
Propulsion Test Directorate
NASA, Stennis Space Center

Technology

Design

4/16/02
Engineering: Primary Responsibilities

- Test Systems Mechanical Design
- Test Systems Electrical Design
- Technology for Safety & Operability

Turning Test Requirements into Test Systems

DACS System Development

4/16/02
Engineering of Test Systems

- **Mechanical Test Systems**
  - Propellant Supply for Oxidizer, Fuel
  - Ignition, Purges, Thrust Mounts
  - Supporting Analyses (static/dynamic flow pressure, structural, thermal)

- **Electrical Test Systems**
  - Instrumentation
  - Controls
  - Low-speed and High-speed Data Acquisition
  - Data Processing algorithms
  - Ancillary: Video, Power, Gas & Fire Detection

**Test Articles**
- Pump, Preburner, Thrust Chamber,
- Powerhead, Engine, Stage

Design – a Systematic way of Mitigating Technical Risk

Powerhead

Pump

Chamber

Engine System
Test Technology

Stennis Space Center

Computational Fluid Dynamics

Applying State-of-the-Art Technology To Support Test Projects & Enhance Safety

Plume Spectroscopy

Plume Diagnostics Instrumentation
Custom spectral analysis systems can detect minute levels of metallic contaminants indicative of abnormal engine wear

Acoustic Data & Modeling

250K Hybrid (9-99)

Affiliations with Government Technologists, University Experts, & NASA Technology Transfer programs
Engineering Workforce & Skills Mix

20 NASA Engineers
(Design/Analysis/Technology)

60 Contractor Engineers
(Design/Analysis/Technology)

A Diverse Skills Base within a Highly Experienced Workforce

Skill Areas

- Mechanical Components & Systems Design
- Fluid and Thermodynamic Analyses
- Cryogenic Engineering
- Pressure Vessel Design & Maintenance
- Instrumentation Systems & Special Sensors
- High-Speed/Low-Speed Data Acquisition Systems
- Materials Compatibility \((O_2, H_2, RP \& H_2O_2)\)
- Plume Effects Predictions, Measurements, & Diagnostics

4/16/02
Engineering Tools

Industry Standard & Custom Methods

- Pro/Engineer (CAD) & Pro/Mechanica (Analysis)
- ROCETS Code (Rocket Engine Transients Simulation)
- Fanno Flow Code
- NIST properties for real Fluids
- ALGOR Pipeplus
- FDNS (Finite Difference Navier Stokes)
- PLIMP (Plume Impingement)
Stennis Space Center
Propulsion Test Program Office

April 16, 2002
Propulsion Test Program Office
Responsibilities

- Manage NASA's rocket propulsion test assets, activities, resources
- Develop testing and facility investments and consolidation strategies
- Set world-class standards for effectiveness and efficiency
- Determine where tests are performed
- Provide full customer services to other Gov. agencies and industry
- Develop and implement advances in test technology
- Improve cooperation with DoD rocket testing
Propulsion Test Concept

Propulsion Community Customer Requirements and Resources

DoD Test Capabilities

SSC
Propulsion Test Program Office
Level II Requirements
Agency Test Management,
(PRTMB) Budget Authority,
Test Assignment,
Investment Control

WSTF
Hyipergolic, High Altitude Test Articles

MSFC
Emerging Technology,
In-House Designed Test Articles,
Cryo-Structural
Excludes Engine Systems & Stages

SSC
Non-Hypergolic, Ambient,
Low Altitude Test Articles

PBS
Large Test Articles, High Altitude/Space Environment
Nation's Rocket Test Locations

NASA Sites:
PBS – Plum Brook Station
MSFC – Marshall Space Flight Center
WSTF – White Sands Test Facility
SSC – Stennis Space Center

DoD Sites:
AEDC – Arnold Engineering Development Center
RTTC – Redstone Technical Test Center
AFRL – Air Force Research Laboratory
NAWC – Naval Air Warfare Center

Industry Sites:
AEROJET – Sacramento, CA
BOEING – Santa Susanna, CA
EMRTC – Energetic Materials Research & Testing Center, Socorro, NM
P&W – Pratt & Whitney, West Palm Beach, FL
ATK – Alliant Techsystems, Magna/Brigham City, UT
ATK – Alliant Techsystems, Rocket City, WV
GD – General Dynamics, Redmond, WA
ARC – Atlantic Research Corp., Manassas, VA
# Summary of NASA's Rocket Test Infrastructure

## PBS

## WSTF

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Current Replacement Value = ~ $2B
RPTMB Process Flow

Is test within center roles?

YES

Does facility require mods > $500K?

YES

NO

Is facility within baseline utilization status?

NO

Board Action Required

YES

Proceed with Test Program
### NASA Facilities Utilization Schedule (sample)

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*NOTE: Active/Inactive/Mothballed Test Stands Included. Based on 360 days in the year. Test Stands are equally weighted toward Site Total. Inactive, Mothballed Test Stands require some level of investment to re-activate.
## Test Stand Capabilities Database (sample)

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Welcome to the NASA John C. Stennis Space Center Propulsion Test Customer Day 2002 (Day 2)
Doing Business with SSC

- How to contact us
- SSC’s evaluation process of your request
  - Does it fit
  - Specific Concerns
  - Type of agreement
  - Estimated (ROM) Cost
- Establishing the project / Project Formulation
  - Requirements by customer
  - Cost estimate and milestone schedule
  - Letter of commitment
  - Rough draft of agreements
- Project Management Activities
  - Single point of contact
  - Detailed requirements
  - Detailed schedules
  - Project Control
- Customer Feedback Opportunities
How to Contact SSC

- Ways to Contact
  - Phone
  - E-mail
  - Direct mail
  - Others

- Individuals
  - In your hand-out material
  - Usually New Business Development Office or RPTMB
  - Organization charts
  - Web base: Stennis Space Center
### Project X Status (PM)

#### FY02 Cost Status

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#### Overview

- Technical -
- Schedule -
- Costs -

#### Status

- Issues/Actions

#### Variance

4/17/02
# Project X Schedule

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<tr>
<th>WBS</th>
<th>TASK</th>
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</tbody>
</table>

**Notes:**
- **BCWS** = Budgeted Cost of Work Scheduled (i.e., Plan)
- **ACWP** = Actual Cost of Work Performed (i.e., Actuals)
- **EAC** = Estimate at Complete

**Formulas:**
- **Schedule index** = Current/Plan = 35%/35% = 1.00
- **Cost index** = Actual %Schedule/(ACWP/EAC) = .35/(8/100) = 4.38

**Index Stoplight Metrics:**
- Green -- Index = or >1.0
- Yellow -- 0.9<Index<1.0
- Red -- Index<0.9

4/17/02
Project X Wrap-up

**FY02 Financial**

- **Budget**: $1,327K
- **EAC**: $1,327K
- **Allocated (PAF)**: $1,085K
- **Obligated**: $1,085K
- **Costed**: $1,084K

**Project Check List**

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<tr>
<th>Category</th>
<th>Plan</th>
<th>Actual</th>
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<tr>
<td>NBDO</td>
<td>n/a</td>
<td>12/??/99</td>
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<tr>
<td>Space Act Agreement (SAA)</td>
<td>n/a</td>
<td>12/??/99</td>
</tr>
<tr>
<td>Handoff to Project Manager</td>
<td>n/a</td>
<td>8/??/99</td>
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<tr>
<td>PM</td>
<td></td>
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<tr>
<td>Team Assignment Memo</td>
<td>8/??/99</td>
<td>8/??/99</td>
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<tr>
<td>Project Requirements Document, Rev 0</td>
<td>11/??/99</td>
<td>11/??/99</td>
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<tr>
<td>TTA or SAA (with EPR)</td>
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<tr>
<td>Detailed Schedule Baseline</td>
<td>01/??/00</td>
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<tr>
<td>Detailed PAF/Phasing Plan</td>
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<tr>
<td>Risk Management Plan</td>
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<td>Final Test Plan</td>
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<td>Test Article Delivery</td>
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**Risk - Mitigation - Corrective Action**

<table>
<thead>
<tr>
<th>Item</th>
<th>Risk</th>
<th>Short Term Mitigation</th>
<th>Long Term Corrective action</th>
<th>Actionee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>1 10° Valve may not function properly after design modifications</td>
<td>Develop Action Plan to Repair</td>
<td>Rework pipe to fit different valve</td>
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<tr>
<td></td>
<td>2 Test Article may produce static spark during operation</td>
<td>Grounding fix implemented into design</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Y</td>
<td>3 Propellant pressurization systems do not have redundant capability</td>
<td>Spare parts are maintained and preventative maintenance performed</td>
<td>Redundant systems are being procured</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Multiple programs at E-1 Complex may create schedule conflicts</td>
<td>Coordinate schedules and prepare priority ranking strategy</td>
<td>Multiple shifts working and coordination between programs</td>
<td></td>
</tr>
</tbody>
</table>

**Notes**

- TTA – Technical Task Agreement
- EPR – Estimated Price Report
- PAF – Project Allocation Form

4/17/02
**REPORT DOCUMENTATION PAGE**

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3. **DATES COVERED (From - To)**

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Stennis Space Center Propulsion Test Customer Day 2002 Presentation

**5a. CONTRACT NUMBER**

**5b. GRANT NUMBER**

**5c. PROGRAM ELEMENT NUMBER**

**5d. PROJECT NUMBER**

**5e. TASK NUMBER**

**5f. WORK UNIT NUMBER**

**6. AUTHOR(S)**
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**13. SUPPLEMENTARY NOTES**

**14. ABSTRACT**