NASA JOHNSON SPACE CENTER
WHITE SANDS TEST FACILITY

Overview Presentation to Yuzhnoye SDO
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Overview

- Constructed in 1962-64 to Support Apollo Project
- Subsidiary Unit of NASA Johnson Space Center
- Occupies 45 km^2 (28 mi^2) in South Central New Mexico, USA

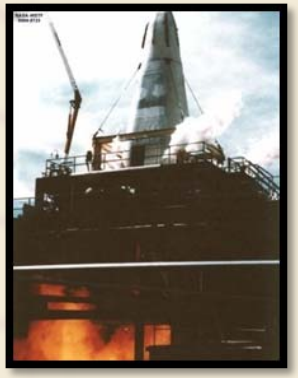
Mission Statement

Our mission is to provide the expertise and infrastructure to test and evaluate spacecraft materials, components, and propulsion systems to enable the safe exploration and use of space.

Facilities

- Rocket Engine System Test Stands with Vacuum
- Long-duration Large-altitude Simulation System
- Full-scale Hypergolic and Cryogenic Propulsion Test Systems
- Chemistry and Metallurgical Laboratories
- Flight Component Repair, Refurbishment, and Test Facilities
- High Energy Blast Facility
- Oxygen-enriched Atmosphere Test Facilities
- Hypergolic Materials and Components Test Facilities
- Hypervelocity and Low Velocity Impact Test Facilities
- White Sands Space Harbor Launch and Landing Site

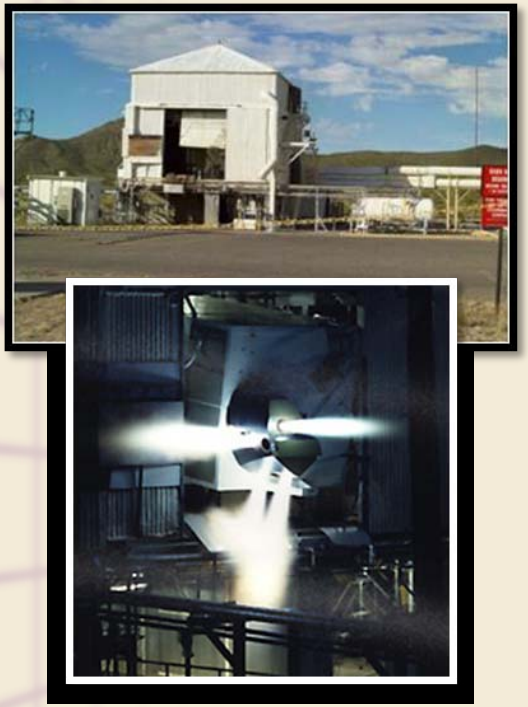
Propulsion Test



Summary

- Nine rocket test stands in two major test areas
- Six altitude test stands
  - Thrust can be measured to 111.2 kN (25,000 lb_f)
  - Maximum ignition altitude equivalent to 76,200 m (250,000 ft) (2.1 Pa (0.0003 psia))
  - Maintainable altitude during firing above 30,500 m (100,000 ft) (0.001 MPa (0.160 psia))
  - Test article dimensions up to 4.6 x 4.6 x 13.7 m high (15 x 15 x 45 ft high)
  - Environmental and propellant conditioning 4 to 49 °C (40 to 120 °F)
  - Solid rocket motors up to 122 cm (48 in) in diameter (dia)
  - Vacuum maintained by steam ejector systems or vacuum pumps
- Three ambient test stands
  - Thrust capability up to 267 kN (60,000 lb_f)
  - Test article up to 7.6 x 7.6 m (25 x 25 ft) (no height restrictions)
  - Environmental and propellant conditioning 4 to 49 °C (40 to 120 °F)
- Average of 300 data channels and 150 event channels per stand

300 Area Test Stands



TS 301

- 10 x 10 x 13.4 m high (33 x 33 x 44 ft high)
- Vertical down-firing engines up to 111 kN (25,000 lb_f) thrust
- Maximum test article size 7.6 x 7.6 x 10.6 m (25 x 25 x 35 ft) (taller with roof removed)
- Water-cooled flame bucket
- 34.5 and 12.4 MPa (5000 and 1800 psia) helium, and 20.7, 6.9, and 1.03 MPa (3000, 1000, and 150 psia) nitrogen system
- 7571 L (2000 gal) monomethylhydrazine (MMH) and nitrogen tetroxide (NTO) run tank and feed system rated for 2.07 MPa (300 psia) and 4 to 49 °C (40 to 120 °F)
- 757 L (200 gal) MMH and NTO run tanks and feed system rated at 13.8 MPa (2000 psia)

300 Area Test Stands

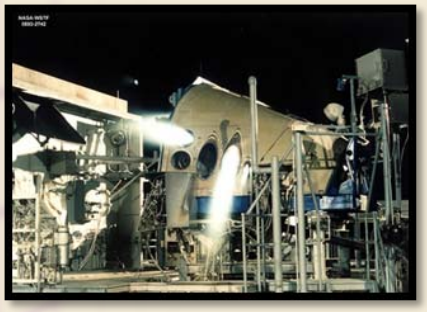
TS 302

- Vacuum test chamber: 9.8 m (32 ft) dia x 11.7 m (38 ft) high (17.7 m (58 ft) with extension)
- Removable lid for large test article installation
- Maximum test article size is 7.6 m (25 ft) dia x 13.7 m (45 ft) high
- Environmental conditioning 4 to 49 °C (40 to 120 °F)
- 41.4 and 12.4 MPa (6000 and 1800 psia) helium and 20.7, 10.3, and 1.0 MPa (3000, 1500, and 150 psia) nitrogen system
- 10,600 L (2800 gal), 3.8 MPa (550 psia) hydrazine propellant system

300 Area Test Stands

TS 303

- Vacuum test chamber: 3.4 m (11 ft) dia x 11.9 m (39 ft) long
- Single engines or test article with multiple engines up to 1.3 kN (300 lb_f) total thrust
- Maximum test article size 2.1 m (7 ft) dia x 7.6 m (25 ft) long
- Test article and test chamber temperature conditioning 4 to 49 °C (40 to 120 °F)
- 1.0 MPa (150 psia) nitrogen system
- 10,600 L (2800 gal), 3.8 MPa (550 psia) hydrazine propellant system

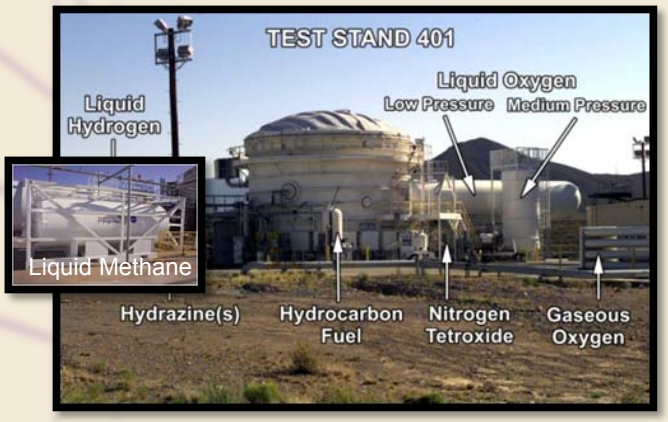


TS 328

- Test stand: 8.8 x 8.2 x 6.1 m high (29 x 27 x 20 ft high)
- Retractable building for engine firings
- Maximum test article size 5.5 x 5.5 x 4.3 m (18 x 18 x 14 ft)
- Maximum thrust 111.2 kN (25,000 lb_f)
- 34.5 and 12.4 MPa (5000 and 1800 psia) helium, and 20.7, 10.3, and 1.0 MPa (3000, 1500, and 150 psia) nitrogen system
- 2839 L (750 gal) MMH and NTO run tank and feed system rated for 2.1 MPa (300 psia) and 4 to 49 °C (40 to 120 °F)

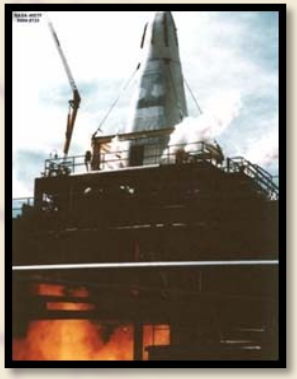
400 Area Test Stands

TS 401



- Vacuum test chamber: 10 m (33 ft) dia x 11.6 m (38 ft) high (17.7 m (58 ft) with extension)
- 111.2 kN (25,000 lb_f) total thrust firing vertically down
- Horizontal firing up to 4.5 kN (1000 lb_f)
- Maximum test article size 4.6 x 4.6 x 13.7 m high (15 x 15 x 45 ft high)
- Precision vertical positioning of up to 18,144 kg (40,000 lb) test articles within 0.25 cm (0.1 in)
- Multi-axis thrust measurement
- 41.4 and 20.7 MPa (6000 and 3000 psia) helium, and 5.5 and 1.0 MPa (800 and 150 psia) nitrogen systems
- 7571 L (2000 gal) MMH and NTO run tank and feed system rated for 4.1 MPa (600 psia) and 4 to 49 °C (40 to 120 °F)
- Helium saturation over all run tank temp. and pressure ranges
- Non-toxic and cryogenic propellant systems capability
  - 1893 L (500 gal), 5.5 MPa (800 psia) hydrocarbon temperature conditioned run tank
  - 5678 L (1500 gal), 3.5 MPa (500 psia) liquid methane
  - 11.3 m^3 (400 ft^3), 41.4 MPa (6000 psia) GOX storage and run tanks
  - 15,899 L (4200 gal), 4.8 MPa (700 psia) LOX tank
  - 52,996 L (14000 gal), 0.69 MPa (100 psia) liquid hydrogen tank

400 Area Test Stands



TS 402

- 10 x 10 x 9 m high (33 x 33 x 30 ft high)
- Single engines or test articles with multiple engines up to 267 kN (60,000 lb_f) total thrust firing vertically down
- Removable roof for large test article installation
- Maximum test article size 4.6 x 4.6 x 9.1 m (15 x 15 x 30 ft) (taller without roof)
- Water-cooled flame bucket installed below lower deck
- 41.4 and 20.7 MPa (6000 and 3000 psia) helium, and 5.5 and 1.0 MPa (800 and 150 psia) nitrogen
- Hypergolic propellants

TS 403

- Similar capabilities as TS 401
  - Cryogenic and non-toxic propellants currently not available
  - 7571 L (2000 gal), 2.1 MPa (300 psia) and 757 L (200 gal), 13.8 MPa (2000 psia) MMH and NTO run tanks

400 Area Test Stands

TS 405

- Vacuum test chamber 2.9 m (9.5 ft) dia x 7.6 m (25 ft) long
- Hypergolic propellant engines up to 4.5 kN (1000 lb_f)
- Propellant and test article thermal conditioning
- Propellant helium saturation
- Solid rocket motor sizes up to 122 cm (48 in) dia and 111.2 kN (25,000 lb_f) thrust firing horizontally
  - 0 to 120 rpm motor spin rate, axial and side-load measurement
- Test article test chamber thermal conditioning -7 to 43 °C (20 to 110 °F)
- 20.7 MPa (3000 psia) helium and 20.7, 5.5, and 1.0 MPa (3000, 800, and 150 psia) nitrogen
- Hypergolic propellant systems
  - 7571 L (2000 gal), 2.1 MPa (300 psia) and 379 L (100 gal), 3.5 MPa (500 psia) MMH and NTO run tanks

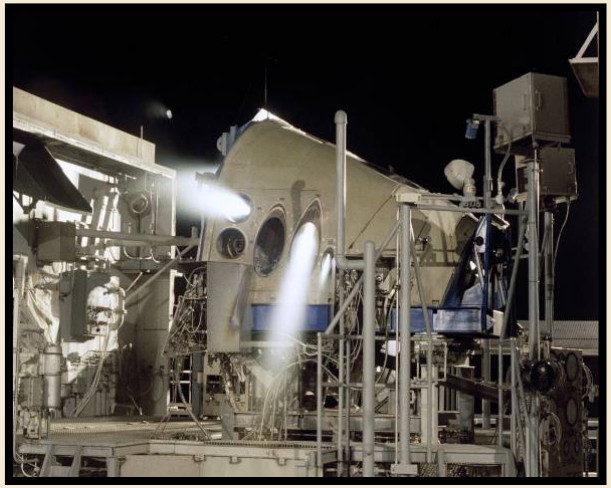
TS 406

- Vacuum test chamber 102 cm (40 in) dia, 203 cm (80 in) long
- Single hypergolic propellant engines up to 4.5 kN (1000 lb_f) at simulated altitude conditions
- Hypergolic propellant systems
  - 7571 L (2000 gal), 2.1 MPa (300 psia) and 76 L (20 gal), 10.3 MPa (1500 psia) MMH and NTO run tanks

Propulsion Test

Cassini – Saturn Orbit Insertion Engine Glows during 3 h 20 min Continuous Firing

Shuttle PRCS Thruster Hot-fire Testing

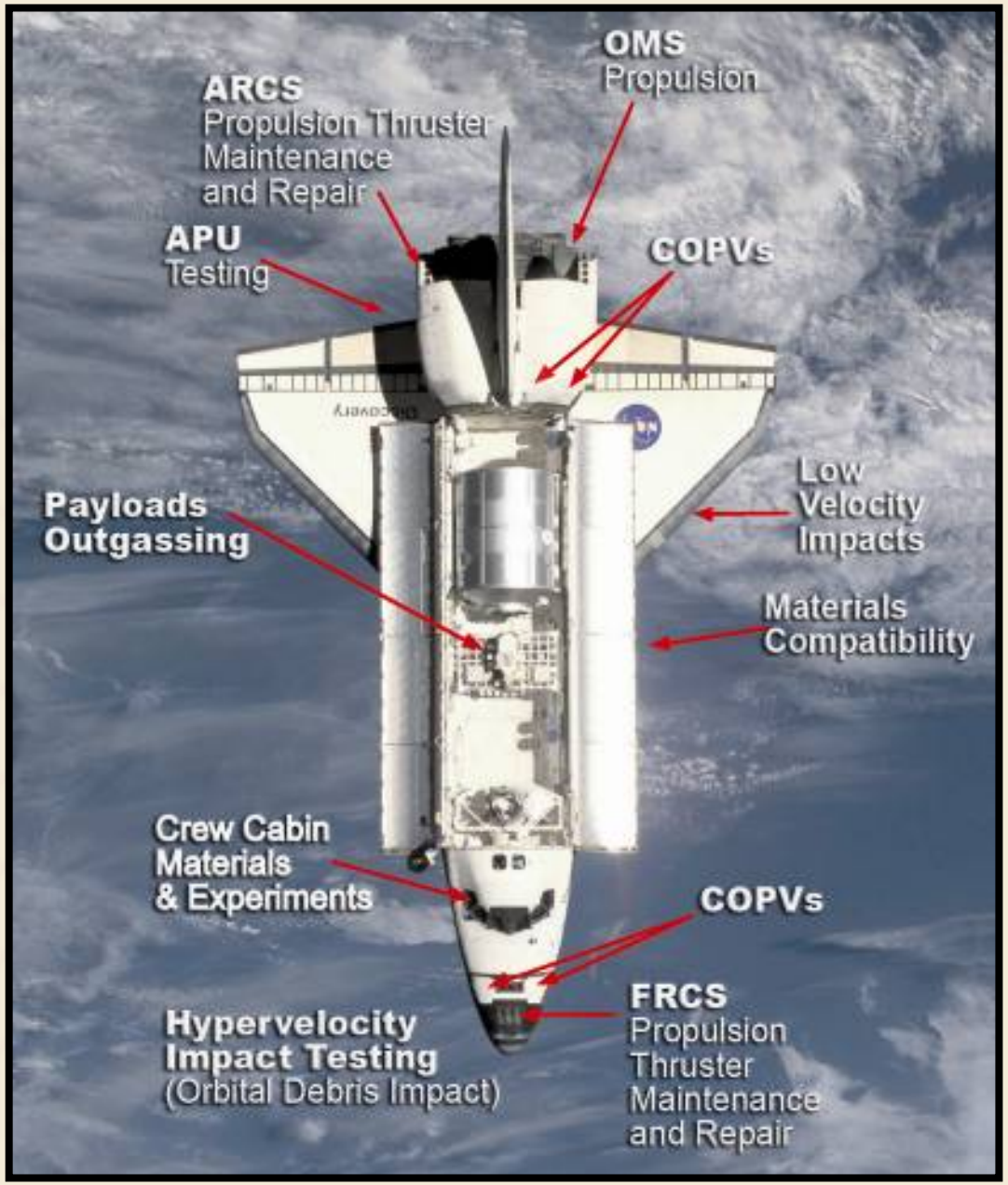


Night Firing of Shuttle Forward RCS Primary and Vernier Thrusters

Backup

(Other Facilities)

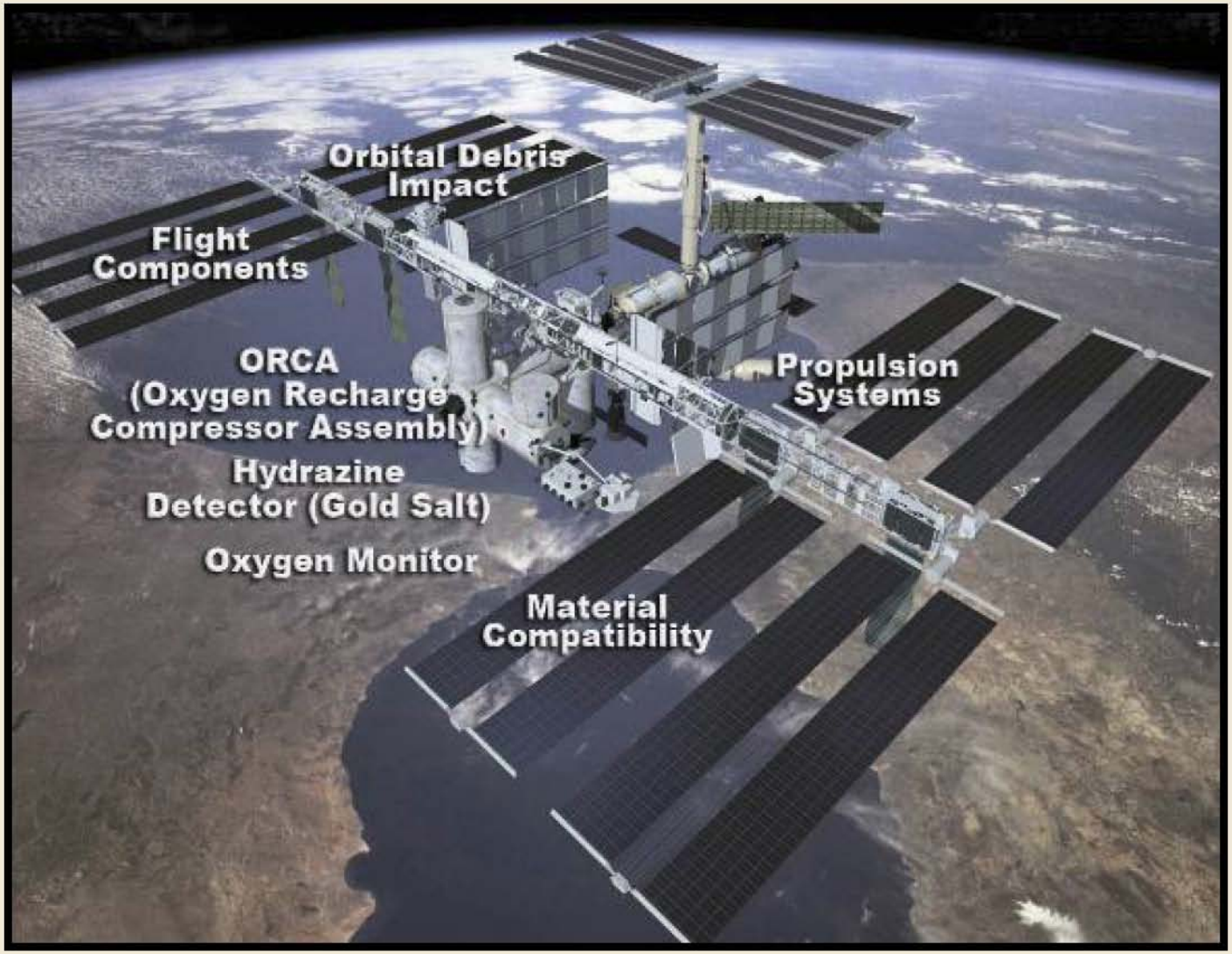
Shuttle: Test and Evaluation



Acronym List

- APU – Auxiliary Power Unit
- ARCS – Aft Reaction Control System
- COPV – Composite Overwrapped Pressure Vessels
- FRCS – Forward Reaction Control System
- OMS – Orbital Maneuvering System

ISS: Test and Evaluation

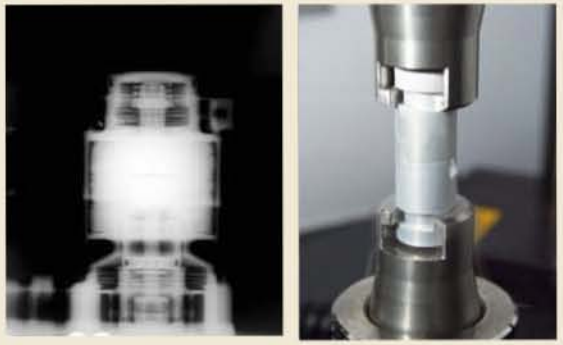


Laboratories Test

MDAL/Offgassing Laboratory

Space Environment Simulation Laboratory

Chemistry & Metallurgy Laboratories

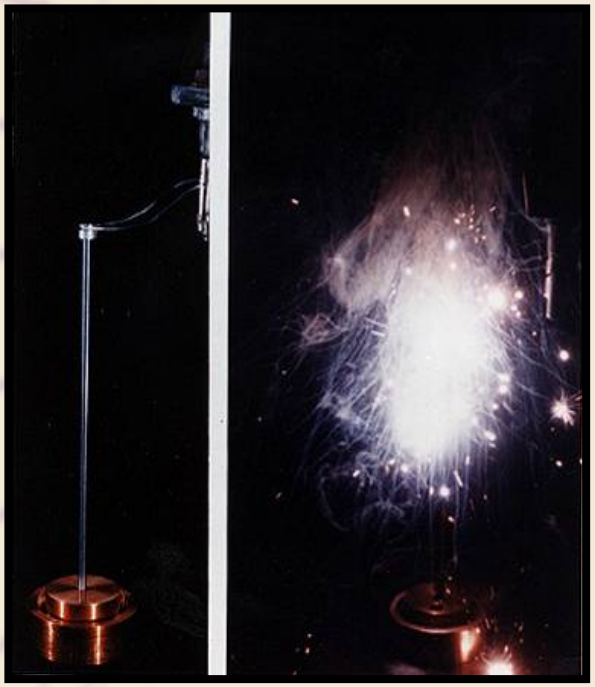


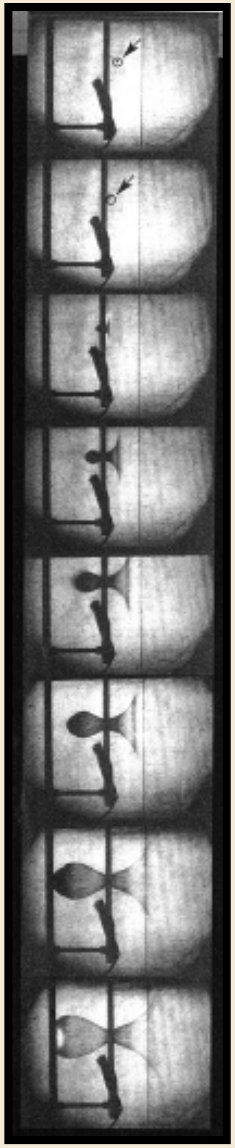
Metallurgy Laboratory

Propellant Laboratories

Instrumentation, Analytical, and Gas Analysis Laboratories

Laboratories Test





- Micrometeoroid/Debris Hypervelocity Impact Testing
- Propellant and Explosion Hazards Assessment
- Research on Flammability of Materials including Metals in Oxygen-enriched Atmospheres

Laboratories Test

Components Failure Test and Analysis

Molecular Analysis of Surface Effects using X-ray Photoelectron Spectroscopy

Hardware Processing

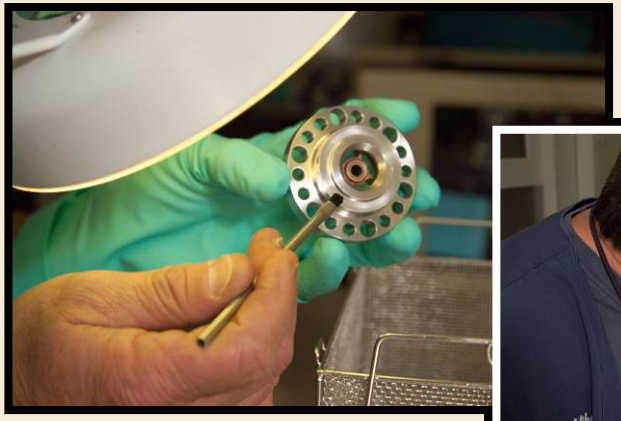
Flight Critical System Components Refurbishment

Critical Flight Hardware Assembly

Flight Hardware Production

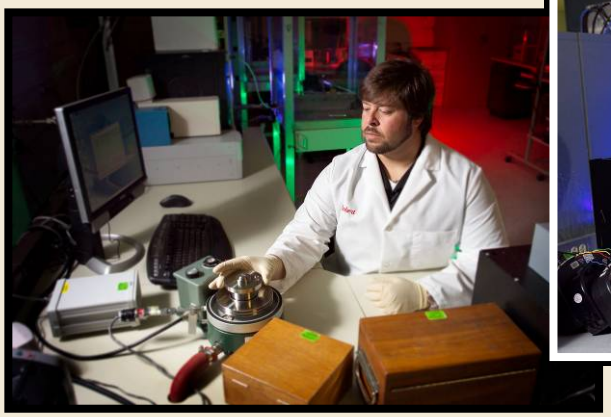
Hardware Processing

Precision Cleaning of Flight Critical Items

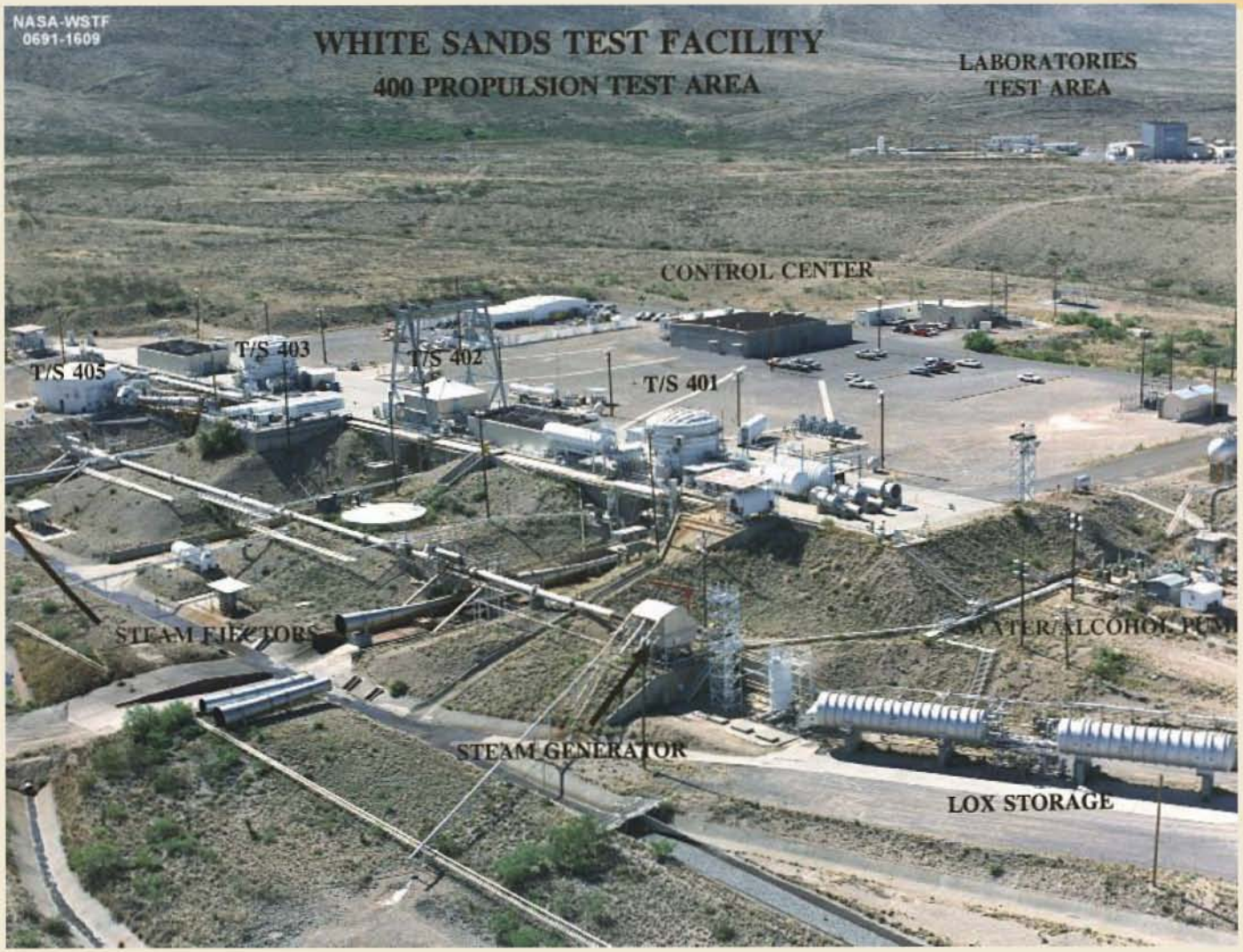


Industrial and Scientific Imaging and Documentation

Measurement Standards and Calibration Lab



Propulsion Test



Propulsion Test