National Aeronautics and Space Administration

Marshall Space Flight Center
Structural Strength Test Lab

Engineering Solutions for Space Science and Exploration


SLS Engine Section


SLS Intertank


SLS Hydrogen Tank


SLS Oxygen Tank

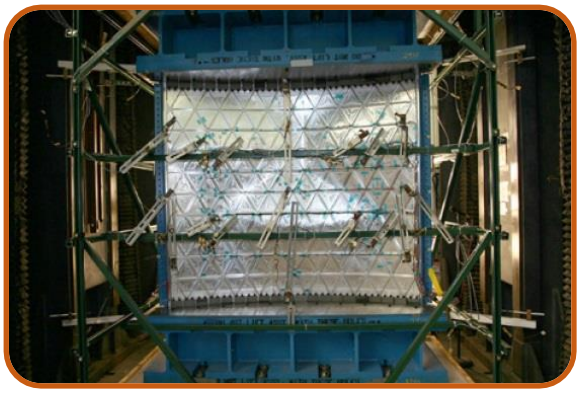

SLS ISPE

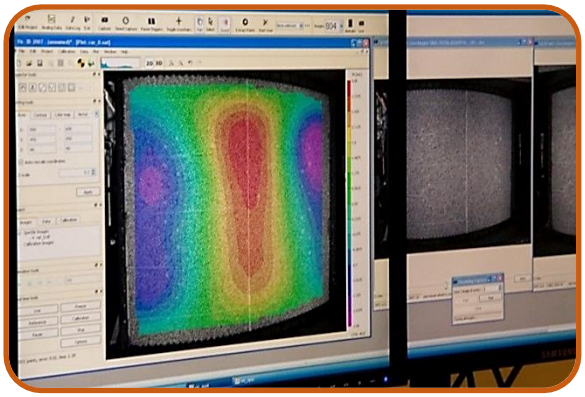

Shell Buckling

Marshall's Structural Strength Test Lab

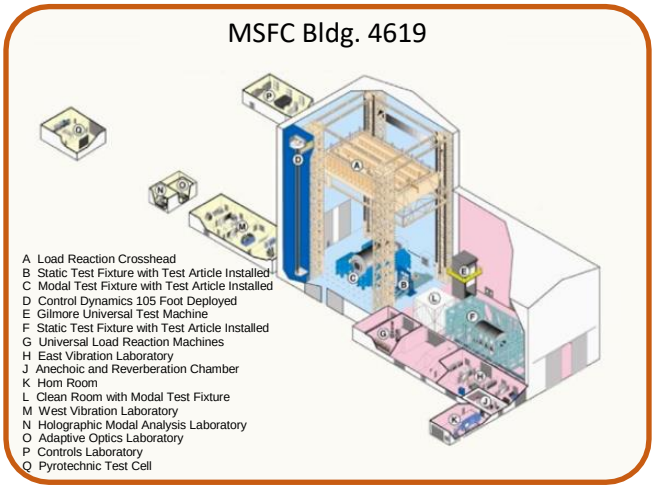
has unique capabilities and experience to apply and react millions of pounds of mechanical loads in compression, tension, and laterally on various size structural test articles. There are multiple facilities and reaction structures with the capability for testing large and small structures. Environmental profiles (including heat, cryogenic, vacuum, humidity, etc.) can be simulated during load testing.

Mechanical loads are applied using closed-loop hydraulic actuator systems with calibrated load cells. Data systems measure, record, and display in real-time strain, displacement, temperature, pressure, flow, etc. Pressure loads can be applied with positive or vacuum pressures. Facility supplies 4,330 psig gaseous Nitrogen, 3,500 psig high purity air, and pumps are available up to 100,000 psig for hydrostatic testing.


Ares I Upper Stage Isogrid Panel Test


Video Image Correlation Data View

MSFC Bldg. 4619



Building 4619 is a high bay test facility that provides laboratory space, test cells, and utility support for static and dynamic testing. The concrete floors include anchor points for bolting down Special Test Equipment (STE) fixtures for structural tests, and overhead cranes support lifting and handling operations for test build-up. Building 4655 provides conditioned high bay with overhead crane, and includes 3 universal test fixtures for quickly building reaction structure for small and intermediate sized structural strength tests. Test Stands 4693, 4697, and 4699 are located in the West Test Area to support hazardous testing of large structural test articles, including pressurized tanks and cryogenic tests. Concrete floor hole patterns are universal between 4619 LTA, 4693, and 4697. Large STE built to support the SLS Structural Qualification Tests are also available for re-use.

Capabilities

Large Structural Tests

- **4619 Load Test Annex (LTA) High Bay**
  - High Bay Dimensions: 161 ft. W x 169 ft. L x 155 ft. H
  - High Bay Door: 60 ft. wide x 75 ft. tall
  - Concrete reaction floor: 80 ft. x 80 ft. x 11 ft. thick
    - 2356 anchors on 18" grid: 110klbf axial, 18klbf shear each
  - Adjustable Crosshead: 40 ft. to 115 ft. elevation
    - 30Mlbf vertical, 2.4Mlbf lateral load
  - Overhead Cranes: (2) 30-ton bridges, (2) 15-ton hooks each
  - Overhead Hoist: 50-ton fixed in center of crosshead
- **4619 Load Test Annex Extension (LTAE) High Bay**
  - High Bay Dimensions: 95 ft. W x 203 ft. L x 97 ft. H
  - High Bay Door: 40 ft. wide x 40 ft. tall
  - Concrete reaction floor: 70 ft. x 160 ft. x 10 ft. thick
    - 106 anchor pads on 10 ft. grid: 340klbf axial, 44klbf shear each
  - Overhead Cranes: (2) 25-ton bridges, 20-ton and 5-ton hook each
- **4693 Cryogenic Structural Test Stand - outdoor**
  - Accommodates test articles: 35 ft. diameter x 165 ft. L
  - Concrete reaction floor: 40 ft. x 48 ft. x 16 ft. thick
    - 924 anchors on 18" grid: 110klbf axial, 18klbf shear each
  - Adjustable Crosshead: 20 ft. to 165 ft. elevation
  - Overhead Hoist: 200-ton fixed in center of crosshead
  - Stand Reaction Capability: 3.2Mlbf axial, 340klbf shear, 2 axis
- **4697 Cryogenic Structural Test Stand - outdoor**
  - Stand Dimensions: 60 ft. W x 60 ft. L x 85 ft. H
  - Concrete reaction floor: 60 ft. x 60 ft. x 7 ft. thick
    - 1681 anchors on 18" grid: 110klbf axial, 18klbf shear each
  - Stand Reaction Capability: 480klbf shear @ 85 ft., 2 axis
  - Load Spiders + pedestals for axial load: 9,000klbf
- **4699 Cryogenic Structural Test Stand - outdoor**
  - Accommodates test articles: 55 ft. tall x 33 ft. diameter
  - Stand Reaction Capability: 250klbf shear @ 65 ft., 1 axis
  - Load Spiders + pedestals for axial load: 2,400klbf.

Intermediate and Small Structural Tests

- **4655 High Bay**
  - High Bay Dimensions: 60 ft. L x 135 ft. W x 50ft H
  - High Bay Door: 20 ft. wide x 30 ft. tall
  - Overhead Crane: 1 bridge, 25-ton hook
  - Universal Test Frames: 6'Cube(10klb) 10'Cube(50klb) 20'Cube(100klbf)
- **4619 Tensile Test Machines**
  - 120klbf Satec Machine - 2Mlbf Machine
  - 260klbf Instron Machine - 3Mlbf Gilmore Machine

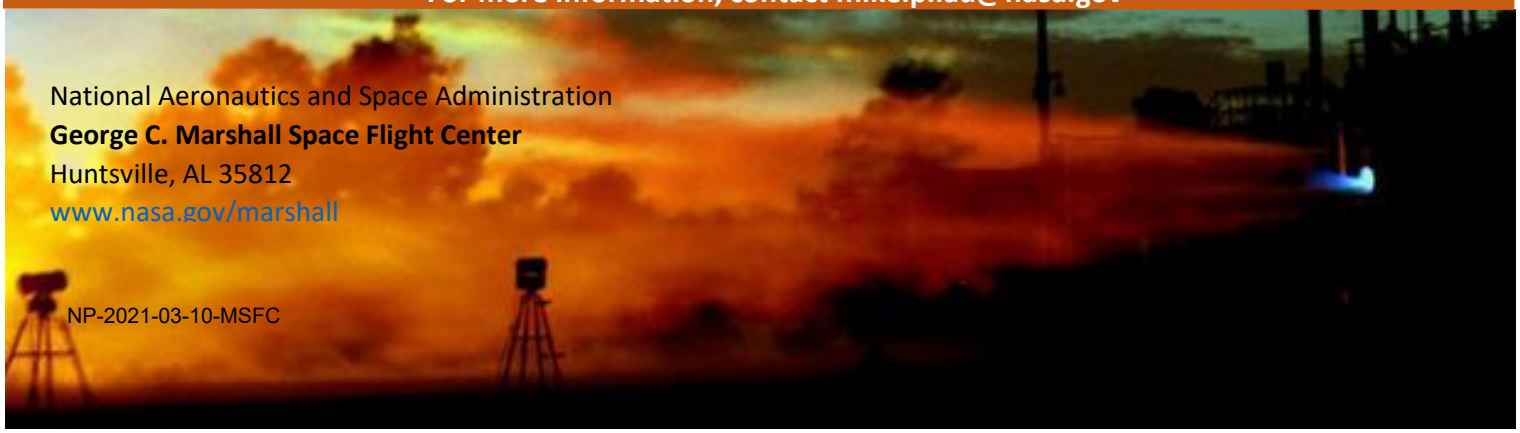
Load Control and Data Acquisition

- **MTS FlexTest 200 Load Control System**
  - 7 standalone systems, 376 total channels
- **Structural Loads Test Measurement Acquisition System**
  - 13,568 total channels strain, deflection, load, and pressure
  - 3,392 total channels thermocouple, 848 channels RTD
  - Real-time data monitoring, plotting, and comparison to predictions
- **Instrumentation**
  - Large inventory of load cells, displacement transducers, pressure transducers, strain gages, thermocouples, etc.
  - Extensive equipment and technicians with 25+ years of experience installing strain gages on multiple substrates for various environments.
- **Video Image Correlation**
  - Calibrated Cameras pairs
  - Full field-of-view strain and deflection measurements
  - Real-time color contour displays during test
- **Other Services**
  - Fixture fabrication, valve lab, calibration facility, and lifting & handling crews are available on site
  - High-speed video photography
  - High Definition real-time video display and recording

Key Benefits

- Capable of providing proof, limit, failure, development, qualification, or flight acceptance levels and environments of testing.
- Unique experience and test facilities to meet customer's needs.
- Machine shop and fabrication capabilities to react and respond quickly to customer requirements and changes.

For more information, contact mike.p.lau@nasa.gov



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NP-2021-03-10-MSFC