



Launch Environment

Rocket boosters and spacecraft are subject to intense acoustic environments during launch, which induce high levels of vibration in structural elements and equipment. In addition, elastic structural interactions with propulsion systems and flight control systems can produce low-frequency, high-deflection flight instabilities. Johnson Space Center (JSC) offers a wide range of tests needed to evaluate all aspects of structural dynamics, including vibration, vibroacoustics, modal characteristics, sound transmission loss, and shock testing. JSC also provides structural static and fatigue load testing for payloads and spacecraft structures. Tests range from mechanical properties test of materials to full-scale verification test of payloads and spacecraft structures. Site facilities provide the capability to perform test and evaluation of both aerospace and nonaerospace hardware.

Services Provided

- Simulations of broadband random vibrations induced in spacecraft by external acoustic pressures
- Sine sweeps to identify resonances
- Vibration of hazardous test articles, including pressurized systems and explosive materials – vibration in a thermal environment
- Vibroacoustic structural testing to high sound pressure levels of large structures, components, and small subsystems
- Static and fatigue load testing using single or multiple actuators up to 220,000 lb
- Tension and compression testing – load or displacement control
- Cyclic testing up to 100 Hz
- Fracture mechanics property testing
- Tensile, lap shear, and compression testing of materials at low and elevated temperatures – fatigue and fracture coupon tests
- Modal characteristics
 - Natural frequencies
 - Damping ratios
 - Mode shapes
- Mathematical or FEA model correlation



Structural Testing

Features

- Twelve load frames can be operated in tension and compression and either load or displacement control.
- Cyclic testing up to 100 Hz, depending on the load and stroke
- Ten load frames can be configured for fracture mechanics property testing, including automated da/dN testing.
- Actuators are controlled up to 6 stroke or 32 load control channels or any combination of both.
- Sizable inventory of linear resistive deflection potentiometers, displacement and velocity transducers, LVDT deflection transducers, RVDT angular displacement transducers, thermocouples, and force washers

Parameter	STL
Load capacity	Up to 220,000 lb _f
Actuator capacity	Up to 150,000 lb _f
Stroke range	6" – 57"
Temperature range	-300 – 800 °F

Vibration Testing

Facility	Frequency Range	Shaker Size Range	Load Direction	Displacement
General Vibration Laboratory	5 – 3000 Hz	4,000 – 40,000 lb _f	x, y, or z	1" to 2" peak-to-peak
Spacecraft Vibration Laboratory	5 – 2000 Hz	50 lb _f shakers up to 8 x 10,000 lb _f shakers	x, y, or z	2" peak-to-peak
Hazardous Vibration Test Stand	20 – 2 000 Hz	11,000 lb _f RMS Up to 16,000 lb _f sine Up to 15,500 lb _f random	x, y, or z	1" stroke

Acoustic Testing

Facility	Facility Size	Sound Pressure Level
Spacecraft Acoustic Laboratory	Chamber size: ~39' x 47' x 75' high Ceiling can be lowered to ~33' high	<u>High ceiling</u> 152 dB (current) 162 dB (future) <u>Low ceiling</u> 155 dB (current) 165 dB (future)
Sonic Fatigue Laboratory	Chamber size: ~19' x 40' x 16'	158 dB (current) 167 dB (future)

Modal Test and Analysis

- Input excitation – flexible
 - Sine, random, burst random/chirp, sine on random (shaker driven)
 - Impact (impact hammer driven)
 - Operational (vibrating) test article
- Shakers – wide array
 - Up to 500 lb capacity with single or multiple shakers
 - Impulse hammers available
- Boundary condition capability – fixed-base, free-free – large seismic mass bases up to 20,000 lb

We have developed customer-friendly agreements to streamline business relationships and are eager to share our unique facilities and expertise with new customers. We invite your inquiries regarding application or adaptation of our capabilities to satisfy your special requirements. Briefings on general or specific subjects of mutual interest can be arranged at JSC or at your business site.

Facility Testing Information

<http://jsceng.nasa.gov>

Point of Contact

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