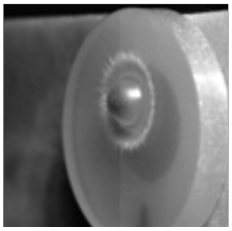
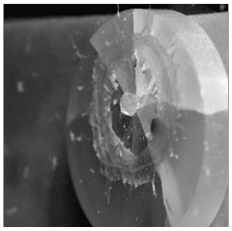
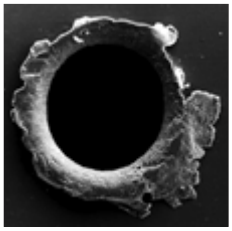
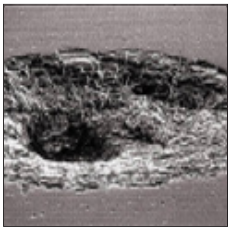
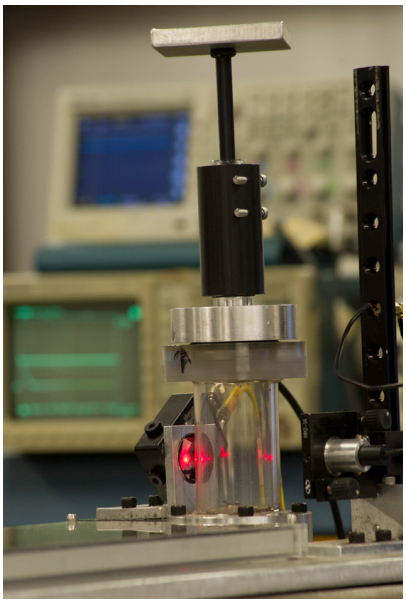
National Aeronautics and
Space Administration

Marshall Space Flight Center

Impact Testing Facility

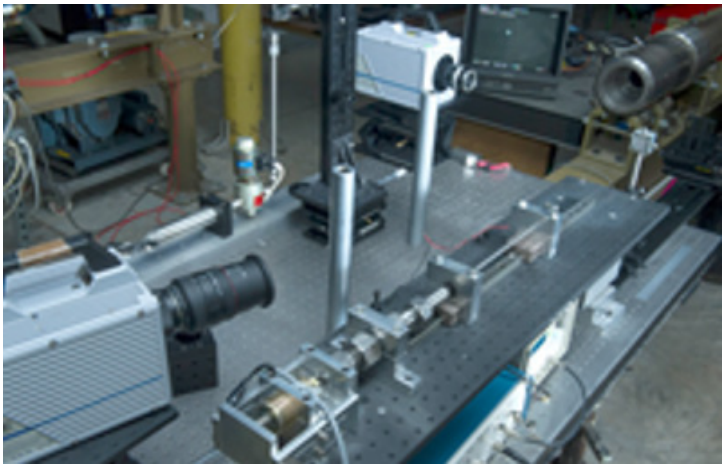
The MSFC Impact Testing Facility (ITF) houses eight gun systems for conducting ballistic and hypervelocity impact tests. The systems use a wide range of projectile and target sizes and shapes at velocities from subsonic through hypersonic and simulate impacts ranging from rain to micrometeoroids and orbital debris in the evaluation of materials and components for flight and ground-based systems. The systems include a two-stage light gas gun, electric, gas, and powder guns, and specialty guns for weather encounter studies.



The ITF 'rain gun' is the only hydrometeor impact gun in the United States that can provide single impact performance data with known water-drop sizes.

The ITF provides testing, custom test configuration design and fabrication, and analytical services in a secure facility. The ITF performs tests that are subject to International Traffic in Arms Regulations and Department of Defense (DoD) secret classified restrictions, as well as proprietary and unrestricted tests for NASA, the DoD, academic institutions, international space agencies, and private industry.

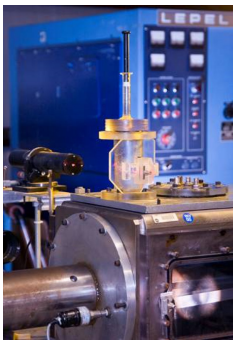
The ITF provides low-cost methods for testing and validating materials and hardware components, which help define follow-on system-level testing normally accomplished by large-scale facilities. Full-scale flight hardware impact testing is available using the ITF's combination indoor/outdoor range.



The microballistic powder gun has target heating capability and excellent impact accuracy at consistent velocities.

These impact test capabilities enhance Marshall's unsurpassed competencies in simulating harsh space environments. By combining impact testing with MSFC's charged particle radiation, ultraviolet radiation, atomic oxygen, and plasma testing facilities and expertise, scientists and engineers can fully examine how the space environment affects materials and systems.

ITF Gun Systems



Hydrometeor Impact Gun (HIG):

- Provides rain impact performance data with a defined single droplet size.
- Used for weather encounter test and evaluation.
- Velocity: Up to 4,800 ft/s with sample mass dependency
- Drop diameters: 1.5 to 5 mm (0.06 to 0.2 in.) (normal rain drop size)
- Specimen size: 19-mm (0.7-in.) diameter

Combined Effects Particle Impacts (CEPITF):

- Simulates rain-drop impacts using 2, 3, and 4 mm (0.04 to 0.12 in.) nylon beads.
- Target heating: 350 to 2000 °C
- Target chamber: 20 in. diameter
- Target size: up to 2 in. diameter (50mm)
- Velocity Range: 2,000 – 10,000+ ft/s (Mach 1.8 – 9)

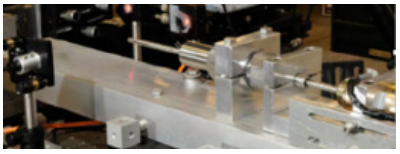
Small Ballistic Gun (SBG):

- Performs small subsonic/ transonic impacts from 50 to 1,500 ft/s.
- Velocity: Up to 1,500 ft/s projectile mass dependent
- Barrel diameter: 0.013 m (0.5 in.), 0.025 m (1 in.), 0.031 m (1.2 in.) for hail
- Projectile size: 25-cm (1-in.) diameter maximum

Large Ballistic Gun (LBG):

- Shoots projectiles of large mass and size at subsonic and transonic velocities.
- Velocity: up to 2,000 ft/s projectile mass dependent
- Barrel diameter: 76.2 mm (3 in.), customizable to 152 mm (6 in.)
- Projectile diameter: Maximum 0.069 m (2.75 in.)
- Target size: Up to and including full-scale flight hardware

Microballistic Powder Gun (MBPG):



- Velocity: Up to 6,000 ft/s (Mach 5.5)
- Projectile Diameter: 1.18 mm, 2 mm, 3 mm, 4 mm
- Target Size: 25 × 25 mm (1 × 1 in.) up to full-scale hardware
- 5 to 90 degree impacts available size dependent
- High Speed Digital Video

Recent Innovations

The microballistic guns have heating capabilities up to approximately 1,200 °C (approximately 2,200 °F), which expand the usefulness of the ITF to determine the effects of high temperatures on materials being impacted during reentry and travel through Earth's atmosphere.

National Aeronautics and Space Administration

Marshall Space Flight Center
Huntsville, AL 35812
www.nasa.gov/center/marshall

www.nasa.gov/

MSFC-02-2025-G-657270 (19)

Doing Business With MSFC