

Plum Brook Facilities in Sandusky, Ohio NASA Glenn Research Center

Plum Brook's world-class facilities are capable of emulating environmental conditions like those found on Earth, in low Earth orbit, on planetary surfaces, or in deep space.

Facility Description

The **Space Power Facility (SPF)** is the world's largest space environmental simulation chamber measuring 100 ft in diameter by 122 ft high. This facility was designed to test nuclear and nonnuclear space hardware in a simulated space and/or planetary environment. Three new space environment capabilities have been recently added to the facility: the world's most powerful spacecraft acoustic test chamber, the world's most powerful low-frequency mechanical vibration test stand, and the capability to perform reverberant mode electromagnetic interference/compatibility (EMI/EMC) testing. The facility is now capable of performing a full suite of testing services simulating a complete space mission from launch to deep space environments—all under one roof.

The **Spacecraft Propulsion Facility (B-2)** is a one-of-a-kind facility capable of testing full-scale, upper-stage launch vehicles and rocket engines under simulated high-altitude conditions. The engine or vehicle can be exposed for indefinite periods to low ambient pressures, low background temperatures, and dynamic solar heating that simulate the environment the hardware will encounter during orbital or interplanetary travel.

The B-2 facility is capable of accommodating large quantities of hazardous commodities such as liquid hydrogen. This makes B-2 an ideal facility for full-scale testing of in-space propellant storage and transfer systems.

The **Hypersonic Tunnel Facility (HTF)** was originally designed to test nuclear thermal rocket nozzles. HTF is a hypersonic (Mach 5, 6, and 7) blowdown, nonvitrated freejet and direct-connect facility that tests large-scale hypersonic air-breathing propulsion systems. This facility contains a large "stand-alone" experimental infrastructure that can be readily reconfigured to test a variety of ground test applications including high-energy, high-risk testing.

The **Cryogenic Components Laboratory (CCL)** is capable of small-scale testing of components such as bearings, seals, and related equipment under cryogenic operating conditions. The CCL also provides capabilities for the densification and conditioning of cryogenic propellants. All test activities at the CCL are conducted from a 7,500-sq-ft remote-control room equipped with programmable logic controllers and a high-speed data acquisition system.



Ariane 5 payload fairing test in the SPF.

Facility Benefits

- Features four unique, world-class facilities
- Remote test installation site
- Large amount of acreage for diversity in testing
- Provides safe, cost-effective, responsive, and reliable performance of research testing
- Accommodates NASA, private industry, and other government research and development programs for space flight hardware
- Highly qualified staff of technicians, engineers, and operators
- Established history of high customer satisfaction

NASA Programs and Projects Previously Supported

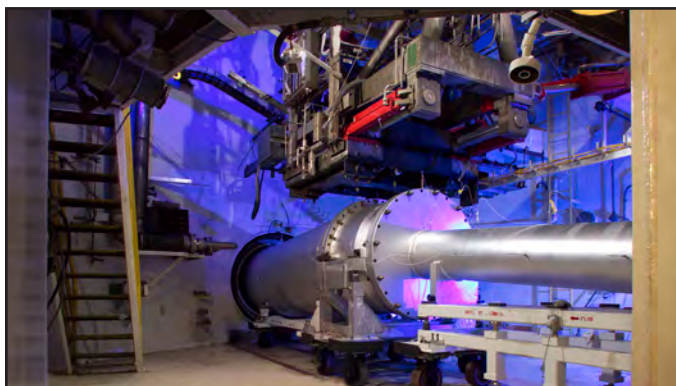
- Mars exploration rover airbag landing system
- International Space Station radiator deployment
- High-energy experiments
- Rocket-fairing separation tests
- Integrated System Test of an Air-Breathing Rocket (ISTAR) Direct Connect Combustion Rig
- High-altitude balloon payloads
- Centaur Upper Stage development testing

Non-NASA Programs and Projects Supported

- European Space Agency Mars Lander System
- European Space Agency Ariane 5 Fairing Separation
- Ion Engine Development
- Extended Expendable Launch Vehicle (EELV) Payload Fairing Separation
- Boeing Delta III Upper Stage Testing

Space Facility Test Capabilities

	SPF	B-2
Dimensions (diameter by length)	100 by 125 ft	38 by 62 ft usable
Vacuum system	(10) 52-in. cryopumps (16) 48-in. ODP (5) turbopumps	(10) 32-in. ODP
No load pressure, torr	1×10^{-6}	5×10^{-7}
Pumping speed liter/sec, air	1,300,000	350,000



Overview of the interior of the HTF.

Facility Testing Information

<http://facilities.grc.nasa.gov>

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Contacts

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Aero Facility Test Capabilities

HTF Hypersonic	
Test section free-jet Mach number	5, 6, 7
Simulated alt., ft	68,000 to 120,000
Test section Reynolds number per ft	0.97×10^6 to 2.3×10^6
Dynamic pressure, lbf/ft ²	300 to 2,200
Test section total temperature, °R	Ambient to 3,900
High-pressure gas storage, scf	675,000 GN ₂ at 4,500 psi 386,000 GO ₂ at 2,200 psi
Fuels	Gaseous H ₂ and O ₂ ; Liquid hydrocarbon (jet fuels) and natural gas
Other capabilities	Direct-connect testing at Sea Level Static (SLS) to Mach 7 condition



Boeing Delta III upper stage test at the B-2 test facility.