



MATERIALS ENVIRONMENT TEST COMPLEX

Purpose:

To test new materials for space flight applications.

The MSFC Materials Environment Test Complex (METCO) provides a one-of-a-kind test capability. The testing simulates flight profile aerothermal environments and material performance patterns in a single test environment. For anomaly investigations, screening tests, and development programs, the facility offers customers substantial schedule, test flexibility, and cost benefits over larger test facilities. The METCO also offers thermal imaging support to provide its customers with real-time thermal response and gradients of the test article. Portable systems are available for performing instrumentation and testing, as well as data acquisition and reduction, either on-site or in other locations.

METCO encompasses several test stations, including a Mach 4 combustion-driven wind tunnel (Improved Hot Gas Facility), a radiant heat lamp system, a 1-million-pound tensile test station, a thermal acoustic test station capable of delivering 170 dB (low- and high-frequency ranges), and elaborate data acquisition systems. A hyperthermal test station is under construction, and a cryogenic biaxial test capability is in design. The METCO has tested material in this state-of-the-art facility for use in America's premier space fleet – the Space Shuttle Orbiter, External Tank, Solid Rocket Boosters and Motors, as well as the Titan and Delta rockets.



Improved Hot Gas Facility (IH&F)

The IHGF is a unique, world-class GH_2 /air combustion-driven wind tunnel used primarily for thermal protection system testing and aerothermal definition. During a test, combustion products are expanded from the combustion



chamber through a 2-dimensional nozzle into a 16-in. x 16-in. test section. A Mach 4 flow environment is induced, and up to 30 Btu/ft² /sec of convective heating can be obtained. The tunnel has been upgraded to include a 300-kW radiant heat lamp system, a model insertion system with varying wedge angle, and improved tunnel control capabilities. The radiant heat lamp system supports combined heat inputs in the wind tunnel and can be used to apply radiant-only heating to test articles.

Large-Capacity Tensile Test Station

A recent addition to the METCO is the tensile test station. This test capability offers uniaxial load testing for large test articles. The station is capable of up to one-half million pounds of tension at typical metallurgical testing strain rates. These tests can be conducted at cryogenic, ambient, and elevated temperatures ranging from -450 °F to 800 °F. The test articles may be up to 2 ft wide and 4 ft long.



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Cryogenic Biaxial Loads Facility

This facility, in the design phase, will be able to induce tensile loads of up to 1.0 million pounds in each axis onto a test article up to 10 ft square. By limiting the test article to 6 ft square, the environments from the Thermal Acoustic Facility may be combined with this facility to make a world-class facility capable of biaxial loads, acoustics, radiant heat, and cryogenic conditioning.



Hyperthermal Convective Test Facility

This facility is used to test the thermal and ablative response of materials that insulate the Redesigned Solid Rocket Motor (RSRM) nozzle. The gas compositions and temperature conditions representative of those encountered in the RSRM nozzle are simulated in this facility and used to develop and qualify new materials for flight.



Thermal Acoustic Facility

This facility was developed in 1997 for advanced space transportation thermal protection system and is capable of duplicating the key acoustic loading and surface temperatures environments of the X-33 hypersonic flight. The facility was modified in 1998 to double the acoustic energy to test Space Transportation System External Tank thermal protection system materials. At present, this facility can deliver radiant heat from 0 to 30 Btu/ft²/sec and up to 172 dB onto a test article up to 6 ft square. Test articles can also be cryogenically conditioned.

Environmental Gas Laboratory (EGL)

The EGL routinely analyses all MSFC gases to ensure that specifications for use are met. This includes analysis for total hydrocarbons, moisture, particulates and other possible contamination found in breathing air, nitrogen, oxygen, helium and hydrogen used throughout the Center.

Propellants and Reactive Fluids Test Facility

The Propellants and Reactive Fluids Test Facility is available to test fuels, oxidizers, monopropellants and other reactive fluids for compatibility with various metallic and non-metallic structural materials. High-Test Hydrogen Peroxide (HTP) has been examined extensively using techniques associated with this facility.

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