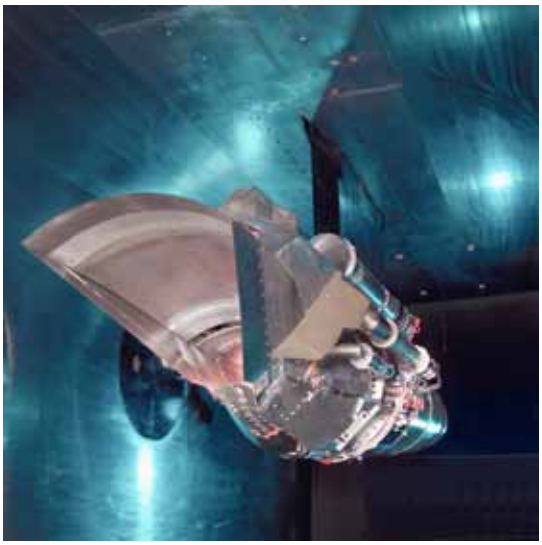
National Aeronautics and Space Administration

NASA's **Aeronautics Test Program**

10- by 10-Foot Supersonic Wind Tunnel

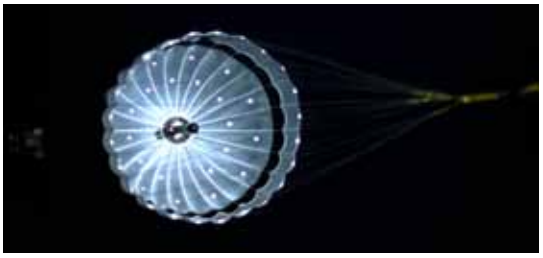
Throughout its history, the 10- by 10-Foot Supersonic Wind Tunnel (10×10 SWT) has made valuable contributions to the advancement of fundamental supersonic propulsion technology. Researchers have used the facility to aid in the development of the Atlas-Centaur, Saturn, and Atlas-Agena-class launch vehicles, and for such vehicle-focused research programs as the High-Speed Civil Transport, the National AeroSpace Plane, and the Joint Strike Fighter.

The test section is large enough to accommodate large-scale models and full-size aircraft components. The 10×10 SWT was specifically designed to test supersonic propulsion components such as inlets, nozzles, and full-scale jet and rocket engines. It also has been effectively utilized for force balances models and spacecraft reentry decelerator testing.



From left to right: Parametric inlet model, operators monitor a test from the control room, Active Inlet Flow Control (AIFC) fan and bellmouth installed in test section, and Mach 5 inlet.

Rocket-based Combined Cycle (RBCC) Test



MSL Parachute

2D Unstart Test

Facility

- The 10 by 10 foot Supersonic Wind Tunnel (SWT) facility is the largest wind tunnel at NASA Glenn Research Center. It is a dual-cycle wind tunnel that can operate as a closed-loop (aerodynamic cycle) or an open-loop (propulsion cycle) system.

Facility Benefits

- Calibrated and documented test section conditions.
- Equipped with model support systems (hydraulics, exhaust, high-pressure air, fuels, etc.)
- Offers continuous operation across the entire speed and altitude regime, allowing greater flexibility and productivity during testing.
- Capable of expanding local Mach number range with gust and Mach plates.
- Employs an experienced staff of technicians, engineers, researchers and operators.

Facility Applications

- Development of launch vehicles
- Aircraft and missile development
- Inlet performance and operability
- Propulsion system integration
- Jet and rocket engines
- Supported programs and projects including the High-Speed Civil Transport, National AeroSpace Plane (NASP), space shuttle, and Joint Strike Fighter (JSF)
- Entry, Descent and Landing (EDL) technology development for parachutes and inflatable decelerators.

Characteristics

Test section dimensions	10 ft high by 10 ft wide by 40 ft long	
Speed	Mach 0 to 0.36 and 2.0 to 3.5	
	Aerodynamic cycle	Propulsion cycle
Simulated altitude	50,000 to 154,000 ft	57,000 to 77,000 ft
Reynolds number	0.1 to 3.4×106 per ft	2.2 to 2.7×106 per ft
Dynamic pressure	20 to 720 psf	500 to 600 psf
Temperature	540 to 750 °R	520 to 1,140 °R
Fuels	Liquid jet fuel, gaseous hydrogen, and gaseous oxygen	

Instrumentation

Pressure measurement Electronically scanned pressure (ESP) system	 832 ports, ±15 psid 192 ports, ±30 psid
Temperature measurement Thermocouples	 48 (type K) 24 (type J, T, or R)
Flow visualization/optical techniques	Schlieren system, sheet laser, pressure-sensitive paint, high-speed video, and Particle Image Velocimetry (PIV)

Data Acquisition and Processing

Steady State Data Acquisition	Real-time acquisition and display of up to 256 engineering unit converted data channels and up to 8,000 calculated channels in tabular or graphical formats with 1 to 2 updates per sec. Analog input accuracies of better than ±0.05% of range (±5 to 10,240 mV) are provided. Custom application-specific features (customer system integration, remote data access, secure testing, to name a few) are available upon request.
Dynamic Data Acquisition	Engineering unit converted data channels (63) and calculations are acquired and displayed on real-time tabular, X–Y, FFT, scope, and other displays. Un-aliased bandwidths of 420 Hz to 44 kHz are provided by a 24-bit A/D per channel sampling at 1000 to 200,000 samples/sec. Data can be transferred in near real-time to customers in standard or custom data formats. Channels can be added, in groups of 63, to meet customer requirements.

Contact Information

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