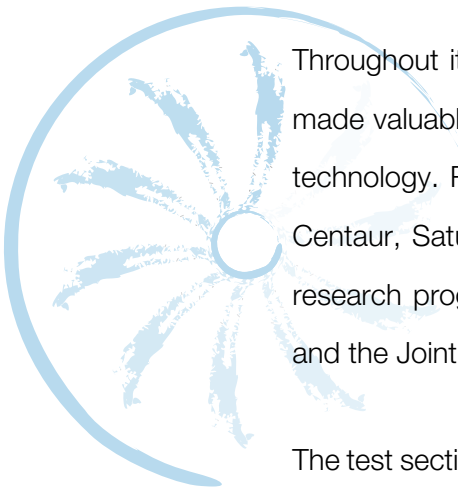




NASA's Aeronautics Test Program

10- by 10-Foot Supersonic Wind Tunnel

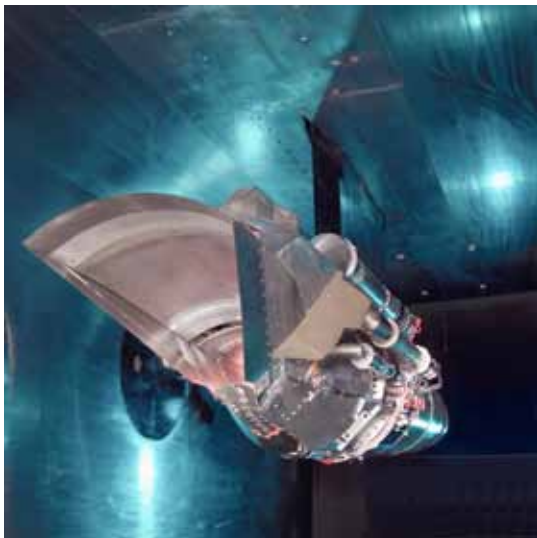


Throughout its history, the 10- by 10-Foot Supersonic Wind Tunnel (10x10 SWT) has made valuable contributions to the advancement of fundamental supersonic propulsion technology. Researchers have used the facility to aid in the development of the Atlas-Centaur, Saturn, and Atlas-Agena-class launch vehicles, 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 10x10 SWT was specifically designed to test supersonic propulsion components such as inlets, nozzles, and full-scale jet and rocket engines. It also has

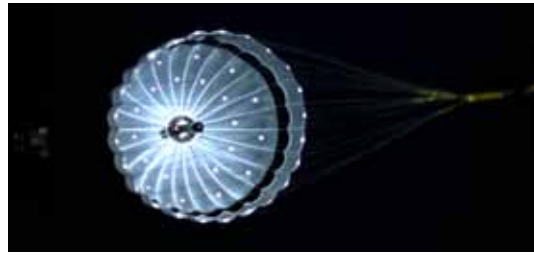
been effectively utilized for force balances models and spacecraft reentry decelerator testing.

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.

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 3.4×10 ⁶ per ft	2.2 to 2.7×10 ⁶ 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	

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.

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.

Instrumentation

Pressure measurement	
Electronically scanned pressure (ESP) system	832 ports, ±15 psid 192 ports, ±30 psid
Temperature measurement	48 (type K)
Thermocouples	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)

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