National Aeronautics and Space Administration

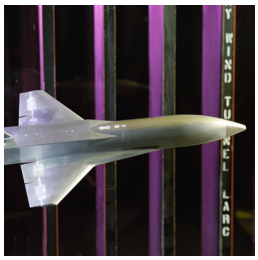
NASA's **Aeronautics Test Program**

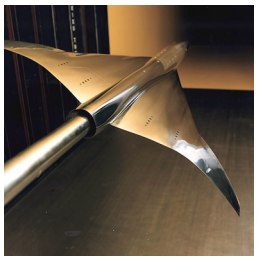
4-Foot Supersonic Unitary Plan Wind Tunnel

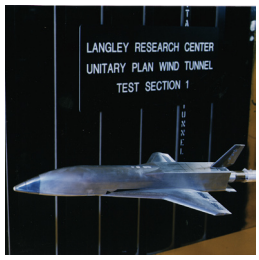
The 4-Foot Supersonic Unitary Plan Wind Tunnel (UPWT) is a closed-circuit, continuous-flow, variable-density supersonic tunnel with two 4- by 4- by 7-foot test sections. The tunnel is instrumented for force and moment studies, surface-pressure measurements, and flow visualization of on-and-off-surface flow patterns. Tests involving jet effects, dynamic stability, model deformation, global-surface and off-body flow measurements, and heat transfer can also be conducted.

The UPWT is equipped with asymmetric sliding-block-type nozzles for varying the ratio of nozzle throat to test section, thus providing continuous variation in Mach number. The low and high Mach number test sections are formed by the downstream contours of each nozzle.

The UPWT has made crucial contributions to the development, assessment, and optimization of advanced aerospace vehicle concepts. UPWT services have included database development during the configuration-design screening process; the initial phase in mission-specific configuration selection; and benchmarking aerodynamic and aerothermodynamic configurations for selected mission concepts.







Facility Benefits

- The tunnel duct circuit can be circumscribed by a 263- and 210-ft rectangle
- High-pressure air and cooling water lines are available at the test section for connection to model components
- Two model-buildup rooms are provided
- A calibration area provides instrumentation and propulsion air systems if quantification of deflection constants and propulsive tares are required
- Flow-visualization capabilities in both test sections include Schlieren, colored and UV oil flow, laser vapor screen, and fluorescent minitufts; optical-based techniques for measuring pressure, temperature, and model deformation are also available

Facility Applications

- Crucial contributions to the development, assessment, and optimization of advanced aerospace vehicle concepts
- Projects supported include major research programs such as the X–43 and X–43C; Joint Strike Fighter; DARPA's Quiet Supersonic Platform; and Ares launch system and Orion crewed spacecraft

Characteristics

Test section dimensions	4 ft high by 4 ft wide by 7 ft long
Area	16 ft^2
Speed	Mach 1.5 to 4.6
Reynolds number	6.0 to 11.0×10^6 per ft
Temperature	–1180 to 3190 °F
Test gas	Normal atmosphere
Drive power	100 000 hp

Instrumentation

Controllers	UNIX, Macintosh, and PC
Capacity/channels	Analog/128 and Digital/40
Customer computers	Yes

Data Acquisition and Processing

Strain gauge balances	Six component
Available corrections	Interactions, temperature effects, attitude tares, axes orientation, pressure tares, and momentum (flow) tares
Electronically scanned pressure (ESP) system	Up to 16 modules and 1024 pressures

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