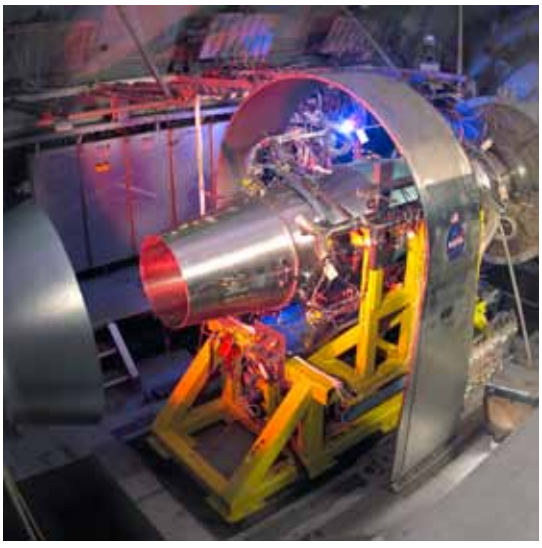
National Aeronautics and Space Administration

NASA's **Aeronautics Test Program**

Propulsion Systems Laboratory

The Propulsion Systems Laboratory (PSL) is one of the premier U.S. facilities for experimental testing of advanced air-breathing propulsion systems. In this facility, altitude simulations at true flight conditions are created from sea-level static to hypersonic regimes for advanced aircraft, space propulsion, and general aviation programs. PSL is NASA's only continuous flow, ground-based facility of its kind.

State-of-the-art test capabilities and techniques utilized in the PSL include multiaxis thrust measurement, vectored and reverse exhaust gas collection, infrared imaging at altitude, aeroelastic measurements, transient pressure, and/or temperature distortion simulations.



Top of page: Jet Engine Test Facility

From left to right: Turbofan engine test setup, technical staff sets up an F–404 engine for testing, and the recently updated PSL control room.

The Propulsion System Laboratory can support testing engines of various sizes.

Facility Benefits

- Creates temperature and pressure-inlet conditions that propulsion systems experience in high-speed, high-altitude flight
- Continuous flow facility with two test cells: PSL–3 and PSL–4
- PSL–3 simulates altitudes up to 70,000 ft and speeds up to Mach 3 for most engine applications; altitudes up to 90,000 ft are capable at lower airflows
- PSL–4 incorporates a high-temperature and high-pressure inlet plenum, addressing high-speed and high-altitude-propulsion-system test requirements for both aviation and space applications
- Axial and multiaxis thrust stand measurement up to 50,000 lbf
- Real-time, high-speed data acquisition and display
- Accommodates government and private industry test programs
- Infrastructure for secure test equipment
- Employs an experienced staff of technicians, engineers, researchers, and operators

Data Acquisition and Processing

Steady State Data Acquisition	Real-time acquisition and display of up to 976 engineering unit converted data channels and up to 8000 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 (126) 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 1,000 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.

Instrumentation

Pressure measurement Electronically scanned pressure (ESP) system	588 ports (each test cell)
Temperature measurement Thermocouples	432 (type K) 48 configurables
Gas analysis	Available upon request
Infrared imaging	Available upon request

Facility Applications

- NASA access to space propulsion
- National defense initiatives
- Commercial development
- Basic research
- Altitude engine icing
- Engine programs including F110, PW308, F100, F404, FJ33/44, PW545, and UAV

Characteristics

Test cell dimensions	24 ft diam by 39 ft long
Simulated altitude	5,000 to 90,000 ft
Simulated flight speed	
PSL–3	To Mach 3.0
PSL–4	To Mach 4.0
Inlet mass flow	
PSL–3 and PSL–4	To 480 lbm/s at 55 psia
PSL–4	To 380 lbm/s at 165 psia
Exhaust mass flow	To 750 lbm/s
Inlet total temperature	
PSL–3	–50 to 600 °F
PSL–4	–90 to 1,000 °F
Core testing capability (alternate air source)	
PSL–4	Up to 40 lbm/s at 1,200 °F Up to 100 lbm/s at 450 °F
Thrust measurement	
Axial	50,000 lbf
Vertical	15,000 lbf
Lateral	15,000 lbf
Fuel systems	Jet fuels (all types), hydrogen, and natural gas

Contact Information

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