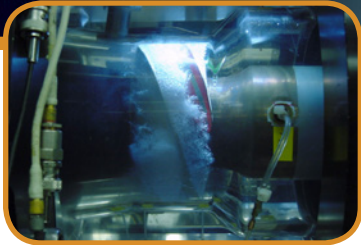


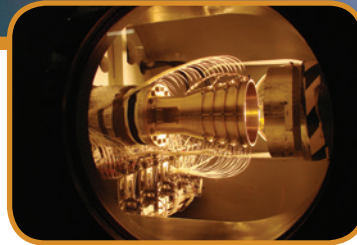


Marshall Space Flight Center Fluid Dynamics

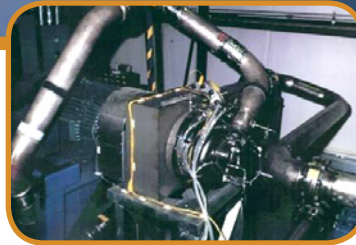
Engineering Solutions for Space Science and Exploration



SSME LOX Inducer.



SSME Derived Side Load Test in
the NTF.



PTE.



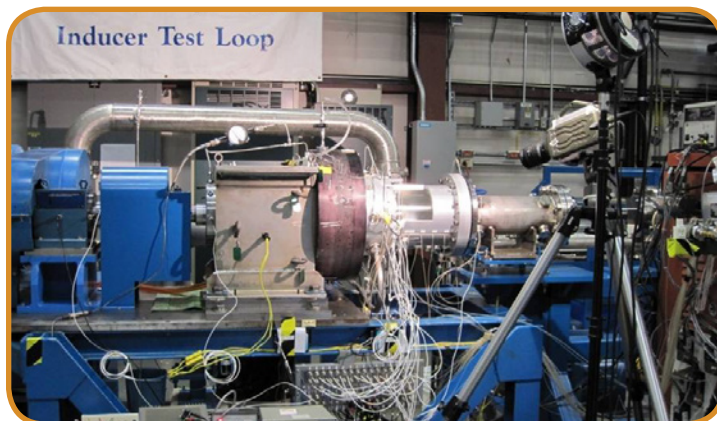
SSME Fuel Turbine.

Inducer Test Loop (ITL)

is a continuous flow water facility providing a controlled simulated environment for the study of suction performance and flow induced anomalies related to pump inducers and fuel supply systems for rocket engines.

Facility Performance/Technical Specifications

- Passive and active model configurations to study inlet duct and flow induced anomalies.
- Rotating balance for six-component force/moment measurement and slipring for on-blade instrumentation capability.
- Flow visualization utilizing acrylic models with high speed photography and laser doppler velocimetry (LDV) to document flow anomalies and environments.
- 50 horsepower with shaft speeds from 1,000 to 6,500 rpm and torque measurements to 110 ft-lbs max.
- Data system with 80 dynamic channels and 128 static channels gathered simultaneously.
- Deaeration of dissolved gas to two parts-per-billion.
- Inlet pressures from 50 psig to two psia and discharge to 275 psig.

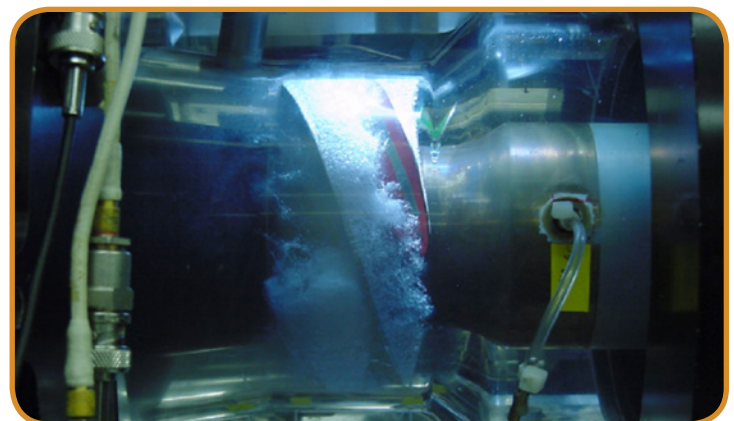


Pump Test Equipment (PTE)

is a continuous flow water facility providing a controlled simulated environment for the study of suction performance and flow induced anomalies related to pumps and fuel supply systems used in rocket engines.

Facility Performance/Technical Specifications

- 500 horsepower with shaft speeds from 1,000 to 8,000 rpm and torque measurement to 1,000 ft-lbs max.
- Rotating balance for six-component force/moment measurement and slipring for on-blade instrumentation capability.
- Inlet pressures from 100 psig to 4 psia and discharge to 580 psig.
- Deaeration of dissolved gas to four parts-per-million.
- Passive and active model configurations to study inlet duct and flow induced anomalies.
- Data system with 80 dynamic channels and 128 static channels gathered simultaneously.
- Flow visualization utilizing acrylic models with high speed photography and LDV to document flow anomalies and environments.

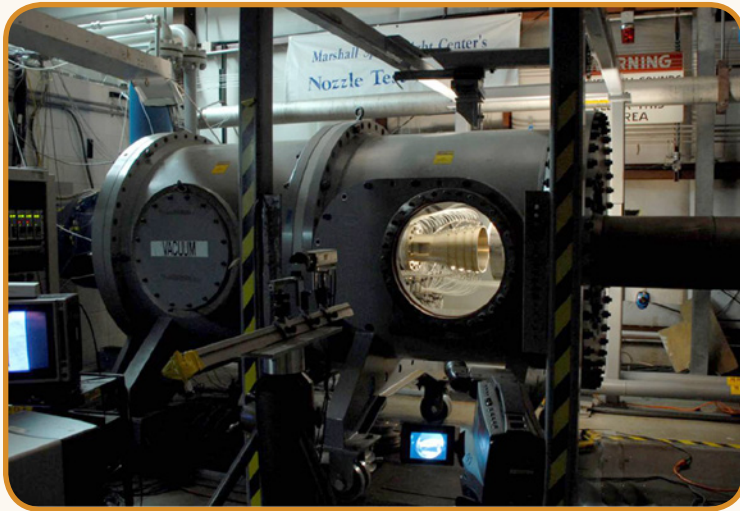


Nozzle Test Facility (NTF)

is a blowdown system providing altitude simulations from sea level up to 150,000-ft elevation for the evaluation of a variety of nozzle configurations and validation of computational fluid dynamic codes and design tools used to predict nozzle performance.

Facility Performance/Technical Specifications

- Chamber pressures from atmosphere to 0.05 psia (150,000-ft altitude simulation).
- Nozzle thrust measurements to 1,000 lbs axial, 500 lbs side loads.
- Pressure ratios ($P_{\text{chamber}}/P_{\text{exit}}$): less than or equal to 7,000.
- Max inlet temperature: 300 °F and max inlet pressure: 350 psig.
- Max nozzle flow rate: 12 lbm/sec (air or nitrogen) with 60 sec of test duration.
- Nozzle max area ratio (based on air liquefaction): 230.
- Data system with 80 dynamic channels and 128 static channels gathered simultaneously.
- Flow visualization utilizes schlieren imaging for plume characterization.

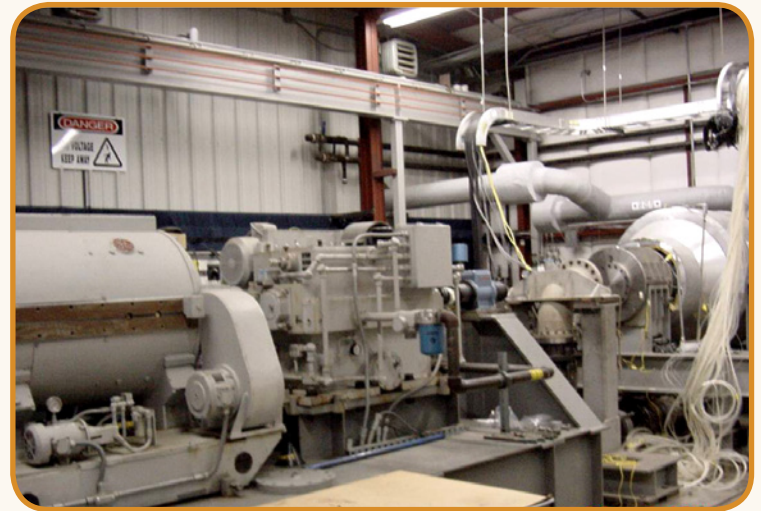


Turbine Test Equipment (TTE)

is a blowdown system providing a controlled simulated environment to the inlet and exit of turbines to obtain turbine efficiency and flow capacity data for the validation of computational fluid dynamic and other design codes used in hardware design.

Facility Performance/Technical Specifications

- Configurations accommodate radial and axial loaded turbines.
- Shaft speeds from 500 to 12,750 rpm with torque measurement to 1,000 ft-lbs.
- 600 horsepower dynamometer system with three-speed gearbox for speed control.
- Max inlet temperature: 300 °F and max inlet pressure: 350 psig.
- Max nozzle flow rate: 20 lbm/sec (air or nitrogen) with 20 minute max test duration.
- On-blade dynamic pressure measurement with # channels.
- Data system with 80 dynamic channels and 128 static channels gathered simultaneously.
- Turbine exhaust pressures controlled from atmosphere down to 5 psia.



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