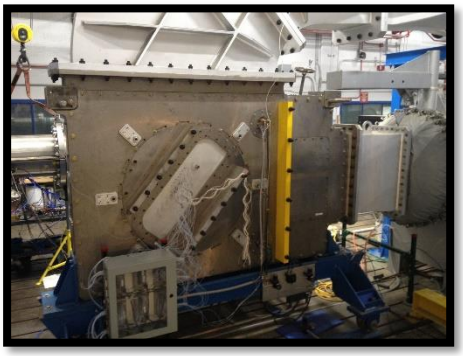
# Facility Factsheet

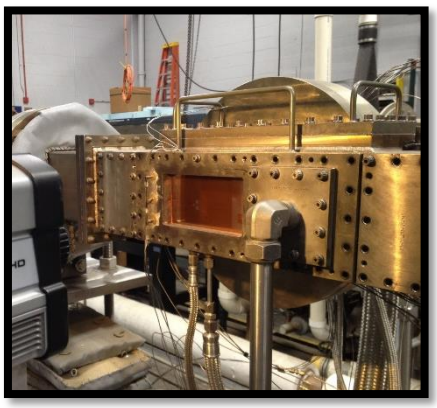
## Heat-transfer and Aerothermal Laboratory (HAL)

### Description:



The Heat-transfer and Aerodynamics Laboratory conducts fundamental experimental research in the areas of turbine aerodynamics, heat transfer, and film cooling. Experiments are designed to improve understanding of the complex flows found in turbine engines, and to provide validation data sets for numerical computations and the evaluation of turbulence models for use in modelling of internal flows. Measurement capabilities include steady and unsteady pressure and temperature probes, thermal anemometry, Particle Image Velocimetry, thermocouple arrays, Pressure Sensitive Paint, and Infrared Thermography.

The laboratory maintains three primary turbine research rigs: the Transonic Turbine Cascade, the Elevated Temperature Advanced Cooling Rig, and the Leading Edge Film Cooling Tunnel. The Transonic Turbine Cascade is used for aerodynamic evaluation of advanced blade geometries. The cascade features a variable inlet incidence capability and upstream and downstream traverse systems for flow evaluations and loss measurements. Steady and unsteady blade loading is measured using a combination of static taps and fast-response surface-mounted transducers. Control of blade row exit static pressure and mass flow rate enables independent variation of exit Mach number and Reynolds number for off-design performance studies. The Elevated Temperature Advanced Cooling Rig is a high-speed, high-temperature heat transfer and cooling effectiveness tunnel, designed to evaluate research articles with advanced internal and external cooling features. The primary measurement technique used is infrared thermography. The Leading Edge Film Cooling Tunnel is a temperature-controlled wind tunnel with a single airfoil leading edge model designed for the study of near-stagnation heat transfer and film cooling. Super-scale models allow the acquisition of high spatial resolution heat transfer data under varying freestream turbulence conditions. Research studies have included both steady and pulsed film cooling. The laboratory also hosts two other major rigs. The first is for altitude research on small engines. The second is used for investigation of inlet distortion and flow control techniques in supersonic inlets. The flow and exhaust capabilities of the HAL make the facility uniquely adaptable in satisfying diverse research requirements.



### Purpose:

To perform aerodynamic and heat transfer research in support of the development and validation of turbine aerodynamic and durability design methods.

### Products:

Aerodynamic data for the validation of in-house turbine design tools.

Overall cooling effectiveness data for highly-coupled internal and external cooling concepts.

Steady and pulsed film cooling heat transfer data to support future turbine durability design.

Validation data to support transition model development.

### Availability:

Primarily in-house and related DoD contractor research. Other U.S. Government agency, DoD contractor and commercial customer programs upon request. Contact: 937-255-4100.