PROPULSION SYSTEMS LABORATORY (PSL) ENGINE ICING MODIFICATIONS
GLEN RESEARCH CENTER

Thomas R. Hoffman – PSL Facility Manager

Objectives
- Establishment of a ground-based, ice-crystal environment, engine test capability that includes altitude effects.
- Better understanding of how ice acquires inside an engine and how it effects engine performance and operability.
- Investigation of test methods and techniques that enables the effective and efficient study of engine icing due to ice crystals along the path of airflow through the core of an engine.
- Development of validation sets required to enable the creation of a system of computer codes that can be specifically applied to assess engine icing susceptibility, as well as engine performance, and operability effects.
- Collaboration with industry partners to utilize system to meet objectives.

Technical Challenges
- Design and build an icing system that is versatile so it can be refined to meet developing engine icing requirements.
- An assessment of PSL’s capability to simulate conditions that lead to engine core icing events.
- The establishment of conditions inside the engine under which ice can accrete, both before and after accretion occurs at a given point in the simulated flight trajectory (altitude).
- Test methods for conducting pertinent engine core icing tests in PSL.
- The creation of methods and techniques needed to measure/monitor engine core ice accretions.
- A complete set of validation data sets including engine design geometry and operating conditions, as well as atmospheric conditions for simulation of engine core icing events.
- A knowledgebase of engine core icing from which engineering tools to address the problem can be further developed.

Technical Approach
Icing system was designed and built to requirements established by collaboration with industry and government experts.

Analysis
Proof of concept tests, instrumentation evaluation and PSL simulation were performed at Cox & Co icing wind tunnel.

Results
Subsystem Design and Installed Hardware

Analysis
Computer simulation using Fluent software was performed and evaluated by NASA and Cox and Co.

Progress Plan
- Main Icing System Installation (complete 6/2011).
  - Construction at 90% complete.
  - Spray bar installation nearly complete.
  - Fabrication set to begin.
  - Includes instrumentation, camera systems.
- Integrated Systems Test (complete 1/2012).
  - Systems Checkout.
  - Full up Icing System Integrity and Check.
- Calibration Test (complete 6/2012).
  - Verify Requirements are met and easily achievable.
- Document System Capabilities.
- Validation Test (start 10/2012).
  - Seeking collaborative test with engine manufacturer.
  - Validate against existing flight data.