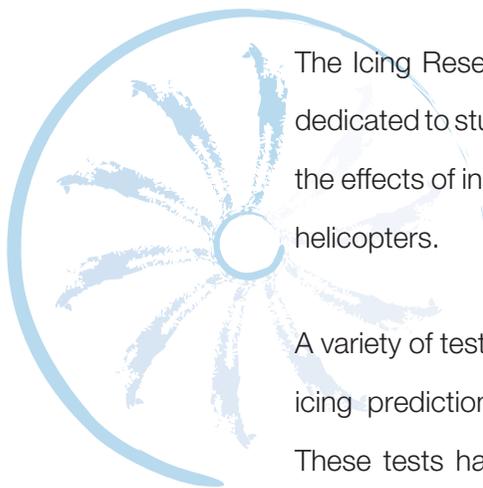




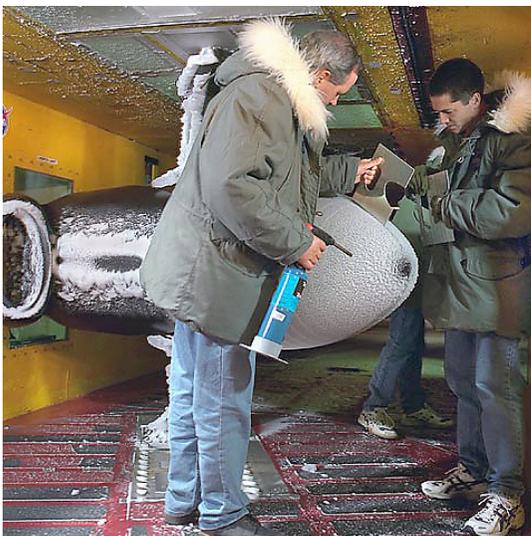
NASA's Aeronautics Test Program

Icing Research Tunnel



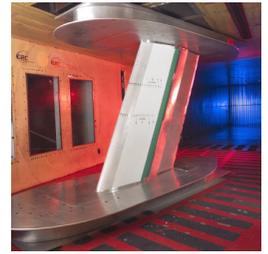
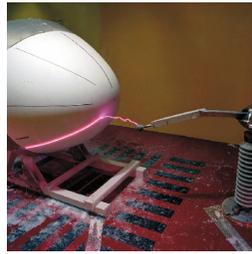
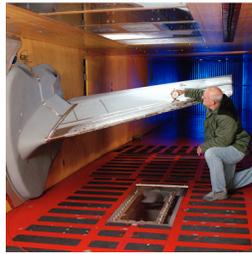
The Icing Research Tunnel (IRT) is one of the world's largest refrigerated wind tunnels dedicated to study aircraft icing. In this facility, natural icing conditions are duplicated to test the effects of in-flight icing on actual aircraft components and models of aircraft, including helicopters.

A variety of tests are performed in the IRT including fundamental studies of icing physics, icing prediction validation, and ice protection system development and certification. These tests have been used successfully to reduce flight test hours for ice detection instrumentation and ice protection systems certification.



From left to right: Bell 609 spinner inlet icing model, NASA scaling test, Longbow model, Sikorsky rotor model, and Ram air turbine.





Facility Benefits

- Replicates the Federal Aviation Administration (FAA) aircraft icing certification standards contained in Federal Aviation Regulation (FAR) part 25, appendix C
- Tests full-size aircraft components as well as models of airplanes and helicopters
- Creates a uniform test section icing cloud approximately 6 ft high by 6 ft wide
- Tests aircraft de-icing and anti-icing systems
- Enables detailed analysis and electronic storage of ice shape data in addition to a wide variety of data collection and observation method
- Provides permanent casting and physical tracing of ice formations for extended study
- Offers two- and three-dimensional scanning of ice shapes
- Accommodates in-house and private industry research programs
- Employs an experienced staff of technicians, engineers, researchers, and operators

Characteristics

Test section dimensions	6 ft high by 9 ft wide by 20 ft long
Liquid water content (LWC)	0.2 to 3.0 g/m ³
Drop size and median volume diameter (MVD)	15 to 50 μm
Uniform icing cloud dimensions	6 by 6 ft
Cloud uniformity, LWC	±10 percent
Test section air velocity	50 to 350 KTS
Test section total temperature	-25 to 40 °F
Simulated engine flow	0.1 to 85 lb/s
Heated auxiliary air (bleed simulation)	up to 5 lb/s

Data Acquisition and Processing

Inputs	Analog, digital, and electronically scanned pressure (ESP) system
Display	Real time, alphanumeric, and plots
Capacity/channels	Analog/256, Digital/32, and ESP/224 (192), 2000 calculated
Dynamic data acquisition	Available upon request

Facility Applications

- Develop and test aircraft de-icing and anti-icing systems for use on the ground and in flight
- Provide data to customers for the certification of components and aircraft
- Research basic icing physics and the aero effect of ice
- Validation of icing computer codes, in particular the NASA code LEWICE
- Support a diverse group of customers including the NASA Aeronautics Research Mission Directorate and aircraft companies such as Boeing, Bell Helicopter, Goodrich, Cessna, and Sikorsky; de-icing and anti-icing equipment manufacturers; U.S. Army; U.S. Navy; and U.S. Air Force

Instrumentation

Pressure Measurement	
Digitally scanned pressure system	224 channels
Pressure transducers	Stand alone
Temperature Measurement	
Thermocouple system	96 (type K, J, T, or E) channels
Resistance Temperature Detection (RTD) system	68 channels

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