ENVIRONMENTAL TESTING

CREATING THE WEATHER YOU CAN'T AFFORD TO WAIT FOR...

The McKinley Climatic Laboratory

The McKinley Climatic Laboratory

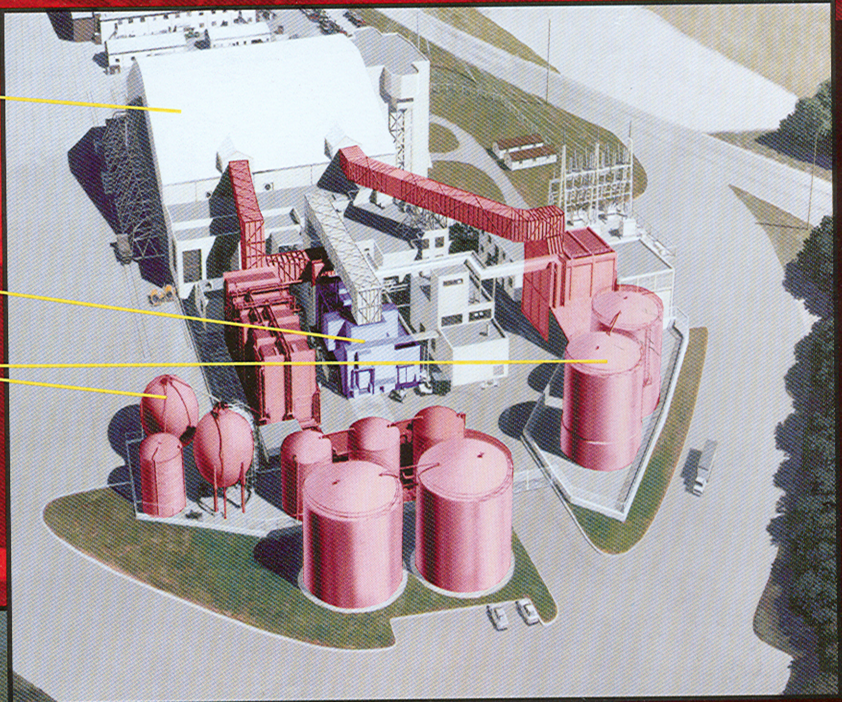
The world's largest environmental testing chamber and five additional specialized testing chambers

From the extremes of frigid northern regions to hot, windswept, arid deserts—at one full-support facility

Main Chamber (MC): 252x260x70 feet

Equipment Test Chamber (ETC): 130x30x25 feet

Air Make-Up (AMU) System: * provides conditioned air for indoor jet engine operation

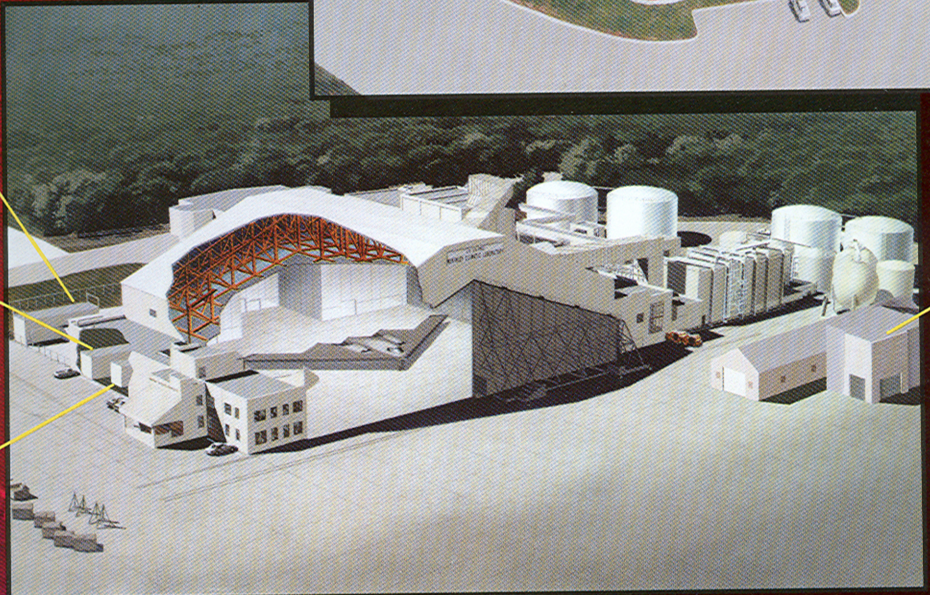


Salt Fog (SF) Chamber: 55x16x16 feet

All Weather Room (AWR): 44x22x15 feet

Temperature-Altitude (TA) Chamber: 13x9x7 feet

Sun, Wind, Rain and Dust (SWRD) Chamber: 50x50x30 feet



* The Air Make-Up System

Jets, and other air-breathing engines, consume conditioned air from inside the chamber and push it through ducts as exhaust, which is vented outdoors.

The AMU System provides conditioned air (hot or cold, as required) to replace this consumed air on a real-time basis.

The AMU System, for example, can provide air at -65°F to the Main Chamber (at 1000 lbm/sec for up to one hour) or to the Equipment Test Chamber (up to 500 lbm/sec for up to one hour). Note that these figures are for operations at -65°F—the duration of jet engine operation at higher test temperatures is significantly longer.

Icing Cloud

The Laboratory can simulate three icing cloud scenarios:

- A stationary aircraft operating in ground fog icing conditions, such as waiting for takeoff at an airport.
- An aircraft in slow flight through an icing cloud, such as during landing or takeoff.
- Aircraft engine icing for FAA certification.

Real-time monitoring of droplet size and liquid water content are accomplished with a laser interferometer.

Above: Sirkosky S-92 helicopter in icing condition

Right: Cessna aircraft with Williams International Engine in Icing Condition

Icing Build-up

Icing evaluations are accomplished by creating either glaze or rime ice build-up on test items.

Freezing Rain

This test simulates a test item outdoors when it is raining and the temperature falls below freezing. The freezing rain or drizzle is produced using arrays of nozzles suspended over the test item.

Above: F117A Stealth Fighter in Freezing Rain Test

Vortex Icing

This test simulates a jet aircraft operating over a wet runway with the ambient temperature at or near freezing. While the jet engine is operating, a vortex (miniature tornado) forms between the engine inlet and the ground. The vortex may pull water off the ground and into the engine inlet. Ice formations may develop inside the engine inlet or on the engine itself.

Snow

To simulate snow, the Climatic Lab uses the same snow-making machinery that is used at ski resorts. This machinery atomizes water at high pressure, with compressed air, and blows the atomized water into the air with a ducted fan.

The Laboratory creates several different snow-related test conditions:

- *Snow loading tests* confirm the structural integrity of test items (the ability to support the weight of snow on top of the test item).
- *Blowing snowstorms* evaluate full-scale operation of equipment in blizzard conditions.
- *Snow field bases* are created for vehicle tire traction evaluations.

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Above: Tire Traction Test on Snow and Ice

High and Low Temperature

- -65°F to +165°F in the MC and ETC
- Ambient to +150°F in the AWR, Altitude Chamber, SWRD and Salt-Fog Chambers

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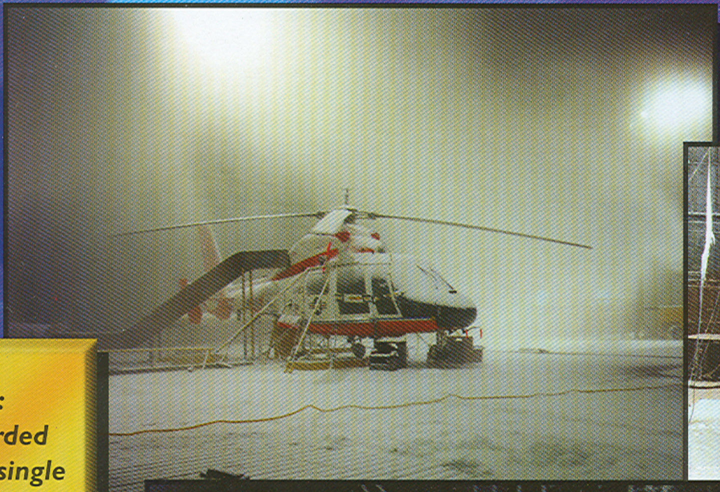
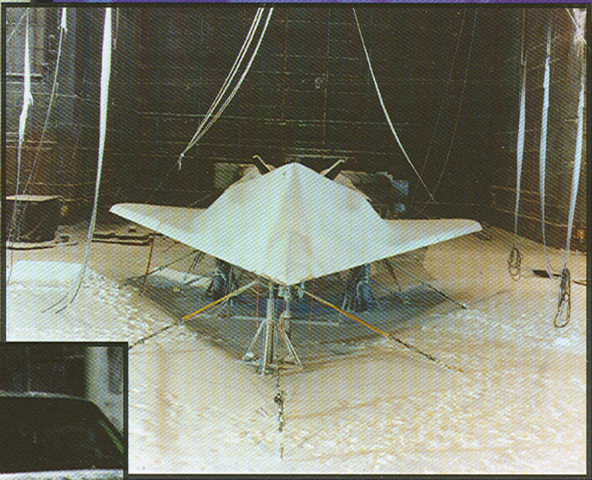
Above: C130J in Low Temperature Test

Right: Boeing B600N Notar Helicopter in Low Tempurature Test

Far Right: F-22 in Low Temperature Test





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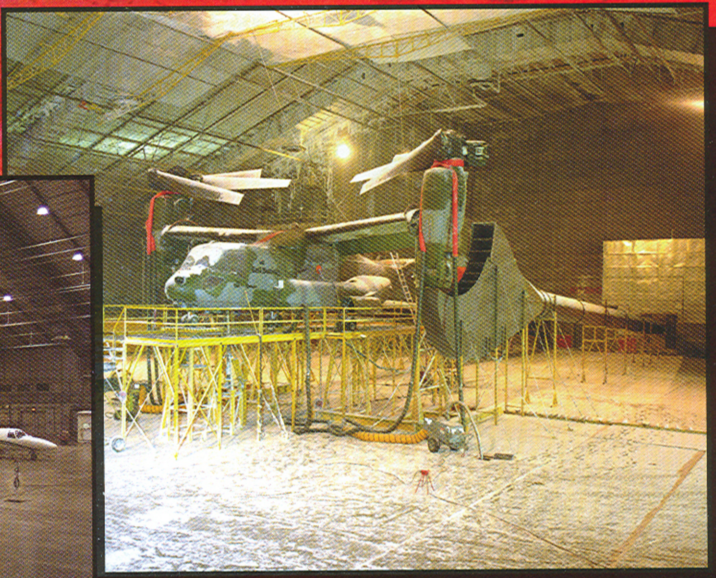
Top Left: Coast Guard HH65 Helicopter in Snow Test

Above: F117A Stealth Fighter in Snow Test

Left: Tire Test in Snow

Right: V22 Tilt-Rotor in Low Temperature Test

Below: Four Cessna Aircraft in Low Temperature Test



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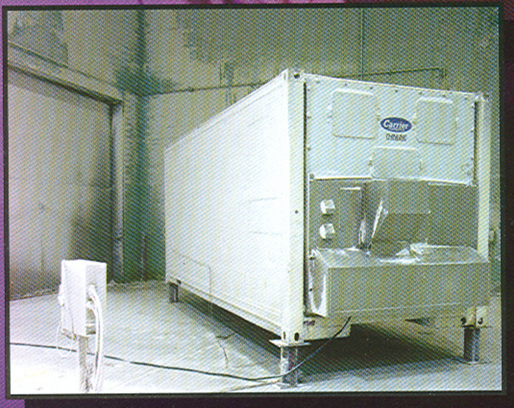
World Record: Highest Recorded Temperature 136°F at El Azizia, Libya, September 13, 1922

Wind

Large, ducted fans create conditions from gentle breezes to hurricane force winds. Wind is often used during simulations of rain intrusion, sand storms, icing clouds, and snow storms.



Transportable Blood Transshipment Center in Dust Test

Sand Storms

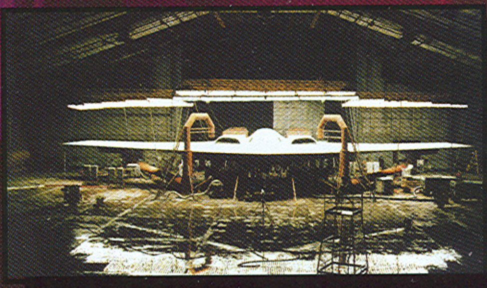
Commercially available sand is dispensed into a wind stream and blown toward the test item to simulate a blowing sand storm.

Dust Storms

Commercially available silica flour is dispensed into a wind stream and blown toward the test item to simulate a blowing dust storm.

Temperature Soak Periods

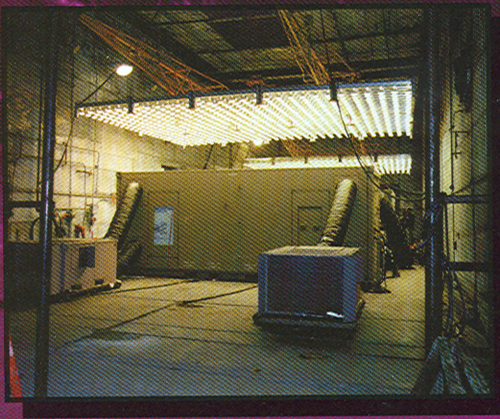
Test items, especially large items such as vehicles, shelters, and aircraft, can require from six to more than 24 hours to reach an extreme test temperature. These temperature soak periods are often scheduled overnight or on weekends as part of test preparation.



Solar Radiation

The thermal effects of solar radiation are simulated using arrays of lamps suspended above the test item. The lamps can provide up to 72 discrete settings between off and full intensity in order to follow a 24 hour diurnal (day-night) cycle. Actinic effects (UV degradation) are not evaluated.

Solar radiation tests are often conducted in conjunction with high temperature exposure. Available in the Main Chamber, Equipment Test Chamber, All Weather Room, and Sun, Wind, Rain, and Dust Chamber.

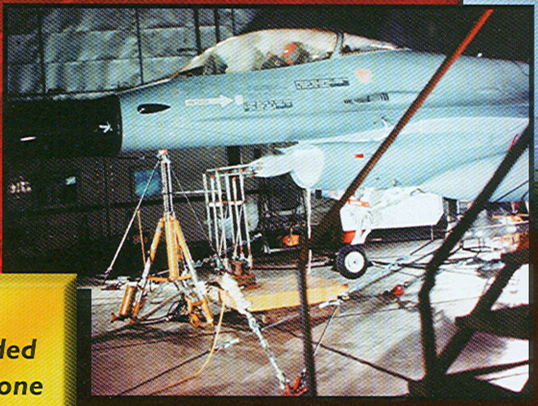


Above: B2 Bomber in Solar Radiation Test

Left: Shelter System in Solar Radiation Test

Rain Intrusion
Rain is simulated by suspending water spray nozzles over the test item. For windblown rain, vertically oriented nozzles and wind machines are used. The desired rainfall rate determines the water flow rate and the selection of nozzles.

Rain Ingestion
This test is conducted to evaluate a jet engine's ability to operate while ingesting large amounts of water (flight through heavy rainstorms).



Above: M1A1 Tank in Rain Test

Left: F16 Fighter in Water Ingestion Test

World Record: Highest Recorded Rainfall Rate (one minute duration): 73.7 inch/hour; Unionville, MD; July 4, 1956

Humidity
Relative humidity can be controlled between 10% and 100% at temperatures from 32°F to 125°F in most chambers. Below freezing, the air's moisture holding capacity is small, and humidity is measured but not controlled. Above 125°F, the amount of moisture that can be added to the air is limited by chamber construction materials.

World Record: Lowest Recorded Relative Humidity 2 % (at 110°F), Death Valley, CA (date unknown)

Salt Fog
This test is conducted to evaluate a test item's ability to withstand the corrosive effects associated with operating in coastal regions where salt-laden fog or sea spray are prevalent.

Fog Visibility
Fog can be created in the Main Chamber to evaluate the ability of optical devices to operate in low visibility conditions.

FULL SERVICE FACILITY

Test Support
Test Assembly
Our personnel assemble tiedown restraint systems, install exhaust ducting, and setup test equipment—such as rain frames, solar frames, and wind machines.

We can also assist test teams with setup and preparation of test items. Support includes forklifts, cranes, and other heavy equipment.

Instrumentation
We provide setup, operation, and maintenance of test instrumentation: remote control color cameras, analog-to-digital conversion, data reduction, real-time data acquisition and display.

Electric Shop
Our personnel assist the test team, supplying power to all equipment.

Machine Shop
In addition to maintaining the facility equipment, the machine shop fabricates all test support hardware involving machining, welding, or wood working.

Protective Clothing
Rain and cold-weather gear are available. Headsets and other hearing protection are also available.

Physical Plant
Electrical Power
Power is available for most specialized requirements.

Water Supply
The Laboratory has both palletized and permanently installed pumps to provide high pressures and flow rates as required.

City water is often used for rain, freezing rain, and icing tests. For jet engine water ingestion, we use demineralized water. Occasionally, sea marker dye is added to the water at the customer's request to aid in icing documentation. In addition, other specific chemical compositions can be provided.

Compressed Air
Compressed air is available up to 1,200 SCFM at 125 psi.

Fully remodeled and renovated Resumed Operations in June 1997

Operational Improvements

Improved Insulation and Vapor Barrier—Walls of polyisocyanurate foam sandwiched between stainless steel sheet metal, in the Main Chamber and Equipment Test Chamber.

Faster Cooling Capability—Time to lower temperature from ambient to -65°F reduced from 48 hours to less than 24 hours.

Greater Aircraft Engine Operating Capability—Doubled our Air Make-up capacity to replace engine exhaust.

Modern Communications and Control Systems—Provide efficient operations with full data access.

Environmental Improvements

Ozone-friendly Fire Protection—Using Aqueous Film Forming Foam (AFFF).

Environmentally Safe Refrigeration—Using new R-22 refrigeration units with greater tonnage and 30% improved efficiency.

Reduced Hazards—Removed all asbestos and minimized use of lead-based paint.

Energy Efficient Office Spaces—Provides reduced environmental impacts and lowers operating costs.

Modern Waste Water Treatment—Improved drainage system routes all waste water through an oil-water separator to an industrial waste water system.

A Historic National Resource

Historic Landmark

The American Society of Mechanical Engineers (ASME) designated the McKinley Climatic Laboratory as a National Historic Mechanical Engineering Landmark in 1987.

Early Interest in Environmental Testing

In 1934, the Baker Board recommended that tactical units train under winter conditions. This, with the interest of General H. Arnold, led to establishment of the Cold Weather Test Detachment at Ladd Field in Fairbanks, Alaska in 1942.

WWII Lessons

In the winter of 1942-43, the warring nations could not get their aircraft into the air during subzero weather. This grounding of combat aircraft made it clear that cold weather testing was indeed necessary.

Meanwhile, the Cold Weather Test Detachment faced many problems. Transportation was often difficult and sometimes hazardous. Uncertain weather played havoc with schedules. Operations were further hampered by a lack of trained and experienced personnel. A more productive means of conducting cold weather testing was needed.

The Climatic Hangar

In September 1943, cold weather testing was assigned to the Army Air Proving Ground Command at Eglin. Lt. Col. Ashley C. McKinley, who had vast experience in cold weather operations and testing, developed the idea of a refrigerated hangar to produce environmental extremes under controlled conditions.

There was a continued operational need. As a global power, the U.S. would require military forces able to operate in all environmental extremes.

Lt. Col. McKinley also reasoned that controlled conditions would yield superior results to testing at Ladd Field and would be up to ten times more economical—an estimate that later proved to be very close to actual savings. The facility, known as the Climatic Hangar, opened in 1947.

First Tests

The first tests to recreate arctic conditions on a large scale began in May 1947. A B-29 bomber; a C-82 cargo plane; P-47, P-51, and P-80 fighters; and an R5D helicopter, as well as trucks, tanks, and clothing were subjected to a temperature of minus 70°F. The tests were highly successful.

In 1972, the facility was renamed the McKinley Climatic

The McKinley Climatic Laboratory

Eglin Air Force Base, Florida

Long History of Support to DoD and other Federal Agencies

The McKinley Climatic Laboratory has been serving military and other U.S. government customers since 1947. We offer our customers an expert staff with vast experience in environmental testing and a modern facility with many unique capabilities.

Now Partnering with Industry and with State and Local Agencies

The expertise and cost savings of environmental testing at the McKinley Climatic Laboratory are now available to state and local governments and to private enterprise.

Two Commercial Teaming Concepts

Cooperative Research and Development Agreement (CRDA)

A written agreement with negotiated terms where the government participates in the development of a process, product, or technology.

When to use a CRDA

A CRDA allows the government to contribute substantially in the development of a marketable process or product.

Key CRDA Features

- Negotiable costs
- Promotes technology/product development
- Not a procurement tool
- Not subject to Federal Acquisition Regulations

Commercial Test Contract (CTC)

A written agreement between the government and commercial entities that specifies services to be provided and fees to be collected.

When to use a CTC

A CTC lets customers use DoD test and evaluation facilities for their purposes in the development of a process or product.

Key CTC Features

- Fee for service
- Contractually binding agreement
- Company product and performance information remains proprietary

Write, Call, or E-mail for More Information

Learn more about our capabilities. Our technical staff will help you coordinate your test requirements and services. Our scheduling office can then provide cost estimates, coordinate funding, and schedule testing.

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