1175

NPS Form 10-900
(Rev. 10-90)

OMB No. 1024-0018

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES
REGISTRATION FORM

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in How to Complete the National Register of Historic Places Registration Form (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name McKinley Climatic Laboratory

other names/site number Climatic Hangar

2. Location

street & number Building 440, Eglin Air Force Base not for publication N/A
city or town Fort Walton Beach vicinity X
state Florida code FL county Okaloosa code 091 zip code 32542

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1986, as amended, I hereby certify that this ____ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ____ meets ____ does not meet the National Register Criteria. I recommend that this property be considered significant ___ nationally ___ statewide ___ locally. (___ See continuation sheet for additional comments.)

Ad McCall — 14 AUG 1997

Signature of certifying official — Date

U.S. Air Force Federal Preservation Officer

State or Federal agency and bureau

In my opinion, the property _x_ meets ____ does not meet the National Register criteria. (___ See continuation sheet for additional comments.)

Suzanne P. Walker, Deputy SHPO — 3/11/96

Signature of commenting or other official — Date

Florida State Historic Preservation Office, Div. of Historical Resources

State or Federal agency and bureau

4. National Park Service Certification

I, hereby certify that this property is:

✓ entered in the National Register ___ See continuation sheet.
____ determined eligible for the National Register ___ See continuation sheet.
____ determined not eligible for the National Register
____ removed from the National Register
____ other (explain): ____________

Carol D. Shull — 10-6-97

Signature of Keeper — Date of Action

5. Classification

Ownership of Property (Check as many boxes as apply)

___ private
___ public-local
___ public-State
_X_ public-Federal

Category of Property (Check only one box)

_X_ building(s)
___ district
___ site
___ structure
___ object

Number of Resources within Property

Contributing	Noncontributing	
3		buildings
		sites
		structures
		objects
3		Total

Number of contributing resources previously listed in the National Register _0_

Name of related multiple property listing (Enter "N/A" if property is not part of a multiple property listing.) __N/A___

6. Function or Use

Historic Functions (Enter categories from instructions)

Cat: DEFENSE Sub: air base
EDUCATION research facility

Current Functions (Enter categories from instructions)

Cat: DEFENSE Sub: air base
EDUCATION research facility

7. Description

Architectural Classification (Enter categories from instructions)

Early 20th Century American

Other: adaptive military style/hangar

Materials (Enter categories from instructions)

foundation CONCRETE
roof METAL: steel
walls CONCRETE
TILE
METAL: steel
other: GLASS

Narrative Description

(Describe the historic and current condition of the property on one or more continuation sheets.)

8. Statement of Significance

Applicable National Register Criteria

(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing)

_X_ **A** Property is associated with events that have made a significant contribution to the broad patterns of our history.

____ **B** Property is associated with the lives of persons significant in our past.

_X_ **C** Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.

____ **D** Property has yielded, or is likely to yield information important in prehistory or history.

Criteria Considerations (Mark "X" in all the boxes that apply.)

____ **A** owned by a religious institution or used for religious purposes.

____ **B** removed from its original location.

____ **C** a birthplace or a grave.

____ **D** a cemetery.

____ **E** a reconstructed building, object, or structure.

____ **F** a commemorative property.

_X_ **G** less than 50 years of age or achieved significance within the past 50 years.

Areas of Significance (Enter categories from instructions)

MILITARY HISTORY
ARCHITECTURE
ENGINEERING
SCIENCE

Period of Significance 1944-1995

Significant Dates 1947

Significant Person (Complete if Criterion B is marked above) N/A

Cultural Affiliation N/A

Architect/Builder U.S. Army Air Corps/Corps of Engineers - supervision

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets.)

9. Major Bibliographical References

(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets.)

Previous documentation on file (NPS)

___ preliminary determination of individual listing (36 CFR 67) has been requested.
___ previously listed in the National Register
___ previously determined eligible by the National Register
___ designated a National Historic Landmark
___ recorded by Historic American Buildings Survey # __________
___ recorded by Historic American Engineering Record # __________

Primary Location of Additional Data

___ State Historic Preservation Office
___ Other State agency
_X_ Federal agency
___ Local government
___ University
___ Other
Name of repository: _Eglin Air Force Base History Office_

10. Geographical Data

Acreage of Property _4.25 acres_

UTM References (Place additional UTM references on a continuation sheet)

	Zone	Easting	Northing
1	16	547270	3371420

Verbal Boundary Description (Describe the boundaries of the property on a continuation sheet.)

Boundary Justification (Explain why the boundaries were selected on a continuation sheet.)

11. Form Prepared By

name/title EGLIN AIR FORCE BASE / Corinne D. Hollon

organization AFDTC/EMPH date December 1, 1995

street & number 501 DeLeon Street, Suite 101 telephone 904-882-4435 ext 227

city or town Eglin Air Force Base state FL zip code 32542-5101

Additional Documentation

Submit the following items with the completed form:

Continuation Sheets

Maps

A USGS map (7.5 or 15 minute series) indicating the property's location.

A sketch map for historic districts and properties having large acreage or numerous resources.

Photographs

Representative black and white photographs of the property.

Additional items (Check with the SHPO or FPO for any additional items)

Property Owner

(Complete this item at the request of the SHPO or FPO.)

name ____

street & number ______________________ telephone ____________

city or town ______________________ state _____ zip code __________

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C. 470 et seq.).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 18.1 hours per response including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, P.0. Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reductions Project (1024-0018), Washington, DC 20503.

SUMMARY

The McKinley Climatic Laboratory was conceived and construction began during the World War II era. The structure was designed to permit testing of aircraft and weapons under extreme environmental conditions, originally including temperatures between -70 and +110 degrees Fahrenheit, snow, ice, and rain. Today the Climatic Laboratory can create temperatures ranging from +170 degrees Fahrenheit to -105 degrees Fahrenheit. The Laboratory has six testing chambers and six small test rooms, each with its own unique capabilities. Two of these chambers, detached from the main building but located on the facility grounds, were built after the original facility (1946). In 1987 the American Society of Mechanical Engineers designated the McKinley Climatic Laboratory a National Historic Mechanical Engineering Landmark. The Laboratory remains a state-of-the-art testing facility and is utilized by both government and private customers in testing a variety of aircraft, armaments, vehicles, and materials.

PRESENT AND ORIGINAL PHYSICAL APPEARANCE

The Climatic Laboratory is an integral member of the Air Force Development Test Center, Eglin Air Force Base. Six testing chambers and six small test rooms together make up the McKinley Climatic Laboratory facility. (Photographs #1-4)

MAIN CHAMBER (MC)

The Main Chamber (MC) is the largest known insulated aircraft hangar, having a total enclosed volume of approximately 3,282,500 cubic feet. The size of the chamber, 252' wide by 201' deep by 70' high in the center and 35' high at the sides, permits testing of the world's largest aircraft and very large pieces of equipment. Also, several tests can be conducted simultaneously depending on the size and complexity of the individual items. The operating temperature ranges from plus 170 degrees Fahrenheit to minus 82 degrees Fahrenheit. Other environmental conditions available in the MC include rain up to 15 inches per hour, icing in the form of freezing rain of a supercooled fog, snow, wind up to 60 knots and solar radiation up to 355 BTU per square foot per hour. In addition, a projectile trap permits automatic gun firing of ammunition up to 30 mm.

An appendant area was added to the MC in 1968 specifically to allow the C-5A Galaxy to be tested. This appendant area is approximately 60 feet by 85 feet with a ceiling height of 75 feet. With this appendant area included, usable floor space is approximately 55,000 square feet.

The floor consists of 12 inches of reinforced concrete laid in blocks 12-1/2 feet square. The reinforced concrete rests on insulation consisting of 15 inches of cellular glass block, vapor sealed with roofing felt on top and bottom. The top layers of felt are approximately 1/2 inch thick and provide a cushion between the reinforced concrete slab and the insulation. An 8 inch concrete slab forms the subfloor structure. The top slab is graded toward 16 six-inch drains uniformly spaced over the floor. (Photograph #5)

The side walls are reinforced concrete and tile construction from the floor to a height of 28 feet. Above the concrete and tile, the entire structure is made of steel. Nine arched trusses, 24 feet in depth, span the 254 feet between the side walls to support the roof and insulated ceiling. All of the steel and concrete wall and roof members are outside the space subjected to extreme temperatures. The rear wall structure is of frame steel. The hangar is designed to withstand a wind stress of between 30 and 40 pounds per square foot, or approximately 100 miles per hour. The walls are insulated with 13 inches of glass wool board enclosed on both sides with 22 gauge galvanized sheetmetal.

The main entrance into the hangar, known as the Main Doors, encompasses the entire front side of the hangar. Self supporting and self propelled, the large door is built in two sections, each weighing 200 tons. The trucks supporting each section run on pairs of rails 25 feet apart. When the door sections move into place to close the hangar, hooks on the sections engage in catches about the perimeter of the opening. A power drive draws up on the hooks and the door sections move toward the hangar approximately 6 inches against sponge rubber gaskets to form a tight seal with the building. To complete the seal, a cam forces rubber pads between the door bottom and the hangar floor. The main door can be opened in 7 minutes. The entire door is insulated with 13 inches of glass wool board enclosed on both sides with welded steel vapor barriers. Mounted within one of these two main doors is a smaller door, 50 feet wide and 15 feet high, which lifts vertically to allow entrance to the chamber without having to open the main doors.

On the south side of the MC, a 10' X 10' door is provided as an entrance lock and is known as the South Lock Door. Originally, the standard procedure for testing smaller pieces of equipment was to prepare a test item of the first floor of the south side of the MC, lift the test item to the second floor of the south side (which is the floor level of the MC) using a freight elevator, and then pass the test item through the South Lock Door. This method of entrance, though still functional, is rarely used.

In the center of the appendant area of the east wall is a 14' X 14' vertical lift door, added to the facility in 1973-1975, which provides access to the rear of the chamber. In addition to these four large doors, which are used to admit test items into the MC, there are also eight personnel doors which are approximately 3.5 feet wide by 7 feet tall.

Directly adjacent to the MC's north and south walls are rooms with windows that allow observation into the chamber. The north observation room is located near the test engineer's office and is normally used only for public affairs tours. The south observation room has recently been renovated to allow for visual test direction and instrumentation monitoring. Additionally, portable insulated shelters are provided which may be placed in the MC for test direction or for use by other test personnel. These booths are fitted with observation windows and are air conditioned and heated. They are also wired with electrical outlets as well as intercom and telephone service.

The ceiling is built atop a corrugated steel deck. The deck is supported on I-Beams which are hung from the trusses by chains. With the exception of a few electrical conduits, the chains are the only members piercing the insulation. Therefore, the heat transfer through the insulation by structural members in minimal. The chains allow the ceiling to be semi-flexible to accommodate thermal expansion and contraction. Like the walls, 13 inches of glass wool board is used for insulation. (Photographs #6 & 7)

The immense size of the MC, alone, permits testing of very large items of equipment and complete weapon systems. Large enough to accommodate the largest aircraft in U.S. military inventory, the MC can also expose several test items to the same environmental condition simultaneously.

ENGINE AND EQUIPMENT TEST FACILITY (ETC)

The Engine Test Cell, designed and built in the beginning of the jet age, was originally used almost exclusively for engine testing. It housed a very large metal test stand to restrain the engines as well as a large inertia block set into the floor to measure engine thrust. Gradually, the requests for these types of tests dwindled as engine manufacturers made great strides in understanding the behavior of jet engines in extreme environments. Today, engine tests are generally integrated with the entire airframe and performed in the MC.

The Engine Test Cell was subsequently renamed the Equipment Test Chamber (ETC) and is currently used to test any item which requires extremely low temperatures, but is not large enough to warrant the employment of the MC. The systems supplying the MC also supply this facility. Due to its smaller size, the extreme temperature range available is greater (plus 170 degrees Fahrenheit to minus 105 degrees Fahrenheit) and the maximum cooling rate is much faster (plus 60 degrees Fahrenheit to minus 80 degrees Fahrenheit in 7-1/2 hours). The size of the facility is 130 feet long, 30 feet wide, and 25 feet high. Every type of condition that can be obtained in the MC can also be obtained in this facility. Insulation is similar to the MC.

An electrically operated door, 30 feet wide by 25 feet high, opens the entire south wall of the room. A 20' X 20' tempering air lock is provided in the southeast corner of the room. Two personnel doors, 3'6" X 7', are provided in the east wall.

The ETC has a room directly adjacent to the chamber fitted with observation windows in the chamber, allowing for visual test direction.

ALL-WEATHER ROOM (AWR)

One of the most versatile facilities at the Climatic Laboratory is the All-Weather Room (AWR), located on the northeast corner of the facility. Here, in the third most used chamber at the Laboratory, anything from arctic to jungle conditions can be produced virtually overnight. The room's overall dimensions are 44' by 22' by 15' high. The temperature range is plus 170 degrees Fahrenheit to minus 80 degrees Fahrenheit in 24 hours. Heating rate is from plus 60 degrees Fahrenheit to plus 170 degrees Fahrenheit in 8 hours. Humidity from 5 percent to 95 percent and rain up to 15 inches per hour can be produced.

A vertical lift door 14'1" wide by 15'5" high opens to an outdoor ramp on the east end of the room. A personnel door 2'6" by 6'6" is provided on the south wall. Small doors, ports, and windows are located within the walls for viewing and to provide access for instrumentation and power leads.

SUN, WIND, RAIN, AND DUST FACILITY (SWRD)

This facility, the newest climatic test chamber at the Laboratory, was added in 1975. The SWRD Chamber is located on the southwest corner of the main facility and is detached from the main building. Designed to withstand internal winds of 100 miles per hour and maintain temperatures from 60 to 165 degrees Fahrenheit, it simulates extreme climatic conditions for ground vehicles. Tropical rains or desert sand storms can be created, as well as extended periods of solar radiation. Silicon dust with the consistency of face powder is used to check equipment for wear and tear from intense dust storms.

The dimensions of the facility are 50 feet by 50 feet by 30 feet high. Vertical lift doors 16 feet wide by 16 feet high are located on all four sides of the chamber. These doors open directly onto an active flightline parking ramp. Personnel doors approximately 3 feet by 7 feet are provided on the east and west walls.

SALT TEST CHAMBER (SF)

The Salt Test Camber (SF) is located on the northwest corner of the facility and is detached from the main building. This chamber was specifically designed and built in 1973-1975 to perform salt fog corrosive testing. It is still used specifically to expose items to a highly corrosive environment. The chamber Is 54 feet 8 inches long, 16 feet wide, and 16 feet high. Temperature can be controlled between plus 70 degrees Fahrenheit to plus 95 degrees Fahrenheit. Relative humidity can be varied from 30 to 100 percent.

Vertical lift doors 15 feet wide by 15 feet high are located on the north and south ends of the SF chamber. One personnel door 3 feet by 6 feet 6 inches is provided on the west wall.

TEMPERATURE-ALTITUDE CHAMBER (TA)

Located adjacent to the AWR, the Temperature-Altitude Chamber (TA) is allowed the use of the AWR refrigeration machinery. (Photograph #8) Originally, the chamber was man-rated. Over the years, however, the demand for personnel testing has dwindled while the need for equipment testing has increased. Today only equipment testing is conducted in the TA Chamber.

A lock originally designed for personnel entrance & exit is now utilized as a secondary chamber, providing a pressure seal which is ruptured for rapid decompression testing. More recently, a second lock was built to do rapid decompression testing of small equipment. In fact, it was specifically designed to test four 55-gallon drums simultaneously. The smaller size of this lock allows for decompression testing to higher altitudes because the volume differential is greater than that for the larger air lock. Today, personnel access to the TA is through a single 2'2" X 5'8" door.

The TA is used to satisfy temperature shock and altitude requirements. Temperatures to minus 94 degrees Fahrenheit and simulated altitudes as high as 80,000 feet (20mm Hg) have been attained. The chamber is constructed of welded steel, insulated with 13 sheets of 1/4 inch thick reflective metal insulation in the chamber and 7 in the lock. The 13'6" long by 9'10" wide by 6'10" high chamber was constructed to withstand pressures from near zero absolute to one atmosphere. The adjacent lock is 9'10" wide X 4'4" long.

Temperature range in the TA is plus 140 degrees Fahrenheit to minus 94 degrees Fahrenheit. Maximum cooling rate is from plus 70 to minus 80 degrees Fahrenheit in five hours. With precooling, the chamber can be cooled from plus 70 to minus 70 degrees Fahrenheit in 12 minutes.

SMALL TEST ROOMS

Four small test rooms complete the global environmental capability of the Climatic Laboratory . Within the complex formed by these rooms, it is possible to travel from jungle to desert to tropical environments in a few steps. These facilities are used to conduct individual tests as well as concurrent subsystem tests, thereby avoiding delays during the major test periods. Each small test room is approximately 12 feet by 12 feet with a ceiling height of 9 feet. The rooms included in this complex are : the Desert Room, the Hot Test Room, the Tropical Marine Room, and the Jungle Test Room.

The Desert Room has a bank of 144 sunlamps which approximates noon day desert solar radiation. Room conditions can vary from plus 60 degrees Fahrenheit and 40 per cent relative humidity to plus 120 degrees Fahrenheit and 7 per cent relative humidity.

The Hot Test Room temperature ranges from plus 70 degrees Fahrenheit to plus 165 degrees Fahrenheit with relative humidities between 10 per cent and 90 per cent.

The Tropical Marine Room conditions can be cycled either way within three hours from plus 105 degrees Fahrenheit and 50 per cent relative humidity to plus 70 degrees Fahrenheit and saturation. Rain producing equipment will provide up to 12 inches per hour.

The Jungle Test Room has a temperature range from plus 110 degrees Fahrenheit and 80 per cent relative humidity to plus 90 degrees Fahrenheit and saturation. Rain, up to 12 inches per hour, can be produced. Also, its tropical conditions are excellent for fungi growth.

See Continuation Sheet 7B for a description of the types of tests performed in the McKinley Climatic Laboratory.

See Continuation Sheet 7C for examples of specific, non-Air Force tests that have occurred in the Climatic Laboratory.

MECHANICAL SYSTEMS: AIR CONDITIONING SYSTEM (Original - 1994)

The air conditioning system which supplies the MC and the Engine and Equipment Test Facility consists mainly of five elements:

1) A refrigeration plant employing approximately 100,000 pounds of Freon-12 and producing 12,000 tons of refrigeration at plus 70 degrees Fahrenheit.

2) A series of cooling and heating coils in the air delivery system which are heat exchangers between the air and cooling medium on the cooling cycle, and the air and the heating medium (steam) on the heating cycle. In 1995, Eglin replaced the Freon 12 used as the cooling medium with Freon-22.

3) A cooling tower for cooling water used in the refrigeration condensers.

4) A steam heating plant.

5) An air make-up system.

The Climatic Laboratory is unique in its ability to test jet engines, within the facility, while the engines are operating. However, this ability was not easy to achieve. To prevent compromising the conditions within the chamber, exhaust ducting is provided to carry the hot exhaust gases outside. Complicating this issue, as the chamber air is ingested into the jet engine, it must be replenished at the same rate as it's consumption in order to prevent collapsing of the chamber walls.

To overcome this potential problem, an air make-up system exists. This system consists of a building housing two 1000 Hp centrifugal fans and a series of heat exchanger coils, coupled with several large insulated storage tanks and a large air duct which directs the air from the air make-up building to the appropriate chamber. Three cylindrical tanks hold 260,000 gallons of calcium chloride and three spherical tanks hold 210,000 gallons of methylene chloride.

For an engine run in a cold chamber, the brine solutions in the tanks are pre-chilled by one of the main refrigeration units. The calcium chloride solution is chilled to 20 degrees Fahrenheit and the methylene chloride is chilled to minus 95 degrees Fahrenheit. During the run, these fluids are pumped out of the tanks and circulated through the coils in the air make-up building. The fans in this building are turned on, drawing outside air through the coils and, through ducts, into the appropriate chamber. The temperature of this air is regulated by the amount of fluid circulating through the coils, and the amount of air supplied is regulated by several air inlet dampers in the air make-up building. As the fluid warms, it is transferred into other insulated storage tanks. Engine run time is limited to the amount of cold brine solution being consumed.

When the engine run occurs in a hot chamber, the same procedure is followed substituting steam from three natural gas-fired boilers for the chilled fluids in the coils of the air make-up building.

PRESENT RENOVATIONS (1994-1997)

The McKinley Climatic Laboratory is undergoing a sixty-two million dollar renovation of its interior and mechanical systems. The renovation will allow the facility to continue to perform as a state-of-the-art climatic testing facility while maintaining its original appearance.

Within the MC, the renovation includes the complete replacement of the insulated wall and ceiling systems, replacement of the insulated floor system, new interior lighting, installation of an AFFF fire protection system, renovation of the two main doors, and replacement of all vertical lift and personnel doors. The MC overhead trusses, which hold the ceiling system in place, will be strengthened to meet current code requirements. The underfloor exhaust system, used to duct exhaust gasses from ground support equipment, will be replaced. The existing 4,000 pound capacity monorail system used for hanging test fixtures over test items will be replaced with a 6,000 pound capacity system. The adjacent southside observation room will be renovated.

The renovation of the ETC includes the complete replacement of the insulated wall and ceiling systems, replacement of the insulated floor system, new interior lighting, installation of an AFFF fire protection system, and replacement of the main and personnel doors. The adjacent observation offices will also be renovated. The internal supply and return air ducting system, which supplies conditioned air to the Main and Equipment Test Chambers, will be replaced. The air dampers, which direct the air to the chambers, will be renovated.

An additional air makeup unit will be added to provide conditioned air to the MC in order to support jet engine operation within the chamber. This system will supply an additional 500 lb/sec of conditioned air to the MC. The system is designed to operate independent from, or in parallel to, the existing air makeup system. With both systems running, the amount to makeup air available to the MC will be approximately 1000 lb/sec.

The north and south lean-to office areas will be renovated and remodeled to provide handicap access to the facility and to provide more efficient work space for test customers and lab personnel. An elevator will be added to the north side of the facility. New HVAC units and ducting will be installed. A sprinkler system will be installed covering occupied and unoccupied areas throughout the facility.

The existing, original electrical system will be replaced with a new code-compliant electrical distribution system. The plant steam and condensate return piping, the majority of which date back to the 1940s, will be replaced with new piping and valves. Also, a new facility monitoring system will be installed which will monitor the plant refrigeration and heating systems, as well as both air makeup unit operations. With the renovation is the addition of an AFFF retention pond, coinciding with the upgrade of the facility drainage systems in order to bring the facility into conformance with federal and state regulations.

The existing telephone system will be replaced with a new programmable system. The facility will be wired for Local Area Network (LAN) capability. A new twisted pair video system will be installed so that testing conducted in the chamber can be monitored, recorded, and displayed throughout the facility. A new public address system will also be installed.

Along with this large renovation project is a separate in-house project to replace the three main refrigeration units. The original units, using R-12 as the cooling medium, will be replaced with units using the more environmentally-friendly R-22. The three new units are, capability wise, 30% larger and will cool both the MC and the ETC. The design of the new refrigeration system, including all piping, valves, and controls, is being done by the Climatic Lab government engineers.

TYPES OF TESTING CONDUCTED AT THE CLIMATIC LABORATORY

LOW TEMPERATURE TESTS

The most common type of testing conducted at the McKinley Climatic Laboratory involves susceptibility of equipment to low temperatures. Most Air Force equipment is required to be operable at -40 degrees Fahrenheit and to be able to withstand -65 degrees Fahrenheit without suffering severe damage.

Low Temperature tests are conducted in the following chambers, minimum temperature in parentheses: MC (-65°F), ETC (-105°F), AWR (-70°F), and TA (-70°F).

Photographs #9 & 10 show a B-1B strategic bomber undergoing low temperature testing at minus 65 degrees Fahrenheit in the MC in 1986.

HIGH TEMPERATURE TESTS

Typically, Air Force equipment is required to be operable at 110 degrees Fahrenheit and to withstand 125 degrees Fahrenheit without suffering severe damage. Like the low temperature environments, the high temperature is easy to simulate for it requires no special test support equipment. Since solar radiation typically occurs in conjunction with high temperature exposure, test items are often subjected to these two types of tests concurrently. (Photograph #11)

High temperature tests are conducted in the following chambers, maximum temperature in parenthesis: MC (170°F), ETC (170°F), AWR (170°F), SWRD Chamber (170°F), SF Chamber (150°F), and TA Chamber (140°F).

HUMIDITY TESTS

A variable humidity environment is difficult to simulate, and most McKinley Laboratory test follow a diurnal cycle; one which simulates the temperature and humidity fluctuations during one day/night period.

Humidity testing is conducted in the following chambers, minimum-maximum relative humidity in parenthesis: MC (10%-100% RH), ETC (10%-100% RH), AWR (5%-95% RH), and SF Chamber (100% only).

SOLAR RADIATION TESTS

The test engineers at the Laboratory use segmented solar array frames (5' X 10') to create a solar radiation pattern. Each frame holds seventy-two 150 Watt incandescent lambs. Originally, ultraviolet lights were also used in the frames to better simulate the total solar spectrum. Unfortunately, the benefit of the test results did not compensate for the increased hazard to test personnel, and this practice was discontinued.

Solar Radiation testing is conducted in the following chambers, maximum number of frames in parentheses: MC (700 frames), ETC (20 frames), AWR (4 frames), and SWRD Chamber (20 frames).

ICING TESTS

Military equipment is required to have an all-weather operational capability. Frequently, military aircraft are required to fly during conditions which tend to allow ice formations to accumulate. Icing can have detrimental effects on the aircraft's capabilities.

The accumulations of ice can effectively change the wing's airfoil shape, increasing and reducing lift. Ice may cause binding of moving parts, obscuration of canopies and windscreens, or may block necessary orifices. Furthermore, there is the possibility of engine compressor and turbine blade damage.

As ice begins to accumulate on equipment, its formation is affected by many parameters, including, air temperature, water droplet temperature, size of the individual water droplets, the effective density of the cloud, and the surface temperature of equipment. A white, frosty, soft and crumbly ice formation is known as rime ice and may obscure windscreens and cause extreme increases in skin friction drag. Glaze ice, on the other hand, is clear, thick and hard and is extremely hazardous to aircraft engines. All of these conditions can be simulated at the McKinley Climatic Laboratory. (Photograph #12)

FREEZING RAIN TESTS

A test item can be subjected to conditions which occur when caught in the open with no shelter during a freezing rain storm. At impact, the water droplets begin to freeze while running off and a layer of glaze ice forms. To conduct this simulation, the Laboratory uses segmented rain frames to construct the necessary configuration to cover the desired area. These frames (10' X 12.5' each) are fitted with nozzles and supplied with pressurized water. The chamber is brought down to just above freezing, and the "rain" is allowed to fall. A yellow-green dye is often mixed with the water to allow for easy identification of ice formations. Within minutes a sheet of glaze ice will begin to accumulate over the surface of the test item and icicles will form.

ICING CLOUD TESTS

This test simulates taxiing or flying slowly through fog or clouds which are at or below the freezing point. As the aircraft impacts the droplets suspended within the cloud, the cold surfaces of the aircraft accumulate ice. At the Climatic Laboratory, tests to simulate this type of icing are performed to tests ways of preventing ice formation of exposed aircraft parts. This test generates a mixture of both glaze and rime ice.

VORTEX ICING TESTS

The McKinley Climatic Laboratory can also simulate a jet aircraft taxiing on a wet runway while the air temperature is either at or slightly below freezing. Pre-chilled water is placed under the engine inlet of the aircraft. Once the engine is started, a vortex (similar to a small tornado) forms between the ground and the engine inlet. The vortex produces a low pressure area that will suck water from the pan into the engine inlet. The water freezes and covers the inside surfaces of the engine inlet with rime ice while encasing the edges of the inlet with glaze ice. If ingested, this ice an cause severe internal damage in the engine.

Icing testing is conducted within the following chambers, maximum number of frames in parenthesis: MC (45 frames), ETC (10 frames), and AWR (3 frames).

RAIN TESTS

Rain testing is designed to simulate exposure to rainfall or aircraft flying through the rain. The former, known as rain intrusion, examines the test item's ability to prevent the penetration of water. The latter, rain ingestion, explores an engine's capability to operate with extensive amounts of water of moisture present in the intake air.

Rain testing is conducted by placing segmented rain frames above the test item, fitting the frames with nozzles, and supplying the frames with pressurized water. The water is then allowed to fall as "rain", in a controlled flow for a controlled period of time. Rain testing occurs in the following chambers, maximum number of frames in parentheses: MC (45 frames), ETC (10 frames), AWR (3 frames), and SWRD Chamber (12 frames). (Photographs #13 & 14)

SAND TESTS

The Laboratory uses several grades of sand to conduct blowing sand tests. The sand is dispensed from a large hopper, by regulating the frequency of a vibrating chute underneath, into an aspirated air steam, and then directed in front of a large wind machine. Blowing sand tests can be conducted in almost any chamber.

DUST TESTS

The Climatic Laboratory uses silica flour to conduct blowing dust tests. The dust is either dispensed in the same manner as the sand tests, or, for a lower concentration, a rotating drum stirs the particles until they are airborne and then the blower is employed. Blowing dust tests are conducted only in the SWRD Chamber.

WIND TESTS

The Laboratory rarely conducts tests strictly to examine the effects of wind. However, it uses 5 1/2 foot diameter wind machines, that generate up to 60 mph winds, to conduct a variety of the tests. Tests requiring the wind machines are conducted only within the following chambers: MC, ETC, AWR, and SWRD Chamber.

SNOW TESTS

The Climatic Laboratory uses snow-making machines in order to conduct snow, icing, and humidity tests. The snow machines are approximately 3' diameter and are the same type used at many ski resorts. Tests requiring the snow machines are conducted only within the following chambers: MC and ETC.

In a below-freezing hangar, the snow machines can be directed upward to create falling snow. This method is used to create blowing snowstorms and to accumulate snow for snow loading tests. If they are directed at the test item, however, the water droplets will not freeze in the air but on the item, creating ice.

Snow loading tests are those in which a 6 to 24" layer of snow is intentionally accumulated on the upper surfaces of a test item. This test is conducted to determine if the item is structurally sound enough to withstand the weight of the snow, and to identify potential problems for either the maintenance personnel or the test item which might result from the snow buildup or removal procedures. (Photographs #15 &16)

SALT FOG TESTS

Salt fog testing is designed to promote corrosion. Because of the corrosive nature of the Sodium chloride/water mixture (5% salinity), these tests are conducted exclusively in the Salt Fog Chamber with the very restricted use of photographic equipment.

FOG VISIBILITY TESTS

For many years, the McKinley Climatic Laboratory created fog within the MC. Usually this was accomplished by accident and not intended to be a part of the on-going testing. Recently, however, engineers designed a way to purposefully create fog conditions within the MC to test the effects of visibility on optical sensors. This test degrades visibility within the chamber to such an extent that it prohibits the use of photographic equipment.

PRESSURE ALTITUDE TESTS

In the past, personnel were tested within the temperature/pressure altitude chamber. Today, only equipment testing is conducted within the altitude chamber. The chamber has two air locks to aide in rapid decompression tests. Pressure can be reduced in the TA to 87mb Hg (50,000 feet) with -70 degrees Fahrenheit in 12 minutes. With more time, pressures can be reduced to 20mb Hg (75,000 feet) and temperatures reduced to -80 degrees Fahrenheit. (Photograph #17)

GUNFIRE TESTS

A projectile trap in the MC is provided for firing a single .50 caliber round. This trap is a large metal casing filled with sand and plywood. Most gunfire has been accomplished in conjunction with other testing of weapon systems in which the gun was integrated. For example, gunfire has been accomplished within the MC during full-scale climatic testing of the A-10 Thunderbolt, the F-16 Falcon, and the F-18 Hornet.

Gunfire testing can be accomplished in the following chambers, maximum burst size in parentheses: MC (30 rounds, 30mm), ETC (30 rounds, 20 mm), AWR (1 round, 0.50 caliber), and SWRD Chamber (1 round, 0.50 caliber).

EXAMPLES OF NON-AIR FORCE TESTING AT CLIMATIC LABORATORY

The McKinley Climatic Laboratory is available for use by the Department of Defense (DoD) and all other government agencies. Contractors holding current contracts with any DoD agency may conduct tests in the facility when sponsored by the agency. Under certain conditions, commercial non-government contractors desiring the use of the McKinley Climatic Laboratory may be sponsored by a Federal executive agency.

The following is a sample of the non-military testing that has been accomplished at the McKinley Climatic Laboratory in recent years.

SHUTTLE FREEZING RAIN TEST

A series of environmental tests were run in the MC to determine under what meteorological conditions ice would form on a space shuttle fuel tank. Formation of clear glaze ice on the fuel tank is unacceptable because the fuel tank is located above the shuttle during launch. Vibrations from the launch could cause the ice to separate from the fuel tank and impact the heat shield tiles causing extensive damage. The test results identified what conditions would produce potentially hazardous ice build up.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) DRIFTING BUOY METEOROLOGICAL SENSOR SYSTEM.

NOAA data buoys are instrumented, remote, unmanned weather stations deployed in the Atlantic and Pacific Oceans and the Gulf of Mexico. The buoys automatically collect weather data for the National Weather Service and other government and private agencies. The buoys' performance was evaluated in the Engine Test Cell while subjected to the following extreme conditions: high/low temperature, temperature shock, temperature altitude, solar radiation, rain, salt fog, leakage immersion, water impact, and ice. No major failures were recorded during this testing.

FEDERAL AVIATION ADMINISTRATION (FAA) DEICING FLUIDS

A portion of an aircraft wing was placed in the Engine Test Cell to evaluate ethylene glycol's deicing ability. An analytical correlation was obtained for estimating onset time for the deicing fluid to crystallize and onset time before snow accumulates.

NATIONAL SCIENCE FOUNDATION (NSF) CLOUDSONDE UNIT

The Cloudsonde unit is a balloon-supported instrumentation system which measures supercooled liquid water concentrations in clouds. It was developed by the Utah State University under a NSF grant. The Engine Test Cell produced clouds with various known liquid water concentrations for the Cloudsonde tests.

GENERAL ELECTRIC MOBILE TOMOGRAPHY SCANNER (MTS)

The MTS consists of a computed tomography scanning system installed in a semi-trailer chassis for mobility. This system was tested in the Engine Test Cell in extreme high and low temperatures and high humidity.

ROCKWELL INTERNATIONAL ADVANCED THERMAL PROTECTION SYSTEM

A wind blown rain test was conducted in the MC on insulation blankets under development to replace the Space Shuttle's tiles. Water absorption can significantly affect insulation weight and subsequent structural and thermal performance. Results indicated insulation packing or distortion significantly affect the system's insulating characteristics and aerodynamic behavior.

MITSUBISHI AIRCRAFT INTERNATIONAL MU-300

Testing was accomplished to obtain FAA approval for operations at extremely low temperatures. The aircraft was operated in the MC at minus 20 degrees Fahrenheit and minus 40 degrees Fahrenheit.

FAA RUNWAY VISIBILITY INSTRUMENTS

These tests evaluated the accuracy and performance of visibility instruments in induced, known conditions. It also determined operating characteristics and dynamic range of the instruments in light and heavy rain, freezing rain, snow, and temperature extremes of minus 50 degrees Fahrenheit to plus 158 degrees Fahrenheit. Seven different types of sensors were evaluated.

KELLY SPRINGFIELD TIRE TEST

The MC floor was covered with approximately one foot of hard packed snow. Instrumented vehicles were then used to measure the acceleration and braking capabilities of numerous types of tires.

COAST GUARD 65A DOLPHIN HELICOPTER

Full-scale development testing took place initially with the helicopter subjected to all available MC climatic conditions. Some major problems were discovered during the testing that led to significant modifications. The helicopter was retested numerous times until the right modifications were implemented.

NASA SPACE CAPSULE ICING TEST

Another MC test immersed a space capsule in a large tank containing 32 degree Fahrenheit water. Three astronauts were placed inside the capsule and the capsule was completely iced over. This occurred over a 12 hour period during which time the astronauts were assisted in their egress from the capsule.

TENNESSEE VALLEY AUTHORITY (TVA) FREEZING RAIN TEST

The TVA was having problems with electrical contacts in freezing rain. A full-scale mock-up was built inside the MC and modifications tested until the solution was found.

COAST GUARD PERSONNEL ARCTIC SURVIVAL TEST

Coast Guard personnel underwent a one-day arctic survival test in the -40 degrees Fahrenheit MC after extensive classroom training on how to survive in arctic conditions. The personnel were left in the chamber for approximately eight hours.

STATEMENT OF SIGNIFICANCE

ADDITIONAL ARCHITECTS/BUILDERS

Under Supervision of U.S. Army Corps of Engineers

Robert and Company - design
J. A. Jones Company - construction
Lt. Col. McKinley - conception and initial design

STATEMENT OF SIGNIFICANCE

SUMMARY

During World War II, it became apparent that the United States was to be a dominant world power. Such a power needed armaments and materials that could function in all climates and under all circumstances. To meet this need, the United States designed and constructed the McKinley Climatic Laboratory.

The McKinley Climatic Laboratory is eligible for listing in the National Register of Historic Places under Criteria A and C and Criteria Consideration G at the national, state, and local levels. Initiated during World War II on the Army Air Corps' Air Corps Proving Ground, Eglin Field, it is significant in the areas of Military history, Architecture, Engineering and Science. Under Criterion A, the Climatic Laboratory possesses significance for its contribution to the Nation's warfighting capabilities during the World War II and Cold War eras. The period of historical significance extends from the end of the World War II era through the Cold War. Under Criterion C, the Laboratory achieved significance for its advanced engineering design.

The Climatic Laboratory is also significant under Criteria Consideration G, for it has achieved significance over the past fifty years. Despite its construction being a high national priority, the McKinley Laboratory's original completion date of March 1945 was repeatedly delayed by a combination of technological challenges, wartime materiel shortages, and post-war strikes by subcontractors. The first operational testing, including a wide variety of aircraft and equipment, occurred in May 1947. Since that time, over 300 different aircraft and 2000 other equipment items have been tested for the Department of Defense, private industry, and a number of allied governments. Col. Ashley C. McKinley first suggested the Climatic Laboratory and , after securing approval and funding, played a key role in its design and construction. Following his death in February 1970, the Climatic Hangar was renamed in his honor. Although 40 years have passed, the Laboratory remains a pinnacle of engineering.

HISTORICAL CONTEXT

The McKinley Climatic Laboratory is located on Eglin Air Force Base. The 464,000 acre Eglin Reservation, in Santa Rosa, Okaloosa, and Walton counties, is located north of Choctawhatchee Bay and the Gulf of Mexico in the lower coastal plain region of Florida's Panhandle.

In fulfilling its military mission, Eglin Air Force Base has made major contributions to the defense of the United States in the development of tactical strategies, testing of weaponry, and missile research. Eglin, the largest Air Force base in the Western Hemisphere, played an important role in World War Two.

Actual development of a military base began in 1933 when U.S. Army Air Corps officials from Maxwell, Alabama, initiated a search for a site suitable for a bombing and gunnery range. In 1935 the War Department acquired by lease 137 acres of land near Valparaiso on which to build an airport. At the same time, the Department requested Congressional authorization to construct facilities there for military operations as well as to secure transfer of a much larger area within the forest for weapons testing.

During World War Two, Eglin Field served as the nation's principal station for air warfare experimentation. The primary purpose of the Proving Ground was to provide a station for tactical tests of aircraft armament and accessory equipment and of aviation tactics and techniques. Accelerated aircraft and armament tests began in September 1941, three months before Pearl Harbor. The early tests encompassed a variety of areas, including a determination of efficient tactics and materials for night attacks upon enemy aircraft, comparisons of low and high altitude bombing, the effectiveness of specific weapons of various caliber, tests of specific aircraft, and such mundane items as tests of storage cabinets and spark plugs .

One early priority of the Proving Grounds was the climatic testing of aircraft. America's involvement in a global war meant that aircraft would be subjected to a variety of climates, ranging from arctic conditions in Alaska and hot deserts in the Middle East to tropical rain forests in the Far East. Gathering data concerning climatic testing of machines, development of adaptive equipment, and expedient acclimatization of troops were critical to military operations. The Arctic, Desert and Tropic Information Center was established at Eglin to coordinate gathering of data and oversee climatic testing of equipment, shelter, food, medicine, clothing, and even the selection and care of personnel.

In 1934 the Congressionally-appointed Baker Board recommended that tactical units be trained in various parts of the United States under winter conditions, and that at least one composite squadron undergo all-year training in Alaska on a continuing basis:

> In order that experience may be gained in cold weather, high and low altitude, and unfamiliar weather operations, and in the difficulties incident thereto, in engine starting, fuel, oil and servicing problems, the Committee recommends that frequent training of tactical units be held in different parts of the United States under winter conditions; and, in addition thereto, that at least one composite squadron be given opportunity for frequent training in Alaska in all-year weather.

This recommendation, coupled with the interest of General H. Arnold, led to the establishment of Ladd Field, at Fairbanks, Alaska. In 1942, cold weather testing began on a regular basis. However, the Cold Weather Test Detachment, operating under the Alaskan Defense Command, faced many difficult transportation, personnel, and supply problems. More importantly, the uncertainty of weather played havoc with schedules. This led many manufacturers and government agencies to doubt the effectiveness of cold weather testing operations.

In the winter of 1942-1943, the otherwise efficient German Air Force could not get its aircraft in the air during subzero weather. This grounding of the entire German Air Force, coupled with the difficulties the Cold Weather Test Detachment was experiencing at Ladd Field, made it clear to the United States that cold weather testing was indeed necessary, and a reliable means of testing must be found. Testing of aircraft and equipment under controlled conditions was clearly a step in that direction. The cold weather testing program was officially assigned to the Army Air Force Proving Ground Command (AAFPGC) at Eglin Field, Florida, on 9 September 1943.

Colonel H. O. Russell and Lt. Colonel Ashley C. McKinley were given the task of developing new and innovative cold weather testing techniques in the Floridian climate. Col. McKinley served in the Army Signal Corps, earning his wings as a dirigible pilot, and, during World War I, commanded a Balloon Observation Company on the front lines. In 1926, McKinley resigned from service to enter private business but soon joined Admiral Byrd, who was planning the first Antarctic expedition, and accompanied him to the South Pole. McKinley was awarded a special Congressional Medal of Honor for his performance on the expedition. He reentered the Army Air Corps in 1941 and was primarily engaged in cold weather testing and operations in Alaska.

Lt. Colonel McKinley was well aware that the United States had established itself as a global power and needed a force capable of operating in all environmental extremes. Further, since environmental testing at Ladd Field in Alaska was expensive and had produced only meager results, McKinley reasoned that testing under controlled conditions would yield far superior test results and would be up to ten times more economical.

Lt. Colonel McKinley suggested that all United States aircraft and equipment be operable at -65 degrees, and that a refrigerated hangar be constructed to produce such an environmental extreme under controlled conditions. A refrigerated laboratory within the continental limits of the U.S. had several clear advantages. First, it would allow testing on a twelve month basis under controlled conditions. Second, it would eliminate the necessity for maintaining a permanent Cold Weather Detachment in Alaska, saving the costs in dollars and personnel to operate the same. The solution, therefore, was to construct such a chamber at Eglin Field.

This project, as outlined by Lt. Col. McKinley, called for a hangar type building of sufficient size to house a Main Chamber for aircraft as large as a B-29, several separate cold rooms, armament test chambers, shops, and offices. The refrigeration equipment was designed to attain minus 70 degrees Fahrenheit 48 hours after start of operation and to maintain this level with an outside temperature as high as 90 degrees Fahrenheit.

Besides meeting the main objective of providing a cold weather test facility, the plan included the capability to simulate the extremes of all climatic conditions. The plans for the project were completed by Col. H. O. Russell and approved by the United States Army Air Force Headquarters on 12 May 1944. The initial cost was set at nearly 2 million dollars, however, that cost had risen to 5.5 million by the time the construction was completed. The U.S. Department of Engineers gave Robert and Company the contract for design and engineering and the J. A. Jones Construction Company the contract for construction. Lt. Col. McKinley was assigned the responsibility to set up a Climatic Section and prepare for test activities for the facility.

The problems and difficulties that this project encountered were considerable. Under peacetime conditions, an experimental project like the Climatic Hangar would first have gone through an extensive engineering stage during which all aspects of construction and development were thoroughly explored. However, due to the urgent need, the desire to get the request approved well in advance of the new fiscal year, and the necessity to indicate the general scope of the project, preengineering was impossible. Development of specifications, engineering, and construction all had to proceed concurrently. Normally , the responsibility for the design and construction of Air Force installations was with the U.S. Department of Engineers. Because of the urgency of this project, however, an agreement was worked out between the Engineers and the Army Air Force Proving Ground Command (AAFPGC) whereby the latter could maintain primary supervision over design and construction to enhance completion of the project.

The design and engineering task was monumental, especially considering the state-of-the-art in the mid 1940s. Nothing similar had ever been attempted. To cool approximately three million cubic feet to minus 70 degrees Fahrenheit posed problems which ordinarily would have required months of subsystem design, research and testing. To meet the ambitious schedule, however, the refrigeration units had to be designed, developed, manufactured, and delivered without testing. The York Corporation, manufacturer of the refrigeration equipment, did a superb job. Their units not only worked satisfactorily, but in many respects performed better than specified.

Because of war-time shortages, delays in the delivery of parts and materiel were inevitable and construction of the Climatic Hangar was slowed repeatedly. By November 1944, the original completion date of 1 March 1945 (which referred only to building construction and not to operational readiness) had slipped to May 1945. In January 1945, partial capability was expected by September. By the end of March, however, the completion date had to be revised once more due to delays in deliveries. January 1946 was then set for completion of the entire project and the start of performance testing. Unexpected post-war strikes at several key subcontractor plants, including the Westinghouse Corporation, supplier of the electrical motors for the refrigeration units, and continuing shortages of critical materials further delayed completion until mid 1946.

The first test of one refrigeration unit in the Main Hangar took place on 2 August 1946, and a more extensive test of two units on the 23rd of the same month. With only two of the three units operating, the Hangar was cooled to minus 70 degrees Fahrenheit in approximately 34 hours. This temperature was maintained for 14 hours. This was outstanding performance since the specification, with all three units operating, was to reach minus 70 degrees Fahrenheit within 48 hours. This unexpected ability later proved to be a major advantage as it allowed the running of more test items for longer periods than was at first contemplated. In addition, it allowed hangar operations at temperatures below minus 70 degrees and saved time during the pull down period.

Despite the successes, some problems were encountered; the resistors on the motor controllers overheated and had to be enlarged, and considerable air leakage developed around the doors and in the ceiling. Although the Hangar required much more work for completion and was far from being in smooth operation, its value as a key test facility was clearly validated.

The lack of any preenginneering, the delays encountered and the experimental nature of the project all contributed to an increase in the original construction budget. Additions such as an electrical substation for the Hangar, facilities for a physiological section and unforeseen expenditures for insulation and fire fighting equipment also contributed to higher costs. In October 1944, the estimate for the completion of the project was about $1 million more that the original estimate of around $2 million. As a result of his conferences a Ladd Field, Alaska, Col. Russell suggested in January 1945 that a jet engine air inlet be incorporated into the design of the Hangar. In February 1945, Headquarters Army Air Force approved an additional $1.5 million and in June of the same year, the Office of the Chief of Engineers allocated $909,300 in additional funds, bringing the final bill for the Climatic Hangar to about $5.3 million.

In May 1947, the first tests were conducted under a simulated arctic environment. Aircraft tested included a Fairchild Packet, a Boeing B-29, a Lockheed P-80, a North American P-51, a Lockheed P-38, and a Sikorsky R5D helicopter. During the tests, temperatures as low as -70 degrees Fahrenheit were reached. The first attempts at the recreation of Arctic conditions on a large scale were successful.

Work on the Hangar continued through 1951 when all three refrigeration units were operated simultaneously for the first time. A total of ten chambers were built to test all sizes of equipment in every climatic condition possible.

The Climatic Hangar was designed to permit engines and other major equipment to be operated during tests. With the exception of actual flight, aircraft could be checked out in every functional mode. Flaps, landing gear, bomb bay doors, bomb release mechanisms, gun turrets, cameras and mechanical equipment could all be tested in operation. Specially built pits even allowed for the dropping of dummy bombs.

HISTORICAL SIGNIFICANCE

With the completion of the Eglin Climatic Hangar, the newly born United States Air Force acquired its largest and most important test facility. On the purely technical side, its merits and achievements were record setting. Cold weather testing was, for the first time, put on a permanent, scientific basis. Early Air Force tests proved so successful that the Climatic Hangar became a facility utilized by all Department of Defense agencies. In 1949, the Navy established a permanent testing detachment at the facility and conducted tests on numerous weapon systems and equipment. Although the permanent detachment was later dissolved, the Navy continues to be a regular facility customer.

Beyond advancing the disciplines of climatic simulation and testing, the concepts for refrigeration and insulation were put to unprecedented practical challenges. Clearly, the Climatic Hangar had pushed a number of technologies to heights never before achieved.

Based upon initial operation, it was evident that the Climatic Laboratory's performance exceeded even the expectations of those involved with its design. From a cost comparison of field testing versus environmental testing under controlled conditions within the Climatic Laboratory, it has been shown that the facility was and still is one of the most outstanding examples of money-saving and method-improvement within the Department of Defense.

In 1965, the Air Force realized that the capability to operate engines inside the hangar was not keeping pace with the development of larger and more powerful engines. Alterations were needed to raise the conditioned air intake capabilities from 200 to 600 pounds per second. In 1966, a study was conducted and a design prepared to accommodate the increased capacity. Construction started in June 1968 and was completed in February 1971.

A new problem surfaced in 1968 with the design and construction of the C-5A aircraft. This was the first aircraft built that would not fit into the original Main Chamber (MC). To meet this new challenge, construction was started in October 1968 on an addition to the MC called the C-5A Empennage Addition. Work was sufficiently complete in June 1969 to allow C-5A testing to start on schedule.

On 11 February 1970, the key person involved in the conception and design of the Climatic Hangar, Lt. Colonel Ashley C. McKinley, died. In 1971, the Hangar was renamed the McKinley Climatic Laboratory in memorial to him. Col McKinley, due to his work in giving birth to the concept of, seeking approval and funding for, and assisting in the design of the Climatic Hangar, is recognized as its founder.

In 1973-1975 the McKinley Climatic Laboratory underwent another renovation, the main products being the additions of the Salt Test Chamber and the Sun, Wind, Rain & Dust Chamber. The Salt Test Chamber, detached off the northwest corner of the main building, was designed and built to perform salt fog corrosive testing. The newest addition to the facility, the 50' X 50' X 30' Sun, Wind, Rain & Dust Chamber stands apart from the southwest corner of the main building. It was designed to produce a variety of test conditions and has the capability to create any temperature between plus 60 and plus 170 degrees Fahrenheit. This period of renovation also produced a new vertical lift attached to the Jet Engine Augmentation Building (the C-5A test facility).

The McKinley Climatic Laboratory is currently undergoing a renovation that entails an upgrade of its entire refrigeration system, including the removal of ozone-depleting coolants. The floor of the MC and other areas of the facility that have been damaged by their exposure to severe environmental conditions over time are being repaired or replaced. Although extensive, the renovations will not alter the facility's historic value. McKinley is to remain the same in appearance and function. The renovation process, although very expensive, was seen by the Department of Defense as the necessary way to keep this one-of-a-kind facility workable and state-of-the-art.

CONCLUSION

The McKinley Climatic Laboratory was designed and constructed in the closing years of World War II, as the United States began to realize its place as a global superpower. The experiences and results of aircraft and missile testing over the last 50 years have revealed the importance of all-weather testing. Over the years, a philosophy has grown out of this testing. This philosophy embraces the concept that extreme environmental testing of weapons systems is a vital necessity in our global military effort. The most important benefit of this testing is reliability. The harsh environments of the global operational theaters continually require more complex and reliable systems to maintain operational capability and ensure the peace.

The McKinley Climatic Laboratory offers controlled environmental testing that affords the opportunity to continually study and understand the mechanics of failure associated with operating in extreme environmental conditions. The full exploitation of extreme environmental testing has led to the understanding and elimination of many of these mechanisms of failure, thereby improving overall weapons system reliability and safety. This is vitally important in these times of increasing technological complexity.

The results obtained from the vast array of aircraft and equipment tested within the Climatic Laboratory have been a major factor in maintaining the position of the United States as the world's leading military power. Much of the aircraft, weapons and materiel that served in aiding and policing the Cold War world were tested in the Climatic Hangar. For many agencies of the Department of Defense, environmental testing conducted at the Air Force Development Test Center (AFDTC), Eglin AFB, is an essential step in establishing a proven military capability to meet global commitments. (See Continuation Sheet 7C for specific examples of non-Air Force tests conducted at the McKinley Climatic Laboratory.) All of these reasons make the McKinley Climatic Laboratory eligible for listing under National Register Criterion G.

The Climatic Laboratory meets Criterion C on the basis of its unique, and highly technical design and construction. The Laboratory was the first climatically controlled hangar large enough to handle all types of aircraft, and remains the largest known climatic test chamber. The intricacy of design and construction, especially when considered against the state-of-the-art during World War II, has allowed McKinley Laboratory to remain in dominant position in the world of climatic testing. Upon completion of the current renovations, the Laboratory will be completely functional and climatic tests will continue at a near capacity pace.

The McKinley Climatic Laboratory is eligible for listing under National Register Criterion A because of its role at the end of World War II and during the Cold War as America's principal climatic testing facility for armaments, weapons, and aircraft. Further, it is an integral member of the Air Force Development Test Center, Eglin Air Force Base, with a World War II wartime mission of testing, training, and weapons development associated with several critical wartime events. The concept of a Climatic Laboratory situated within the continental United States grew out of the wartime desire for precise testing as well as the urgency associated with the global war. It was due to the concept, design and initial construction of the Climatic Laboratory that Eglin was tasked with climatic testing, originally in its Building 6, during the war. This climatic testing fit well with Eglin's larger role as a testing and weapons development base, a role that was associated intimately with such events as the Doolittle raid on Tokyo, the Normandy invasion, the destruction of Germany's V-1 and V-2 rocket launching sites, the bombing campaigns against Germany and Japan, and the tests of the aircraft that dropped the atomic weapons on Japan, among many others. Although the first tests conducted in the Climatic Laboratory were not begun until after the close of the war, it was designed and construction begun in 1944 and was meant to be operational by 1945. The concept, state-of-the art design and construction attributes of the Laboratory were all very much the products of the World War II effort.

NPS Form 10-900-a OMB No. 1024-0018
(8-86)

United States Department of the Interior
National Park Service

NATIONAL REGISTER OF HISTORIC PLACES CONTINUATION SHEET

Section 9 Page 1 Mckinley Climatic Laboratory
name of property
Okaloosa, Florida
county and State

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GEOGRAPHICAL DATA

BOUNDARY DESCRIPTION

The boundary is drawn to encompass only the McKinley Climatic Laboratory on Eglin Air Force Base. The Laboratory is located on the northwestern side of Eglin Boulevard. The Climatic Laboratory consists of six chambers, four in the main building, Building 440, and two detached chambers in Buildings 430 and 448. The boundary line starts at a point 10 feet west of the western corner of Building 430 and runs southeast 10 feet away from and parallel to the side of Buildings 430 and 440. Ten feet south of the southernmost corner of Building 440, the boundary line turns and runs northeast to a point 10 feet east of Building 448's easternmost corner. From this point, the line turns and runs northwest, 10 feet from and parallel to Buildings 448 and 440. Upon passing 10 feet from the northernmost corner of Building 440, the line turns to the west-southwest, running through the parking lot to a point 10 feet north of Building 430's northernmost corner. From this point, the line runs southwest 10 feet from and parallel to the northwestern side of Building 430, meeting the boundary's originating point 10 feet west of the westernmost corner of Building 430. This forms an irregular pentagonal boundary.

BOUNDARY JUSTIFICATION

The boundary is drawn to include only the McKinley Climatic Laboratory. Thus, the boundary encompasses Facility 440, the Climatic Laboratory main building, and its two detached chambers, the Salt Fog Chamber (Facility 448) and the Sun, Wind, Rain & Dust Chamber (Facility 430). The main building contains the four original chambers, known as the MC, the ETC, the AWR, and the TA. Together, these six chambers are the McKinley Climatic Laboratory. Outside of the boundary line lies a scatter of structures unrelated to the significance of the McKinley Laboratory. Much of the area outside of the boundary is parking lot.

SUPPLEMENTARY LISTING RECORD

NRIS Reference Number: 97001145 **Date Listed:** 10/06/97

McKinley Climatic Laboratory — Okaloosa — FLORIDA
Property Name — **County** — **State**

N/A
Multiple Name

This property is listed in the National Register of Historic Places in accordance with the attached nomination documentation subject to the following exceptions, exclusions, or amendments, notwithstanding the National Park Service certification included in the nomination documentation.

Signature of the Keeper — 10/9/97 **Date of Action**

Amended Items in Nomination:

Section No. 3: This nomination is amended to show that the FPO recommends that the property be considered significant at the national, State, and local levels.

Section No. 8: The period of significance is amended to end in 1989, when the opening of the Berlin Wall signaled the end of the Cold War.

Section No. 10: The boundary description is amended to read: "The boundary is drawn to encompass only the McKinley Climatic Laboratory on Eglin Air Force Base. The Laboratory is located on

(Continued)

the northwestern edge of Eglin Boulevard. The Climatic Laboratory consists of six chambers, four in the main building, Building 440, and two detached chambers in Buildings 430 and 448. The boundary line starts at a point 10 feet west of the western corner of Building 430 and runs southeast 10 feet away from and parallel to the side of Buildings 430 and 440. Ten feet south of the southernmost corner of Building 440, the boundary line turns and runs northeast to a point 10 feet east of Building 448's easternmost corner. From this point, the line turns and runs northwest, 10 feet from and parallel to Buildings 448 and 440. Upon passing 10 feet from the northernmost corner of Building 440, the line turns to the west-southwest, running through the parking lot to a point 10 feet north of Building 430's northernmost corner. From this point, the line runs southwest 10 feet from and parallel to the northwestern side of Building 430, meeting the boundary's originating point 10 feet west of the westernmost corner of Building 430. This forms an irregular pentagonal boundary."

The boundary justification should read: "The boundary is drawn to include only the McKinley Climatic Laboratory. Thus, the boundary encompasses Facility 440, the Climatic Laboratory main building, and its two detached chambers, the Salt Fog Chamber (Facility 448) and the Sun, Wind, Rain & Dust Chamber (Facility 430). The main building contains the four original chambers, knows as the MC, the ETC, the AWR, and the TA. Together, these six chambers are the McKinley Climatic Laboratory. Outside of the boundary line lies a scatter of structures unrelated to the significance of the McKinley Laboratory. Much of the area outside of the boundary is parking lot."

These changes have been confirmed with the Air Force FPO.

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