

LORING AIR FORCE BASE, DOUBLE CANTILEVER HANGAR
(Loring Air Force Base, Building 8289)
East of Arizona Road; west of the southern
portion of Taxiway J
Limestone Vicinity
Aroostook County
Maine

HAER No. ME-64-C

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA



PHOTOGRAPHS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, Pennsylvania 19106

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HISTORIC AMERICAN ENGINEERING RECORD

LORING AIR FORCE BASE, DOUBLE CANTILEVER HANGAR
(Loring Air Force Base, Building 8280)

HAER NO. ME-64-C

Location: East of Arizona Road; west of the southern portion of Taxiway J
Limestone Vicinity
Aroostook County, Maine

USGS 7.5-minute Fort Fairfield NW Quadrangle
Universal Transverse Mercator Coordinates:
19:584497.5198353

Date(s) of Construction: 1955

Architect: Kuljian Corporation
Contractor: Albert A. Lutz Company, Inc.

Present Owner(s): United States Air Force
Air Force Base Conversion Agency (AFBCA) - Loring
RRI, Box 1719
Limestone, Maine 04750-7943

Present Occupants: Vacant

Present Use: Vacant

Significance: The Double Cantilever (DC) Hangar was an integral part of Loring Air Force Base's (AFB) aircraft maintenance system, responsible for sustaining the aircraft's ready condition should aggressive Soviet behavior warrant a retaliatory attack. It was the first and only hangar at Loring AFB capable of housing five B-36 bombers simultaneously. The hangar stands as the focal center of the base's aircraft maintenance facilities built to assist Strategic Air Command (SAC) in the execution of its Cold War mission, and was one of the first double-cantilever hangars built for the Air Force in response to SAC's demand for larger, more efficient maintenance space. Important construction features include its unique foundation based on ejected caisson construction, its longitudinal arched trusses allowing maximum vertical clearance, its 35-ton trusses cantilevering 95 feet at both ends from their center shop supports, and the flawless design that prevents structural sway or sag.

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Project Information:

Pursuant to the recommendations of the 1990 Defense Base Closure and Realignment Commission, Loring AFB was closed in September 1994. In order to mitigate adverse effects to historic properties that may occur with conveyance of property to a non-federal agency, mitigation measures were recommended in the Loring AFB Historic Building Inventory and Evaluation. The Maine State Historic Preservation Officer (SHPO) has concurred with the Air Force's recommendation of Historic American Building Survey (HABS)/Historic American Engineering Record (HAER) recordation of National Register-eligible properties in lieu of nomination to the National Register.

Earth Tech, Inc.
1461 East Cooley Drive, Suite 100
Colton, California 92324

SUMMARY DESCRIPTION OF THE DOUBLE CANTILEVER HANGAR

Historical Background. Construction of the Double Cantilever (DC) Hangar at Loring Air Force Base (AFB) began in early 1954. The DC Hangar was designed by the Kuljian Corporation of Philadelphia (Eads 1956:62). The project fell under the jurisdiction of the New England Division of the U.S. Army Corps of Engineers (USACE). The contractor for the project was the Albert A. Lutz Company, Incorporated, of New York. The associated parking aprons were constructed by B. Perini & Sons, Incorporated, of Framingham, Massachusetts.

Description and Construction Details. Loring AFB Field Maintenance Hangar No. 8280, commonly known as the DC Hangar, is a steel double-cantilevered truss structure. The hangar is just east of Arizona Road and its adjacent railroad spur. Directly east of the hangar lies the southernmost stretch of Loring AFB's alpha taxiway (an alternate runway now called Taxiway J). Access aprons abut the DC Hangar on the northern and southern elevations to provide access to the hangar's entrances. The aprons are accessed by short taxiways from the adjacent maintenance apron.

The defining feature of the DC Hangar is its structural composition, which is an adaptation of the century-old cantilever principle. The result of the design is the creation of a very large maintenance building unparalleled by any other military structure. The main hangar is 250 feet by 600 feet, plus associated appurtenances.

The DC Hangar was designed to provide a maximum of usable space, while being built as inexpensively as possible. To overcome northern Maine's adverse building conditions, a unique method was used to construct the hangar's massive concrete foundation. Begun early in 1954, 260 concrete caissons were inserted into the solid ground by shooting the concrete into the earth with a 7,000-pound hydraulic ram. These 24-inch-diameter caissons rest 25 feet below the ground's surface on a large limestone formation.

With the foundation complete, the floor slab was poured. The slab was of Portland cement concrete, 14 inches thick, with edges thickened to 17.5 inches at the expansion joints. Embedded in the reinforced concrete floor was a network of steel pipe that supplied the hangar with a radiant heat source. A water collection directed wastewater to the adjacent Plane Wash Waste Disposal Plant.

Sixteen structural steel columns encased in concrete support the roof. Grouped in four sets of four, the columns are spaced equally along the longitudinal centerline of the hangar and provide the support base for the cantilevered design. The strategic placement of the column groups creates sufficient space for four interior, three-story concrete shop buildings.

The superstructure is an intricate gridwork of riveted steel with two types of trusses. The 23-foot-deep main trusses are supported at the center by the concrete shop structures, and cantilever 95 feet in both directions from the supports. These 35-ton transverse trusses frame

into the longitudinal arched trusses that extend lengthwise under the roof and span the distance between the transverse trusses. The arches allow for maximum vertical clearance.

The end walls (north and south elevations) of the hangar are identical. Both ends are composed entirely of three sets of motor-controlled sliding doors. The doors occupy the full length of the hangar on the north and south ends. Each set contains six individual doors; each individual door is 35 feet wide and 64 feet high, and weighs 17 tons. Because of their extreme weight, mobile cranes were needed to install each of the 36 panels on the DC Hangar. The steel and glass doors run on railroad tracks cast in the floor and are supported by guide rails in the top of the hangar. The panels roll into pockets along the front wall that extend approximately 38 feet beyond the sides of the hangar. These pockets are backed by steel supports. When fully open, the doors create an entrance over 300 feet wide to accommodate the large wingspan of a B-36. The central two panels of each set of sliding doors contain fuselage inserts. The inserts accommodate the tail sections of different types of planes as they are being repaired in the hangar, providing maximum usable interior space. Both end walls have four pedestrian doors that are set within the larger sliding panels.

The side walls (east and west elevations) of the hangar are 64 feet high and 250 feet long. They are faced with a protected corrugated metal called Galbestos. The western elevation has three sets of multipane windows near the center. Below the windows are the Plane Wash Waste Disposal Plant (north) and the Reservoir and Pump House (south). Both buildings are small, one-story, concrete-block structures with flat roofs and corrugated metal siding. They both contain a minimal number of doors and windows to provide light and access to the interior. The western elevation also has an overhead door at its southern end.

The interior of Loring AFB's DC Hangar is an immense space comprising three open aircraft maintenance bays, which are broken only by the four three-story concrete shop buildings equally spaced along the longitudinal center. Within the shop buildings are sheet metal, propeller, machine, electric and battery, tire and wheel, hydraulic, welding shops; an issue and tool crib; and numerous office spaces. The shops are serviced by freight-type hydraulic elevators and a monorail system. The long ends of the hangar provide natural light for the interior and an intricate truss gridwork remains exposed at ceiling level. The longitudinal trusses are arched to allow maximum vertical clearance. Lights that hang from the ceiling can be lowered on individual wire cords to simplify maintenance. The interior side walls of the hangar are constructed of concrete block and contain no windows. The floor is a concrete slab and contains approximately 16 miles of embedded radiant heat piping. An indoor running track was installed in the northern half of the DC Hangar in May 1991.

The DC Hangar was completed on 3 November 1954, at a total cost of \$4.636 million (Stevens and Tyson 1980:73). Enclosing 194,247 square feet, or approximately 3.5 acres, of interior space, the DC Hangar became the largest building at Loring AFB, surpassing the Arch Hangar in terms of space and aircraft maintenance capabilities.

SOURCES OF INFORMATION

A. Engineering Drawings

Engineering drawings are kept on file at the Air Force *Base* Conversion Agency at Loring Air Force Base. Upon conveyance of the base property, the drawings will be kept on file at the Loring Development Authority at 5100 Texas Road, Limestone, Maine.

B. Historic Views

Historic photographs are kept on file at the Air Force Base Conversion Agency at Loring Air Force Base. Upon conveyance of the base property, the photographs will be kept on file at the Loring Development Authority at 5100 Texas Road, Limestone, Maine.

C. Bibliography

Eads, Colonel E.M., USAF

1956 "Double-Cantilever Hangar Encloses 3 $\frac{1}{2}$ Acres." *Civil Engineering*. Vol. 26, May.

Stevens, W., and P. Tyson.

1980 The Loring Episode. Copy of file, Loring Air Force Base, Limestone, Maine.

U.S. Air Force

1998 *Historic Building Inventory and Evaluation, Loring Air Force Base, Maine*.

D. Likely Sources Not Yet Investigated

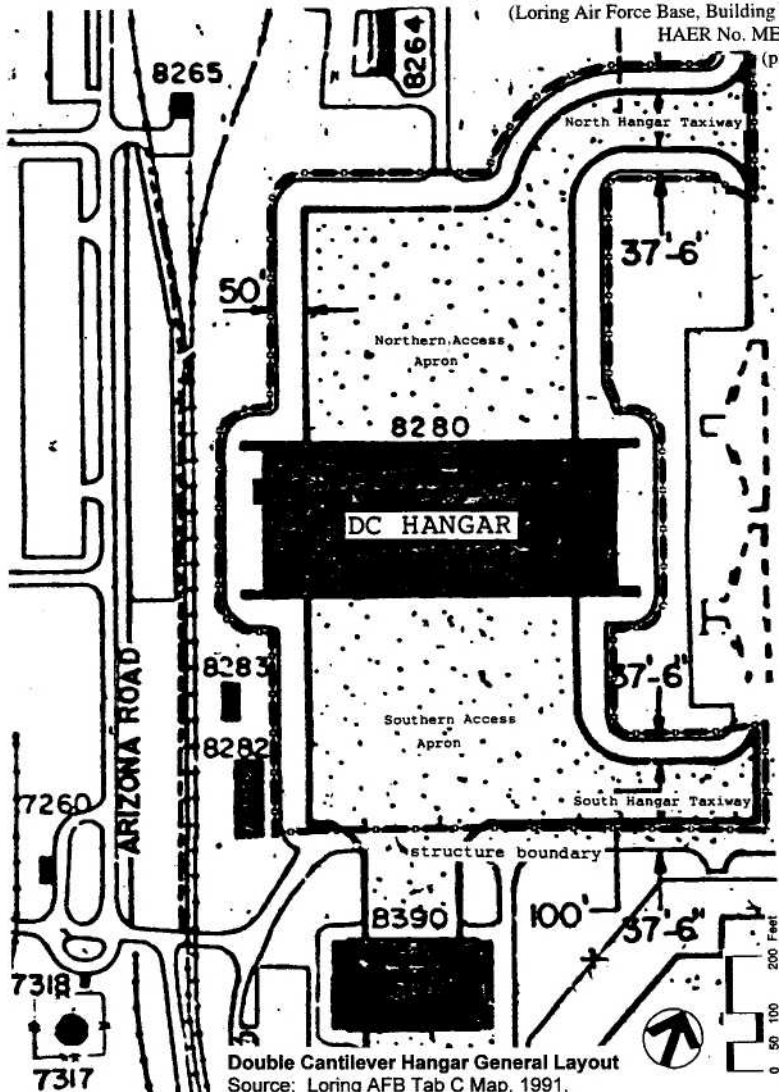
All likely national and local archival sources have been investigated.

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Location of Double Cantilever Hangar (Building 8280)
Source: Loring AFB Tab Map, 1993,
located at AFBCA, Loring AFB, Maine

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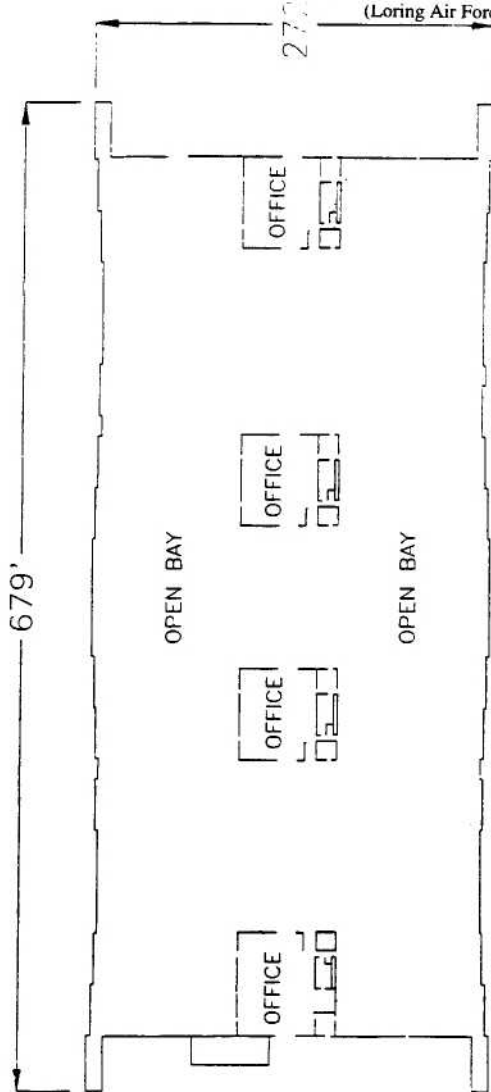


Double Cantilever Hangar General Layout
Source: Loring AFB Tab C Map, 1991,
located at AFBCA, Loring AFB, Maine



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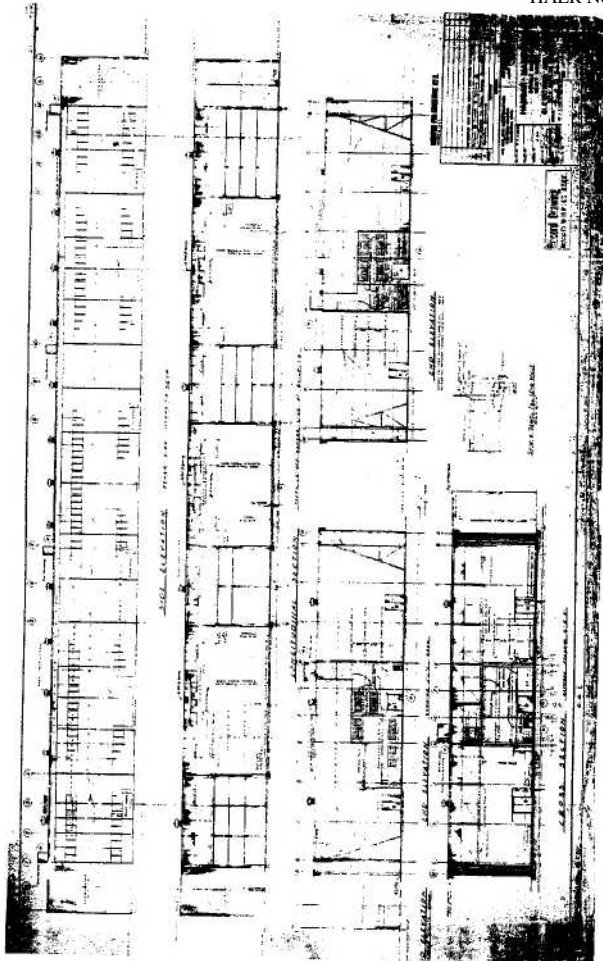
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SCALE: 1" = 80'

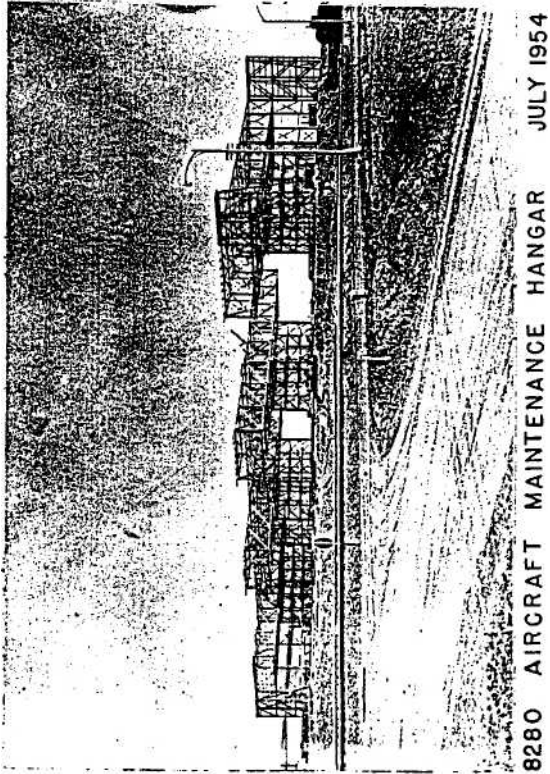
DC HANGAR

Double Cantilever Hangar Floor Plan



Construction drawing of elevations and section for Hangar-Maintenance, Double Cantilever Heavy Bomber A/C, dated December 10, 1951, with revisions through October 20, 1953. Drawing by Kuljian Corporation Architects, Engineers, located at AFBCA, Loring AFB, Maine.

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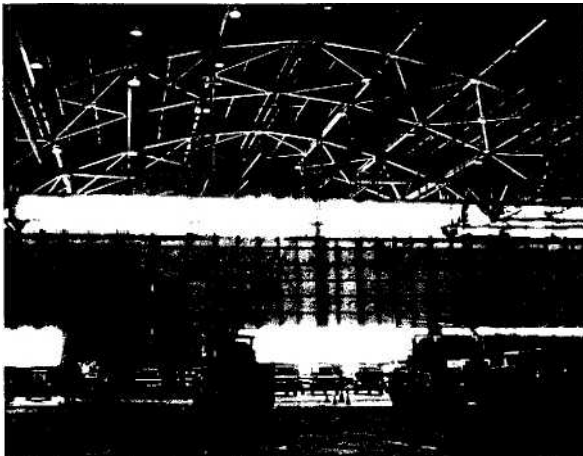
Double Cantilever Hangar under construction, dated July 1954. Photograph located at AFBCA, Loring AFB, Maine.

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Aerial view showing the Double Cantilever Hangar, Arch Hangar, and Nose Dock Hangar. Photograph located at AFBCA, Loring AFB, Maine.

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Interior view of northern side of Double Cantilever Hangar, with sliding doors, fuselage insert, and arched trusses, looking north.

Photograph date: February 1994. Photograph location: AFBCA, Loring AFB, Maine.

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Interior view of trusswork at northern end, looking east.

Photograph date: February 1994. Photograph location: AFBCA, Loring AFB, Maine.

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Interior view of detail of trusswork, view from top of western shop building.
Photograph date: February 1994. Photograph location: AFBCA, Loring AFB, Maine.

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Interior view of detail of sliding doors on south side, looking east.
Photograph date: February 1994. Photograph location: AFBCA, Loring AFB, Maine.