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United States Department of the Interior
National Park Service

National Register of Historic Places
Registration Form

FEB 13 1989

NATIONAL
REGISTER

This form is for use in nominating or requesting determinations of eligibility for individual properties or districts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, styles, materials, and areas of significance, enter only the categories and subcategories listed in the instructions. For additional space use continuation sheets (Form 10-900a). Type all entries.

1. Name of Property

historic name United States Naval Air Station Dirigible Hangars A and B
other names/site number Tillamook Naval Air Station Dirigible Hangars
U. S. Naval Air Station, Tillamook, Dirigible Hangars

2. Location

street & number Port of Tillamook Bay Industrial Park N/A not for publication
city, town Tillamook vicinity
state Oregon code OR county Tillamook code 057 zip code 97141

3. Classification

Ownership of Property	Category of Property	Number of Resources within Property	
		Contributing	Noncontributing
<input type="checkbox"/> private	<input checked="" type="checkbox"/> building(s)	<u>2</u>	<u> </u> buildings
<input checked="" type="checkbox"/> public-local	<input type="checkbox"/> district	<u> </u>	<u> </u> sites
<input type="checkbox"/> public-State	<input type="checkbox"/> site	<u> </u>	<u> </u> structures
<input type="checkbox"/> public-Federal	<input type="checkbox"/> structure	<u> </u>	<u> </u> objects
	<input type="checkbox"/> object	<u>2</u>	<u> </u> Total

Name of related multiple property listing: N/A

Number of contributing resources previously listed in the National Register N/A

4. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act of 1966, 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. See continuation sheet.

[Signature] January 30, 1989
Signature of certifying official Date
Oregon State Historic Preservation Office
State or Federal agency and bureau

In my opinion, the property meets does not meet the National Register criteria. See continuation sheet.

Signature of commenting or other official Date

State or Federal agency and bureau

5. National Park Service Certification

I, hereby, certify that this property is:

entered in the National Register. [Signature] 3/29/89
 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:) _____

Signature of the Keeper

Date of Action

6. Function or Use

Historic Functions (enter categories from instructions)

Defense: Naval air facility, airship
hangars

Current Functions (enter categories from instructions)

Industry: manufacturing facility
vacant/not in use

7. Description

Architectural Classification

(enter categories from instructions)

No style

Materials (enter categories from instructions)

foundation concretewalls wood

roof asphalt (roll roofing)other galvanized sheet metal

Describe present and historic physical appearance.

8. Statement of Significance

Certifying official has considered the significance of this property in relation to other properties:

nationally statewide locally

Applicable National Register Criteria A B C D

Criteria Considerations (Exceptions) A B C D E F G

Areas of Significance (enter categories from instructions)

Engineering
Military

Period of Significance

1942-1949

Significant Dates

1943

Cultural Affiliation

N/A

Significant Person

N/A

Architect/Builder

U.S. Bureau of Yards and Docks
Sound Construction and Engineering Company

State significance of property, and justify criteria, criteria considerations, and areas and periods of significance noted above.

9. Major Bibliographical References

- The New International Encyclopaedia (New York: Dodd, Mead and Company, 1926), Volume 1, dirigible airships and aeronautics, 175-178; Supplement, 9-12.
- Tillamook County Pioneer Museum, "History and Chronological Highlights of Tillamook Naval Air Station," Tillamook Oregon, n.d.
- U.S. Navy, "Technical Report and Project History, Tillamook Naval Air Station, Tillamook, Oregon," 1943.
- Verboort, W. Richard, and Jensen, M. Wayne, Jr., "Blimp Hangars, U.S. Naval Air Station, Tillamook County, Oregon," manuscript for American Society of Civil Engineers projected publication, ASCE 100 Classic Wood Structures, n.d.
- Yachnis, M., "Fifty-Year Development of Naval Facilities Construction," Journal of the Construction Division, ASCE, Vol. 101, No. C01 (March 1975), 15-16.

See continuation sheet

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
- Federal agency
- Local government
- University
- Other

Specify repository:

Tillamook County Pioneer Museum
2106 Second Street, Tillamook OR 97141

10. Geographical Data

Acreage of property 56.81 acres Tillamook, Oregon 1:62500

UTM References

A 1 10 | 4 3 7 | 4 5 10 | 5 10 3 10 10 10 10
Zone Easting Northing

B 1 10 | 4 3 7 | 4 5 10 | 5 10 2 8 9 10 10
Zone Easting Northing

C 1 10 | 4 3 6 | 7 10 10 | 5 10 2 8 9 10 10

D 1 10 | 4 3 6 | 7 10 10 | 5 10 3 10 10 10 10

See continuation sheet

Verbal Boundary Description The nominated area is located in SW $\frac{1}{4}$ SW $\frac{1}{4}$ Section 4, NW $\frac{1}{4}$ Section 9, NE $\frac{1}{4}$ Section 8, and SE $\frac{1}{4}$ SE $\frac{1}{4}$ Section 5, Township 1S, Range 9W of the Willamette Meridian, in Tillamook County, Oregon. It is comprised of that portion of the former United States Naval Air Station at Tillamook occupied by Dirigible Hangars A and B and 50 to 100 feet on all sides of either building, plus, in the angle between the hangars, which are offset perpendicular to one another, an area approximately 1,200 feet square which encompasses the historic airships operations and training site. See continuation sheet

Boundary Justification The boundaries of the nominated area of approximately 56.81 acres are drawn to include A and B dirigible hangars and the maneuvering area between them. Most of the historically associated buildings and structures of the U.S. Naval Air Station of Tillamook are no longer standing. Those few remaining, an administration building, officers quarters and a recreation building, are under varied ownerships and are not included in this nomination. The historic landing circles are located at some remove with the runways northwesterly of the hangars and are not See continuation sheet included in the nomination.

11. Form Prepared By

name/title M. Wayne Jensen Jr., Director (context statement, Elisabeth Potter, SHPO)
organization Tillamook County Pioneer Museum date August, 1988
street & number 2106 Second Street telephone (503) 842-4553
city or town Tillamook state Oregon zip code 97141

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The two hangars built at Tillamook N. A. S. were built for the "K" type blimps. Hangar "A" was built at a cost of \$2,405,395.00. Hangar "B" for \$3,110,048.00.

They have an egg-shaped roof shell. Stiffened with a series of 51 transverse arch ribs. Each building is 1050 feet long, 296 feet wide and 175 feet high. By reason of dimensional magnitude and the volume of lumber used, they are among the largest buildings in the world framed of timber.

The arch ribs are of the open-web truss type, spaced on 20 foot centers. Each rib is supported on reinforced concrete abutment bents 24 feet high. The concrete bents provide unobstructed shop and office space along each side of the building. The timber arched ribs are a constant 18½ feet in depth, except at the base anchorage to the concrete bents where they flare to 19 feet. Panel lengths of the truss system are about 12 feet along the extrados and 11½ feet along the intrados of the ribs. Chords vary from two 4 x 12 inch pieces, the web diagonals from two 3 x 8 inch pieces and web verticals from one 4 x 8 to 6 x 8 inch piece.

Purlin trusses at each panel point span 20 feet, the distance between arched ribs. The top chord of the purlin truss is a 3 x 10. There are two diagonals, connected at the center of the chord, to halve its span and to serve as sway bracing between arches. The bottom chord of the purlin truss also serves as a strut between arches. The 3 x 12 inch rafters are supported at 6 feet 9 inch centers on the purlins and the roof is sheathed with 2 inch tongue-and-groove planking. The sheathing constitutes the main bracing for top chords of the arch ribs but this is supplemented by "V" bracing in the lower part of the building height. In the plane of the bottom chord of the arched ribs, cross bracing is placed in every other bay. Both split-ring and shear-plate timber connectors were used liberally in joining the members.

Two interior catwalks run the length of the hangar, one on each side at a height of 137 feet above the ground. Stairways at each end of the hangar lead from the ground to the catwalks and thence to the roof. A middle stairway leads only to the catwalks. A monitor runs the full length of the ridge of the building.

At each end of the hangars there are two pillars which have pockets to house the six huge doors when they are open (three in each pillar).

All structural lumber and deck planking were pressure impregnated with Minalith and Protixal chemicals for high fire retardance. Federal specifications under which the salts were manufactured and applied are similar to those in use today (Mil-C-2865) and (Mil-C-2799). Because of the large volume of treated timber products required to meet a wartime emergency, the material was treated at some 50 different plants.

Roofing applied at the time of construction was two types. Roll roofing 36 inches

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wide was laid horizontally with each strip overlapping the lower one, shingle fashion, by 19 inches on the side slopes almost to the top of the hangar. The exposed portion (17 inches wide) was mineral surfaced and the lapped portion was cemented to the undercourse. On the upper section of the deck the lap was mopped with hot asphalt to the undercourse and galvanized roofing nails were used to fasten the roofing to the sheathing. Built-up roofing comprised of four plies of asphalt felt, each ply mopped with hot asphalt, was applied to the flatter section of the roof deck. The roofs of the hangars have since been covered with galvanized metal sheeting.

Steel cables have been suspended from the roof trusses for lights and coverings over machinery. Alterations of windows and doorways in the office areas have taken place. However, none of these have changed the huge awesome appearance of both the inside and outside of the hangars which are well-known landmarks in the area.

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The deactivated United States Naval Air Station at Tillamook Bay, Oregon, is located at the southerly end of an estuarine valley formed by the meeting of the Wilson and Trask rivers with the Pacific Ocean. The site is two and a half miles southeasterly of Tillamook, an historic dairying center and seat of Tillamook County. The town's population at present is 3,980. Dairy farms which spread over the bottomlands behind Tillamook Bay are the basis of the major local industry, that of cheese manufacturing and exporting. The pocket-shaped valley, no more than six miles square in extent, is bordered by foothills of the rugged Coast Range. The former Naval Air Station is thus protected at the southernmost reach of the flat terrain and is backed up to a knob, or hill, rising from the valley floor to a height of 364 feet. The site is readily accessible from the Coast Highway (U.S. 101), which forms the reservation's west boundary, and is served by a spur line of the Southern Pacific Railroad. Since its disestablishment in 1949, the air station has become an airport and industrial park managed by the Port of Tillamook Bay. The Port took title to its holding in 1964. Portions of the 2,000-acre reservation are variously held or occupied by the Bonneville Power Administration, the U. S. Bureau of Land Management, the State of Oregon, Tillamook County Parks, and the Tillamook Educational Service District. In the intervening years, the dirigible hangars, too large to dismantle economically, were adapted as lumber processing sites. At present, only one of the hangars is in use. It is leased to a company developing a high lift blimp crane for industrial application.

Because most of the historic structural features of the air station are no longer in place, the boundaries of the nominated area of 56.81 acres are drawn to include only the dominant buildings, dirigible hangars A and B, and the 33-acre operations and training area between them. The hangars, among the largest wood structures in the world at the time of their construction, occupy seven acres each, and, including their immediate sites, account for 23 and one-half acres, the balance of the nominated area. The air station was supported by 600 personnel at its height in 1944-1945. It is laid out on a grid system turned on point at roughly a 45° angle to compass directions. The hangars are situated northerly of the magazine area, between the runways on the west and administrative, supply, recreation and domiciliary areas on the east. They are oriented perpendicular to one another, offset at their westerly ends to provide maneuvering space. The landing circles are located to the northwest of the hangars, between the diagonally-crossed air strips.

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The historic period of significance of the nominated area extends from 1942, when the Navy air station was commissioned, to 1949, when it was deactivated. The prime date is 1943, the year construction of the hangars under auspices of the U. S. Bureau of Yards and Docks was completed with remarkable speed by Sound Construction and Engineering Company of Seattle, Washington. Either hangar is 1,050 feet long, 296.5 feet wide, and 175.32 feet in height, including rooftop monitor. Pressure-treated Pacific Northwest lumber was used for the vast number of structural framing members with the object of conserving steel for the overseas war effort. The roof support system, consisting of nearly parabolic open-web truss arch ribs on reinforced concrete bents spaced at 20-foot intervals, tested building technology of the day and proved sound. In this context, the nominated features meet National Register Criterion C.

The dirigible hangars at Tillamook Bay are two of only ten such buildings built to similar specifications in the United States after Japan's attack on Pearl Harbor. Suddenly, after December 7, 1941, the nation's involvement in the Second World War was riveted to defense of its own shoreline. Of the six Second World War dirigible hangars on the West Coast, those at Tillamook Bay served as mooring and maintenance sites for two squadrons of the steerable, non-rigid lighter-than-air craft which the U. S. Navy favored for patrol missions at the time. Blimps launched from Tillamook Bay patrolled the coastline from the California border to the Strait of Juan de Fuca, the Canadian border.

Dirigibles used by the United States military during the Second World War represented the ultimate refinement of steerable lighter-than-air craft. Compared to zeppelins, which were rigid airships having long bodies supported by internal cells filled with hydrogen, blimps, or non-rigid airships, had a shorter, fatter envelope inflated with helium, the next lightest gas to hydrogen. Because helium did not have the lifting power of hydrogen, the blimp's envelope had to be greater in volume to lift equivalent loads. Helium offered a decided safety advantage over hydrogen in that it is non-inflammable and non-explosive. After the War and Navy Departments stimulated adequate production of helium beginning in the 1920s, the blimp became the standard lighter-than-air craft employed by the U. S. military. Airships of the Naval Air Station at Tillamook were K series blimps over 250 feet long. They had huge cubic-foot displacements and powerful engines. Their useful load carrying capacity was not especially great, however. They were slow, and while not notably maneuverable, they had hovering ability, and they were stable--the ideal craft for reconnaissance.

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The other comparable dirigible hangars on the West Coast are located in California. One pair is at the Marine Corps Air (Helicopter) Station at Santa Ana and the other two are at the U. S. Naval Air Station, Moffett Field, near San Jose. Because the hangars in California are on active bases, they have been adapted for support services and house maintenance shops, training classrooms and offices. Inevitably, not all of the space in a 17-story blimp hangar can be used efficiently, and maintenance costs are enormous. The future of the hangars is uncertain. The status of the four hangars erected contemporaneously on the East Coast is unknown.

In the context of United States military affairs, the dirigible hangars at Tillamook Bay in Oregon meet National Register Criterion A for exceptional significance at the national level as intact representatives of a finite number of buildings having had a highly specialized application in war time. The blimps moored and maintained in these hangars were an indispensable part of the ground-sea-air defense network. Their crews tracked movements of enemy submarines, engaged in bombardment, accompanied shipping convoys, and pioneered air-to-sea rescue operations which are commonplace today using helicopters. Because its traditional role in aeronautical reconnaissance soon was utterly eclipsed by long-range patrol craft capable of covering greater distances with more efficient fueling, the U. S. Navy's dirigible command reached its height in the coastal defense fervor of the Second World War. The perceived threat of enemy attack on the U. S. mainland, especially at major harbors where ship building and staging of vital overseas supplies were carried on, was not without foundation. After Pearl Harbor, the West Coast was hastily armed with fighter and bomber forces, reinforced artillery and Coast Guard patrols. In sporadic incidents, the Oregon coast was shelled by a Japanese submarine near the mouth of the Columbia River, and its forested southern interior was penetrated by incendiary bombs. The dirigible period in United States military affairs arose in the First World War and ended abruptly at the close of the Second War. It is reasonable, therefore, to evaluate the significance of sites and structures associated with this phase of the country's military activity even though the period ended slightly less than 50 years ago. The hangars at Tillamook, along with the comparable resources in California and elsewhere, meet the criteria for exception to the National Register's normal 50-year rule.

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SUMMARY HISTORY

Plans for building an airport at Tillamook took shape during the summer of 1941. By September the CAA, the Army Interceptor Command and the County Commissioners had decided on a location south of town. When war was declared in December 1941, the Navy launched its full non-rigid airship program. The Tillamook valley was a naturally protected site between San Francisco and the Straits of Juan de Fuca which made it an ideal base for patrol of this coastal region. The County and the U.S. Army released their options on the land to the Navy in April 1942.

Work began on the "Lighter-Than-Air" station immediately with the clearing of 2000 acres of dairy farm land four miles south of the city of Tillamook and six miles inland. This area at the southern end of Tillamook Bay was composed of old gravel bars, filled-in river beds and sedimentation. It required over two million cubic yards of gravel for grading. The Administration buildings went up first and were soon followed by barracks, mess halls and roads. Railroad connections to Tillamook and the airport were finished along with the gatehouse and fence by September.

Many problems were faced during the construction of the base. Shortages of wartime manpower and materials, severe weather conditions and an unstable construction site were some of them. The dimensions of the hangars were so huge that there was no precedent for the manner of construction. The heaviest precipitation in more than 25 years dumped 18.57 inches of rain in November 1942. December topped that with 19.60 inches and January added 15.70 inches of snow - the first in 30 years. The run-off turned the whole area into a vast swamp with hazardous fog adding to the dilemma.

Because critical materials were so hard to come by, the design used wood wherever possible - wood gutters and downspouts, fence posts, concrete gasoline storage tanks and concrete footings designed to use a minimum of reinforcing steel. 2050 tons of steel were saved by the decision to use timber arches instead of steel. The enormous size of the framework led to unique building procedures being developed at Tillamook. Scale models ($\frac{1}{2}$ " to 1') were made and used to find the solutions to these difficult problems.

The arched trusses were each completely assembled on jigs from fire retardant treated lumber cut to length, grooved for rings and bored for bolts. All lighting fixtures and other fittings were attached while in the jigs so that working on them after erection could be avoided. The trusses were then taken apart and brought to the hangars in four parts and raised into place in three. The crown connection was made on the ground just before this section was hoisted into place by two stiff leg derricks (190 foot booms with 15 foot jibs) that were mounted on rails inside the hangars. Radios had to be used between the ground and the derricks which were often hidden in the fog and low clouds.

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Each hangar is 1050 feet long, 296 feet wide and 175 feet high. There are 51 timber open-web type arched trusses in each hangar and they are 20 feet wide and 18.5 feet deep. Each truss is supported on reinforced concrete abutment bents that are 24 feet high. The space under and between the bents was used for shops and offices. Catwalks on each side at the 137 foot level run the length of the hangars and are reached at either end by stairways. Six massive doors - three on each side - are housed in the two pillars at the ends of each building. All construction on the Base was done by the Sound Construction and Engineering Co. of Seattle, Washington in cooperation with the U.S. Bureau of Yards and Docks.

Hangar "B" was started in October 1942 and finally finished on August 15, 1943. Delays caused by bad weather, finding experienced help, construction problems and treated lumber deliveries accounted for the length of time involved. Hangar "A" was started on July 26, 1943 and finished except for the final roofing on August 27, 1943 in just 27 working days.

These are some of the largest all wood clear span buildings in the world. They cover over seven acres of floor space - enough room to play six football games at the same time in each one.

Eight "K" series airships (blimps) were housed at the Tillamook Naval Air Station. The "K" series blimps carried a crew of from eight to ten and were used for extended flight operations on the coastal patrols. The ships were 251.7 feet long, 79 feet high and 62.5 feet wide. They were armed with four depth charges and two 50 caliber machine guns which were mounted in the extreme forward upper section of the car. "K-31" was destroyed when blown off its mooring mast by high winds on March 27, 1943. This was before the hangars were finished and the airships were moored and tied down outside. The only fatalities at the Tillamook Squadron occurred on October 17, 1943 with the loss of five station-based officers and men aboard "K-111" off the California coast. "K-103" crashed into Tillamook Bay on March 18, 1945 with no loss of life.

The techniques for air-sea rescue were developed at Tillamook Naval Air Station. On April 24, 1945, taking advantage of the hovering abilities and slow air speed of the blimps, a cable with a breeches buoy was dropped and dragged from the airship across the waters of Tillamook Bay to a man in a small boat who caught the buoy and was then hoisted up and hauled safely aboard. Canadian Air Force and Military personnel were also on hand to observe this first air-sea rescue.

Squadrons of FM-2's used the Naval Air Station Tillamook (NAST) as a refueling and rearming facility.

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CHRONOLOGICAL HIGHLIGHTS

- 1941 - July - Citizens push for building an airport.
Sept. - Plans for Tillamook County Airport drawn up by the CAA, the Army Interceptor Command and the County Commissioners.
Dec. - Pearl Harbor attack on the 7th and war was declared.
- 1942 - April - Airport site selected by the Navy. Clearing begun.
June - Sound Construction Co. and Lt.Comdr.W.J.Stribling, Officer-in-Charge of construction arrive. Employment office set up.
July - Grading and road work under way.
Aug. - Grading finished - support buildings in progress.
Sept. - Railroad connection to Tillamook established.
Oct. - Hangar "B" started.
Nov. - Construction continues. 18.57 inches of rain.
Dec. - On orders from the Thirteenth Naval District the Naval Air Station at Tillamook, Ore. was placed in commission by Comdr.Karl Lange,USNR with Lt.W.R.Peeler as Exec. Officer. There were 21 officers, 46 enlisted men and 17 Civil Service workers. On the 11th the Squadron was commissioned with Lt.Comdr.E.J.Sullivan,USN in charge. Construction continues. 19.60 inches of rain.
- 1943 - Jan. - Construction continues. 15.70 inches of snow.
Feb. - First "K" ship lands with aid of mobile masts.
March - Lt.Peeler makes Lt.Comdr. The first Marines reported aboard under command of Capt.John Sherman,USMCR.
April - Families of married enlisted men arrive as Navy housing nears finish.
May - Construction continues.
June - First inspection made by Rear Admiral C.E.Rosendahl.
July - Hangar "A" started on the 26th.
Aug. - Hangar "B" finished on the 15th. Hangar "A" finished on the 27th
Sept. - Blimp Hedron (repair unit) was set up to service the airships. Lt.Comdr. W.J.Keim replaced Lt.Comdr.Dixon as Officer-in-Charge of the Squadron.
Dec. - Citizens of Tillamook were invited aboard for the first anniversary ceremonies. Construction continues.

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- 1944 - Jan. - Station and facilities still under construction with addition of a Chapel and Recreation building.
- March - Modifications add more taxiways, runways, gunnery training building, more communications facilities and an enlarged operations building. Lt.Comdr.Peeler replaced Lt.Comdr.E.R.Sullivan as Squadron Captain. Former Station Exec. Officer Lt.Comdr.H.F.Burfeind replaced acting Station Exec. Officer Lt.Comdr.F.P.Reinero. Enlisted men G.T.Lang, BMA l/c and D.A.Yeamans, QM 3/c were awarded the Purple Heart.
- April - First contingent of enlisted WAVES reported aboard.
- May - Station, Squadron and Hedron paid tribute to late Secy. of the Navy Wm.F.Knox. Lt.Comdr.H.Burfeind was detached. Rear Admiral C.E. Rosendahl flew in for an informal inspection.
- July - The first all-station show "Its in the Bag" was a feature of the successful Independence Day War Bond Drive. Major H.C.Griswold, USMCR was replaced by Major W.R.Conger, USMCR.
- Sept. - Station personnel donated 160 pints of blood to the war effort when the Red Cross came aboard.
- Oct. - Rear Admiral C.E.Rosendahl, accompanied by Capt.H.Coulter, USN, ComFairShipsPac, made his third inspection. Major Conger was replaced by Major J.J.Svoboda, USMCR. Memorial services were held for the crew lost off the California coast.
- Nov. - Chief's Quarters and new Operations buildings were nearing completion. Station was readied to receive FM-2 planes aboard for long-term storage.
- Dec. - Maintenance of the Outlying Field at Newport, Oregon became a Station responsibility.
- 1945 - Feb. - Capt.Lange was replaced by Comdr.T.M.Whelan as Commanding Officer.
- May - V-E Day was commemorated and the first FM-2's were received for storage.
- July - 400 Navy fire fighters were housed at the Station to help fight the Wilson River forest fire.
- Aug. - V-J Day was celebrated with the rest of the Nation.
- Sept. - Officers and enlisted personnel were being discharged under the point system.
- Dec. - Nola Jean Flisram MAM 3/c was the last WAVE detached from the Base.

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- 1946 - Jan. - The Blimps depart.
Comdr.F.N.Klein announced that the Naval Air Station will continue to function as a storage place for surplus planes with about 200 Naval personnel and 100 Civil Service employees.
- 1948 - The Navy decides to close the Station. The County negotiated a lease with the Navy and a Commission was appointed to operate the Airport and maintain the Station facilities until Oct. 18, 1963.
- 1963 - Formal application was made by the Commission to aquire the Tillamook Naval Air Station for industrial development.

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PROBLEMS FACED

General

Many problems were encountered during the construction of these two gigantic structures and their support facilities. Foremost was the fact that construction was carried on during wartime. Because of this manpower, equipment and materials were all in short supply. In addition, weather during construction, and the construction site itself contributed to the problems. Finally, framework dimensions of the hangars were so large that there was no precedent for the manner of erection.

The Construction Site

The following data concerning site conditions is quoted directly from the USN report, "Technical Report and Project History".

1/ "This site, especially the area where the buildings and operation facilities are located is on what was once the southerly end of Tillamook Bay. Through sedimentation and numerous changes in the location of the rivers flowing through the area, the entire Tillamook valley below the 100 foot (30.5 m) contour is spotted with gravel bars, filled-in river beds, and deep deposits of silts and clay--no definite pattern of formation being apparent. Surface indications were of little help in the determination of subsurface conditions. Only after extensive excavation was it possible to establish a general idea of what was to be generally expected. After clearing, some areas that were expected to be quite wet dried up due to improved drainage, while other apparently stable sections developed into almost bottomless clay pits when the surface sod was removed."

"The facilities for which more thorough sub-surface investigations were made were the two hangars. Several test pits were dug; later, drillings were made, and the results were transmitted to the Bureau of Yards and Docks."

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Climatic Conditions

The USN Technical Report also discusses the weather during the construction period.

"The most severe characteristic prevalent during construction was the heavy rate of rainfall and the resultant run-off. During the month of November, 1942 the rainfall amounted to 18.57 inches (47.2 cm), while the following month, December, exceeded this amount by one inch (2.5 cm). The clay soil during this period and until late spring was very difficult to move thereby seriously handicapping clearing and grading."

In addition to the rain, severe fog conditions plagued the area during installation of the trusses. Fortunately the crane operators and workers on the trusses had telephones, since it was frequently so foggy that construction workers could not see the ground or the crane, and the crane operator could not see where the section of truss was to be attached.

Work Force

Because of the war effort, it was extremely difficult to find construction workers.

The work force consisted of a mixture of union workers of many trades, and non-union workers. Many of the non-union workers were from the surrounding farm area and had no prior heavy construction experience. There were no strikes during the construction of the facility. In addition, agreement was reached among the union officials that carpenters, piledrivermen, and iron workers could work at each others trade on the construction of the hangars without being obliged to join the representative union. This proved definitely advantageous to project operations.

Wages ranged from \$0.75 per hour for well driller helpers to \$2.00 per hour for operators of large cranes and power shovels. Most of the union tradesmen were in the \$1.32 to \$1.625 per hour pay range. A total of 3,924,109 hours were expended in construction the complete facility. There were 289 lost time accidents during construction, for a total of 7,079 days lost.

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Equipment

Two rail mounted stiff leg derricks were obtained to erect the hangars. The derricks originally had 150 foot (46 m) booms. For this job the booms were extended to 190 feet (58 m) and provided with a 15 foot (4.5 m) jib. In addition to the two stiff leg derricks there were three crawler cranes used in various phases of the operation.

Some other equipment was available from the local logging industry. Gravel and log trucks, lumber loaders and similar equipment was used for lack of other construction equipment.

Materials

Extensive steps were taken to influence the design so that a minimum of critical materials would be used. Again, quoting the USN Technical Report, one can see the extent to which this concern was carried out.

"By the use of wood gutters and down spouts the use of galvanized iron was minimized. Concrete was designed with as little reinforcing steel as possible, composition wall board was used extensively in place of plywood, etc. Steel was saved by using prestressed concrete underground gasoline storage tanks instead of the conventional steel tanks.

Steel was further saved by the use of wooden fence posts. Particularly serious problems were encountered in obtaining proper electrical equipment. Here it was not only a case of trying to save or eliminate critical materials, but it also was a case of substitution because materials specified were not available."

Additional savings were effected by increasing allowable unit stresses above those commonly in use, wherever savings of critical materials could be made. These decisions were made by Budocks.

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WHY WOOD WAS USED

Wood was used for construction of these two structures because steel and other metals were at such a premium because of the war. By the use of wood approximately 2050 tons of steel were saved. All structural lumber and deck planks used in the blimp hangars were pressure impregnated with Minalith and Protixal chemicals for fire retardance. Federal specifications under which the salts were manufactured and applied were similar to those in use today. Because of the large volume of wood to be treated and short time frame for construction, the material was treated at some to different plants.

DESIGN & CONSTRUCTION DECISIONS

The most important design decision was the use of timber arches instead of steel, which had previously been used by the Navy. 2/ Other major design problems involved the need to re-design most of the hangar footings because of the lack of uniformity of the foundation material.

Many construction decisions were involved. The most interesting was the task of how the arches were to be assembled and erected. Again, quoting from the USN Technical Report:

"The most outstanding of the unusual tasks involved in the construction of this station was the assembly and erection of the timber arched trusses for the two hangars. The dimensions of this framework were of such vast extent that precedent in the erection was lacking and, consequently, several different techniques were studied. The procedure developed at Tillamook was unique and involved the use of a minimum of "hard-to-get" equipment and critical materials."

"Truss members and bracing were delivered to the site cut to length, grooved for rings and bored for bolts.

This material as well as the necessary hardware was segregated and piled adjacent to jigs for rapid and economical handling. Lumber carriers were used in moving the lumber to and from the stockpiles and to the jigs. The jigs and the lumber storage yard were located on the site of the Landing Circle assessible to both hangars.

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Trusses were completely assembled while on the jigs and all connections were made and bolted. After this they were taken apart in four sections to be moved into the hangars. Where shear plates were used at field connected panel points, the holes were reamed for tight-fitting bolts."

"After truss sections were removed from the jigs, but before erection, conduits, supports for the lighting fixtures and everything possible were installed on the ground to minimize the amount of work to be done after erection. This was desirable, not only from the standpoint of economy but also because the timbers, particularly in damp weather, became slippery and highly hazardous to climb around on and the selected method of erection provided no scaffolding from which men could work."

A scale model, 1/4 inch to the foot (1:48), was made of several of the trusses, the concrete bents, derricks and other construction equipment in order to study methods of erection, placement of the equipment and placement and handling of the material. This study proved so useful that the plan arrived at by experimenting with the model was carried through in detail and no major changes were in the field.

The plan adopted for erection of the trusses used two stiff leg derricks each mounted on standard gauge railway trucks and tied together with heavy timbers to be moved in unison along three lines of track, one down the center line of the hangar, the others fifty feet (15 m) each side of the center line.

The trusses were brought into the hangars in four sections and erected in three. The connection at the crown was made on the ground in front of the derricks just before this section was hoisted in place.

Erection of the trusses on the first hangar was delayed considerably because of the weather, the difficulty of securing experienced help, and delays in delivery of the treated lumber. On the second hangar, however, the 51 trusses were erected, including all fill-in of the purlins and rafters, monitor, catwalks and monorail for the roof sheathing, in twenty-seven working days from 12:00 o'clock noon, July 26, to 12:00 o'clock noon, August 27, 1943.

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DETAILS

Design Criteria

The hangars' design was based on semi-permanent construction. Budocks standard specifications, amended by war-time restrictions on critical materials, were used as standards of design. The Architect-Engineer supplemented these standards with various joint committee specifications.

In general, the unit stresses used were those indicated by the Joint Committee recommendation for concrete structures, American Institute of Steel Construction for structural steel work, and the City of Portland, Oregon building code for timber construction, except that unit stresses were increased in conformity to directives of the Bureau of Yards and Docks wherever any appreciable saving of critical materials could be made by such procedure.

General Summary of Facilities Constructed:

1. Total cubeage of Buildings	77,611,000 cu.ft.	(2,713,110 m)
2. Total area of paving asphalt	310,000 sq.yd.	(259,160 m)
3. Total area armor coat (roads, taxi ways)	110,000 sq.yd.	(91,960 m)
4. Total volume of earthwork	2,873,891 cu.yd.	(2,198,500 m)
5. Total volume of road gravel	1,092,318 cu.yd.	(835,600 m)
6. Total lumber	10,349,500 bd.ft.	(24,150 m)
7. Total concrete	30,900 cu.yd.	(23,600 m)
8. Total brick	390,000	
9. Total reinforcing steel	700 tons	
10. Total plywood	203,000 sq.ft.	(18,900 m)
11. Total plasterboard	328,000 sq.ft.	(30,500 m)
12. Total asbestos board	230,500 sq.ft.	(21,400 m)
13. Total Byplap	120,500 sq.ft.	(11,200 m)
14. Total roofing	1,350,000 sq.ft.	(125,500 m)
15. Total paint	7,000 gals.	(27 m)
16. Total water mains	30,250 ft.	(9,200 m)
17. Total sanitary sewer (Vitrified)	16,090 ft.	(4,910 m)
18. Total storm sewer (concrete)	18,323 ft.	(5,590 m)
19. Total steam lines	7,390 ft.	(2,250 m)
20. Total helium lines	4,908 ft.	(1,500 m)

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Details of the Timber Arch Trusses

The arched trusses are of the open-web type, spaced on 20 foot (6.1 m) centers. Each truss is supported on reinforced concrete abutment bents 24 feet (7.3 m) high. The concrete bents provide unobstructed shop and office space along each side of the building. The timber arched trusses are a constant 18.5 feet (5.6 m) in depth, except at the base anchorage to the concrete bents where they flare to 19 feet (5.8 m). Panel lengths of the trusses are about 12 feet (3.7 m) along the extrados and 11.5 feet (3.5 m) along the intrados. Chords are typically two 4 x 12 inch (10 x 30 cm) timbers. The web diagonals are typically two 3 x 8 inch (7.6 x 20 cm) timbers. Web verticals vary from one 4 x 8 to one 6 x 8 inch (10 x 20 to 15 x 20 cm) timber. Purlin trusses at each panel point span 20 feet (6.1 m), the distance between the arched trusses. The top chord of the purlin truss is a 3 x 10 (7.6 cm x 25.4 cm). There are two diagonals, connected at the center, to halve its span, and to serve as sway bracing between arches. The bottom chord of the purlin truss also serves as a strut between arches. The 3 x 12 inch (7.6 x 30.5 cm) rafters are supported at 6.66 foot (2 m) centers on the purlins, and the roof is sheathed with a 2 inch (5 cm) tongue-and-groove planking. The sheathing constitutes the main bracing for top chords of the arched trusses. This is supplemented by "V" bracing in the lower part of the building height. In the plane of the bottom chord of the arched trusses, cross bracing is placed in every other bay. Both split-ring and shear-plate timber connectors were used liberally to join the members.

Two interior catwalks run the length of the hangar, one on each side, at a height of 137 feet (42 m) above the ground. Stairways at each end of the hangar lead from the ground to the catwalks and thence to the roof, and a middle stairway leads to the catwalks only. A monitor runs the full length of the ridge of the building. At each end of the hangars there are two pillars which have pockets to house the six huge doors when they are open. (Three doors in each pillar.)

Roofing applied at the time of construction was of two types. Roll roofing 36 inches (0.9 m) wide was laid horizontally with each strip over lapping the lower one, shingle fashion, almost to the top of the hangar. The exposed portion was mineral surfaced and the lapped portion was cemented to the undercourse. On the upper section of the deck, the lap was mopped with hot asphalt to the undercourse and galvanized roofing nails were used to fasten the roofing to the sheathing. The roofs were later covered with galvanized corrugated sheet metal.

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HISTORICAL SIGNIFICANCE OF PROJECT

The project to construct the two blimp hangars is significant from several standpoints. First, the blimp hangars are among the largest all wood clear span buildings in the world. Second, the construction process was technically resourceful, if not advanced. This is most significant considering the wartime limitations on men and equipment. Finally, the length of life and usefulness of these "semi-permanent" buildings is significant.

The Naval Air Station was taken over by the Port of Tillamook Bay in 1964. During the middle 60's the hangars were leased out by the Port. One hangar was used to house a sawmill and the other a complete plywood veneer facility. In 1973 the sawmill and plywood plants were bought out by a large company. Operation of the facilities continued into the early 80's and were then closed out. Currently (1988) one of the hangars is leased by a company that is developing a high lift blimp-crane to be used in logging and other industries.

SOURCES

- 1/ U.S. Navy "Technical Report and Project History, Tillamook Naval Air Station, Tillamook, Oregon", 1943 (Archives, Pioneer Museum, Tillamook, OR).
- 2/ Yachnis, M. "Fifty-Year Development of Naval Facilities Construction", Journal of the Construction Division, ASCE, Vol. 101, No. C01, Proc. Paper 11175, March 1975, pgs. 15-16.

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The nominated area, containing in all approximately 56.81 acres, is more particularly described as follows:

Beginning at the point of intersection of the northeasterly edge of "C" Street and the southeasterly edge of Blimp Road, thence southwesterly along southeasterly edge of Blimp Road approximately 750 feet to the road's turning at a right angle, thence southeasterly along the northeasterly edge of the road known as Hangar Road approximately 1,150 feet to the southeasterly edge of 4th Street, thence southwesterly along the southeasterly edge of 4th Street, extended, approximately 450 feet, thence at a right angle approximately 2,350 feet, thence at a right angle approximately 2,350 feet to the northeasterly edge of "E" Street extended, thence southeasterly along the northeasterly edge of "E" Street extended approximately 450 feet to the point of intersection with the southeasterly edge of Hangar Road, also known as Moffett Road, thence southwesterly along the southeasterly edge of said road approximately 1,150 feet to the point of intersection with the northeasterly edge of "C" Street, thence southeasterly along the northeasterly edge of "C" Street approximately 750 feet to the point of beginning, containing in all 56.81 acres, more or less.

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PHOTOGRAPHS

United States Naval Air Station Dirigible Hangars A and B
Tillamook
Tillamook County
Oregon

All negatives and copy negatives held by:
Tillamook County Pioneer Museum
2106 Second Street
Tillamook OR 97141

1 of 20
Historic view, 1943, U.S.N.
Hangar B under construction
Looking southwesterly at northerly end, showing falsework for assembly of hangar door pockets and concrete bents for support of timber arches.

2 of 20
Historic view, 1943, U.S.N.
Hangar B under construction
Looking northeasterly at southerly end

3 of 20
Historic view, 1943, U.S.N.
Hangar B under construction
Looking northeasterly from southerly end, showing track cranes which lift crown sections of timber arch trusses into place.

4 of 20
Historic view, 1943, U.S.N.
Hangar B, construction nearing completion, falsework being dismantled.
Looking northeasterly at southerly end

5 of 20
Historic aerial oblique view, 1944, U.S.N.
Hangars A and B
Looking northeasterly

6 of 20
Historic view, 1944, U.S.N.
K series non-rigid airship, or "blimp" on hangar apron in maneuvering area.

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Historic view, 1944, U.S.N.

Hangar interior showing dirigible squadron.

Looking in from hangar apron

8 of 20

Historic view, 1944, U.S.N.

Hangar interior showing dirigible squadron.

Looking in from hangar apron

9 of 20

Hangar A, date unknown, U.S.N.

Looking easterly at westerly elevation (?)

10 of 20

Hangars A and B, 1980

Looking southwesterly from former administrative area.

At this time, hangars were adapted for wood products manufacturing.

11 of 20

Hangar A, 1988

Looking southwesterly at northerly end

12 of 20

Hangar A, 1988

Looking southwesterly at easterly elevation

13 of 20

Hangar B, 1988

Looking westerly at easterly elevation

14 of 20

Hangar B, 1988

Looking southwesterly at northerly end

15 of 20

Historic plan of disestablished air station showing full extent of war time development.

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Hangar B, 1980

Looking southwesterly at north end

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Hangar B, 1980
Looking southwesterly along southeasterly elevation

18 of 20
Interior, Hangar B, 1980
Looking south

19 of 20
Interior, Hangar B, 1980
Looking north

20 of 20
Interior, Hangar B, 1980
Looking north

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES
EVALUATION/RETURN SHEET

REQUESTED ACTION: ADDITIONAL DOCUMENTATION

PROPERTY US Naval Air Station Dirigible Hangar B
NAME:

MULTIPLE
NAME:

STATE & COUNTY: OREGON, Tillamook

DATE RECEIVED: 7/05/94 DATE OF PENDING LIST:
DATE OF 16TH DAY: DATE OF 45TH DAY: 8/19/94
DATE OF WEEKLY LIST:

REFERENCE NUMBER: 89000201

NOMINATOR: STATE

REASONS FOR REVIEW:

APPEAL: N DATA PROBLEM: N LANDSCAPE: N LESS THAN 50 YEARS: N
OTHER: Y PDIL: N PERIOD: N PROGRAM UNAPPROVED: N
REQUEST: N SAMPLE: N SLR DRAFT: N NATIONAL: N

COMMENT WAIVER: N

ACCEPT RETURN REJECT 8-15-94 DATE

ABSTRACT/SUMMARY COMMENTS:

The documentation provided modifies the name of the listed property to read: "U.S. Naval Air Station Dirigible Hangar B," thus dropping Hangar A from the formal title. The revision reflects the fact that "Hangar A" was destroyed by fire in August of 1992 and therefore no longer retained sufficient integrity to be listed in the National Register. A separate Boundary Decrease submission removed that portion of the site associated with the former Hangar A location. The listed property now includes the single remaining historic structure located at the former naval station site [Hangar B] and its intact associated environment. "Hangar B" remains individually eligible under both Criteria A and C.

[The listed area is 14.46 acres. The number of contributing resources is 1 building.]

RECOM. / CRITERIA Accept Additional Documentation
REVIEWER PAUL LUSIGNAN
DISCIPLINE HISTORIAN
DATE 8/15/94

DOCUMENTATION see attached comments Y (N) see attached SLR Y (N)

CLASSIFICATION

count resource type

STATE/FEDERAL AGENCY CERTIFICATION

FUNCTION

historic current

DESCRIPTION

architectural classification
 materials
 descriptive text

SIGNIFICANCE

Period Areas of Significance--Check and justify below

Specific dates Builder/Architect
Statement of Significance (in one paragraph)

summary paragraph
 completeness
 clarity
 applicable criteria
 justification of areas checked
 relating significance to the resource
 context
 relationship of integrity to significance
 justification of exception
 other

BIBLIOGRAPHY

GEOGRAPHICAL DATA

acreage verbal boundary description
 UTMS boundary justification

ACCOMPANYING DOCUMENTATION/PRESENTATION

sketch maps USGS maps photographs presentation

OTHER COMMENTS

Questions concerning this nomination may be directed to

Phone _____

Signed _____ Date _____