NAVAL SURFACE WARFARE CENTER,
TRANSONIC WIND TUNNEL BUILDING
(Naval Surface Warfare Center,
Buildings No. 12, 13, 157, 158, and 187)
Bounded to the sourth by the Clara
Barton Parkway and to the north and east
by MacArthur Boulevard
~~Bethseda vicinity~~ Silver Spring
Montgomery County
Maryland

HAER No. MD-118-B

HAER
MD,
16-SILSPR,
3B-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

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

HISTORIC AMERICAN ENGINEERING RECORD

HAER MD 16-SILSPR, 3B-

NAVAL SURFACE WARFARE CENTER, TRANSONIC WIND TUNNEL BUILDING
(Naval Surface Warfare Center, Buildings No. 12, 13, 157, 158, and 187) HAER No. MD-118-B

Location: Bounded to the south by the Clara Barton Parkway and to the north and east by MacArthur Boulevard
~~Bethesda Vicinity~~ Silver Spring
Montgomery County
Maryland

USGS Falls Church, Virginia Quadrangle
Universal Transverse Mercator Coordinates:
18.309660.4316100

Date of Construction: 1943-1945

Engineer: Bureau of Yards and Docks, Navy Department
Architect: Bureau of Yards and Docks, Navy Department

Present Owner: U.S. Department of the Navy
Department of Defense

Present Use: Vacant

Significance: The Transonic Wind Tunnel Building is an aviation testing facility contained within the Naval Surface Warfare Center (NSWC) Carderock Division Historic District. Naval Surface Warfare Center is associated with events that have made a significant contribution to the broad patterns of military technology. The research facilities at NSWC have provided the U.S. Navy with accurate, cost effective data on air and sea vehicle performance, and have made possible evaluative changes to improve performance, in advance of construction.

Project Information: Under the 1995 round of Base Closure and Realignment (BRAC), research functions carried out at Naval Surface Warfare Center White Oak, Maryland will be relocated to Naval Surface Warfare Center Carderock Division. The Transonic Wind Tunnel Building will be altered to accommodate these new functions. Documentation of these three buildings to the standards of the Historic American Engineering Record prior to alteration was prescribed as a stipulation of a Memorandum of Agreement negotiated among the Maryland State Historic Preservation Officer and the Department of the Navy, and accepted by the Advisory Council on Historic Preservation. This documentation was undertaken in June and July 1995 in partial fulfillment of that agreement.

Geoffrey Eden Melhuish
Assistant Project Manager
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Architectural Description

The Transonic Wind Tunnel Building is composed of an equipment building (Building 12), an operations building (Building 13), a Transonic Wind Tunnel (Building 157), a cooling system (Buildings 158, and 187), and an air drying system. Construction of the Transonic Wind Tunnel Building took place from 1952 through 1955.

The equipment building (Building 12) is a tall, one story poured concrete building. The structure occupies a rectangular footprint measuring approximately 191 by 51 feet and rises to a height of 53 feet.[1] The interior is an open plan and houses the motor assembly and control room for the 3-meter Transonic Wind Tunnel.

Building 12 rests on a poured concrete foundation with interior concrete load bearing wall and piers in the basement level. Windows are located at three different heights along the building's exterior and include six-over-six, double hung sash, and 10-light industrial sash metal windows. The building terminates in a low pitched reinforced concrete slab roof. A parapet wall defines the structure's roof line.

Entries to the equipment building are located on the north and east elevations. The north elevation features a single metal door at ground level that leads to the air drying system. The east elevation features a sliding track door and a single light metal fire door.

The structure was designed without interior columns; reinforced concrete piers located along the walls support the reinforced concrete roof. This structural system created the space required for the large equipment. The fan assembly of the Transonic Wind Tunnel occupies the northern portion of the building. The control room and operating panels occupy the south side of the east elevation. The area south of the fan assembly is open. A traveling crane, mounted at the eave, spans the north/south axis of the room.

The basement of Building 12 is accessible from two interior points: a metal stairway located at the eastern end of the building and an equipment opening marked by metal access panels located in the floor, south of the wind tunnel. A metal tubular railing encloses the stairway.

The Operations Building (Building 13) adjoins the north elevation of Building 12. Constructed in 1954, this building houses the test facilities to support Building 157, the Transonic Wind Tunnel. This two-story, poured concrete building is constructed with a L-shaped ground plan measuring approximately 136 by 69 feet and rises to a height of 53 feet.[2] The interior of the building features framed office space and the test chamber for the 3-meter Transonic Wind Tunnel.

Building 13 rests on a poured concrete foundation; interior concrete load bearing walls and piers are found in the basement. The window units are three-over-five light metal sash. The building terminates in a low pitched reinforced concrete slab roof. A parapet wall with a flat projecting concrete eave defines

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[1] 7 x 10 Foot Sonic Wind Tunnel, Electric Equipment Building, First Floor Plan and Details, Bureau of Yards and Docks, 1 September 1950.

[2] 7 x 10 Foot Sonic Wind Tunnel: Laboratory & Office Building, First Floor Plan, Elevations, 14 December 1950.

the structure's roof line.

Entries to the operations building are located on the north and east elevations. The north elevation features a double metal four-light door with six-light transom. The east elevation features a single-light metal door which leads to an open administrative space. The interior of the building comprises divided office spaces connected by hallways. The office space and hallways feature suspended ceilings and fluorescent lighting. The original test chamber and access door of the Transonic Wind tunnel are obscured by these recent additions.

In preparation for the completion of the Transonic Wind Tunnel, a cooling tower (Building 158) and a pump house (Building 187) were also constructed in 1954. Building 158 is a wood frame structure comprising two attached cooling cells. The tower, constructed entirely of redwood, rests on an enclosed, underground concrete holding reservoir. The cooling tower was built to cool hot water created during wind tunnel test sessions.

The tower is composed of regularly spaced vertical wooden beams with cross bracing. The lower exterior walls of the tower feature louvered panels which conduct air inward; the exterior walls of the upper portion of the cooling tower are sheathed in closely spaced horizontal wood slats.

The interior of the structure is comprised of a succession of evenly spaced lightweight, redwood slats, that are configured to form a grill. The wood frame walls terminate into a flat roof that contains two large metal cooling fans. A wood railing surrounds the top of the tower.

A vertical pipe running up the east side of the tower delivered hot water from the wind tunnel to the top of the cooling tower, where a sprayer nozzle diffused water into the tower. The water was then conducted by gravity over multiple layers of wood slats within the tower. The fans located on the roof drew air upward through the bottom of the tower, thus cooling the water as it ran down the slats. The cooled water was collected in the holding tank. From the holding tank, water was pumped to the wind tunnel for reuse.[3] The redwood used in the design of the tower was an important feature of the structure because redwood does not deteriorate if it is kept continuously wet.

Building 187, the pump house, is a one-story poured concrete building constructed with a rectangular ground plan. The poured concrete walls terminate is a flat concrete slab roof. Metal seven-light industrial sash are found on the east and west elevation. The primary entrance is through a paired metal door on the north elevation. The pump house was used to pump water from the wind tunnel to the top of the cooling tower and cooled water from the settling tank to the wind tunnel radiator. Water is circulated at the rate of 12,000 GPM.[4]

Building 157, the Transonic Wind Tunnel is located to the west of Building 13 and north of Building 12. This closed circuit, single-return wind tunnel was constructed in 1955. The tunnel test area contains a seven foot high, ten foot wide, and fourteen foot long test section. The low velocity sections of the wind tunnel are constructed of reinforced concrete, while the remainder of the structure is machined steel.

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[3] John Washko, personal interview, 17 June 1996.

[4] Gallons Per Minute.

The air stream of the Transonic Tunnel is provided by two counter rotating fans operating in a nineteen foot section of the tunnel. Each fan has manually adjusted blades to control the airstream. The fans are independently driven by twin Allis-Chalmers 12,000 horsepower-synchronous-speed motors.[5] Each motor is connected to one of two axial flow fan stages by a variable-speed Dynamatic coupling. The wind tunnel was capable of operating over a Mach number range from 0.4 to 1.17 and an altitude range from sea-level to 40,000 feet.

The test section of the wind tunnel is 7 feet high, 10 feet wide, and 14 feet long. The ceiling and floor contain six, 18 foot long slots. Effuser flaps are located at the downstream end of each slot to control flow reentry rate and test chamber Mach number. Models were installed and removed through a moveable wall section located upstream of the test section[6].

A 3-ton electric hoist is mounted in the test section bay for moving heavy models. Each side of the test chamber wall contains moveable Schlieren windows to enable the observation of any position of a model in the test chamber from various angles. A large viewing window located in the control room enables monitoring models and equipment during testing.

Two air dryers located outside of the wind tunnel at the west elevation provide moisture free air within the tunnel. Air is removed from the test chambers by a 150 horsepower Spencer turbocompressor. The tunnel air passes first passes through a cooling radiator and then into one of the two cylindrical desiccant air dryers. Once the air has been dried it reenters the tunnel downstream of the main drive.[7]

History

At the end of World War II, a feasibility study was completed that demonstrated the practicality of constructing larger wind tunnels to permit the accurate testing of complete scale aircraft models. Officials at the Carderock facility recommended that a 3-meter sonic wind tunnel, discovered in Ottobrun, Germany, be transported to the United States and installed at the Aerodynamics Laboratory.[6] Reconstruction of the wind tunnel was proposed in stages. Projected costs for overhauling the German motors and other equipment proved more expensive than the cost of fabricating an American-made system with twice the power. As a result, components of the German tunnel that could be easily shipped or were hard to obtain in the United States were shipped to Carderock. Parts installed at the Maryland installation included the fan assembly and the wind tunnel structural system.

The new wind tunnel at Carderock first operated on March 13, 1956 as a subsonic facility. It took over a year to secure the funding and equipment necessary to enable for transonic testing; in February 1958

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[5] Norman J. Fresh, *The Aerodynamics Laboratory (The First 50 Years)* Aero Report 1070. (Bethesda: Naval Surface Warfare Center, 1964), 24.

[6] John Washko, personal interview, 17 June 1996.

[7] John Washko, personal interview, 17 June 1996.

[6] Fresh, *The Aerodynamics Laboratory (The First 50 Years)*, 22.

transonic testing was introduced at Carderock, more than ten years after the technology was proven at a NACA laboratory.[9] Throughout the 1950s, the Aeronautical Laboratory at Carderock concentrated its efforts on tests to improve the aerodynamic qualities of missiles and aircraft, to assist in the development of new designs, and to modify existing equipment.

In July 1990, a catastrophic blade failure caused serious damage to the fan assembly and power section of the west wind tunnel unit. The failure immobilized the unit; it has not been repaired.[10]

HAER recordation of the Transonic Wind Tunnel Building was undertaken in anticipation of its adaptive reuse for new activities moving to the installation as a result of the 1995 Base Realignment and Closure Act. Building 12 and 13 are slated for renovations as office space.

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[9] In 1946, researchers at the NACA Aerodynamic Laboratory located in Langley, Virginia designed a slotted wall wind tunnel that closely duplicated free flight conditions.

[10] Fresh, *The Aerodynamics Laboratory (The First 50 Years)*, 20.

SOURCE OF INFORMATION/BIBLIOGRAPHY

A. Engineering Drawings:

Drawings in the collection Naval Surface Warfare Center Carderock Division, Bethesda, Maryland:

1949, October 13. 7 x 10 Foot Sonic Wind Tunnel, Electric Equipment Building, First Floor Plan and Details. One sheet. Bureau of Yards and Docks.

1950, September 1. 7 x 10 Foot Sonic Wind Tunnel, Electric Equipment Building. Fifteen sheets. Bureau of Yards and Docks.

1950, December 14. 7 x 10 Foot Sonic Wind Tunnel, Laboratory & Office Building, First Floor Plan. Twenty-four sheets. Justement, Elam & Darby - Arch. & Engr., Washington, D.C.

1952, April 21. 7 x 10 Foot Sonic Wind Tunnel, Plot and Grading Plan. Eighty-three sheets. Sanderson and Porter, Engineers, New York.

1950, Air dryer: Elevation and details. One Sheet.

B. Historic Views (All historic views courtesy of Naval Surface Warfare Center Carderock Division, Bethesda, Maryland):

View south of Transonic Wind Tunnel, 1946.

View south of Transonic Wind Tunnel internal Radiator, 1946.

View northeast of Transonic Wind Tunnel Corner Vanes, 1946.

View northwest of Transonic Wind Tunnel Fan Assembly, 1946.

C. Interviews:

Washko, John (Supervisor Mechanical Engineer Technician). Interview by Geoffrey E. Melhuish, 17 June 1996. Transcript, Naval Surface Warfare Center Carderock Division, Bethesda, Maryland.

D. Bibliography:

Fresh, Norman J. *The Aerodynamics Laboratory (The First 50 Years).* Aero Report 1070. MSS, Naval Surface Warfare Center, Bethesda, MD, 1970.