National Aeronautics and Space Administration

Glenn Research Center

Altitude Wind Tunnel and Space Power Chambers

The Altitude Wind Tunnel (AWT) was designed and constructed between 1941 and 1944 for the National Advisory Committee for Aeronautics' (NACA's) new Aircraft Engine Research Laboratory (AERL) in Cleveland, Ohio. The engine lab was located on the former parking area for the National Air Races adjacent to the Cleveland Municipal Airport. The site of the AWT and the AERL is the present John H. Glenn Research Center at Lewis Field.

The AWT tunnel was 263 feet long on the north and south legs, and 121 feet long on the east and west sides. The larger west side of the tunnel was 51 feet in diameter throughout. The east side of the tunnel was 31 feet in diameter on the southeast end and 27 feet in diameter on the northeast. The throat section, which connected the northwest corner to the test section in the middle of the long northern leg, narrowed from 51 feet to 20 feet at the test section. Because of the altitude simulating capability, the steel used to construct the tunnel was both thicker and stronger than that used on other tunnels. The shell was made from 1-inch-thick steel to withstand the external pressure when the tunnel was evacuated to simulate high altitude pressure levels. A chromium, copper steel alloy was used to endure the low temperatures of the high altitudes.

The AWT was the first wind tunnel in the United States, and possibly the world, capable of operating full-scale aircraft engines in conditions that replicated those actually encountered by aircraft during flight. In 1940, the NACA was lacking a facility capable of testing full-scale engines even in ambient conditions. The Langley Memorial Aeronautical Laboratory and the new Ames Aeronautical Laboratory focused on aerodynamics, not propulsion. A special committee recommended building an entire laboratory to study engines. The massive AWT facility was a key component in the overall design of this new AERL laboratory in Cleveland.

STATE MAP

Although initially constructed during World War II to study reciprocating engines, the AWT's first 10 years were spent almost exclusively improving turbojet and ramjet engines. These tests included the nation's first jet aircraft, the Bell YP–59A with its General Electric I–16 engines, in early 1944, the Westinghouse 19XB, and the Pratt & Whitney J57 from 1953 to 1955. During this period, the tunnel contributed significantly to the improved capabilities of turbojet through a steady stream of investigations on a number of centrifugal and axial-flow engines. The AWT also played a primary role in resolving cooling problems for the B–29 bomber's Wright R–3350 engines.

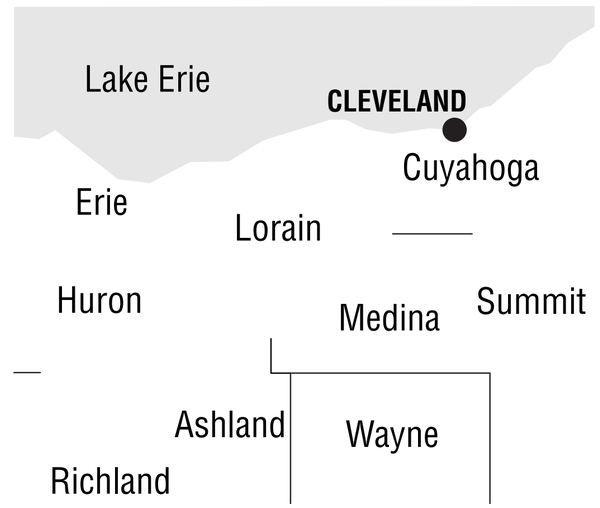
In the late 1950s, the AWT shifted its focus to space. After several small rocket engine tests in 1957 and 1958, the facility was no longer used as a wind tunnel. Instead, the cavernous interior of the tunnel was used for a series of Project Mercury qualification tests and training sessions from 1958 through 1960. The tests included the guidance system for the unoccupied Big Joe capsule, the Mercury capsule's retrorockets and escape tower, and training the original astronaut corps on the rotating Multi Axis Spin Test Inertial Facility. The tunnel was sealed off in 1961 to create two altitude chambers and renamed the Space Power Chambers (SPC). One of the chambers could create a vacuum that simulated the atmosperic and solar conditions at 100 miles above sea level.

The SPC was involved in many tests for the Centaur second-stage rocket. The initial tests focused on preparing the rocket for the Surveyor Moon missions of the mid-1960s. These tests included operating the electronics systems in a space environment, verifying new hydrogen venting systems, and payload shroud separation tests. In the late 1960s and early 1970s, SPC was used for additional payload shroud separation tests for Centaur's new larger payloads. The facility was last used for testing in 1975.

In the early 1980s, a considerable amount of manpower and money invested to explore the costs and options to renovate the SPC for use once again as a wind tunnel for icing and Vertical/Short Take-Off and Landing (V/STOL) testing. The project was cancelled when it appeared that the actual rehabilitation of the tunnel would exceed the $160 million already proposed. The renovated AWT's predicted capabilities were also questioned, and it was suggested that the research needs could be met by existing wind tunnels.

Although the AWT/SPC facility has been mostly dormant since the mid-1970s, during its previous 30 years it played a significant role in the development of the nation's aerospace progress—from the World War II reciprocating engine to the first turbojet models to more advanced jets of the 1950s through Project Mercury, the Apollo Program, and ensuing Centaur interplanetary flights. Although it is not listed, NASA Glenn is treating the AWT as though it were eligible for the National Register of Historic Places.

This report is part of a wider effort to document the AWT prior to its demolition, which began in December 2008. This documentation was formally begun in May 2005 after Statement of Work 6.31 for the NASA Glenn History Program was finalized. On May 7, 2007, the Ohio State Historical Preservation Office approved NASA Glenn's stated efforts to document the AWT before its destruction.



REGIONAL MAP

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NASA Altitude Wind Tunnel Recording Project
Historic American Engineering Record
National Park Service
United States Department of the Interior

Historic American Engineer Record
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