FULL-SCALE WIND TUNNEL
1929-1932

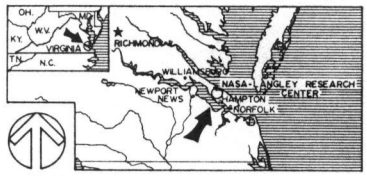
THE FULL-SCALE WIND TUNNEL

Early aeronautical researchers constructed wind tunnels to obtain data about the forces generated by air flowing over aircraft surfaces. They quickly discovered that at atmospheric pressure, all the aerodynamic characteristics of a small model could not be directly correlated to the flight performance of a full-sized aircraft. Several critical research areas could only be explored with full-scale models or with the actual aircraft.

Under the direction of Smith J. DeFrance, the Langley Memorial Aeronautical Laboratory built a full-scale wind tunnel and placed it in operation in May of 1931. The tunnel's 30 x 60 foot, open-jet test section was 56 feet long and could easily accommodate the largest aircraft of the period. Until 1945 it was the world's largest wind tunnel.

A six component recording balance measured the forces acting on test aircraft. This instrumentation logged data on drag, lift and cross-wind forces and the commensurate pitching, yawing and rolling moments. Engineers also investigated aircraft engine cooling and cowling airflow problems under conditions approximating flight.

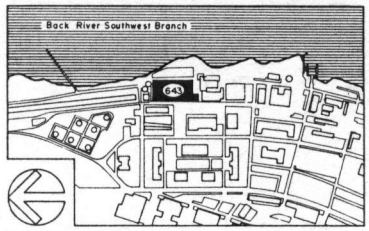
Downstream of the test aircraft, two four-bladed wooden propellers directly connected to 4000-horsepower motors circulated the air through the test section. Motor control equipment regulated wind speed between 25 and 118 miles per hour. In operation the two motors used about 3 megawatts of electricity.



STATE MAP

MAPS BASED ON "1994 ROAD ATLAS" PUBLISHED BY RAND McNALLY. NO SCALE.

Based on Hardlines: Design and Delineation's interpretation/integration of field work, historic photographs, and National Advisory Committee for Aeronautics as-built drawings D-2504-05, 2510, 2726-45, 2752-53, 2809, 2964, 2981-82, 3051, 3120-21, 3489-95, 3810, 3820, and LD-5467



SITE PLAN

1"=600'-0" 0 500 1000 1500 2000 FT

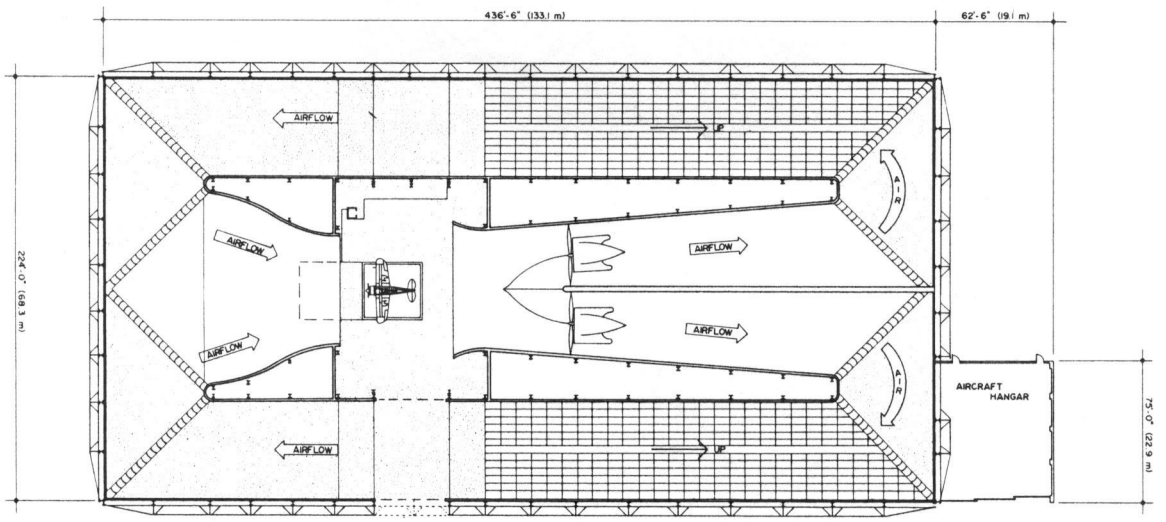
1:7200 0 100 200 300 400 500 M

SOURCE: DRAWING No. LD-740138, NASA-LANGLEY RESEARCH CENTER, VA

Early tests on aircraft indicated that surface roughness, external struts, landing gear and protruding rivets increased drag and imposed serious penalties on aircraft performance. Performance of most World War II military aircraft was significantly improved by "drag cleanup tests" run in the full-scale wind tunnel. The facility was used to test a variety of vehicles including military aircraft, dirigibles, submarines, the project Mercury space capsule and supersonic aircraft. In the 1960s and 1970s the tunnel was modified and equipped for dynamic free-flight model testing. When the facility was closed in September of 1995, it was NASA's oldest operating wind tunnel.

The success of the American aerospace industry is due in no small part to the aeronautical research performed in the full-scale wind tunnel.

(For complete project information see the Historical Report.)



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PLAN

Note:
The N.A.C.A. Full-Scale Wind Tunnel was designed with an aircraft hangar attached to the Southwest corner of the building. The hangar was not built at the same time as the wind tunnel; however, and was added in 1932.

1"=30'-0" 0 10 20 30 40 50 100 FT

1:360 0 5 10 20 30 M

DELINEATED BY Hardlines: Design & Delineation, 1995-1996

NASA-LANGLEY RESEARCH CENTER RECORDING PROJECT
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

NASA-LANGLEY RESEARCH CENTER - FULL-SCALE WIND TUNNEL
BUILDING NUMBER 643
HAMPTON HAMPTON VIRGINIA

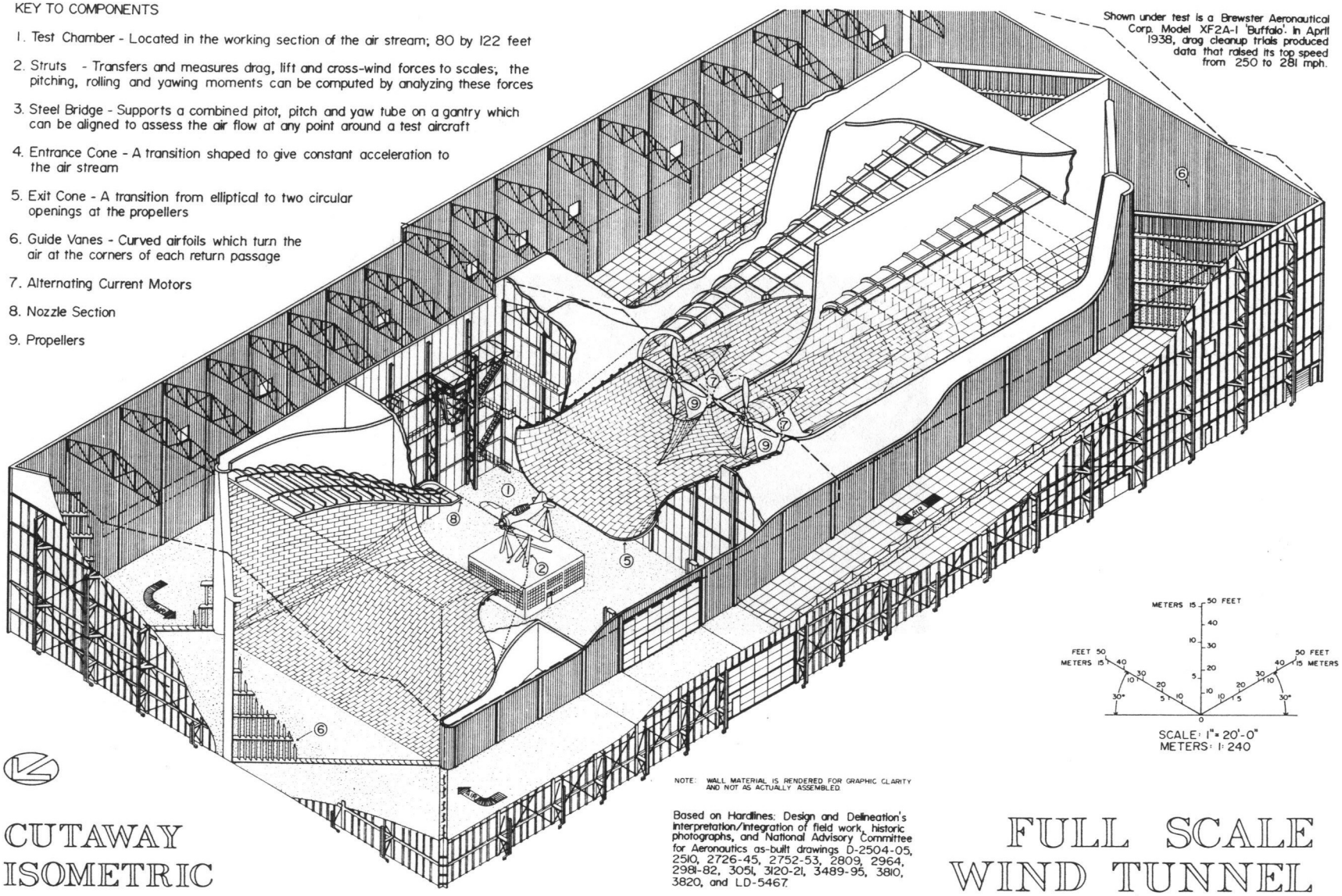
SHEET 1 of 2

HISTORIC AMERICAN ENGINEERING RECORD
VA-118-A

KEY TO COMPONENTS

1. Test Chamber - Located in the working section of the air stream; 80 by 122 feet
2. Struts - Transfers and measures drag, lift and cross-wind forces to scales; the pitching, rolling and yawing moments can be computed by analyzing these forces
3. Steel Bridge - Supports a combined pitot, pitch and yaw tube on a gantry which can be aligned to assess the air flow at any point around a test aircraft
4. Entrance Cone - A transition shaped to give constant acceleration to the air stream
5. Exit Cone - A transition from elliptical to two circular openings at the propellers
6. Guide Vanes - Curved airfoils which turn the air at the corners of each return passage
7. Alternating Current Motors
8. Nozzle Section
9. Propellers

Shown under test is a Brewster Aeronautical Corp. Model XF2A-1 'Buffalo'. In April 1938, drag cleanup trials produced data that raised its top speed from 250 to 281 mph.



SCALE: 1"= 20'-0"
METERS: 1: 240

NOTE: WALL MATERIAL IS RENDERED FOR GRAPHIC CLARITY AND NOT AS ACTUALLY ASSEMBLED

Based on Hardlines: Design and Delineation's interpretation/integration of field work, historic photographs, and National Advisory Committee for Aeronautics as-built drawings D-2504-05, 2510, 2726-45, 2752-53, 2809, 2964, 2981-82, 3051, 3120-21, 3489-95, 3810, 3820, and LD-5467.

CUTAWAY ISOMETRIC

FULL SCALE WIND TUNNEL

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HAMPTON VIRGINIA

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