55+ Years of High-Speed Wind Tunnels at White Oak

An Historical Account

By

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WOL - White Oak Laboratory

- Formerly the Naval Surface Warfare Center, Dahlgren Division
- Formerly the Naval Ordnance Laboratory
- Transferred to the Air Force on 1 Oct 97 as part of BRAC 95 action. Now part of AEDC.

- Established after World War II, building on the accomplishments of the German scientists who worked at the Peenemunde Rocket Development Station.
Early German Supersonic Wind Tunnel Developments

- 1936 – Pennemunde Rocket Development Station was established on the Baltic Sea with the purpose of developing a long range guided missile, the V2, under the direction of Dr. Werner von Braun.

- 1937 – Dr. Rudolf Hermann joined the staff from the Technical University of Aachen where he had developed a 10x10 cm supersonic wind tunnel to Mach 3.3.

- 1937 – An Aerodynamics Institute was founded at Pennemunde with Dr. Hermann as Director and Dr. Kurzweg as Assistant.

- 1938 – First of two 40x40 cm supersonic wind tunnels was in operation at Mach 2.5.
40x40 supersonic wind tunnel as it appeared in Germany
<table>
<thead>
<tr>
<th>August 17, 1943</th>
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- The Allies carry out a severe air raid on Pennemunde.
- Much of the infrastructure at Pennemunde was destroyed, but the wind tunnel equipment and almost all instruments were untouched.
- It was decided that the wind tunnels would be moved to Kochel in Bavaria.
- Equipment was loaded on 300 railroad boxcars for the move.
- On 15 November 1944, one 40x40 wind tunnel was operational again in Kochel.
To the United States

- In July 1945 the custody of the Kochel wind tunnel facilities was awarded to the US Navy, to be installed at the Naval Ordnance Laboratory in White Oak, MD.
- Jan 1946 – wind tunnels had been received in the US.
- 1946/47 – 12 German scientists come to White Oak
  - Dr. Hermann Kurzweg
  - Dr. Richard Lehnert
  - Dr. Gerhard Eber
  - Dr. Ernest Winkler
  - Mr. Edmund Stollenwerk
  - Dr. Karl Grunewald
  - Mr. Zettlerseider
  - Mr. Max Peucher
  - Dr. Peter Wegener
  - Dr. Willi Heybey
  - Dr. Eva Winkler
  - Mr. Florian Geineder
- 1 July 1948 – two 40x40 cm wind tunnels are operational for shakedown and calibration at White Oak.
40x40 cm Supersonic Wind Tunnel at White Oak
## White Oak Wind Tunnel Developments

<table>
<thead>
<tr>
<th>Tunnel 1</th>
<th>40x40 cm</th>
<th>Used extensively in the early development of US missile weapon systems.</th>
<th>Closed in 1990’s. Museum piece.</th>
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</thead>
<tbody>
<tr>
<td>Supersonic</td>
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<td>Tunnel 2</td>
<td>40x40 cm</td>
<td>Upgraded to higher pressure and continuous flow.</td>
<td>Closed in 1990’s.</td>
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<td>Supersonic</td>
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<td>Tunnel 3</td>
<td>18x18 cm</td>
<td>Diffuser studies, aided in the design of the 16x16 ft supersonic W.T. at AEDC.</td>
<td>Given to the U of MD.</td>
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<tr>
<td>Supersonic</td>
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<td>Tunnel 4</td>
<td>12x12 cm</td>
<td>First air-liquifaction-free Mach 10 facility. Upgraded to Mach 18.</td>
<td>Orig. nozzle to VKI. Dismantled in 1968.</td>
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<tr>
<td>Hypersonic</td>
<td></td>
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<td>Tunnel 6</td>
<td>12x12 cm</td>
<td>Turbulence and shock wave studies.</td>
<td>Dismantled in 1955.</td>
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<td>Supersonic</td>
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<tr>
<td>Tunnel 7</td>
<td>12x12 inch</td>
<td>Compressible turbulent B.L. studies to Mach 5.</td>
<td>Dismantled in 1970’s.</td>
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<td>B.L. Channel</td>
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<td>Tunnel 8</td>
<td>20 inch dia.</td>
<td>Hypersonic pebble bed heated blowdown tunnel to Mach 10</td>
<td>Dismantled in 1997.</td>
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<td>Hypersonic</td>
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<td>Hypervelocity</td>
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Hypervelocity Wind Tunnel 9 History

- Congressional approval for construction of Tunnel 9 in 1967.
  - Naval Ordnance Lab, Naval Surface Weapons Center
- 1976-1995 20 years of Unique testing for the DoD NASA and Industry
  - The Space Shuttle, missiles and high-speed research

- NSWC White Oak was identified for closure during BRAC 95
  - Tunnel 9 facility was declared excess by the Navy (March 1995)
- Hypervelocity Wind Tunnel 9 Identified as critical and world unique
  - Retained by the DoD under BRAC reuse provisions
  - AEDC holds 1st meeting at White Oak (August 1995)
  - Tunnel 9 was transferred to AEDC on 1 October 1997 (25 Months)
Tunnel 9 Construction Begins

Naval Ordnance Lab Headquarters

Ready For Painting

Construction Continues

Buildings Rise
HYPERVELOCITY WIND TUNNEL NO. 9 TODAY