

Hypervelocity Wind Tunnel 9



Hypersonic Testing of Strategic and Tactical Systems

**ARNOLD ENGINEERING DEVELOPMENT CENTER
White Oak
An Air Force Materiel Command Test Center**

Hypervelocity Wind Tunnel 9

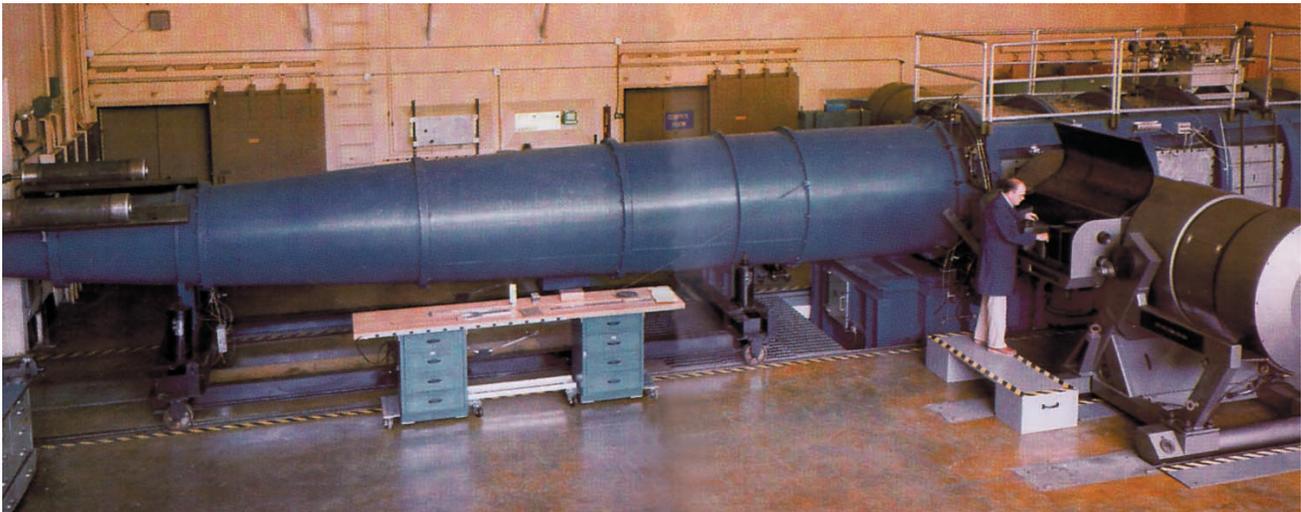
The Hypervelocity Wind Tunnel 9, located at the White Oak, Maryland site of the Arnold Engineering Development Center, became operational in 1976. Tunnel 9 provides aerodynamic simulation in the critical altitude regimes associated with strategic offensive missile systems, advanced defensive interceptor systems, and hypersonic vehicle technologies. Numerous experiments have been performed in the facility which have supported the Navy Mk4 and Mk5 reentry body development for its fleet ballistic missile systems, the Ballistic Missile Defense Organization and Army endo-atmospheric interceptor programs, the Air Force reentry and decoy programs, the NASA space Shuttle, and various hypersonic technologies such as waveriders, scramjets, and the National Aerospace Plane.

Tunnel 9 has noteworthy advantages over other facilities. The facility utilizes a unique storage heater with pressures up to 1900 atmospheres and temperatures up to 3650 degrees Rankine. Axisymmetric contoured nozzles from Mach 7 to 16.5 are available. When compared to other hypervelocity facilities which have run times of a few milliseconds, the long test times (up to 15 seconds) available in Tunnel 9 provide higher productivity by allowing for

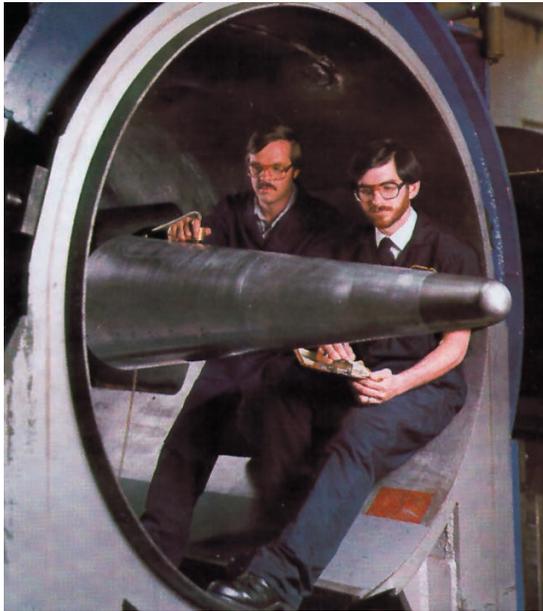
parametric variation, e.g. an angle-of-attack sweep or flow survey, during a single run. The five foot (1.5 meters) diameter test cell accommodates full-scale reentry bodies, full-scale endo-interceptors, and large-scale aerospace vehicle and hypersonic inlet models. The combination of test conditions, long test times, and large test cell provides a meaningful, productive, and cost-effective test environment for aerodynamic, aerothermal, aero-structural, aero-optic, shroud removal, and hypersonic inlet experiments.

The Mach 7 Thermal/Structural Test Leg is capable of providing flight duplication (true ambient atmospheric temperature and pressure) for seconds at a time. This capability is particularly important to endo-interceptor programs where sensor window survivability, cooling, mounting, and aero-optic performance are critical.

Tunnel 9 is available to government agencies and commercial industry for unclassified or classified testing. Test models may be built at Tunnel 9 or by the customer, following consultation and planning. Design and engineering, instrumentation, assembly and installation by Tunnel 9's professional staff is also available.



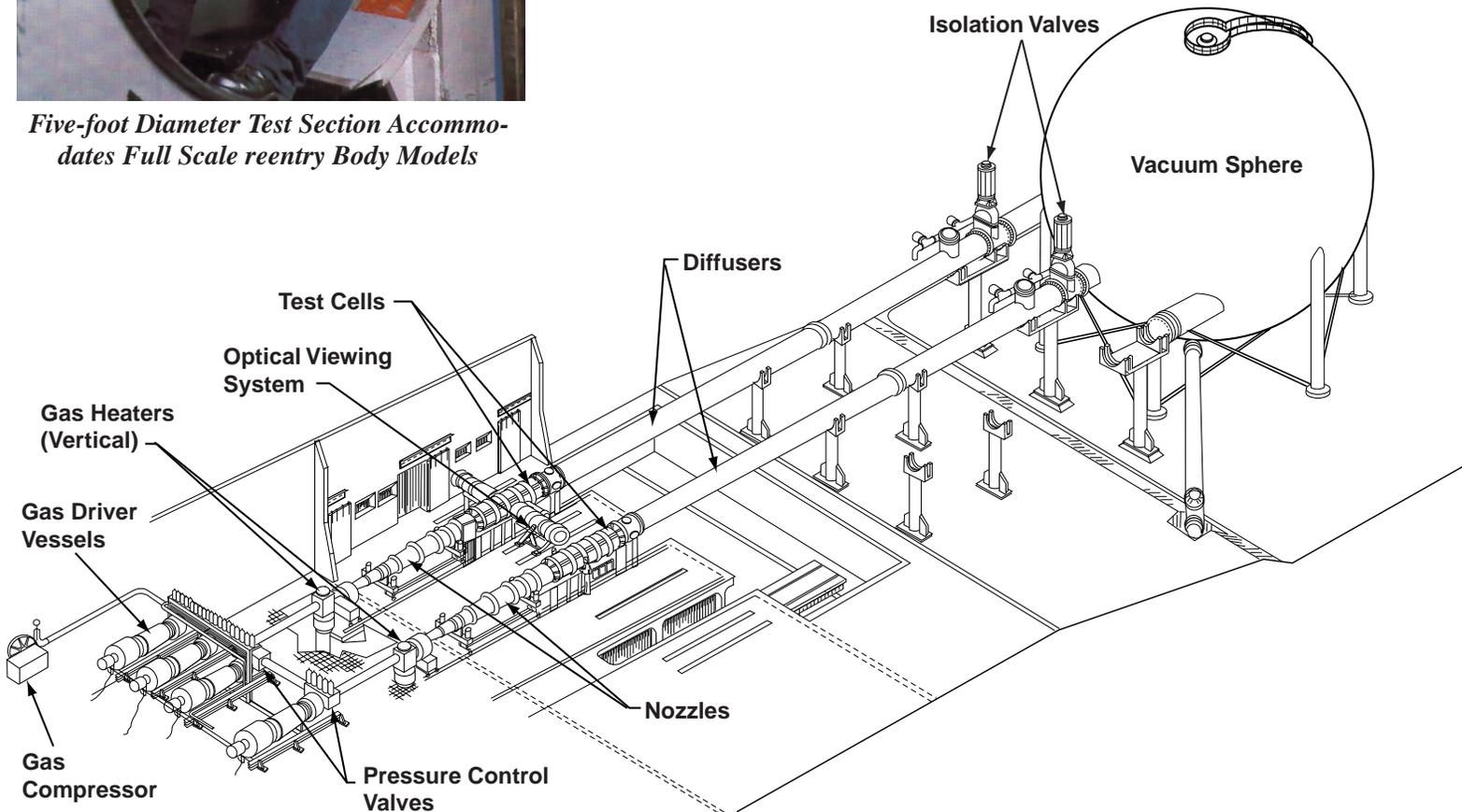
Mach 10 Leg of the NSWC Hypersonic Tunnel 9

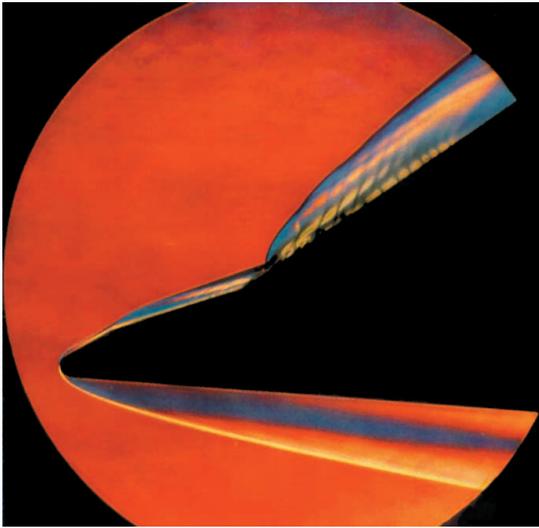


Five-foot Diameter Test Section Accommodates Full Scale reentry Body Models

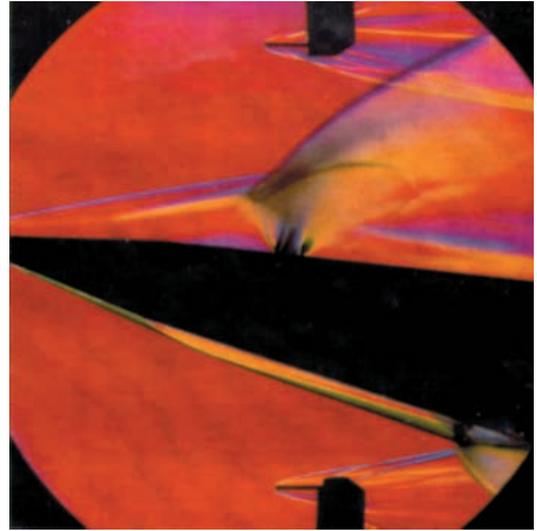
Tunnel 9 Performance Characteristics

Contoured Nozzle (Mach #)	Supply Pressure Range (psia)	Nominal Supply Temperature (degrees F)	Reynolds No. Range (x 10 ⁶ /ft.)	Run Time Range (seconds)	Comments
7	2,600–11,800	3,000	3.7–15.8	1–6	Flight Duplication
8	1,000–12,000	1,100	4.5–50.0	0.33–5	Shroud Separation
10	500–14,000	1,350	0.86–20.0	0.23–8	Naturally Turb B.L.
14	100–20,000	2,750	0.072–3.8	0.7–15	High Mach/Re#
16.5	21,000	2,880	3.24	3.5	High Mach/Re#





Aerothermal Testing of Actively Cooled Interceptor Sensor Window



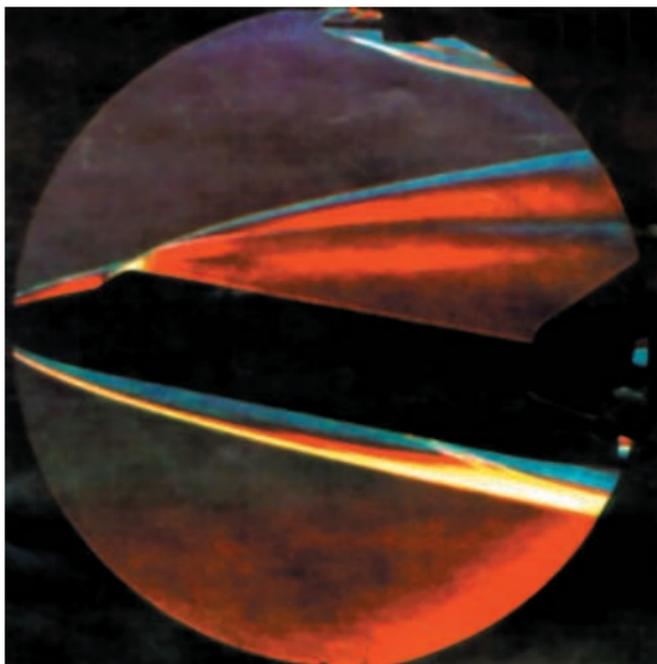
Jet Interaction Control Testing of Hypersonic Vehicle



Aero-optic Testing of Interceptor Forebody



Full-Scale Shroud Separation Testing



Testing of Space Shuttle Orbiter

For detailed information about the capabilities of the Hypervelocity Wind Tunnel Number 9 contact:

Arnold Engineering Development Center
White Oak
10905 New Hampshire Ave
Silver Springs, MD 20903-1050
301-394-1750
FAX 301-394-4631



World Wide Web Site <http://www.arnold.af.mil>

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