HISTORIC WIND TUNNEL WINS NEW LEASE ON LIFE

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With James Schultz

An early design for a supersonic transport undergoes low speed testing in the Langley Full-Scale Tunnel. Although the airplane was designed for supersonic flight, its behavior at low speeds was crucial to safe take offs and landings. Photo courtesy of NASA.

Planes came. So did helicopters, the Mercury space capsule, parachutes and parafoils, the occasional dirigible and, once, the fastest submarine in the world. For almost 65 years, NASA Langley's Full-Scale Wind Tunnel in Hampton was among the biggest and best on the planet, a place where aerodynamic researchers gained a comprehensive understanding of the effects of air flow and air resistance on a variety of large objects. Generations of aircraft passed through the Full-Scale Tunnel; all emerged more airworthy than when they entered.

NASA closed the tunnel in October 1995. But now Old Dominion University has given the facility a new lease on life by signing a permanent operating agreement with NASA. The university's long-term plan is to equip the tunnel for testing cars, trucks and trains — an investment that is drawing the keen interest of major manufacturers as well as racing teams for whom wind tunnel time is a valuable and scarce commodity. Preliminary testing of two NASCAR-class cars in the tunnel has already been completed.

Despite major advances in computer modeling, there is no substitute for testing of a full-scale vehicle under conditions that closely mimic those in the real world. For those businesses that rely on streamlining improvements to increase operating efficiency (sleeker cars that cut air resistance can significantly boost mileage), the Full-Scale Tunnel is an ideal resource to aid in economic competitiveness.

The University of Michigan solar-powered car is tested in the Langley Full-Scale Tunnel prior to entry in SunRayce '97. The tests concentrated on reducing the drag of the vehicle. Photo courtesy of NASA.

For Old Dominion students, the ability to participate in model development, testing and tunnel operations is an invaluable hands-on training opportunity. The long history and trailblazing nature of the facility, combined with its spectacular size, is suitably inspirational to college-age men and women, some of whose grandfathers may have flown the very World War II fighters that tunnel researchers are credited with having made superior to those flown by Japanese and German aviators.

Rich in History and Results

Construction of the Full-Scale Tunnel began in February 1930 in a swampy corner of Langley Field. The entire complex cost almost $1 million and was completed within 16 months, formally opening in late May 1931.

The facility's dimensions remain impressive. The tunnel is still the second largest in the United States in terms of test section size, and is one of the four largest in the world. The test section is 30 feet high, 60 feet wide and 56 feet long. The tunnel's closed-loop design allows for continuous air flow at speeds ranging from 25 to 120 mph. The building enclosing the test section, supporting equipment, laboratory space, fabrication areas and offices is 434 feet long and 222 feet wide, reaching a maximum height of 97 feet, and places nearly 2.5 acres under roof, enclosing roughly 8 million cubic feet.

During decades of service with NASA's predecessor agency, the National Advisory Committee for Aeronautics, and then with NASA, the Full-Scale Tunnel hosted an extensive range of tests intended to improve design and in-flight performance. Work was done on military and civilian biplanes, all major U.S. World War II-era fighters, general aviation aircraft, all current U.S. jet fighters, parachutes and parafoils, airships, submarines and at least one building. Unusual or unique test capabilities included dynamic stability measurements, free-flight testing of powered and tethered models and a variety of helicopter work.

Although the basic structure of the wind tunnel has seen little alteration since its inception, all major sub-systems have seen numerous upgrades, with major refurbishments occurring as recently as the early 1980s. And there was eventually a new name: the 30-By-60-Foot Tunnel, reflecting the size of the test section.

The University Steps In

By the mid-1990s, declining federal budgets led NASA decision makers to draft plans to close some older tunnels. NASA Langley officially shut the doors to the Full-Scale Tunnel on Oct. 22, 1995. Faculty and administrators in Old Dominion's College of Engineering had been observing NASA's cutbacks with distinctly mixed feelings, but believed the tunnel could now offer new opportunities. Thus was born the notion of university operation of the facility. Negotiations were lengthy and difficult, but an interim operating agreement was signed on Aug. 1, 1996 and a permanent agreement concluded a year later, on Aug. 18, 1997.

Serious recommissioning work did not start until well into autumn 1996. Air was circulating soon thereafter. Preliminary flow surveys and calibration checks were carried out, and validation experiments conducted to ensure the accuracy of data. Studies were done on a small commuter jet and an experimental aircraft, which had been previously tested in the same facility by NASA.

The first revenue-generating test was carried out in spring 1997 for McDonnell Douglas Corporation, under contract from the U.S. Air Force. The test was designed to investigate the causes and effects of asymmetric flow on the forward fuselage of an F-15 aircraft, suspected as a cause of occasional loss of control in low-speed, high-angle-of-attack maneuvering. Researchers traced the cause to irregularities in a small protective nose cap about half the size of an egg cup.

Old Dominion University is now operating one of the finest wind tunnels ever to have been built in the United States. A crown jewel of this country's aeronautical past, the Langley Full-Scale Tunnel will once again shine under the university's stewardship.

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