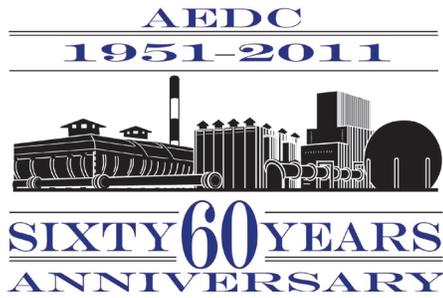


Over 60 years, AEDC's wind tunnels have seen a wide variety of work



By Patrick Ary
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When the Air Force sent Capt. Win Phipps to AEDC in 1989, his last job before being assigned to the base was to switch phones over to a new digital system.

Today, as a civilian test manager for the base's wind tunnel systems, he has seen advances in aviation that go way beyond the jump from an analog to a digital phone.

"In the 90s I supported numerous strategic planning sessions at the Gossick Leadership Center for years, and I remember all the debates on whether we'd see unmanned fighters or unmanned aircraft," Phipps said. "That debate went on for several years, and now remotely-piloted aircraft has become the norm for aircraft in development that we may see."

In fact, today the premier unmanned aircraft – the RQ-4 Global Hawk used extensively in the wars in Iraq and Afghanistan – was tested in AEDC's wind tunnels during its development. It's one of several leaps forward in aviation that was put to the test at Arnold AFB.

AEDC operates wind tunnels in two primary facilities on base: the Propulsion Wind Tunnel Facility (PWT) and the von Kármán Gas Dynamics Facility (VKF). AEDC



A Lockheed Martin engineer inspects a model of the F-35 Joint Strike Fighter Lightning II during a break in aerodynamics load testing in AEDC's 16-foot transonic wind tunnel in 2006. (File photo)

also manages two wind tunnels at remote operating locations: the Hypervelocity Wind Tunnel 9 in Mary-

land and the National Full-Scale Aerodynamics Complex at Moffett Field, Calif.

The body of work that has come through the tunnels in the last 60 years is staggering. The facilities are capable of aerodynamic and propulsion integration testing for large-scale aircraft models. Propulsion systems and inlets can be tested simultaneously in PWT to make sure engines receive adequate airflow. Workers can also test store separation systems to ensure bombs and missiles separate cleanly from aircraft when released.

Because of the vast capabilities of the tunnels, they've seen everything from fighter jets to weapons systems and space vehicles. There have even been tests on parachute systems and ejection seats, according to ATA Aerodynamics and Propulsion Section Manager Bill Peters.

"We have actually performed ejection seat testing with instrumented mannequins exposed to the actual flight conditions and orientations," Peters said. "Testing has been conducted to simulate the environment that might be expected as the pilot was ejected from the cockpit. Often times, the tests in the past were to measure loads on the head, torso and limbs and occasionally we might see a loss of an arm or a leg. We've done a large variety of testing to ensure the flight safety of both aircraft and missiles and occasionally their occupants."

AEDC currently does much of the pre-flight safety certification process for weapon separation testing of missiles and stores from parent aircraft as part of what is called the Capture Trajectory System (CTS) integration testing process.

Prior to the advent of computers at AEDC in the 60s, much reliance was placed upon slide rules and tables of typical aerodynamic properties as part of the trade in preparing for tests, Peters said. Because com-



This 30-foot compressor rotor was installed in AEDC's 16-foot transonic wind tunnel Oct. 10, 1955. Today wind tunnel 16T is still used for a variety of tests.
(File photo)

putational fluid dynamics (CFD) didn't exist at the time, experimentation was fraught with risk but the intent was to use ground test facilities over flight testing to gain a first level of understanding of risks and to reduce them prior to full-scale development.

Likewise, in development of the current test facilities at AEDC, smaller-scale model wind tunnels were built to assist in the design of the current larger facilities like 16T and 16S. Tunnels 1T and 1S were constructed and helped pave the way for the base's 16-foot-square tunnels. Likewise, Tunnels D and E were forerunners to VKF Tunnels A, B and C.

"We did not have CFD tools, so what could be done but to rely upon the work and theories of aerodynamicists such as [Dr. Bernhard] Goethert and [Dr. Theodore] von Kármán and their insights on the important features for the design of

the facilities?" Peters said. "Pilot wind tunnels at AEDC were used to discern and discover the essential geometry and performance features for design. With the modern resources of desktop computing and processing, computational tools are continuing to be developed, which add a significant ingredient in risk reductions of testing in the wind tunnels."

The first PWT test was performed in June 1953 on a .03-scale model of the Bomarc missile for the Boeing company. It was conducted in a one-foot cross-section prototype transonic tunnel know as "PeeWee."

That tunnel was the predecessor for the 16-foot transonic tunnel 16T, which was completed in 1956. That facility is still in use today – a fact that ATA Flight Systems Product Manager Rick Bishop says is a testament to the engineers of that time.

"All of the rotary drive equipment is pretty much what came with it,"