Defense Advanced Research Projects Agency

Technology Transition

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- Advanced Unmanned Undersea Vehicle (UUV Enabling Technologies, Deployable Surveillance System, Mine Countermeasure System)
- BETA correlation and fusion demonstration
- Advanced Simulation and Defense Simulation Internet
- Distributed Wargaming
- ASTOVL/COTL Common Affordable Lightweight Fighter

In the mid 1980s, the Packard Commission on Defense recommended that DARPA should be given the new role of demonstrating some "prototypes" in advanced development activities in order to reduce the cost and technical uncertainties prior to starting full scale development.

In the mid-1980s, the Packard Commission on Defense, commissioned by President Reagan, recommended that the Defense Department use more prototyping in acquisition programs to reduce the technical and cost uncertainties prior to making the formal commitment to acquire the system. The Commission specifically recommended that DARPA be given the new role of demonstrating some "prototypes" in advanced development activities to reduce the cost and technical uncertainties prior to starting full-scale development. A key role model for a DARPA prototype was the HAVE BLUE Program, which reduced the uncertainties in the F-117 full-scale development program and helped enable successful development of the F-117 in a much shorter than normal time.

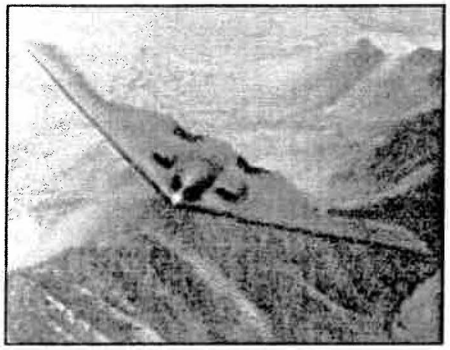
The DARPA prototyping initiative in response to the Packard Commission recommendations was somewhat limited in scope and effect by the small budget allocation, the concerns of Congress over beginning new programs before requirements were established, and the reluctance of the Services to commit to accepting the projects after prototyping was finished.

Three programs were initiated in 1986-87. Only one of these programs, the Unmanned Undersea Vehicle project, was not Special Access and can be described herein. The prototyping initiative was not continued after the initial projects were completed or phased out.

The OSD ACTD initiative was started in 1993. In contrast to EEMIT and Packard prototyping, ACTD programs require a partnership between the war fighter and the developer. The decision to acquire the system is specifically not addressed until after demonstration and user evaluation have occurred. Another key difference is the intent to leave the equipment with the war fighter so that it can be "deployed" and used, at least in some limited way. In addition, ACTD projects have the option to build a limited number of production systems for deployment following the ACTD completion. DARPA quickly became a major player in ACTDs and initiated a number of ACTD programs, including the following:

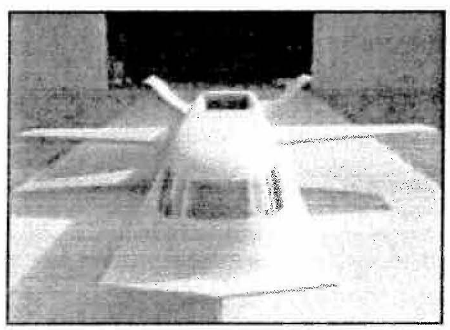
STEALTH BOMBER

Early research and development by DARPA led to the design and fabrication of the TACIT BLUE low observable stealth aircraft. Most notably, it was the first aircraft to demonstrate a low radar cross section using curved surfaces, along with a low probability of intercept radar and data link. As such, the DARPA TACIT BLUE Program contributed directly to the development of the B-2 Stealth Bomber so successfully deployed by the Air Force.



The B2 Stealth Bomber.

In the early 1970s a study by DARPA, the Air Vehicle Observables workshop, brought to light the extent of the vulnerabilities of U.S. aircraft and their on-board equipment to detection and attack by our adversaries. After the successes of the DARPA HAVE BLUE Stealth Fighter Program, DARPA initiated the TACIT BLUE Technology Demonstration Program, an effort to demonstrate that a low observable surveillance aircraft with a low probability of intercept radar and other sensors could operate close to the forward line of battle with a high degree of survivability. TACIT BLUE first flew in February 1982 and accumulated 135 flights over a three-year period.



TACIT BLUE.

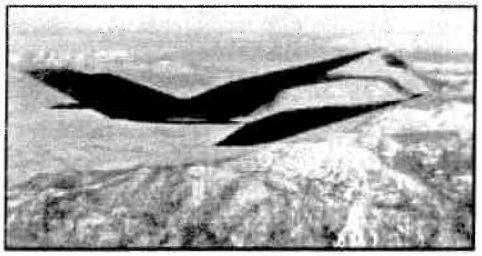
Other technologies addressed by DARPA included the reduction of radar cross section through a combination of shaping to form a limited number of radar return spikes designed to be less detectable by ground-based radars, radar absorbent materials, infrared shielding, heat dissipation, reduced visual signatures, low-probability-of-intercept (LPI) radar, active signature cancellation, and inlet shielding, exhaust cooling and shaping, and windshield coatings.

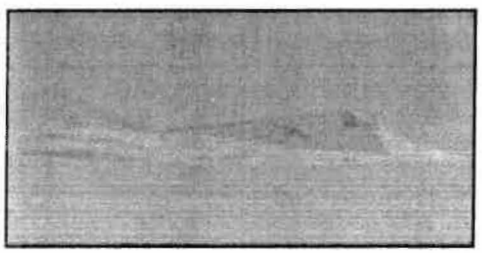
Building on the success of the HAVE BLUE prototype Stealth Fighter, DARPA supported a second demonstrator, TACIT BLUE, which provided the curved surface stealth technology base for the B-2 Stealth Bomber.

STEALTH FIGHTER

TRANSITIONS TO THE AIR FORCE

This very successful Stealth Fighter, Air Force F-117, was developed from technology demonstrated by a DARPA prototype, the HAVE BLUE aircraft.





- *Top: The Stealth Fighter Air Force F-117*
- *Center: Radar Signature Reduction.*
- *Bottom: The HAVE BLUE aircraft.*

Early efforts by DARPA led to the development of the Air Force F-117 tactical fighter that was so successful in the Desert Storm operation, flying 1,271 sorties without a single aircraft loss, successfully penetrating air defenses, and delivering 2,000 tons of ordnance to account for some 40% of all targets with an 80%-85% hit rate.

In the early 1970s a study by DARPA, the Air Vehicle Observables workshop, brought to light the extent of the vulnerabilities of U.S. aircraft and their on-board equipment to detection and attack by our adversaries. Based on the study and encouragement from Office of the Secretary of Defense and others, DARPA embarked on a program to develop the technologies for stealthy aircraft. Under a codeword program, "HAVE BLUE," two aircraft were built, and first flight occurred successfully in April 1977. Technologies addressed by DARPA included the reduction of radar cross section through a combination of shaping to form a limited number of radar return spikes designed to be less detectable by ground-based radars, radar absorbent materials, infrared shielding, heat dissipation, reduced visual signatures, low-probability-of-intercept (LPI) radar, active signature cancellation, and inlet shielding, exhaust cooling and shaping, and windshield coatings.

In November 1978, the Air Force initiated a program for the F-117 based on the HAVE BLUE demonstrations and the DARPA-developed technologies. First flight of the F-117 was in June 1981 and the aircraft became operational in October 1983. A total of 59 aircraft were built, and 36 were deployed to Saudi Arabia in late 1990, from which they were highly successful in F-117 Nighthawks attacks against high-value Iraqi targets.

LOW PROBABILITY OF INTERCEPT AIRBORNE RADAR

TRANSITIONS TO THE AIR FORCE

The program generated a design and a prototype radar that provided next generation waveforms, beam forming techniques, frequency agility, and power management.

A DARPA program to develop and demonstrate a low-probability-of-intercept (LPI) radar as a part of the DARPA HAVE BLUE stealth demonstrator provided critical insights for the design of the B-2 radar, as well as the DARPA/Air Force TACIT BLUE surveillance radar. The successful demonstration that a radar useful for air intercept and ground target detection could be built so as to be undetectable by state-of-the-art radar warning receivers is key to future stealth aircraft programs.

As the HAVE BLUE stealth aircraft program began, it became clear that emitting sensor and communication systems would compromise the stealth and could actually be used to track the aircraft. Several analyses were conducted, and a DARPA program was initiated to attack the most difficult emitter, the aircraft radar. The program generated a design and a prototype radar that provided next-generation waveforms, beam-forming techniques, frequency agility, and power management. The resulting LPI radar was tested in a roofhouse against some very capable radar warning receivers. The radar was not detected. The technologies for LPI radar were transitioned from this DARPA program to the B-2 and the TACIT BLUE surveillance aircraft technology demonstration program.