

THE SKY'S THE LIMIT

ROTORCRAFT INNOVATION REACHES NEW HEIGHTS THROUGH SBIR



Consider the helicopter.

Since its invention nearly a century ago, this unique flying machine has become a backbone of both military and civilian transport systems, used for a variety of mission types, including moving cargo and personnel. With the advent of automation and given new concepts for powering and maneuvering, rotary-wing aircraft are becoming even faster and more efficient. New capabilities are being tested for delivery to the Department of Defense (DoD) end-user, and have

received a significant boost under the U.S. government's Small Business Innovation Research (SBIR) program. Welcome to the new age of rotorcraft.

One of the first SBIR contracts to catalyze the industry came in 1992, when the Naval Air Systems Command (NAVAIR) issued an SBIR call searching for alternative tail rotor design concepts for the U.S. Marine Corps AH-1W Super Cobra helicopter. That call was answered by Piasecki Aircraft Corporation of Essington, Pennsylvania, a company that specializes in

design, development, fabrication, rapid prototyping, and flight-testing of experimental rotorcraft, unmanned aerial systems, and advanced enabling techniques of both military and commercial systems.



Piasecki Aircraft secured the 1992 NAVAIR SBIR, as well as a subsequent NAVAIR contract that provided for design, fabrication, and ground testing of the company's Vectored Thrust Ducted Propeller (VTDP) compound helicopter technology for integration with a Super Cobra and a U.S. Navy SH-60 Seahawk helicopter.

The VTDP replaces the conventional helicopter tail rotor with a multi-bladed propeller contained within a hardened composite duct, allowing for thrust from the propeller in multiple directions. In forward flight, the VTDP serves as an auxiliary propulsion system, providing thrust and control beyond what a conventional overhead single rotor can provide. And when paired with fixed-wings attached on the sides of the helicopter, lift and control is further augmented as the aircraft accelerates, significantly reducing strain on the main rotor and increasing overall efficiency of the aircraft, providing greater speed and range while offering less vibration than conventional helicopters.

Under the guidance of another NAVAIR contract, Piasecki Aircraft developed the X-49A, a Seahawk helicopter modified with the VTDP, lifting wing, modified drive system, and integrated controls. Over a series of 79 flight events, the X-49A accumulated 86 flight hours of data and demonstrated up to a 42 percent increase in forward speed at equivalent power, and greater than a 50 percent reduction in vibration and fatigue on helicopter components.


Piasecki Aircraft also used a series of

SBIR contracts to develop ducted fan technologies for innovative, unmanned aerial vehicle (UAV) platforms. In 2005, Piasecki won an SBIR contract for development of a Combat Medic Unmanned Aerial Vehicle (CM-UAV) to deliver time critical medical supplies and recover casualties from hazardous areas and combat zones. This effort included studies of a range of vertical lift rotorcraft as well as autonomous control and sensor technologies, enabling autonomous vertical flight in complex terrain. Piasecki completed vehicle configuration studies, selecting

a twin-ducted fan vehicle with a small landing footprint able to land in a city street and carry modular payloads, including autonomous ground vehicles to facilitate recovery of combat casualties in hostile environments. Under the SBIR program and in collaboration with Carnegie Mellon University, Piasecki demonstrated the world's first autonomous man-rated helicopter in 2010, using its KlearPath auton-

omous flight control system to provide autonomous guidance, navigation, control, collision avoidance, and landing zone selection capabilities.

The SBIR program has been a critical factor in the company's success and tradition of technological innovation, said John Piasecki, President and CEO of Piasecki Aircraft Corporation.

"The SBIR program is an immensely valuable conduit for innovation of ideas. Almost every one of our major flight research programs started out as an SBIR contract," Piasecki said. "Small businesses are passionate about what they do, and about putting forward their ideas. The SBIR program provides a pathway to mature those ideas and provide options to the DoD that they otherwise would never have." 

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Piasecki Aircraft Corp. • Essington, PA
Modernization Priority: Autonomy

SBIR contract: NAS3-27655 • Agency: Army • Topic: A93-139, Electromotive Propulsion Design Concepts for Rotorcraft

SBIR contract: N00019-95-C-0254 • Agency: Navy • Topic: N91-317 • Attack Helicopter Alternative Tail Rotor Applicability

SBIR contract: W81XWH-07-C-0050 • Agency: DHA • Topic: OSD06-UM8 • UAV Combat Medic Collaboration for Resupply and Evacuation