Boeing/DARPA to Demonstrate Revolutionary Canard Rotor/Wing Concept

The next generation high-speed, vertical takeoff and landing (VTOL) unmanned air vehicles (UAVs) is about to lift off, thanks to a $24 million agreement signed recently between the Defense Advanced Research Projects Agency (DARPA) and The Boeing Company.

Over the next 37 months, the Boeing Phantom Works will design, build and fly two technology demonstrators to assess and validate an advanced rotorcraft concept known as the canard rotor/wing (CRW). The versatile CRW aircraft, which features a unique reaction drive rotor system, combines the speed of a fixed-wing aircraft with the flexibility of rotary-wing flight.

"Boeing has leveraged specific expertise that was developed during the company's previous work on reaction drive rotor systems, including both the XH-17 in the early 1950s and the XV-9A in the mid-1960s," said Steve Bass, CRW program manager for the Phantom Works. "The Boeing patented CRW concept is an outgrowth from these previous activities."

"An operational CRW UAV would be able to take off and land in confined areas without a launch or recovery system, rapidly transition to and from a fixed wing mode and fly at speeds in access of 375 knots," said Dr. Larry Birckelbaw, DARPA program manager for the joint program.

"The flexibility achieved through these various flight modes, combined with the high-speed performance and survivability of this revolutionary new concept makes the CRW an exciting option for manned and unmanned applications," Birckelbaw said.

Possible manned and unmanned missions for such a vehicle include reconnaissance, communications and data relay, logistics re-supply, urban operations and delivery of both lethal and non-lethal munitions. The Navy and Marine Corps have expressed a strong interest in the CRW concept for both tactical UAV applications requiring VTOL operations from small-deck ships and manned applications such as a V-22 Osprey escort. They have funded a portion of the research activities to date and are considering transitioning this technology into a UAV engineering, manufacturing, and development phase following its successful flight demonstration.

The CRW concept combines the low disk loading hover efficiency and low-speed flight characteristics of a helicopter with the high-subsonic cruise speed of a fixed-wing aircraft. It is propelled in both rotary-wing and fixed-wing modes using a conventional turbofan engine. A diverter valve directs the exhaust gas produced by the engine either to the rotor or aft to the jet thrust nozzle, or to both during transition.

By using a reaction-drive rotor system, the CRW concept eliminates the need for a mechanical drive train and transmission, as well as the need for an anti-torque system. Eliminating these typically heavy, maintenance-intensive systems will greatly reduce vehicle weight, maintenance, complexity, and cost. The CRW concept offers a significant leap-ahead in terms of system performance and platform flexibility for next generation advanced rotorcraft systems.

DARPA and Boeing have agreed to a 50/50 cost share agreement to validate this revolutionary concept in a joint advanced technology demonstration program know as "Dragonfly". Each will contribute $12 million toward the program, leading to flight demonstration in early 2001.

Development of the technology demonstrators will be conducted by Phantom Works personnel at Boeing facilities in Mesa, Ariz.; St. Louis, Mo.; and Philadelphia, Pa. The Phantom Works is an R&D unit of Boeing that specializes in developing innovative, affordable solutions to meet aerospace needs.

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