

## **Boeing Team Demonstrates Revolutionary UAV Control Capabilities and Integration with Fighters**

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Boeing [NYSE: BA], a leader in aerospace technology development, along with a team of leading industry and academic researchers, has demonstrated for the first time that manned fighter aircraft such as the F-15E can effectively utilize an unmanned aerial vehicle (UAV) as a partner in coordinated combat operations.

"The ability of manned aircraft to coordinate operations with unmanned aircraft will provide new dimensions in survivability and mission effectiveness," said Patrick Stokes, Boeing Software Enabled Control (SEC) program manager.

Recently completed flight demonstrations and experiments at NASA's Dryden Flight Research Center at Edwards Air Force Base, Calif., demonstrated emerging autonomous control technologies that will allow real-time collision avoidance, autonomous evasive maneuvers, autonomous rerouting in response to pop-up threats and in-flight faults, and even UAV mission tasking using voice commands and a common language vocabulary.

The experiments included advanced control technologies developed by industry and academic teams from the University of California -- Berkeley, California Institute of Technology, University of Colorado, Honeywell, Massachusetts Institute of Technology, University of Minnesota, Northrop Grumman, and Stanford University.

This demonstration effort was conducted as part of the SEC program sponsored by the Defense Advanced Research Projects Agency (DARPA) with technical direction from the U.S. Air Force Research Laboratory.

"The SEC program provides the control technology necessary to fully exploit the unique features and capabilities of unmanned platforms, and to help them realize their potential for tactical operations," said John Bay, DARPA's SEC program manager.

A Boeing-developed transformational software infrastructure called the Open Control Platform (OCP) was a key to the demonstrations. The OCP provides a middleware platform and run-time framework for embedded flight software, integration with control design tools, and software that enables the distributed simulation of multiple UAVs under control.

Bay said SEC technologies are being transitioned to DARPA's Joint Unmanned Combat Air Systems (J-UCAS) program and are aimed at addressing the needs of future, highly maneuverable, autonomous air vehicles.

In the flight demonstrations and experiments conducted in June, multiple war-fighting scenarios were flown with Boeing's J-UCAS T-33 flying test bed, along with an F-15E Strike Eagle fighter. The T-33 test bed contains a J-UCAS avionics pallet that allows the vehicle to operate as a UAV.

With the T-33's J-UCAS avionics operating in an autonomous mode and without the use of a ground controller, the weapons systems operator in the back seat of the F-15E successfully tasked it through a series of flight maneuvers specifically designed to address challenging obstacles that will face future UAVs, Stokes said. In addition, the demonstrations further showcased the robust integration capabilities and technical versatility of the F-15E.

The team that developed the OCP software technology integral to the SEC demonstration is part of Boeing Phantom Works' Network Centric Operations organization, charged with exploring advanced control technologies for multi-vehicle control of networked autonomous vehicles.

Phantom Works is the advanced research and development unit and catalyst of innovation for the Boeing enterprise. Through its Integrated Defense Advanced Systems group, it provides leading edge systems and technology solutions to Boeing Integrated Defense Systems, one of the world's largest space and defense businesses.

Headquartered in St. Louis, Boeing Integrated Defense Systems is a \$27 billion business that provides systems solutions to its global military, government and commercial customers. It is a leading provider of intelligence, surveillance and reconnaissance; the world's largest military aircraft manufacturer; the world's largest satellite manufacturer and a leading provider of space-based communications; the primary systems integrator for U.S. missile defense; NASA's largest contractor; and a global leader in launch services.

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