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Under a U.S. Air Force Research Laboratory industry team, the Boeing [NYSE: BA] Automated Aerial Refueling (AAR) program successfully completed flight tests in August that demonstrated for the first time an unmanned air vehicle's ability to autonomously maintain a steady refueling station behind a tanker aircraft.

"With autonomous air refueling capabilities, unmanned aircraft will have greater combat radius and loiter time," said David Riley, Boeing Phantom Works AAR program manager. "This can enable a quicker response for time-critical targets and will reduce the need for forward-staging refueling areas. Another benefit is increased in-theater military presence with fewer military assets."

Boeing Phantom Works, along with the AAR national team, conducted the flight tests with the New York Air National Guard 107th Air Refueling Wing, which provided a KC-135R refueling tanker, and Calspan Corp., which provided a Learjet equipped with a special Boeing flight control system that allowed it to fly as an unmanned air vehicle. The flight tests integrate components on both the tanker and receiver aircraft to demonstrate that the receiver aircraft (the UAV) can autonomously hold position relative to the tanker while the tanker executes its standard air refueling maneuvers.

Six flights were conducted with the Boeing flight control system engaged, which enabled the Learjet to autonomously hold various positions in space -- contact, pre-contact or observation -- around the KC-135R. During a flight on Aug. 15, the Learjet was flown manually to the contact position behind the KC-135R -- the point from which Air Force aircraft receive fuel from a tanker's refueling boom. The aircraft's flight control system was then engaged, said Riley, and it autonomously held the contact position for 23 minutes while the tanker flew two full air refueling orbits, or holding patterns.

Two previous flight test efforts were conducted in August 2004 and September 2005 to evaluate the suitability of the Learjet behind a KC-135 and to take GPS measurements to determine positioning for future flights. As a prelude to the Station-Keeping Flight Test, some Learjet inner-loop flight control laws were tested.

The AAR flight test program will continue through 2007 to complete this phase of the program and ready the technology for transition to Air Force assets. Over the next year, the AAR team will build on the success of the station-keeping flight tests that will lead to new automated refueling capabilities.

In August 2007, the AAR team will demonstrate autonomous maneuvering around the tanker. The Learjet will engage the AAR system at the observation position on the tanker wing and will be directed from a control station to go to the pre-contact and contact positions upon approval from the tanker crew.

Phantom Works -- which built the AAR flight control computer, developed the station keeping control laws, and is conducting the flight tests -- is the advanced R&D unit of Boeing. Its charter is to provide innovative technology solutions that reduce the cycle time and cost of aerospace products and services while improving their quality and performance.

The AAR team also includes a diverse set of government and contractor organizations. The U.S. government team includes:

- The Air Vehicles, Sensors, Human Effectiveness and Information Directorates at the Air Force Research Laboratory
- The Air Force Flight Test Center and Air Force Test Pilot School at Edwards AFB

- Naval Air Systems Command (NAVAIR)
- 107th Air Refueling Wing, 827th Aircraft Sustainment Group at Tinker AFB
- DARPA Information Exploitation Office
- Aeronautical Systems Center
- Air Mobility Command

The AAR contractor team includes:

- Calspan -- operates the Learjet
- Rockwell Collins -- supports KC-135 operations and builds the Tactical Targeting Network Technologies data link
- L3 Communications, SySense and the Illinois Institute of Technology -- work with NAVAIR developing the precision global positioning system-based relative navigation system
- Northrop Grumman -- built the GPS receivers and developed an EO/IR position sensing system
- General Dynamics Advanced Information Systems -- provides systems engineering and flight test management assistance
- Syngenics -- coordinates the AAR trade studies
- Bihrl Applied Research -- integrates simulations environments
- The Institute for Scientific Research -- develops image processing algorithms
- Coherent Solutions -- develops required navigation performance

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