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NEWS RELEASE

Air Force Research Laboratory utilizes experimental “surfing” formation flight to reduce fuel cost

WRIGHT-PATTERSON AIR FORCE BASE, Ohio -- Rising fuel costs affect everyone, especially the military. The Air Force Research Laboratory (AFRL) is developing new energy-savings breakthroughs such as the Surfing Aircraft Vortices for Energy (\$AVE) project.

AFRL recently concluded a series of successful test flights demonstrating how modifications to C-17 Formation Flight System (FFS) software allow pilots to “surf” the vortex of a lead plane for long distances, thereby conserving energy. The demonstration is the first step toward reducing fuel consumption by several percent, potentially saving the Air Force millions of gallons of fuel annually.

AFRL conducted the \$AVE test flights with the 412 Test Wing at Edwards Air Force Base in conjunction with the Defense Advanced Research Projects Agency (DARPA), Boeing, Air Mobility Command, the Air Force Life Cycle Management Center, and NASA Dryden Flight Research Center.

“Large flocks of migratory birds fly in a ‘V’ formation to reduce their aerodynamic drag, thus reducing energy required for flight,” explained William Blake, AFRL program manager. “In a similar way, we reduce the energy required for aircraft to fly using this biologically-motivated type of formation.”

Over the course of the two-week tests, Edwards Air Force Base flight crews conducted multiple flights during which two highly-instrumented test C-17s, a lead aircraft and a trail aircraft, were flown with the trail aircraft following 4000 feet or more behind the lead. The flight tests also collected engine and aircraft structural life cycle data to confirm previous flight tests, which showed that \$AVE operations would not impact the life cycle of the airframe or the aircraft engines. All flights were completed successfully. Early indications from the tests showed a reduction of fuel consumption of up to ten percent on the trail aircraft.

“It is possible for pilots to fly in the proper \$AVE formation position manually, but precise flying for extended periods requires complete concentration and is fatiguing,” said Bob Arbach, DARPA program manager. “The AFRL \$AVE program leverages the DARPA Formation Flight

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for Aerodynamic Benefit program, which analyzed wingtip vortices using computational fluid dynamics models, predicted optimum formation positions, and modified C-17 FFS software enabling precise auto-pilot and auto-throttle \$AVE operations.”

The \$AVE tests showed the C-17 trailing aircraft achieves and then maintains proper formation flight position automatically without active assistance from pilots. This test was the first flight demonstration of the autonomous \$AVE capability. Military and potentially commercial use of \$AVE technology could save millions of dollars in fuel costs annually. AFRL will now analyze the data from these tests and investigate the implementation of \$AVE technology for other aircraft types.

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Photo 1: 121002-F-FX606-001



Photo caption 1: Cockpit view from trail C-17 in \$AVE formation (lead C-17 visible through window).

Photo 2: 121002-F-FX606-002



Photo Caption 2: Cockpit view from trail C-17 in \$AVE formation (lead C-17 visible through side window).

Photo 3: 121002-F-FX606-003



Photo Caption 3: Cockpit view from trail C-17 in \$AVE formation (lead C-17 visible through window).

Photo 4: 121002-F-FX606-004



Photo Caption 4: AFRL/DARPA Surfing Aircraft Vortices for Energy (SAVE) concept.

Photo 5: 121002-F-FX606-005



Photo Caption 5: View from tail camera of trail C-17 in SAVE formation. [USAF photo]