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Supporting a Historic Flight

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Scientists from the University of Dayton Research Institute played a supporting role in making aviation history March 25 when the U.S. Air Force successfully flew the first "all-engine" test flight using a biomass jet fuel blend.

Although the Air Force has tested aircraft fueled in part by biomass-derived and conventional fuels, the March 25 flight of an A-10 Thunderbolt II jet over Eglin Air Force Base, Fla., marked the first time in history a plane flew with all engines fueled entirely by such a blend, Air Force officials said. The A-10 was fueled by a blend of fuel derived from camelina oil – a flowering plant in the same family as mustard, cabbage and broccoli – and conventional JP-8 jet fuel.

University of Dayton researchers supported the Air Force Petroleum Agency by analyzing and testing properties of the biofuel blend used in the flight. The Air Force Research Laboratory sponsored the work performed at Wright-Patterson Air Force Base.

"This is truly a landmark occasion for the Air Force, for aviation and for the nation," said Dilip Ballal, University of Dayton Research Institute division head for energy and environmental engineering. "It demonstrates the Air Force's commitment to helping the U.S. wean from its dependence on foreign oil sources with minimal impact to the environment."

Air Force officials said the successful A-10 test flight represents a milestone in the worldwide development of alternative aviation fuels and paves the way for accelerated testing of hydrotreated renewable jet fuels – a class of fuel derived from plant oils or animal fat feedstocks, with an emphasis on sources that do not compete with food crops.

In addition, biomass-derived fuels offer the potential to reduce greenhouse gas emissions, officials said. Initial tests have demonstrated a reduction of particulate emissions during combustion of biofuels, and testing will continue to explore additional benefits.

The Research Institute has a significant history in alternative fuels research supported by the Air Force, most recently in the form of biofuels – those derived from biological sources, said Steven Zabarnick, group leader for fuel science at the Research Institute. In 2008, the Research Institute received $10 million to lead the design and construction of the Air Force's Assured Aerospace Fuels Research Facility, dedicated to the advancement of alternative fuels, and in December, the Research Institute and the Air Force signed a cooperative agreement worth up to $49.5 million over seven years for research into advanced fuels and combustion technologies.

"Fuels, particularly jet fuels, have very specific requirements that must be met," Zabarnick said. "So in working with alternative fuels, we must carefully analyze and measure their chemical properties as well as test and evaluate how those fuels are behaving in aircraft engines."

Zabarnick said he is particularly enjoying research on fuels designed to better serve the environment.

"Biomass sources such as the Camelina plant, which requires very little water or fertilizer, can be grown on land that might not be considered arable for food-source plants," he said.

The Air Force plans to continue hydrotreated renewable jet fuel certification test flights this summer, to eventually include the F-15 Eagle, F-22 Raptor and C-17 Globemaster, with the goal of acquiring 50 percent of its fuel from cost-competitive domestic alternative-fuel blends by 2016.

The Air Force annually burns the same amount of fuel as a medium-sized airline, Zabarnick said, adding that the service is working closely with the commercial aviation industry in the development of alternative fuels.

"Successful certification of alternative fuels, along with demonstration of market demand, will enable sizeable quantities to be produced in the U.S. at prices competitive with traditional fossil fuels," Zabarnick said.

Air Force-sponsored fuels and combustion programs have created 20 new high-tech, professional jobs within the last year

alone, and provide hands-on research opportunities for some 30 University of Dayton School of Engineering students working alongside faculty and University of Dayton Research Institute researchers.

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