Air Force Scientists Test, Develop Bio Jet Fuels

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WASHINGTON, March 30, 2010 – While the world searches for more efficient ways to fuel automobiles and create usable energy, Air Force scientists are looking for cleaner, more efficient ways to fuel the military's aircraft.

On March 25, an A-10 Thunderbolt II flew solely on a blend of biomass-derived fuel and conventional JP-8 jet fuel – the first flight of its kind.

Air Force Materiel Command fuels experts Jeff Braun, director of the Air Force's alternative fuels certification office; Tim Edwards, a senior chemical engineer with the Air Force Research Laboratory's propulsion directorate; and Betty Rodriguez, chief engineer for the alternative fuels certification office, direct the research and certification of synthetic and biomass-derived alternative aviation fuels from Wright-Patterson Air Force Base, Ohio, and they participated in a "DoD Live" bloggers roundtable and offered their perspectives on the history-making demonstration flight.

The A-10 was powered by a blend of conventional JP-8 and a biomass fuel derived from camelina, a nonfood rotation crop similar to soybean and mustard. The alternative fuels certification office is preparing to test fuels made primarily from plant oils and animal fats. They are part of a family of fuels Braun said are called "hydro-treatable renewable jet," or HRJ, fuels. He and his colleagues hope to create biomass fuels that the Air Force will certify for use across its spectrum of aircraft and support vehicles.

The A-10 flight is the latest phase of a long research and development process evaluating candidate biofuels from various industry sources. Part of that process, Edwards said, is testing different kinds of biomass materials and biomass processing methods.

"This is the first step of many we're going to follow through," Rodriguez said. "We're going to continue expanding the envelope, basically testing engines and testing aircraft."

To a certain extent, researchers can tailor the new biofuels by specifying desirable chemical properties which enable clean burning, for example. Braun underscored the Air Force is "feedstock agnostic," noting that what the fuel was made from isn't important so long as it has the desired performance and safety specifications.

"The way we look at it is to figure out what fuels make the most sense from an aviation industry perspective -- which ones have the potential to make the most fuel the most affordably with the least environmental impact," Edwards said.

He added that the Air Force Research Laboratory has invested a lot of money in environmental research covering lifecycle greenhouse gas footprints and other factors in developing materials for bio-fuels.

"We're just trying to figure out which kinds of processes for making jet fuel for aviation seem to be the winners, and look into those for further development," Edwards said.

A major benefit HRJ fuels offer the Air Force is that they can be produced within existing

refineries – new facilities don't necessarily need to be built. But some new plants are being built solely to produce biomass fuels such as HRJ or "green" diesel, Edwards said.

One such refinery is being built by Tyson Foods and will use animal fats from its food production factories to create biomass fuels. Another company, called AltAir Fuels, is building an HRJ plant near an existing refinery in Washington state, Edwards said.

"It turns out the primary cost comes from feed stock; the processing isn't all that expensive," Edwards said. "In places where you can get affordable feed stock, at least the industry seems to think it's cost-effective, because they're getting capital to start building plants."

The Air Force is the Defense Department's largest consumer of jet fuel, but burns only the equivalent of a mid-sized airline. It's closely cooperating with industry as part of a consortium of commercial airlines and engine manufacturers called the Commercial Aviation Alternative Fuels Initiative. The expectation is that once biofuels are certified for use, production economies of scale will make them affordable, on par with petroleum-based jet fuel.

Biomass fuels also can be made from algae and other plant oils. Both options are being vigorously pursued by the aviation industry and the Air Force as well, Edwards said.

"Where we can get our hands on algae oils, we've proven that those fuels are pretty much the same as the camelina oil we flew on last week," Edwards said. "Looking ahead to when algae hits it big – people are putting hundreds of millions of dollars into it – we're helping to enable that algae feedstock for aviation applications."

Reducing demand and increasing supply are two of the legs of the Air Force's energy strategy, Edwards said, with a focus on creating and building more effective, cleaner engines. Rodriguez added that the advancement of biofuels and creating effective, efficient blended fuels that can be dropped in without any modifications to aircraft or systems are a big part of that.

Edwards said even as the Air Force prepares to begin certification testing of HRJ fuels, scientists at the Air Force Research Laboratory are exploring the next generation of new fuels, made from cellulosic biomass sources or derived from advanced fermentation processes that produce hydrocarbons. These aren't nearly ready for certification, as they require further development, Rodriguez said, but they do show promise.

"We're at the cutting edge of alternative fuels," Rodriguez said. "Everybody's pulling together to make this possibility a reality, to create a family of fuels we can burn safely and won't impact the performance of our aircraft and ground support equipment."

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