

DEPARTMENT OF THE AIR FORCE

**PRESENTATION TO THE
SENATE COMMERCE, SCIENCE, AND TRANSPORTATION COMMITTEE
SUBCOMMITTEE ON AVIATION OPERATIONS, SAFETY, AND SECURITY**

UNITED STATES SENATE

**SUBJECT: UNITED STATES AIR FORCE'S ALTERNATIVE AVIATION FUEL
PROGRAM**

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28 JULY 2011

**NOT FOR PUBLICATION UNTIL RELEASED
BY THE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
UNITED STATES SENATE**

From aviation operations to installation infrastructure within the homeland and abroad, energy enables the dynamic and unique defense capabilities of global vigilance, global reach and global power the Air Force executes to fly, fight and win...in air, space and cyberspace. Effective and efficient energy management is not only necessary—it is critical to assuring available energy today and sustainable energy into the future to ensure the Air Force can execute these missions. There is a recognized need to have assured access to reliable energy sources and ensure that sufficient energy is available to meet Air Force operational needs. The Air Force is proud to be a leader in America's ongoing quest for efficient and effective energy use through improved processes, better operational procedures and new technologies, as well as in helping the nation decrease its dependence on imported oil through alternative fuel and renewable energy usage.

In his recent Blueprint for a Secure Energy Future, President Obama put forward a plan to develop and secure America's energy supplies. At the same time, he challenged Federal agencies to lead by example and help scale up new technologies to support energy security and reduce energy and fuel consumption, resulting in lower costs and reduced pollution. Over the last four years, the Air Force has been testing and certifying alternative aviation fuels for unrestricted operational use. The Air Force is certifying its fleet on two fuel blends—the first is a 50/50 blend of traditional JP-8 and synthetic fuel derived through the Fischer-Tropsch process and the second is a 50/50 blend of traditional JP-8 and biomass-derived “hydroprocessed renewable jet” (HRJ). A third fuel blend, a 50/50 blend of traditional JP-8 and alternative fuel derived from cellulosic-based materials, will begin initial feasibility studies within the next few months. The Air Force's alternative aviation fuel initiative is helping the Air Force and the

nation improve its energy security posture and is part of the solution to meet some of the President's goals.

The Air Force recognizes that there are many national energy policy objectives, to include the economic impacts of energy costs, the need to reduce greenhouse gas emissions and the national security implications of a high reliance on imported oil. While addressing these challenges, it is of vital importance the Air Force have the energy available necessary to accomplish its missions. Accordingly, the Air Force has developed a comprehensive energy strategy to improve its ability to manage supply and demand in a way that enhances mission capability and readiness. This energy strategy is supportive of DoD's priority program to "Increase Energy Efficiencies" to reduce energy consumption and increase renewable energy.

AIR FORCE ENERGY POLICY: The Air Force's Energy Vision—*Make Energy a Consideration in All We Do*—highlights that energy is central to all aspects of the Air Force's mission execution. In July 2009, the Air Force formally institutionalized its energy program along with its strategy and goals with the issuance of Air Force policy. In December 2009, the Air Force released its Energy Plan, which established "End State Goals" for 2030 and provided a strategic framework to translate formal policy into actionable energy "Focus" areas.

Three primary pillars underpin the Air Force approach's to energy: *Reduce Demand, Increase Supply, and Change the Culture*. Each pillar is defined and further developed to include implementing goals, objectives and metrics. This three-pronged approach integrates *demand-side* energy efficiency and mission effectiveness with *supply-side* alternative energy utilization, both of which are enhanced by creating a culture that values energy as a mission-critical

resource. The Air Force's alternative aviation fuel program supports the Air Force energy strategy by addressing the need for assured domestic supplies of non-petroleum based aviation fuel.

PROGRAM OBJECTIVES: The Air Force is motivated by the need to develop a robust, resilient and ready energy security posture, which includes having aviation fuel when and where it is needed to ensure freedom of operation. By increasing the types of fuels available to Air Force aircraft with no degradation in performance, the Air Force is ensuring mission accomplishment and improved national energy security through diversification of supply options. Alternative aviation fuels can have second order effects, multiple fuels sources may insulate the Air Force against volatile oil prices and reduce the environmental impact from aircraft.

The Air Force's long-term goal is to be prepared to cost competitively acquire 50 percent of its domestic aviation fuel requirement via alternative fuel blends by 2016. As part of the goal, the alternative aviation fuel component in the blend will need to be derived from domestic sources and produced in a manner that is more environmentally friendly compared to fuels produced from conventional petroleum. Additionally, any alternative aviation fuel needs to be a drop-in fuel that does not require unique systems or components, or modification to existing systems.

OVERVIEW: The Air Force is currently certifying its aircraft and associated support vehicles, equipment and infrastructure for unrestricted operational use on two 50/50 alternative fuel blends. The first blend is a 50-50 mixture of JP-8 and synthetic fuel produced via the Fischer-Tropsch process. The Fischer-Tropsch process starts with a carbon-based feedstock, such as

coal, natural gas, biomass or any other carbon-based material, and is gasified before it is converted into a fuel that contains the same chemical properties as traditional petroleum.

The second blend is a 50-50 mixture of JP-8 and HRJ biomass-derived fuel. Under this process, a renewable fuel with properties similar to petroleum is produced from triglycerides, such as plant oils and animal fats. Both the synthetic fuel and the biofuel need to be blended with traditional JP-8, as they do not contain some of the aromatic and other compounds necessary in aviation fuel to safely operate the aircraft.

To ensure an alternative aviation fuel can be used in Air Force aircraft and systems, it undergoes an initial evaluation phase at the Air Force Research Laboratory at Wright-Patterson Air Force Base in Ohio, before undergoing a test and certification phase. This phase, led by the Air Force Alternative Fuel Certification Office, includes engines and flight tests to identify any potential issues with the alternative aviation fuel.

The Air Force is not the only organization evaluating alternative aviation fuels. It is partnering with the airline and aircraft manufacturing industries through the Commercial Aviation Alternative Fuels Initiative to jointly review potential candidate fuels on the basis that the fuels be drop-in with no safety issues or cost increases. The Air Force is also seeking greater efficiencies through joint efforts with the U.S. Navy, the U.S. Army and allied militaries. For example, the Air Force is working with the Canadian Air Force to study of the effects of the HRJ alternative aviation fuel blend on the C-130H aircraft.

FISCHER-TROPSCH SYNTHETIC FUEL BLEND: The Air Force alternative aviation fuel initiative began on September 19, 2006, when a B-52 Stratofortress took off from Edwards Air Force Base in California to conduct a flight test that involved running two of the bomber's engines on a synthetic fuel blend, while the jet's other six engines ran on traditional JP-8 jet fuel. This synthetic fuel blend was a 50-50 blend of traditional JP-8 and Fischer-Tropsch synthetic fuel produced using natural gas as the feedstock.

Following that first flight, the Air Force has achieved a number of successes using a synthetic fuel blend, including the first transcontinental flight, the first supersonic flight, the first aerial refueling and the first fighter demonstration flight. Currently, more than 99 percent of the Air Force fleet is certified for unrestricted operational use of this 50/50 synthetic fuel blend and certification activities are on-track for completion this year. To date, the Air Force has not identified any performance or safety-of-flight anomalies as a result of the synthetic fuel blend, and the military JP-8 Fuel Specification was revised in 2010 to include Fischer-Tropsch synthetic fuel as a blending component. Additionally, the Air Force expects to complete the synthetic fuel certification efforts under budget.

The only remaining Air Force-owned platform left to be certified is the MQ-9 Reaper, which is scheduled to undergo testing and certification later this fall. The only two remaining aircraft in the Air Force fleet requiring certification, the CV-22 Osprey and the F-35 Joint Strike Fighter, are being worked in coordination with the Navy, as both systems are Navy-managed assets.

BIO-MASS DERIVED ALTERNATIVE FUEL BLEND: Following the success of the synthetic fuel

certification, the Air Force began evaluation in January 2009 of the 50/50 blend of traditional JP-8 and HRJ biomass-derived fuel. Due to anticipated cost and availability of candidate fuels, the close chemical similarity of HRJ to the previously evaluated synthetic aviation fuel produced using the Fischer-Tropsch process, and the incorporation of “Lessons Learned” from the initial synthetic aviation fuel certification effort, the Air Force determined a fleet-wide certification effort was unnecessary. Rather, the Air Force evaluated only representative aircraft and the most challenging systems from the synthetic fuel certification effort. The remainder of the aircraft will utilize the data obtained during testing of those aircraft and will be certified by similarity.

The Air Force announced its second alternative aviation fuel certification effort when it flew an A-10 Thunderbolt II in March 2010 from Eglin Air Force Base in Florida powered solely by a blend of biomass-derived and conventional JP-8 fuel. This A-10 was the first aircraft ever to be completely powered by such a blend. On February 4, 2011, the Air Force certified the C-17 Globemaster for unrestricted operations using the 50/50 biofuel blend - first Air Force platform certified to fly on the biofuel blend. Only a few months ago, the Air Force’s Thunderbirds became the first Department of Defense aerial demonstration team to fly on an alternative aviation fuel blend when three of the six aircraft conducted aerial maneuvers using the biofuel blend at the Joint Service Open House air show at Joint Base Andrews in Maryland. Since the second certification effort began, the Air Force has tested and certified the F-15, C-17 and F-16 aircraft for unrestricted operations, and has demonstrated performance of the A-10 and F-22 using a 50/50 blend of traditional JP-8 and HRJ-derived biofuel. Fleet-wide certification is on track for completion by 2013.

The Air Force has acquired three HRJ fuels in support of its certification efforts, including 200,000 gallons of fuel derived from camelina oil, 200,000 gallons derived from animal fats, and 40,000 gallons derived from waste greases. These fuels were developed domestically, providing an opportunity for U.S. job growth in an industry that improves the nation's energy security posture. For example, the fuel used to power the Thunderbirds was developed from camelina grown in Montana, while the camelina seed oil used in the HRJ process was cultivated in Montana and Washington State. In both cases, the camelina was grown in rotation with non-irrigated wheat when those fields would otherwise lie fallow, and uses the same infrastructure used for planting and harvesting. The oil was then shipped to Texas, where it went through the refining process to prepare it for use by the F-16s that were part of the Thunderbirds squadron.

To ensure both the synthetic fuel and the biofuel met the Air Force's drop-in requirement, the Air Force tested a C-17 Globemaster on blends of JP-8, Fischer-Tropsch synthetic fuel, and HRJ fuel in August 2010 at Edwards Air Force Base. The tests demonstrated the Air Force could treat both blends as JP-8 drop-ins, as well as co-mingle both alternative fuels. On July 1, 2011, ASTM International, a standards board for materials and products, approved the commercial standard for the renewable fuel which is made from natural plant oils and animal fats and is referred to as "hydroprocessed esters and fatty acids." This approval provides commercially-derived aircraft, including several Air Force aircraft, the option to use 50/50 HRJ blends in their day-to-day operations and provide industry with another potential customer.

WAY FORWARD: Even after certification of the synthetic fuel and biofuel blends is completed, the Air Force will continue to review and evaluate potential alternative aviation fuel candidates.

The Secretary of the Air Force recently approved an effort to conduct an initial feasibility demonstration, analysis, and evaluation of the alcohol-to-jet pathway, which uses cellulosic-based materials, such as agricultural and forest waste, to develop an alternative aviation fuel. This initial phase will require no additional funding beyond what has already been provided and enables the Air Force to ensure commercially approved fuels do not compromise the safety and effectiveness of the Air Force systems that may eventually use them. Following the initial study, the Air Force will re-evaluate the alcohol-to-jet pathway to determine if full fleet certification is required. The alcohol-to-jet pathway has been identified by industry as having more commercial potential when compared to both the synthetic and the biofuel blends.

The Air Force has certified nearly all its aircraft and equipment for unrestricted operational use of a 50/50 synthetic fuel blend and is well on its way to certifying its fleet to use a 50/50 biofuel blend. Following full certification, the Air Force will be looking to private industry to develop alternative aviation fuels in commercial-scale quantities. From a feedstock and process perspective, the Air Force is agnostic—as long as the fuel meets the desired performance, environmental and safety specifications, the Air Force will include it in its aviation fuel portfolio. In addition to certifying that all new fuels are safe and effective, the Air Force will use only fuels that comply with all applicable laws and regulations. Even after certification has been completed, the Air Force will not be a producer of alternative aviation fuel, but will use what the market cost competitively provides. This is another reason for pursuing multiple alternative aviation fuel certifications, as it provides the opportunity for the Air Force to ensure it can use any aviation fuel that is commercially available.

SUMMARY: Energy availability and security impacts all Air Force missions, operations, and organizations. The Air Force must have assured energy access to meet the demands of contingency operations abroad and protect the homeland from emerging threats. To enhance energy security, the Air Force is developing a portfolio of renewable and alternative energy sources, including drop-in alternative aviation fuels. By reducing energy demand, increasing the amount and diversity of energy supply, and changing the culture to make energy a consideration in every activity, the Air Force will increase warfighting capabilities, enhance mission effectiveness through efficiency, and help the nation to reduce its dependence on imported oil.