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Q and A: How Viable Are Biofuels in the Aviation Industry?

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TAM Airlines, Brazil's largest carrier, announced Nov. 23 that it successfully conducted an experimental 45-minute flight off the coast of Rio de Janeiro using a 50 percent blend of locally sourced Brazilian jatropha-based bio-kerosene and conventional aviation kerosene. A joint project between TAM, Airbus and CFM International, the flight was the first flown in Latin America and the sixth worldwide since 2008 to use aviation biofuel. How viable are biofuels as a commercial alternative to traditional kerosene in the aviation industry? What environmental advantages or disadvantages do they pose? How advanced are safety standards for the use of biofuels or other fuel alternatives?

A: Lourdes Q. Maurice, chief scientific and technical advisor for environment in the Federal Aviation Administration's Office of Environment and Energy:

"Alternative fuels for aviation have been around for decades and biofuels are a viable alternative to petroleum-derived jet fuels. Tremendous advances have occurred in the last few years. I believe that there is enough market pull-both from an environmental perspective as well as energy security to make these fuels ready for prime time. The issue is not are they viable, but can they be made in sufficient quantities? I believe the answer is yes, but it will take significant cooperation between government and industry, as well as across borders. The U.S. Commercial Aviation Alternative Fuels Initiative (CAAFI) is indeed a government-industry coalition, with significant international engagement, which is seeking to stimulate deployment of biofuels for aviation. Biofuels have advantages in terms of both climate and air quality impacts. From a climate perspective, if the feedstocks to produce the fuels are grown in a sustainable manner, biofuels offer significant carbon dioxide emissions reductions (some studies have shown improvements of as much as 80 percent). From an air quality perspective, we have seen that biofuels result in lower particulate matter emissions, which is a major contributor to health impacts. The disadvantages would be if the feedstocks are not grown in a sustainable manner. We have to be very careful of land use and water resource requirements, for example. The industry is seeking to develop 'drop in fuels,' with the goal to make a product that behaves exactly the same as conventional fuel. Last year, ASTM International paved the way by qualifying Fisher-Tropsch fuels and in Sept. 2009 they approved the first alternative jet fuel specification, which enables the use of a 50 percent blend of synthesized hydrocarbon fuel from biomass, gas or coal mixed with Jet A. The specification is structured so that additional fuel

processes and sources can be approved as testing is completed and data become available. We anticipate the approval of a second alternative fuel blend of 50 percent hydroprocessed renewable jet biofuel and Jet A by 2011."

A: Jeff Gazzard, board member of the Aviation Environment Federation:

"Biofuels for aviation use will be safe if and when produced to an internationally agreed industry specification, currently expected by mid-2011 at the earliest. Supplies at the pump will be a 50/50 blend, as in the TAM trial, because the aromatic compounds in normal kerosene are still vital to preserve and ensure system seals and lubricity performance. However, there are significant chain-of-custody and product liability issues present throughout the delivery process from biofuel producer through to oil company blending for a 50/50 mix-this is not going to take place on airport aprons with a giant food mixer! That's the good news. The current enthusiasm for headline-generating test flights using tiny, virtually hand-crafted laboratory scale quantities has more to do with the aviation industry using its' PR muscle to manufacture consent for unrestrained fossil-fuelled growth rather than millions of liters of sustainable aviation biofuel actually being manufactured any time soon. The two main stumbling blocks are environmental and economic and will continue to be for quite some time. Current jet fuel demand is around 5 million barrels per day, or 5.8 percent of total global oil consumption. A paper in April from Mohammad Mazraati of OPEC forecast that, even with current trends of fuel intensity improvements by the aviation industry, jet fuel demand could increase by a further 2.7 million barrels per day by 2030. Getting this amount from jatropha production, used partially in the recent TAM flight, would need almost 480 million hectares or 34 percent of the world's total current arable area. Frankly, this isn't going to happen. And with present biofuel economics pricing each liter at more than twice that of kerosene, massive subsidies or tax-linked price increases will also be needed to drive development forward. And the jury is still out regarding the environmental sustainability of all biofuels with land use, water/fertilizer intensity, labor demands and the over-arching food versus fuel question still to be answered satisfactorily. Aviation biofuels need careful analysis throughout the entire downstream and upstream process areas as well as huge financial stimuli-independent high level analysis on their sustainability is missing to date and we see no real signs of the massive investment needed to bring them to market within a generation."

A: Kirk Haney, CEO of SG Biofuels in Encinitas, Calif.:

"The aviation industry has set aggressive targets for the increased use of renewable jet fuel, creating significant market demand. But two major challenges stand in the way-increased production of suitable feedstock and developing a fully integrated supply chain that addresses downstream processing and distribution. Especially in Latin America, where large tracks of suitable land and growing conditions exist, jatropha has emerged as a preferred feedstock to fill current supply shortages. Jatropha's strengths are its performance, the ability to cost-effectively and sustainably produce large volumes over the next several years and the participation of major players in energy and agribusiness addressing downstream logistics. Significant advancements through breeding and biotechnology are now enabling profitable, large-scale plantation projects. And, because it is nonedible and grows on marginalized land not suitable for food production, it has also been identified as one of the most sustainable sources. Testing by TAM, as well as previous tests by Air New Zealand, Japan Airlines and Continental, have validated that jatropha not only performs well, but its performance exceeds traditional jet fuel for three key reasons: A

low cloudpoint allows the fuel to function effectively at the cold temperatures required by aviation use. The oil burns hotter and produces more energy than traditional kerosene, improving overall fuel efficiency. And testing confirms a 60 to 65 percent reduction in greenhouse gas emissions from the jatropha-jet fuel blend compared to traditional jet fuel flights. Boeing, Airbus and a host of airlines have all validated the potential of jatropha as a replacement feedstock for jet fuel. Other major players, including Flint Hills Resources, a major U.S. oil refiner, see its potential for aviation and are investing in the crop. Now, through both upstream and downstream advancements, the pieces are finally in place for large-scale production of crude jatropha oil to meet the significant demand for bio-jet fuel."

A: Daniel Chereau, manager for efficiencies and environment at the Latin American and Caribbean Air Transport Association:

"Over the last years, airlines have shown great interest in promoting the certification and safe use of biofuels in air transportation because of the significant reduction in net CO2 emissions throughout their lifecycle. Contrary to the case of fossil fuels, biofuels capture a significant amount of CO2 from the atmosphere before being processed and burnt. Even though great advances have been made over the last few years to obtain a safe, sustainable and economically viable drop-in bio alternative to traditional jet fuel, there's still a significant amount of work to do. A drop-in fuel-which can be blended and consumed seamlessly together with aviation kerosene in currently used aircraft-has to pass several tests before its mass adoption. Safety is a top priority in air transport, hence certification processes are strict. The aim is for biofuels used in aircraft to fit the same specifications used for jet fuel today, no matter what kind of feedstock they originate from. This brings another important issue: sustainability. The feedstock utilized can't otherwise be used for human consumption or even be grown using resources like land and water that could potentially be used for food. Lastly, in order for biofuels to be commercially viable, their price must reach affordable levels through improvements in technology and economies of scale. Airlines understand this and are collaborating with aircraft and engine manufacturers, authorities and biofuels suppliers. CAAFI in the United States, the Mexican government's state policy and TAM's flight test are some good examples."

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