Statement of
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Senate Commerce, Science and Transportation Committee

Madam Chair and Ranking Member:

Thank you for the opportunity to testify today on sustainable aviation fuels.

As you know, The Boeing Company ("Boeing") designs and manufactures commercial and military aircraft, helicopters, missiles, satellites and related components and equipment. We employ approximately 160,000 workers in the United States, and several thousand more overseas.

Introduction

Two years ago, I appeared before Congress to testify about the **promise** of sustainable fuels for the aviation industry. Boeing and four of its airline customers had just completed test flights demonstrating that plant-derived oils could be operated in commercial aircraft without modification to the aircraft or engines. At that time, I stated that Boeing was "bullish" on sustainable aviation fuels because of the potential environmental benefits they could provide relative to reduced life cycle greenhouse (GHG) emissions, the potential economic benefits associated with increased fuel availability, and the national security implications that come with reliance on imported liquid petroleum fuels.

What a difference a couple of years make. Today, I am here to testify to the **reality** of sustainable aviation fuels. On July 1, 2011, ASTM International (formerly the American Society of Testing and Materials) approved the commercial use of renewable jet fuels derived from natural plant oils and animal fat. In an amendment to its D7566 jet fuel specification, ASTM gave the green light for up to a 50 percent blend of hydroprocessed fatty acid esters and free fatty acid (HEFA) fuels – also known as hydrotreated renewable jet (HRJ) fuels – to be mixed with conventional kerosene.[1] Commercial airlines are already flying on blends of HRJ fuels. KLM (flying a Boeing 737-800 aircraft) recently flew the first-ever commercial passenger flight (from

[1] The previous D7566 standard, approved by ASTM in 2009, allowed for the use of fuel produced from coal, natural gas or biomass using the Fischer-Tropsch process. Both of the alternative aviation fuels approved by ASTM are complete drop-in substitutes for the petroleum-based fuels currently used in aviation, and are able to use existing fuel transportation and storage infrastructure. The generic term "kerosene" is used in this document to refer to jet fuel derived from petroleum.

Amsterdam to Paris) on a blend of HRJ and conventional jet fuel. Lufthansa recently started daily HRJ-powered commercial flights from Hamburg to Frankfurt. KLM plans to start regular commercial flights later this fall. TUI/Thomson Airways is making its first HRJ-powered commercial flight today, July 28 – flying from the UK to Spain with a Boeing 757. In addition, Aeromexico next week will fly a Boeing 777 airplane from Mexico City to Madrid, Spain – thus beginning transatlantic bio-powered service. All these airlines are using a blend of HRJ and kerosene.

The ASTM's adoption of the D7566 standard for HRJ reflects an aviation industry co-operative effort – that would not have happened as soon as it did – without the combined work of the U.S. Air Force (USAF), the Federal Aviation Administration (FAA), and the commercial aviation industry (airlines, as well as aircraft and engine manufacturers and their suppliers). By working together, we were able to perform fuel property tests, materials compatibility testing and engine tests before our first demonstration flights. Once airborne, we were able to put these new fuels through their paces with climbs, engine accelerations and decelerations, windmill engine restarts, starter assisted restarts, and simulated go-around maneuvers. What we learned is that these fuels match or exceed the performance of conventional jet fuel. For example, HRJ has excellent thermal stability properties which may reduce maintenance costs and very high energy density compared to conventional jet fuel. Higher energy density translates to burning less fuel per passenger mile.[2]

Nevertheless, while the industry is rightfully pleased with its accomplishments thus far, much work needs to be done to make these alternative fuels commercially available and economically competitive.

Sustainable Aviation Fuel Plays an Important Role in the Commercial Aviation Industry's Environmental Commitments

We recognize that the aviation sector, as a key contributor to global GDP, must continually strive to lessen its environmental impact in line with industry growth. To be effective these improvements must be made on a global basis. Over the next 20 years, we expect the global aircraft fleet to more than double, from the current fleet of 17,000 airplanes to more than 35,000. This rapid growth not only presents economic opportunity, but also environmental concerns if that growth is not offset by emission reductions.

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[2] The common industry fuel approval process, as embodied in the ASTM process, takes time but results in a very thorough outcome. The thoroughness assures that conforming fuels can be used across the existing fleet without modification or further regulatory action. In short, all airplanes are already approved for any conforming fuel. The process can be slowed or accelerated depending upon the availability of test data. If resources like those of the USAF or NASA are readily available, the necessary test data will be available and the process will move faster. Congressional attention towards assuring availability of test resources would be welcome.

It is for this reason that the commercial aviation industry, through work with the International Civil Aviation Organization (ICAO) – the United Nations body that governs all aspects of commercial aviation – has committed to carbon-neutral growth from 2020 and aspires to a 50 percent net reduction in aircraft emissions by 2050 (relative to a 2005 baseline).

To get there, the commercial aviation industry has developed a three-part strategy that we call "planes, practices and fuels." It involves:

- Technology innovation -- manufacturers continuing to make more fuel efficient planes through weight reduction programs, aerodynamic improvements and other measures;
- NextGen -- accelerating the implementation of advanced air traffic management practices that reduce delays and allow aircraft to fly shorter and more efficient routes; and
- Developing and promoting the commercialization of sustainable aviation fuel as an alternative to conventional jet fuel.

The Boeing 787 Dreamliner and 747-8 are great examples of the industry's technology innovation; each will increase fuel efficiency over predecessor aircraft by approximately 20 and 16 percent, respectively.[3] At Boeing, our strategy is to lead the way in pioneering new technologies for environmentally progressive products and services, and these two aircraft are examples of that effort.

While full build-out and implementation of NextGen will also be a key contributor to reducing aircraft emissions by 12 to 15 percent, neither NextGen nor greater innovative technology will get the commercial aviation industry to a 50 percent reduction in emissions by 2050. That is where sustainable aviation fuels come in – they are so to speak, where the "rubber hits the runway." Sustainable aviation fuel is our industry's sole alternative energy source for the foreseeable future. Unlike other transport sectors, airplanes cannot use plug-in electricity or hybrid power systems.

Specifically, with regard to developing the commercialization of sustainable aviation fuel, Boeing has taken action because we see it as an enabler of greater growth in the commercial aviation industry and therefore in our long term business interest. Our strategy is not however aimed at becoming a fuel producer. We believe that our interest, and frankly the public interest, is better served if Boeing's unique expertise and position in the aerospace industry is focused on accelerating the broad availability of sustainable aviation fuel. That means not just one supply chain success, not just one feedstock success, not just one processing method success – instead it means enabling multiple successes to drive broad commercial availability around the world.

At Boeing, our focus is on sustainable alternatives that have the potential to provide greatly reduced lifecycle greenhouse gas emissions and greater economic benefits associated with

[3] Today's jet planes are 70 percent more fuel efficient, which means they produce 70 percent fewer emissions than aircraft produced a mere 50 years ago.

increased fuel availability. By sustainable fuels we mean those that comply with robust criteria to ensure that they have significantly better life cycle emissions than traditional fuels, and do not adversely impact food supply, ecosystems, or communities.

It is important to recognize that no one feedstock or processing method will supply all of the aviation industry's needs. Instead, a variety of feedstocks and processing methods will be necessary and they will need to be diversified based upon what is commercially available in the locality where the fuel is being produced.[4] It is for this reason that we are participating in a broad range of projects around the world. The central goal of these projects is to develop the scientific, economic and environmental information necessary to develop sustainable aviation fuel resources. (A summary of those projects is attached to my testimony.)

A Blueprint for the Commercial Viability of Sustainable Aviation Fuels

There are more than 20 U.S. renewable fuels projects in various stages of development, several of which have the potential to produce sustainable aviation fuel. These projects cover a wide range of feedstocks and process technologies, but all have one thing in common – the need for additional support for near-term development. Funding for production has been slowed by the troubled economy and the perception of risk associated with investing in emerging technologies. Just as with the development of the Internet, rural electrification, and technological advances growing from the space program, a strong governmental role is essential in assisting the sustainable aviation fuels industry through its embryonic development. Obtaining safe, reliable and environmentally preferred aviation fuels sustains not only the aviation industry, but also builds new agricultural and fuel processing economies as well, all the while providing an important national security hedge against political instability in oil producing regions.

There are a number of actions that the government could be doing to spur the production of sustainable aviation fuels. Of particular importance, Boeing encourages the adoption of:

- Legislation (S.1079) to allow the Department of Defense (DOD) and branches of the U.S. military to enter into long-term contracts for the purchase of sustainable aviation fuels. Current law does not provide attractive conditions for private investment into production facilities. Providing DOD with the authority to enter into longer term contracts of 10-15 years would assist producers in obtaining necessary private financing. Financiers are looking for a commitment of at least 10 years by a party with a AAA credit rating as a prerequisite for underwriting;

[4] In the Pacific Northwest, for example, we have identified oilseed crops, algae, municipal solid waste and woody biomass from forest waste as potential sources for the development and production of sustainable aviation fuel.

- Legislation to extend the tax credit under Section 40A of the Internal Revenue Code for producers of biodiesel, renewable diesel and certain aviation fuels derived from biomass; and
- Funding for research and development on the next generation of sustainable aviation fuels. Boeing has already begun work with the FAA, the USAF and other industry partners on ASTM approval of new technology parthways to make a bio-derived jet fuel. One of the most promising technologies is the conversion of alcohols to jet fuel. Alcohol-to-jet production processes can work with the existing ethanol and conventional chemical and petroleum production facilities to covert these fuels into aviation fuel. At last count, there were over 150 ethanol facilities in the United States, and for a small capital investment (compared to a new facility), once the fuel is approved by ASTM, they can convert some of the ethanol into aviation fuel.

Madam Chair, it should be no surprise if these recommendations sound familiar; you have been a strong supporter of these legislative initiatives, and we greatly appreciate your efforts. I would also note that these recommendations come directly out of the Sustainable Aviation Fuels Northwest (SAFN) report on sustainable aviation fuels in the Pacific Northwest.[5] SAFN is the nation's first stakeholder effort to explore opportunities and challenges surrounding the production of sustainable aviation fuels. The report reflects more than 10 months of work and the perspectives of more than 40 stakeholders, and is just one example of the projects that Boeing is involved in around the world.

No discussion of incentives for the production of sustainable aviation fuels would be complete without mentioning programs administered by the United States Department of Agriculture (USDA).[6] The 2008 Farm Bill provides a number of important programs aimed at encouraging the production of biofuels. For example:

- The Biorefinery Assistance Program (Section 9003) – Provides loan guarantees for the construction or retrofitting of rural biorefineries to assist in the development of new and emerging technologies for the development of advanced biofuels;
- The Biomass Crop Assistance Program (Section 9011) – Provides eligible farmers with matching payments for the sale and delivery of energy crops to biomass conversion facilities;

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[5] SAFN was convened by regional leaders in the aviation industry, including Boeing, Alaska Airlines, the operators of the region's three largest airports – Port of Seattle, Port of Portland and Spokane International Airport – and Washington State University, a leader in sustainable fuel research. The regional energy nonprofit, Climate Solutions was retained to facilitate and prepare the report. Full report available at www.safnw.com

[6] In July 2010, Boeing, the Air Transport Association (ATA) and USDA signed a resolution memorializing their commitment to work together on a "Farm to Fly" initiative to accelerate the availability of a commercially viable sustainable aviation biofuel industry in the United States. The "Farm to Fly" effort has been a very productive forum creating a better understanding of industry potential as well as understanding of how the existing USDA authority can be used to enhance development and use of energy crops to create fuel and jobs. A summary report is being finalized for publication.

- Crop Insurance Coverage for Energy Crops (Section 12023) – Requires the Risk Management Agency to develop policies to ensure dedicated energy crops in the same manner as crops used for food and fiber.
- The Bioenergy Program for Advanced Biofuels (Section 9005) – allows the Secretary of USDA to provide production payments to advanced biofuel producers to support expansion of advanced biofuels.

These are just a few of the programs administered by USDA aimed at spurring the growth of energy crops and the production of sustainable fuels. And while we recognize and understand that issues concerning the budget and federal deficit are paramount, we would hope that Congress would find a way to continue to support these important programs as they apply to advanced biofuels during reauthorization of next year's Farm Bill.

Conclusion

Madam Chair, this concludes my prepared testimony. I am happy to answer any questions you may have.

Regional Solutions: Global Success

Boeing has initiated and participated in a wide variety of projects around the world. Participating in such a wide variety of projects gives us the opportunity to engage with stakeholders, gain perspective, develop scientific, economic and environmental data, and encourage practical steps forward. A summary of projects includes:

- Algal Biomass Organization -- Boeing is a founding member of the Algal Biomass Organization, a trade association for algae-to-energy companies and initiatives. Boeing serves on the board of directors and also participates in regular technical and policy projects.

- Commercial Aviation Alternative Fuels Initiative – This partnership among the Air Transport Association, Federal Aviation Administration, Airports Council International-North America and the Aerospace Industries Association explores new U.S. opportunities for sourcing fossil and bio-derived fuels. Boeing initiated the public meeting that led to the formation of CAAFI and participates in technical, research and policy teams.

- "Farm to Fly" – The U.S. Department of Agriculture, Boeing, and the Air Transport Association collaborate to promote development of renewable fuels for aviation. Based on a working together resolution, several key policy recommendations have been proposed to the U.S. Government, with follow-on activities currently underway.

- Latin America Jatropha Sustainability Study -- Yale University received funding from Boeing to do the first sustainability assessment of jatropha, a plant suitable for use as an aviation fuel. The peer-reviewed results, based on field data from actual jatropha farms, were released in March 2011.

- Sustainable Aviation Biofuel Evaluation Study -- Boeing and PetroChina are leading a comprehensive evaluation for establishing a sustainable aviation biofuels industry in China including agronomy, energy inputs and outputs, lifecycle emissions, infrastructure and government policy support. Other U.S. participants include Honeywell's UOP and United Technologies Corporation, while Chinese participants include the Civil Aviation Authority of China, the State Forestry Administration and Air China.

- Sustainable Aviation Fuels Northwest – Sustainable Aviation Fuels Northwest is sponsored by Alaska Airlines, Boeing, the Port of Seattle, the Port of Portland, Spokane International Airport and Washington State University. Boeing initiated and co-funded the project, which convened a diverse stakeholder group looking at the feasibility of developing regionally sourced, sustainable aviation fuels in a four-state region. A final report released in May 2011 is available at http://www.safnw.com/.

- Sustainable Aviation Fuels Roadmap -- The Sustainable Aviations Fuels Road Map project was developed in collaboration with the Australasian section of the Sustainable Aviation Fuel Users Group (Air New Zealand, Boeing, Qantas, and Virgin Blue) and the Australian Defence Science and Technology Organisation. Boeing initiated and co-funded the regional project, which looked at all phases of developing a sustainable biofuel industry and was coordinated by The Commonwealth Scientific and Industrial Research Organisation. A report issued in May 2011 can be found at: http://www.csiro.au/files/files/p10rv.pdf

- Sustainable Aviation Fuel Users Group (SAFUG) – SAFUG is a global airline coalition accounting for approximately 25 percent of annual commercial aviation fuel consumption. Its members are driving the development of commercial supply chains and supporting the implementation of sustainability standards via the Roundtable on Sustainable Biofuels' global multi-stakeholder processes. Boeing is a founding affiliate and helps coordinate global activity. More information is available at www.safug.org.

- Plan de Vuelo -- A multi-stakeholder process in Mexico led by SAFUG member Aeropuertos y Servicios Auxiliares (ASA). As part of Mexico's Inter-Ministerial Biofuel Development Commission, ASA is guiding the creation of a Mexican biofuels industry, compliant with global sustainability standards. Boeing worked closely with the Mexican government to facilitate this process and the project report will be released during summer 2011.

- Sustainable Biomass Consortium -- Boeing and the École Polytechnique Fédérale de Lausanne created the Sustainable Biomass Consortium, a research initiative for increasing harmonization between voluntary standards and regulatory requirements for biomass for jet fuel. The Consortium aims to lower sustainability certification costs collaborate with civil society and governments on research help, align regional and regulatory requirements, and independently verify the sustainability and traceability of biomass sources.

- Sustainable Bioenergy Research Center -- Boeing, the Masdar Institute, Etihad Airways and Honeywell's UOP have established a research institution and demonstration project in Abu Dhabi devoted to sustainable energy solutions. The Sustainable Bioenergy Research Project uses integrated saltwater agricultural systems to develop and commercialize aviation biofuel sources and co-products. Saltwater is used to create an aquaculture-based seafood farming system in parallel with the growth of mangroves and salicornia, a species of saltwater-tolerant plants that offers potential as a sustainable biofuel feedstock.