AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

FROM THE WRIGHT BROTHERS TO THE RIGHT SOLUTIONS: CURBING SOARING AVIATION EMISSIONS

HEARING

BEFORE THE

SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

APRIL 2, 2008

Serial No. 110–31



Printed for the use of the Select Committee on Energy Independence and Global Warming

globalwarming.house.gov

U.S. GOVERNMENT PRINTING OFFICE

61–640 WASHINGTON : 2010

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING

EDWARD J. MARKEY, Massachusetts, *Chairman*

EARL BLUMENAUER, Oregon
JAY INSLEE, Washington
JOHN B. LARSON, Connecticut
HILDA L. SOLIS, California
STEPHANIE HERSETH SANDLIN, South Dakota
EMANUEL CLEAVER, Missouri
JOHN J. HALL, New York
JERRY MCNERNEY, California

F. JAMES SENSENBRENNER, JR., Wisconsin, *Ranking Member*
JOHN B. SHADEGG, Arizona
GREG WALDEN, Oregon
CANDICE S. MILLER, Michigan
JOHN SULLIVAN, Oklahoma
MARSHA BLACKBURN, Tennessee

PROFESSIONAL STAFF

GERARD J. WALDRON, *Staff Director*
ALIYA BRODSKY, *Chief Clerk*
THOMAS WEIMER, *Minority Staff Director*

CONTENTS

Page

Hon. Edward J. Markey, a Representative in Congress from the Commonwealth of Massachusetts, opening statement 1
Prepared Statement 3
Hon. F. James Sensenbrenner, Jr., a Representative in Congress from the State of Wisconsin, opening statement 5
Hon. Jay Inslee, a Representative in Congress from the State of Washington, opening statement 6
Hon. John Larson, a Representative in Congress from the State of Connecticut, opening statement 6
Hon. Emanuel Cleaver II, a Representative in Congress from the State of Missouri, opening statement 7
Prepared Statement 8
Hon. John Hall, a Representative in Congress from the State of New York, opening statement 9
Hon. Jerry McNerney, a Representative in Congress from the State of California, opening statement 9
Hon. Earl Blumenauer, a Representative in Congress from the State of Oregon, prepared statement 11
Hon. Hilda Solis, a Representative in Congress from the State of California, prepared statement 12

WITNESSES

Panel One
Dan Elwell, Assistant Administrator for Aviation Policy, Planning, and Environment, U.S. Federal Aviation Administration 14
Prepared Statement 16
Answers to Submitted Questions 101
Bob Meyers, Principal Deputy Assistant Administrator for the Office of Air and Radiation, U.S. Environmental Protection Agency 29
Prepared Statement 31
Panel Two
Jim May, President and CEO, Air Transport Association 54
Prepared Statement 57
Tom Windmuller, Senior Vice President, International Air Transport Association 71
Prepared Statement 73
Answers to Submitted Questions 111
Deron Lovaas, Transportation and Energy Co-Director, Natural Resources Defense Council 80
Prepared Statement 83
Answers to Submitted Questions 124

SUBMITTED MATERIALS

Hon. Edward J. Markey, supplemental testimony submitted by Virgin Atlantic Airlines 46
Hon. Edward J. Markey, supplemental testimony submitted by The Boeing Company 51

FROM THE WRIGHT BROTHERS TO THE RIGHT SOLUTIONS: CURBING SOARING AVIATION EMISSIONS

WEDNESDAY, APRIL 2, 2008

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON ENERGY INDEPENDENCE
AND GLOBAL WARMING,
Washington, DC.

The committee met, pursuant to call, at 1:50 p.m. in room 2318, Rayburn House Office Building, Hon. Edward J. Markey (chairman of the committee) presiding.

Present: Representatives Markey, Blumenauer, Inslee, Larson, Solis, Herseth Sandlin, Cleaver, Hall, McNerney, Sensenbrenner, Walden, and Sullivan.

Staff present: Ana Unruh Cohen and Danielle Baussan.

The CHAIRMAN. This second hearing today is called to order. The select committee analyzes all causes of global warming. It can't let aviation fly under the radar. Aviation emissions currently amount for 12 percent of U.S. transportation emissions and 3 percent of emissions nationally and worldwide. The impact of these emissions cannot be ignored. The CO_2, nitrous oxide and particulate matter leaked into high altitudes alter our climate. Scientific debate does not center on whether CO_2 in the stratosphere is harmful. The question is how much more harmful CO_2 may be when compounded by other aviation emissions in the stratosphere.

The aviation industry has improved emission output through technology, but the rapidly increasing number of flights will exacerbate aviation emissions. The FAA has forecasted over a billion commercial passengers annually by 2015, and the intergovernmental panel on climate change has predicted that even assuming efficiency and infrastructure improvements, aviation emissions could double or triple by 2050. Aviation must answer for the heat trappings of their own success.

Today's hearing on aviation emissions should not be viewed as a mere blip on the screen. States, cities and organizations have petitioned the EPA to regulate aviation greenhouse gas emissions. Aviation fuels are currently being considered under a cap-and-trade system in Congress. The European Commission plans to integrate domestic and U.S. flights into the EU trading system. As local governments and other nations move to limit the impact of aviation on the environment, Congress cannot linger in a holding pattern. The witnesses before us today address the three factors responsible for aviation emissions, operations technologies and fuel.

Regulating fuel emissions largely falls to the Environmental Protection Agency. The Federal Aviation Administration can discuss its vision to streamline aviation operations for more efficient flights, and the Natural Resources Defense Counsel's transportation fuel director can discuss aviation fuel options and consequences. The Air Transport Association and International Air Transport Association can discuss different approaches to aviation cap-and-trade regulations. Virgin Atlantic General Counsel Jill Brady was unable to attend today's hearing, but submitted written testimony discussing Virgin's groundbreaking commercial flight using biofuels and support for an international cap-and-trade scheme.

I encourage the public to read her testimony and all the other testimony. As aviation's contribution to global warming creeps up the IPCC charts, we cannot wait until it becomes a bigger threat. At one time, the number of automobiles on the road was not a significant contributor to global warming emissions. But even after that harm was established, decades of inattention and legislative delays led us to the environmental emergency that formed this select committee.

With that in mind, I look forward to hearing everyone's testimony today. And now I turn to recognize the ranking member for an opening statement.

[The prepared statement of Mr. Markey follows:]



THE SELECT COMMITTEE ON
ENERGY INDEPENDENCE AND GLOBAL WARMING

Remarks of Edward Markey, Chair
Select Committee on Energy Independence and Global Warming
April 2, 2008 Hearing
"From the Wright Brothers to the Right Solutions: Curbing Soaring Aviation Emissions"

As the Select Committee analyzes all causes of global warming, it cannot let aviation fly under the radar. Aviation emissions currently account for 12 percent of U.S. transportation emissions and 3 percent of emissions nationally and worldwide.

The impact of these emissions cannot be ignored. The CO_2, nitrous oxide, and particulate matter leaked into high altitudes alter our climate. Scientific debate does not center on whether CO_2 in the stratosphere is harmful; it questions how much more harmful CO_2 may be when compounded by other aviation emissions in the stratosphere.

The aviation industry has improved emission output through technology, but the rapidly increasing number of flights will exacerbate aviation emissions. The FAA has forecasted over a billion commercial passengers annually by 2015, and the Intergovernmental Panel on Climate Change has predicted that, even assuming efficiency and infrastructure improvements, aviation emissions could double or triple by 2050. Aviation must answer for the heat-trappings of their own success.

Today's hearing on aviation emissions should not be viewed as a mere "blip on the screen." States, cities and organizations have petitioned the EPA to regulate aviation greenhouse gas emissions. Aviation fuels are currently being considered under a cap and trade system in Congress. The European Commission plans to integrate domestic and U.S. flights into the EU trading system. As local governments and other nations move to limit the impact of aviation on the environment, Congress cannot linger in a holding pattern.

The witnesses before us today address the three factors responsible for aviation emissions: operations, technology, and fuel. Regulating fuel emissions largely falls to the Environmental Protection Agency. The Federal Aviation Administration can discuss its vision to streamline aviation operations for more efficient flights. And the Natural Resources Defense Council's transportation fuel director can discuss aviation fuel options and consequences.

The Air Transport Association and International Air Transport Association can discuss different approaches to aviation cap and trade regulations. Virgin Atlantic general counsel Jill Brady was unable to attend today's hearing but submitted written testimony discussing Virgin's groundbreaking commercial flight using biofuels and support for an international cap and trade scheme. I encourage the public to read her testimony as well as the testimony of the Boeing Corporation.

As aviation's contribution to global warming creeps up the IPCC charts, we cannot wait until it becomes a bigger threat. At one time, the number of automobiles on the road was not a significant contributor of global warming emissions. But even after that harm was established, decades of inattention and legislative delays led us to the environmental emergency that formed this Select Committee. With that in mind, I look forward to hearing everyone's testimony.

Mr. SENSENBRENNER. Thank you, Mr. Chairman. I want to thank you for scheduling this hearing today. I look forward to learning more about this topic. One of my many curiosities about this topic, perhaps the most pressing is why the aviation industry is a major focus in the global warming debate. By all measures, aviation produces just a tiny fraction of the world's greenhouse gasses. In the U.S. aviation accounts for only 3 percent of emissions compared to electricity generation, ground transport, industry and agriculture, all of which produce many times more greenhouse gasses. Furthermore, the aviation industry has been doing a good job of improving fuel efficiency because if they didn't do that, they would all be out of business with fuel prices being what they are. And it didn't take heavy-handed government regulations such as cap-and-trade to make it happen.

In the past 4 years, U.S. airlines have improved fuel efficiency by 11 percent mostly due to the market driven pressures of the high price of oil and the lower value of the dollar. This is positive progress, and the industry deserves commendation for this improvement. In spite of these numbers, the European Union wants to include aviation in its emission trading scheme which would clearly throw additional costs onto the airline industry. I don't understand why government regulators want to punish an industry that is already making good progress without the pressure of regulation.

Then again, I don't understand how hampering the economy with regulatory schemes like cap-and-trade is the proper way to confront climate change in the first place. Last month, an EU commissioner said that if the U.S. didn't join the EU emission trading scheme or apply a similar program to U.S. airlines by 2010, EU would begin denying incoming flights in 2012. I wonder if this threat also applies to India and China, each of which has a growing airline industry to meet the demand of their growing economies. In fact, testimony today will show that these two countries will build 100 new airports over the next decade to meet the demand.

And, no, India and China don't have emissions trading system of their own, and it doesn't look like they are going to get one soon. There may be advances in clean fuel technology that help reduce airlines greenhouse gas output even further. As I have said many times, technological advancement must be part of any plan to confront climate change. However, I do not believe that any advances in fuel technologies should come at the expense of safety. There are already some concerns that biofuels can cause engines to stall, which is a safety risk I believe is too great, especially considering the airlines' minimal contribution to greenhouse gas emissions.

If large scale changes are needed in the aviation industry, the U.N.'s international civil aviation organization is the best place to address these questions. And it isn't often that I embrace a U.N. organization to do anything.

However, in this case, the U.N. is taking more thoughtful approach to aviation emissions and technology than is the European Union.

When it comes to global warming, many people cry that the sky is falling. But I worry if we make careless changes to the airline industry, it will be the planes falling from the sky. I believe it is

more prudent at this point to recognize the good work that the airlines are doing before we force changes that could jeopardize both the safety and the economic health of the industry. I yield back the balance of my time.

The CHAIRMAN. The gentleman's time is expired. The Chair recognizes the gentleman from Washington State, Mr. Inslee.

Mr. INSLEE. To respond to Mr. Sensenbrenner about why we are concerned about an industry that has only 3 percent, I just think we all have to get on the bus, everybody, whether we are 3 percent or half a percent or a tenth of a percent, we all have to get on the bus. We are not going to solve this problem unless every industry participates. That includes Congress, that includes us in our homes and that includes the airline industry. So it hardly will be an excuse, and obviously I'm from Seattle, an aerospace industry, and you might think a hometown team would say ignore that industry, but you can't ignore any industry.

So I have good news to report to the committee, and we are going to hear about it today. There are some bragging rights coming out of Seattle that to do my job of bragging about my home town team, let me brag about them a little bit. The first biofuels operated commercial jet airplane, the jet, was manufactured in Seattle, with Boeing 747 using standardized engines with no modifications whatsoever to the engines. It flew on February 24, 237 miles from London to Amsterdam safely, didn't fall out of the sky, no injuries reported and it was a smooth flight. And it used a fuel generated by Imperium Biofuels in Grace Harbor, Washington, used 3,175 gallons of biofuels. It was produced by Imperium. This was kind of an all Washington State project with help by Sir Richard Branson. And it just shows what the power of the human intellect can do in aerospace, and we look forward to more successes.

I also want to point out in the aerospace industry, our ground operations are part of this as well. And there is really some good things we can do on the ground. Seattle-Tacoma International Airport has done some great things reducing its CO_2 emissions in its operations. They are using 25 percent green power. They have reduced their electrical consumption 24 percent, and they are implementing a way to use preconditioned air so you don't have to use the airplane engines to condition the air in the airplanes while they are sitting on the tarmac. So we are developing some great systemic things in Seattle, and I look forward to hearing about more success.

The CHAIRMAN. Mr. Larson.

Mr. LARSON. I want to thank the chairman and thank him for holding this hearing today. And I also bring with me some bragging rights from the aerospace industry and my home town is that of East Hartford, Connecticut, where my dad worked at Pratt Whitney for 37 years where we continue to keep the eagle flying as we say, from East Hartford and I'm proud as well and I think all the more reason to have hearings like this and to set standards and goals to see the kind of technological advances that, in fact, can be made that are going to help us all in our effort to limit the carbon footprint that we have and create greater efficiencies that will improve our travel, and of course, save overall dollars.

Pratt Whitney announced the successful design of engines that were beyond Mitsubishi and with technology that reduces air emissions 40 percent below the 1996 regulations and saving taxpayers $600,000 each year due to lower operating and maintenance costs and improved productivity.

It does, Mr. Chairman, beg the question, too, you know perhaps at a future date, we could have the Air Force in here and the Pentagon in terms of listening to their testimony inasmuch as they are the largest consumers of energy in the United States government system. And the Air Force obviously is the largest consumer of fuel in the country.

And with that, I look forward to hearing from our testimony and thank the chairman for holding this insightful hearing.

The CHAIRMAN. Thank you. I appreciate the gentleman from Connecticut. And now we turn and recognize the gentleman from Missouri, Mr. Cleaver.

Mr. CLEAVER. Thank you, Mr. Chairman. I think Mr. Larson and Mr. Inslee pretty much covered what my comments are. I would only add, and then yield back the balance of my time. There are a lot of questions that have not been answered and I think that we have got to go through a period of examining what happens to the pollution at a higher altitude and whether there is a greater impact, even though we have 3 percent emissions. It could be that it creates problems of its own. We don't know, and so I think it is appropriate that we examine it. And I appreciate the hearing and our guests who have come here today. Thank you, Mr. Chairman, I yield back the balance of my time.

[The prepared statement of Mr. Cleaver follows:]

U.S. Representative Emanuel Cleaver, II
5th District, Missouri
Statement for the Record
House Select Committee on Energy Independence and Global Warming Hearing
"From the Wright Brothers to the Right Solutions: Curbing Soaring Aviation Emissions"
Wednesday, April 2, 2008

Chairman Markey, Ranking Member Sensenbrenner, other Members of the Select Committee, good morning. I would like to welcome our distinguished panel of witnesses to the hearing today.

The growing demand for travel in our country and in our world has boosted the demand and use of fuel for aviation. Although aviation is not a chief contributor of greenhouse gas emissions, the increased demand for this service would likely have a greater effect on the release of emissions like carbon dioxide, nitrous oxide, and particulate matter, thus increasing the effects of global warming. The aviation industry must be equipped to accommodate this demand for service, while at the same time, making an effort to protect the environment. Mindful changes to fuel, technology, and flight operations could all have a positive effect on the release of emissions.

Many improvements have been made to our automobiles in recent years, such as increases to fuel efficiency standards and the expansion of renewable fuels like E85. However, we should not allow this progress to be hindered by the potential increased emissions from aviation. We need to work together to form a solution that will balance the demand for service, the need for safety, and the necessity to control global warming. I hope that we can start outlining a resolution to this concern in today's hearing.

I thank all of our witnesses for their insight and suggestions, and I appreciate them taking the time to visit with our committee this morning.

Thank you.

Mr. LARSON [presiding]. Thank you, Mr. Cleaver. With that, I recognize the gentleman from New York, Mr. Hall.

Mr. HALL. Thank you, Mr. Chair. And I also would like to welcome our witnesses and thank the chairman for holding this hearing today. And I reassure our ranking member that I, for one, do not, as a member of this committee, want to punish an industry that has already done a lot in their own interests and also in the environments interest by installing wing lifts or removing magazines which add to up to a surprising amount of weight. I don't think there has been too many customer complaints about magazines being removed from airlines, and any efforts that are being made, not only in the air but on the ground, as I understand, to reduce consumption of release of greenhouse gasses from ground equipment that is involved with loading airlines with baggage or food services or what have you.

I'm proud to say that in my district, Stewart Airport, which has just been taken over by the Port Authority of New Jersey, is going to be, according to their announcement at their big press conference, they would like to be the first carbon negative airport, and compensate with solar and geothermal and passive features and so on and with using alternative fuels as much as possible on the ground for the emissions that they release in the air. That may be a big ticket, and I admire them for making such an ambitious announcement. And I wish them luck in meeting that goal and will do everything I can to try to help. But I just think I agree with, I guess it was Mr. Inslee said that we all have to try; I as an individual, we as Members of Congress and you as members of your company and your industry, in order to have a chance at reaching the goals that this committee is constituted to find a route to, those being energy independence and to stop the advance of climate change that we all must do our part.

And I am appreciative of the fact that the industry we are hearing from today has already done a lot along those lines and looking forward to hearing what else you think can be done, and I yield back the balance of my time.

Mr. LARSON. I thank the gentleman from New York for his words and recognize the gentleman from California, Mr. McNerney.

Mr. MCNERNEY. Thank you, Mr. Chairman. I want to welcome the panel here for their testimony. And I look at all the issues, I look at this issue, I look at all the issues surrounding global warming as not only a threat but as an opportunity, in this case there is an opportunity to find ways to make the airline industry more efficient which will ultimately save money, there has been some very good recommendations out there that are worth pursuing, one by Mr. Lovins, Henry Lovins, to encourage the airline industry to tax considerations, to retire some of the older more inefficient planes with new ones.

That certainly wouldn't hurt the State of Washington. And there is all kinds of things we can do to improve airline efficiency which would reduce greenhouse gasses. So I look forward to what this hearing would produce. And thank you very much and I yield back to the chair.

Mr. LARSON. I thank the gentleman from California, and now on to our panelists and again, we want to thank them for being here today.

[The prepared statements of Mr. Blumenauer and Ms. Solis follow:]

Rep. Earl Blumenauer
Statement for the Record
Hearing on Greenhouse Gas Emissions from Aviation
April 2, 2008

I appreciate the Chairman calling this important hearing, because airline emissions are growing, and the unique circumstances of airline travel – the altitude and types of pollutants emitted – mean that the climate impacts are significant.

Just as with cars, technology will not get us all the way to our climate goals. Improvements in fuel efficiency will be surpassed by annual traffic growth, leading to increased CO2 emissions. And some of those alternatives fuels, like liquid coal, actually take us in the wrong direction.

This is why I believe we need a holistic, inter-modal approach to transportation; one that goes beyond the traditional stovepipes. I would argue that we need to focus not just on flight patterns and the efficiency of planes, but on how to get people from point A to point B in the most efficient, most environmentally sustainable way possible. Sometimes this might involve a plane trip; sometimes it might involve rail; sometimes a combination of the two.

The point is that we need to get people out of their silos. I hope the Department of Transportation sees itself as just that, not just a Department with a Federal Aviation Administration, a Federal Highways Administration, and a Federal Railroad Administration. Those people all need to talk to each other and think strategically about transporting people and goods across the country.

For example, I was pleased to see Mr. Lovaas mention intercity rail in his testimony. He envisions a gradual modal shift from aviation to high-speed rail where economically competitive and feasible. We will need to make a significant investment in high speed rail to make this work, of course, but this is the direction we should be heading.

If our transportation system is to survive and prosper in a carbon constrained economy, which we will see in the near future, we will need a holistic approach and bold vision by the Federal government.

I would be very curious to hear from our witnesses about how we can help make this happen.

I appreciate Mr. Windmuller's testimony about the need for "more, better, and more efficient air traffic infrastructure." This is certainly part of the answer, and needs to be considered in the context of a new national plan for infrastructure for the 21st century.

Opening Statement – Congresswoman Hilda L. Solis
Select Committee Hearing on Aviation Emissions
April 2, 2008

Chairman Markey, thank you for holding today's hearing on emissions related to aviation.

Aviation emissions generate 12% of transportation related carbon dioxide emissions and 3% of the U.S. total carbon dioxide emissions.

While this may not seem like a large amount, the FAA estimates that U.S. aviation demand will double or triple by 2025.

In California, aviation emissions are one of three uncontrolled sources.

Marine vessels and locomotives are the other two.

The future growth of aviation emissions is further complicated by the increasing cost of jet fuel and the impact this is having on the industry.

Jet fuel prices have increased 30% since this January, and 70% over the last year.

The chief economist for the Air Transport Association of America was recently quoted as saying that "every penny more per gallon adds $195 million to the industry's expenses per year."

This increasing cost is risking economy stability for many of the airlines and those who work for them and depend on them for business and recreational travel.

Services have been reduced, fares have been increased, capacity has been cut, customers have been charged to check a second bag, and staff has been laid off.

None of these are good signs in a struggling economy.

The expected growth in aviation demand and the impact of the cost of jet fuel presents an important opportunity for us to work together with the industry to move the aviation industry forward.

This includes not only through advancements in operations and airplane technology, but also through fuel choice.

I understand there may be unique challenges to these changes, including ensuring that fuel contains sufficient power for planes and that the fuel is resilient to changes in altitude and temperature.

However, these are challenges that it is imperative to address.

In addition to the impact of emissions related to climate change, the increasing cost of jet fu

I look forward to this opportunity to hearing more about both opportunities and challenges associated with aviation emissions and working together to ensure that as the industry grows, it grows green.

I yield back the balance of my time.

Mr. LARSON. And first, I would like to recognize as the Chair comes back and assumes his position, Dan Elwell, the assistant administrator for aviation, policy, planning and environment of the United States Federal Aviation Administration, and Mr. Bob Meyers who is the principal deputy assistant administrator for the Office of Air and Radiation U.S. Environmental Protection Agency.

STATEMENTS OF DAN ELWELL, ASSISTANT ADMINISTRATOR, AVIATION, POLICY, PLANNING AND ENVIRONMENT, UNITED STATES FEDERAL AVIATION ADMINISTRATION; AND BOB MEYERS, DEPUTY ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Mr. LARSON. Thank you both for joining us and with that I yield to the chairman.

The CHAIRMAN. I thank the gentleman and Mr. Elwell. Whenever you are ready.

STATEMENT OF DAN ELWELL

Mr. ELWELL. Thank you. Good morning, chairman Markey. Thank you for the opportunity to testify before you, Congressman Sensenbrenner and the members of the select committee.

The environment is a page 1 issue no matter where page 1 happens to be. It was the central theme of the FAA's annual forecast conference last month, and the subject of acting Administrator Sturgell's speech to the International Aviation Club. Whether you followed the proceedings in Bali or the recent meeting of the group on international aviation and climate change in Montreal, one thing is clear: Aviation's contribution to global change is getting a lot of attention, which is as it should be. And that is why I am so pleased to share with you today both U.S. aviation's exceptional environmental record to date and our plans to make it even better. The bottom line for us at the FAA and indeed for every citizen of this great land is that when you have the opportunity to do something for the environment, you do it. This issue should neither be partisan nor polemic. As global citizens, we have got to move forward with each opportunity. At the FAA that is specifically what is happening. We recognize the significance of taking care of the planet.

In a day and age where aviation activity is on the verge of doubling, where annual passenger totals will surge past 1 billion, it is imperative that we take steps that will make a lasting difference. Those steps form the very foundation for our plan for the next generation of air traffic control.

NextGen is known as our blue print for the future. It also happens to be our plan to keep aviation green. With the aviation industry experiencing record growth, aircraft emissions remain a central environmental challenge as they contribute to global climate change and impact local air quality and noise near airports. From a business standpoint, failure to address these concerns could slow or stop the growth of aviation and the benefits it brings to our Nation.

Aviation accounts for roughly 10 million jobs in the U.S. and over 5 percent of our national GDP. For the record, as I already said,

aviation greenhouse gas emissions represent less than 3 percent of the world's total. Nevertheless we must do what it takes to reduce that number.

To provide some context, there is some good news. When you compare 2006 to the year 2000, U.S. commercial aviation moved 12 percent more passengers and 22 percent more freight while burning less fuel. Between 2000 and 2006, aviation emissions in the U.S. actually declined—that's right, declined—by about 4 percent, reducing our carbon output by about 6 million tons.

During the same period, European aviation emissions increased some 30 percent. And in light of this data, recent rhetoric from the EU threatening to cut or reduce U.S. flights to Europe if we don't pay for our carbon is, at best, impolitic, at worst, hypocritical. It is not surprising that the rest of the world rejected the European plan during the 36th international Civil Aviation Organization assembly in Montreal last year.

We, like most of the world, believe that the most efficient means of reducing aviation emissions is to reduce the amount of fuel that is burned. The aviation industry has made and continues to make significant improvements. Aircraft fuel efficiency has improved 70 percent over the last 40 years and it is only getting better. On a per-passenger mile basis, Boeing's new 787 will be as fuel efficient as today's subcompact hybrid car. These advances are taking place without a single government imposed emission standard for CO_2 and no mention of a cap.

In the past 4 years alone, U.S. airlines have improved their fuel efficiency by 11 percent, U.S. airlines have voluntarily committed to an additional 30 percent improvement by 2025. With that said, forecasts are one thing, getting there is quite another. But with the price of oil over $100 a barrel, the motivation to reduce fuel consumption has never been greater.

But back to what the FAA is doing. We have already implemented a program to reduce vertical separation between aircraft at high altitudes. It is saving about 3 million tons of CO_2 per year. We are redesigning air space. We are altering the routes planes use to descend into airports both here and overseas. That will allow us to use smooth continuous approaches that burn less fuel and make less noise while doing so.

In short, anyplace and any way we can make a difference we are. And as we head into the design, development and execution of NextGen, I think that getting to zero emissions growth is a reasonable goal. In my written testimony, I described the five-pillar approach that will get us there. It takes advantage of efforts like our aviation climate change research initiative, the commercial aviation alternative fuels initiative, FAA's proposed research consortium called CLEEN and a partnership for air transportation noise and emissions reduction.

Aviation has faced many challenges in the past. We have solved them by coming together to produce collaborative efforts that have changed the way we operate as an agency and has literally changed the way Americans fly. I am confident that we will continue with that in the environmental challenge ahead. Thank you.

The CHAIRMAN [presiding]. Thank you, Mr. Elwell, very much.

[The statement of Mr. Elwell follows:]

STATEMENT OF DANIEL K. ELWELL, ASSISTANT ADMINISTRATOR, OFFICE OF AVIATION POLICY, PLANNING AND ENVIRONMENT, FEDERAL AVIATION ADMINISTRATION, BEFORE THE SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING, HEARING ON AVIATION EMISSIONS. APRIL 2, 2008

Chairman Markey, Congressman Sensenbrenner, Members of the Select Committee:

I am pleased to appear before you this morning to address an issue that is central to any discussion of aviation and the environment, aviation emissions. Today I will provide a brief overview of the Federal Aviation Administration's (FAA) activities that help to minimize the environmental impacts associated with aviation emissions, some observations on the current international discussion on emissions trading for aviation, and how Congress can help in moving forward our efforts to address aviation greenhouse gas (GHG) emissions. What should be clear is there is a strong commitment at the very heart of the Next Generation Air Transportation System (NextGen) plan that we have developed--a commitment to provide a systematic, well-informed and performance-based approach to tackling aviation emissions and other environmental issues.

The aviation industry is experiencing record growth globally. It is moving the equivalent of 1/3rd of the world's population each year across the world. Airbus and Boeing have record sales, profits for airlines have recovered, and two of the fastest growing economies in the world--China and India--are on track to build 100 new airports in the next decade to meet demand.

At the same time, just as aviation is knitting together the world, redefining what opportunity and what neighbor means, concern has grown about its contribution to greenhouse gas emissions and potential impacts on climate change. Aircraft emissions remain a central environmental concern and challenge as they contribute to global climate change, impact the local air quality near airports, and could slow the growth of aviation and the benefits it brings to our nation. While we do not have all the answers at this point, what we do have in the NextGen plan is a commitment to provide a systematic, well-informed and performance-based approach to tackling aviation emissions and other environmental issues.

There appears to be a disconnect between perception and performance on aviation emissions, at least in the United States. In some quarters there is a perception that aviation greenhouse gas emissions are growing out of control and that it needs to be reigned in by emissions caps and taxes. But consider the facts that we know about performance of the sector and our plans for continued improvement.

Worldwide, aviation represents less than 3% of total man made greenhouse gas emissions. And in the U.S., how have we been doing? EPA has measured domestic aviation emissions at approximately 3% of GHG emissions. And there is a very positive trend. When you compare today to 2000, U.S. commercial aviation is moving 12% more passengers and 22% more freight while burning less fuel, reducing our carbon output by a million tons. This compares favorably with the U.S. economy overall and aviation has

clearly outperformed passenger vehicles in improving its energy efficiency in the past few decades (see Chart 1).

Now let's give these numbers some context. Consider, for example, the performance of the other major aviation market in the world: the European Union. Between 2000 and 2006, aviation CO_2 emissions in the U.S. declined by about 4%. During the same period in Europe, emissions increased by around 30%! In part, this explains our different perceptions of the problem across the Atlantic (see Chart 2).

The fastest means of reducing aviation emissions is to reduce the amount of fuel that is burned. The aviation industry has made and continues to make significant improvements in fuel efficiency. Commercial jet aircraft fuel efficiency has improved 70% [1]over the last 40 years and continues to get better. On a per passenger mile basis, Boeing's new 787 will be as fuel efficient as today's subcompact hybrid car. Also, according to the Air Transport Association (ATA), U.S. commercial airlines have committed to a 30% improvement in fuel efficiency over 2005 by 2025.

FAA tracks commercial aviation fuel efficiency and encourages fuel efficiency by U.S. airlines. In just the past four years (2003-2007), U.S. airlines have improved their fuel efficiency 11% (see Chart 3). Since 2000, the restructuring of U.S. airline fleets in the aftermath of September 11th, the rise in fuel costs, utilization of fuel efficient operational procedures, and improvements in air traffic management have all contributed to these

[1] Intergovernmental Panel on Climate Change (IPCC) special report entitled, *Aviation and the Global Atmosphere*, 1999.

savings. With oil now over $100 dollars per barrel and fuel at about a third of operating cost, you can imagine the incentive U.S. airlines have to reduce fuel consumption. Further, given the weakness of the dollar, the price of fuel for U.S. airlines is about 50% higher than their European counterparts (see Chart 4).

I noted the contribution FAA has made in improving the emissions efficiency of air transport in the United States. Some efforts, like the introduction of Reduced Vertical Separation Minimum (RVSM), have been very successful, saving about 3 million tons of CO_2 annually. RVSM is an International Civil Aviation Organization (ICAO) approved concept that reduces the aircraft separation standard at certain high altitudes, allowing aircraft to safely fly more optimum profiles, gain fuel savings and increase airspace capacity. Other efforts, like the redesign of the Northeast airspace, are more difficult to put in place, but no less important to our overall goal of increasing capacity while minimizing emissions.

So, the good news is we are starting from a record of exceptional performance historically as we move ahead. So what is our program as we go forward?

First, we must improve our scientific understanding of the impacts of aviation emissions. While CO_2's impacts are well known, our understanding of impacts from other emissions--especially at altitude--ranges from fair to poor (see Chart 5). We must ensure that we identify the harmful emissions, accurately measure their impact and design appropriate technologies, or procedures to mitigate or eliminate their effects. This is

especially true given the interdependencies that exist—for example, strategies to increase fuel efficiency (and therefore reduce CO_2 emissions) can make it more difficult to reduce emissions of nitrogen oxides. As part of our NextGen effort to advance our understanding in this area, we recently launched the Aviation Climate Change Research Initiative (ACCRI) in partnership with the National Aeronautics and Space Administration (NASA) and other agencies. This initiative will help accelerate our scientific understanding to inform policy decisions in this area.

Second, we must accelerate air traffic management improvements and efficiencies to reduce fuel burn. Improving energy efficiency has the dual benefit of improving both environmental and operational performance of the aviation sector. As I said before, we have saved millions of tons of carbon emissions over the past couple of years by putting RVSM in place. We are accelerating implementation of other enhanced air traffic control navigation and other procedures to further improve the fuel efficiency of the system. Through the use of Required Area Navigation (RNAV) and Required Navigation Performance (RNP) technology, aircraft will be able to use descent procedures that burn less fuel and result in quieter operations. In addition, satellite-based air traffic control paired with Automatic Dependent Surveillance-Broadcast (ADS-B) technology on aircraft allow for safer but closer separations between aircraft and more direct routing, which will improve fuel efficiency and also reduce carbon dioxide emissions. In essence, NextGen itself will improve environmental performance. We are already achieving early gains at a test program at Dallas-Fort Worth International Airport, where American

Airlines' use of NextGen-related procedures is reducing carbon dioxide emissions by levels equivalent to removing 15,000 cars from the road for a year.

A good example of emissions reductions from aviation operational improvements is Continuous Descent Arrival or CDA. CDA allows an airplane to fly a continuous descent path to land at an airport, rather than the traditional "step downs" or intermediate level flight operations. The airplane initiates descent from a high altitude in a near "idle" engine (low power) condition until reaching a stabilization point prior to touch down on the runway. Trials in Louisville, KY have shown a fuel savings (and thus GHG savings) averaging about 12% for the arrival portion of the flight. And testing at Atlanta Hartsfield International Airport of continuous descent arrivals shows savings of 1,300 pounds of carbon dioxide for each and every flight.

CDA is one of those win-win strategies, having environmental and operational benefits that can reduce noise, emissions, and fuel burn, as well as flight time. The cumulative impact of measures like this throughout the system can have a real impact. As additional advanced aircraft and air navigation procedures planned for the NextGen system are developed and deployed, we will see an even greater reduction in greenhouse gas emissions impacts from aviation.

Third, we must hasten the development of promising environmental improvements in aircraft technology. This builds upon the fact that the vast majority of improvements in environmental performance over the last three decades have come from enhancements in

engine and airframe design. Both the House and Senate have included a number of our environmental proposals in their pending aviation reauthorization bills (H.R. 2881 and S. 1300) including a proposal to create a research consortium, to be called CLEEN--Continuous, Low Energy, Emissions, and Noise--focused on accelerating the maturation of lower energy, emissions and noise technology for aircraft. While action on that legislation is not completed, we already have in place a cooperative working relationship with NASA and broad participation of outside stakeholders through our research advisory committee, the Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence advisory board, and our NextGen Environmental Working Group.

Fourth, it is imperative to explore the potential of alternative fuels for aviation--fuels that could have benefits for energy security as well as emissions performance, depending on the fuel's lifecycle greenhouse gas emissions profile. The FAA is a major partner in the Commercial Aviation Alternative Fuels Initiative, or CAAFI. CAAFI's participants, which include a cross-section of airlines, manufacturers, airports, fuel producers, federal agencies and international players, are implementing a road-map to explore the use of alternative fuels for commercial aviation. Let me emphasize this is not "pie in the sky". CAAFI participants have already used coal-to-liquid and gas-to-liquid fuels in jets, and most recently completed a bio-fuels flight demonstration. We are keenly aware production processes could increase the overall carbon footprint, so CAAFI is doing careful life cycle carbon emissions analyses and focusing on approaches that will lead to overall reductions.

Data indicate that low sulfur synthetic and bio-based fuels promise significant health benefits from reductions in Particulate Matter (PM) emissions. Certain fuel options also promise reduced carbon emissions. To begin to measure these, FAA sponsored a life-cycle analysis of the "well to wake" greenhouse gas emissions of multiple alternative fuels in a study due this spring that addresses the feasibility of alternative fuels for aviation.

Finally, a variety of market-based measures may offer assistance in managing aviation emissions growth. Approaches using tax incentives, emissions trading or carbon offsets may all have a role to play, though each can pose challenges in design and implementation. Consider carbon offsetting. This is a scheme which allows airline passengers to pay for carbon reductions accomplished somewhere else to compensate for the emissions generated by the aircraft flight they took. While offered by several airlines, a number of questions have arisen related to calculations of carbon emissions (calculations of the same flight can produce carbon numbers that vary by a factor of three) and how the funds collected are spent. More recently in the U.S. we are looking for market-based measures to increase utilization of congested airspace, so that we can simultaneously increase efficiency and drive down emissions per passenger.

With respect to emissions trading, the U.S. participated in the development of emissions trading guidance for aviation under the auspices of ICAO, the United Nations standard setting organization of international aviation. The U.S. and the rest of the world, except

for Europe, agreed on this guidance last September for countries that decide to employ emissions trading for international aviation. The overwhelming majority of countries--developed and developing, Kyoto signatories and non-Kyoto signatories--all agreed emissions trading should only be applied to another country's airlines on the basis of agreement between States. European countries refused to join consensus, as their proposed legislation would force international airlines into their emissions trading system without the consent of governments

The U.S. has significant concerns about the European Union (EU) legislation that is currently being developed to place aviation into their emissions trading system. On top of the legal issues with respect to the Chicago Convention and our air services agreements, recent discussions with EU officials made clear that adoption of emissions trading for aviation has become an end in itself, rather than improving environmental performance. The facts that U.S. airlines pay substantially more for their fuel than their European competitors, that the U.S. has a domestic fuel tax unlike their EU competitors, and that U.S. airlines have actually reduced their emissions unlike the substantial growth from EU airlines, were dismissed.

As ICAO recognized in its work, an emissions trading system is only one approach and it remains the decision of a State whether to employ such a measure. Market based measures can reduce emissions at lower costs. However, the price of fuel already provides both airlines and manufacturers strong market incentives to reduce fuel consumption. Between 1985 and 2004, aviation outperformed every other transport

mode in reducing its emission intensity (see Chart 6). Between 2000 and 2006, the price of fuel more than doubled. Consequently, U.S. commercial carriers bought 750 million fewer gallons in 2006 than they purchased in 2000 even while carrying twelve percent more passengers and 22 percent more cargo. This lends support to the 2001 finding of ICAO's Committee on Aviation Environmental Protection (CAEP) that the price of fuel obviates the need for CO_2 emissions standards for aviation.

Environmental advances in the aviation sector historically have been most helped by positive economic measures that further stimulate research and innovation in the industry's fleets. As the record on aircraft noise and fuel efficiency demonstrates, implementation of new technology and operational procedures have been remarkable tools for limiting and reducing aviation environmental impacts.

As a recent Congressional Budget Office report (February 2008) highlighted, use of emissions trading as a market-measure to reduce emissions poses a number of issues. FAA remains concerned that such issues become more complex when dealing with aircraft that operate internationally. Poorly designed and implemented emissions trading system could actually hamper the ability of aviation to become cleaner and quieter.

We believe ICAO must continue to exercise global leadership to achieve aviation growth in an environmentally responsible fashion. ICAO offers the best forum to find the harmonized approaches we need for a global industry like aviation. It allows the proper balance of collaboration and State sovereignty. We are committed to supporting that

effort. In February, I represented the U.S. at the first meeting of the fifteen-nation Group on International Aviation and Climate Change (GIACC). This high-level group was conceived during last year's ICAO Assembly and is developing an international plan to address international aviation greenhouse gas emissions. Our hope is to take the approach I have outlined here--a balanced approach derived from the recognition that operational and technological environmental performance improvements, coupled with market measures where necessary, can form the basis to derive data-driven, challenging, aspirational goals for the international community in reducing the growth of aviation's greenhouse gas emissions impacts. At the GIACC, we ultimately seek an effective, globally devised strategy, collaboratively entered into.

In addition to FAA's work at ICAO we are pursuing partnerships with other authorities and the international industry in a number of highly technical system areas to advance improvements in aviation's environmental performance. For example, last year the FAA and European Commission (27 countries) announced the Atlantic Interoperability Initiative to Reduce Emissions, or AIRE. The AIRE initiative is targeted to undertake demonstrations in both the U.S. and Europe to accelerate the ability of airlines and air navigation authorities to employ enhanced air traffic procedures that reduce aviation's emissions and noise footprint on either side of the Atlantic. We (the U.S., Australia and New Zealand) also just launched a similar initiative in the Pacific—ASPIRE--or the Asia and South Pacific Initiative to Reduce Emissions.

Aviation has succeeded in its first century because it has constantly met the challenge of innovation and record setting – flying faster, cleaner, quieter and safer. In doing so, aviation has transformed the world. Any fair reading of history will show that until now, aviation has done an exceptional job in improving its environmental performance. But to be blunt, the issue is not past performance, but what we are doing for the future.

In closing, it is clear today that aircraft emissions impact the climate, are an issue of both domestic and international concern and remain a potential constraint on the future growth of aviation. It is also evident we have no "silver bullets." What we do have is an approach to reduce aviation greenhouse gas emissions in a growing NextGen system. We have already initiated a number of endeavors – "silver buckshot" if you will – that will help get us there. We need the help of Congress. We have outlined a significant set of initiatives underway to address aviation emissions. We have proposals before Congress in FAA's reauthorization proposal that, if authorized and funded, would accelerate all these efforts.

Success will require partnership and shared responsibilities among many stakeholders—with air carriers operating cleaner and quieter aircraft; airframe and engine manufacturers improving efficiency of their products; air traffic management facilitating environmentally-friendly procedures consistent with safe and efficient operation; alternative fuel producers scaling up environmentally sound fuel production; airports investing in cleaner infrastructure; and federal programs and investments supporting the necessary technology and operational improvements. The FAA is committed to working

with all stakeholders to find the right balance to manage capacity growth while addressing aviation emissions.

Mr. Chairman, that completes my prepared statement. I would be happy to answer any questions you or Members of the Committee may have.

The CHAIRMAN. Our second witness on the first panel is Bob Meyers, the principal deputy assistant administrator in the Office of Air and Radiation at the U.S. Environmental Protection Agency. Mr. Meyers and I have been walking around the corridors of the Rayburn building here since the beginning of time almost.

Mr. MEYERS. Something like that, Mr. Chairman.

The CHAIRMAN. When did you start working up here in the Rayburn building?

Mr. MEYERS. I started working for Congress in the late 1970s.

The CHAIRMAN. Around the same time I arrived here. We welcome you here and we appreciate your testimony.

STATEMENT OF BOB MEYERS

Mr. MEYERS. Thank you. Mr. Chairman and members of the committee. I appreciate the opportunity to appear before the committee concerning the important issue of aviation emissions and climate change. On December 4 and December 31st of last year, EPA received two petitions to set greenhouse gas emission standards for aircraft engines under the Clean Air Act. One petition was filed by several States, the City of New York the South Coast Air Quality Management District and the District of Columbia. The other was filed by several environmental organizations. The petitions raised similar but not identical issues. The relief requested in the petition centers on the finding of endangerment and adoption of Clean Air Act regulations.

As Administrator Johnson recently informed the committee, EPA intends to issue an advanced notice of proposed rulemaking later this spring. This ANPR will cover a variety of issues arising from the supreme court's decision in Mass v. EPA and among the issues addressed, ANPR will seek comment and relevant data concerning the two aviation petitions the Agency has received.

The ANPR will also seek comment and data with respect to additional petitions the Agency has received concerning non road and marine sources. Through the ANPR process EPA expects to gain valuable information and public insights regarding greenhouse gas emissions from such sources air connections among various Clean Air Act provisions and possible regulatory requirements. Your letter of invitation requested that I address four issues. Some of the questions posited were similar to the questions previously received by the Agency that were addressed in my letter to the committee of March 31st. In today's testimony, I would like to provide further response to your concerns and specifically information regarding emissions, potential use of biofuels, FAA coordination and the EU emissions trading scheme.

Very briefly, the compound submitted from aircraft jet engines that directly relate to climate change are carbon dioxide and small amounts of methane and nitrous oxide. There are also emissions which more indirectly affect radiation forcing climate. As detailed in my written statement, the works of the International Panel on Climate Change reports to the Council of the International Civil Aviation Organization and other sources have examined these emissions. Overall, aircraft operations in the U.S. are estimated to account for about 10 percent of greenhouse gas emissions from the

U.S. transportation sector and approximately 3 percent of total U.S. GHG emissions.

Section 231 of the Clean Air Act gives EPA authority to determine whether aircraft emissions contribute to air pollution which may be reasonably anticipated to endanger public health or welfare, and to set emission standards following a positive finding.

Section 232 of the Act provides FAA with the authority to certify aircraft engines for emission purposes and to enforce compliance with EPA's standards. EPA has utilized this authority on several occasions including the 1982 standards for HC, or hydrocarbons, 1997 standards for NOx and CO, and further NOx standards in 2005. These standards essentially cover criteria pollutants and precursors for purposes of improving local air quality.

With respect to fuel, commercial aircraft uses a petroleum-based fuel commonly referred to as Jet-A kerosene. In 2006, the air travel industry and FAA established the commercial aviation alternative fuels initiative to explore the potential use of alternative fuels for aircraft for energy security and possible environmental improvements. And since the FAA's primary authority is this area, I would defer to the FAA to address their ongoing work in this area.

Overall, as mentioned, U.S. aviation emissions have declined in recent years. Moreover, it is likely the aircraft fuel efficiency will improve in the future due to technology developments for lighter and more aerodynamic aircraft, as well as more efficient engines. In the long term, the expected increase in air traffic and lead times that are necessary for technology change and deployment could effect recent trends. As indicated previously, our upcoming ANPR will provide a context in which these issues can be assessed. With respect to coordination with the FAA, various offices within EPA and FAA are in frequent contact regarding aviation and environmental issues, including the next generation of air transport system plan.

EPA has had substantial interactions with FAA in the development of aviation GHG inventories and we expect to continue our coordination with FAA in developing our responses to the two administrative petitions.

Finally, you asked whether EPA was examining how the U.S. might comply with the EU trading scheme. As my letter of March 31st addresses this issue, I would just generally state that the EPA technical staff had provided background data information regarding emissions and cap-and-trade programs during an interagency process.

Again, thank you, Mr. Chairman and members, for giving me this opportunity, and this concludes my prepared statement.

The CHAIRMAN. Thank you, Mr. Meyers, very much.

[The statement of Mr. Meyers follows:]

ROBERT J. MEYERS
PRINCIPAL DEPUTY ASSISTANT ADMINISTRATOR
OFFICE OF AIR AND RADIATION
U.S. ENVIRONMENTAL PROTECTION AGENCY

BEFORE THE SELECT COMMITTEE ON ENERGY INDEPENDENCE AND GLOBAL WARMING
U.S. HOUSE OF REPRESENTATIVES
APRIL 2, 2008

Mr. Chairman and members of the Committee, I appreciate the opportunity to discuss with you today the important issue of aviation emissions and global warming. My testimony will cover the following items: background information on greenhouse gas (GHG) emissions from aircraft, historical regulation of aircraft emissions, the aircraft GHG petitions we have received, the potential use of biofuels, coordination with FAA, and the European Union Emissions Trading Scheme.

The compounds emitted from aircraft jet engines that directly relate to climate change are carbon dioxide (CO_2) and small amounts of methane (CH_4), and nitrous oxide (N_2O). Aircraft operations in the U.S. are estimated to account for about 10 percent of GHG emissions from the U.S. transportation sector. Compared to all sectors in the U.S., aircraft operations account for approximately 3 percent of total U.S. GHG emissions.

Aircraft also emit other compounds that are indirectly related to climate change such as oxides of nitrogen (NOx), water vapor, and aerosols. NOx is a precursor to cruise-altitude ozone, which is a GHG. An increase in ozone also results in increased tropospheric hydroxyl radical (OH) and reduced CH_4, and thus offsetting the warming

effect from the increase in ozone. Water vapor and aerosols modify cloud cover, which in turn can either amplify or dampen global warming.

Section 231 of the Clean Air Act gives EPA authority to determine whether aircraft emissions contribute to air pollution which may reasonably be anticipated to endanger public health or welfare, and to set emissions standards following a positive finding. Section 232 of the Act provides FAA the authority to certify aircraft engines for emissions purposes and enforce compliance with EPA's standards. The United Nations International Civil Aviation Organization (ICAO) is chartered to develop international standards that each sovereign country may then adopt. Historically, the most common way for EPA to set aircraft emissions standards for criteria pollutants has been to follow what is adopted by ICAO. This approach was recently upheld as reasonable by the U.S. Court of Appeals for the D.C. Circuit. FAA leads the U.S. delegation to ICAO, and EPA staff serve as technical advisers.

Thus, international standards are first adopted by ICAO, and subsequently EPA initiates a Clean Air Act rulemaking to establish domestic standards equivalent to ICAO's standards. This long-standing practice assures consistency between U.S. and international standards, requirements, and test procedures. Since aircraft and aircraft engines are international commodities, there is commercial benefit to consistency between U.S. and international emission standards and control program requirements. We have established aircraft emission standards covering criteria pollutants for local air quality; however, these standards do not cover CO_2 and other GHGs.

Commercial aircraft use a petroleum-based fuel commonly referred to as jet A kerosene. Industry (manufacturers, operators and airports) and FAA established the Commercial Aviation Alternative Fuels Initiative (CAAFI) in 2006 to explore the potential use of alternative fuels for aircraft for energy security and possible environmental improvements. CAAFI's goals are to have available for certification in 2008 a 50 percent Fischer-Tropsch synthetic kerosene fuel, 2010 for 100 percent synthetic fuel, and as early as 2013 for other biofuels. However, any alternative fuel will need to be compatible with current jet fuel for commercial aircraft to prevent the need for tank and system flushing on re-fueling and to meet comprehensive performance and safety specifications.

As you may know, in February 2008, Boeing, General Electric, and Virgin Atlantic airlines tested a Boeing 747 that was partly powered by a biofuel made from babassu nuts and coconut oil, a first for a commercial aircraft. Boeing has indicated plans for future tests of this fuel using different engines and aircraft types. The company will also test other types of biofuels.

As you are aware, EPA recently received two separate petitions addressing GHG emissions from aircraft. These petitions ask EPA to: a) find that aircraft-related GHG emissions cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare; b) propose regulations to control such emissions; and c) promulgate final regulations. Also, the petitioners highlighted operational measures

and fuel controls as ways to reduce aircraft GHG emissions. There has been considerable study conducted with respect to GHG emissions from the aviation sector. The next step in our process is to seek public comment on these two petitions, including seeking input on the scientific, policy and technical issues that the petitions raise. We plan to solicit public comment and information on the petitions as part of the Advanced Notice of Proposed Rulemaking that we intend to issue later this Spring. In particular, we will request information on potentially available technological controls for aircraft and their engines and operational measures to reduce emissions from aircraft – including information on what is feasible in the near-term or long-term as well as relevant cost and safety information.

We project that aircraft fuel efficiency will improve in the future due to technology developments for lighter and more aerodynamic aircraft and more efficient engine. U.S. aviation emissions have declined in recent years, but due to the expected increase in air traffic and lead times for technology change, it could prove challenging to continue this declining trend.

With respect to coordination with FAA, various offices within EPA and FAA are in frequent contact regarding aviation and environment issues. We have frequently discussed the relationship between measures to control air pollutants such as NOx and engine fuel efficiency as part of our past interagency coordination during the ICAO standards setting processes. EPA has had substantial interactions with FAA in the development of aviation GHG inventories. We expect to continue our coordination with

FAA in developing our responses to the two administrative petitions. Finally, EPA participates in the Environmental Working Group that is developing the environmental strategy for the Next Generation Air Transportation System plan.

In regard to international issues, recently, the European Commission proposed to include by 2012 CO_2 emissions from all flights arriving at or departing from a European Union airport, including U.S.-certified aircraft, in the European Union Emissions Trading Scheme (ETS). It would cap aviation-related CO_2 emissions at 100% of the sector's average emissions during 2004-2006. If the proposal is adopted, airlines from non-EU countries will be required to submit CO_2 allowances to cover emissions from flights that arrive at and depart from European airports during the compliance period, or pay a non-compliance penalty. This proposal provides for exclusion for arriving flights from non-EU countries who adopt equivalent GHG mitigation measures for international aviation. EPA technical staff provided aviation emissions data background and information on cap and trade programs for the interagency discussion, and participated in interagency meetings on the U.S. response, but did not participate directly in the formulation or communication of legal positions with respect to the European Union cap on the emission of GHGs from aviation.

The U.S. and other nations have expressed serious concern about the legality of the proposed EU legislation in the context of both the Chicago Convention of 1944, which established the International Civil Aviation Organization, and bilateral air services agreements. At the 36th Session of the ICAO Assembly in September 2007, there was

focus on aviation emissions related to climate change, including discussions on the use of emissions trading. The Assembly agreed to establish a high-level group through ICAO to develop a framework of action that nations could use to address these GHG emissions. A report with recommendations is due to be completed before the next Assembly Session in 2010. In addition, the Assembly urged all countries to not apply an emissions trading system to other nations' air carriers except on the basis of mutual consent between those nations.

As we go forward, we will keep the Committee apprised of EPA's continued evaluation of issues related to aircraft GHGs and our response to the petitions.

Thank you, Mr. Chairman and the members of the Committee for this opportunity. This concludes my prepared statement. I would be pleased to answer any questions that you may have.

The CHAIRMAN. And the Chair will now recognize himself for 5 minutes for questioning.

Mr. Elwell, the NextGen program was formed to plan for the future of aviation. In both your testimony and your response to the select committee's letter last year, your environmental efforts seem to be tangential rather than central to the future of aviation. Given the future of carbon constrained economy and the inevitability of some sort of European aviation emissions cap-and-trade system, how is it that you have not focused on global warming emissions as you plan for a rapidly increasing aviation industry?

Mr. ELWELL. Well, Mr. Chairman, in referencing NextGen, we have an integrated work plan, a rather large document, but we have devoted an entire section of the integrated work plan, which is basically the template from which we will implement NextGen. And the chapter is dedicated to environmental considerations and how we will mitigate our environmental footprint, so I wouldn't characterize our treatment of the environmental issue with regard to NextGen as tangential.

The CHAIRMAN. Does the FAA see coal-to-liquid fuels as the future of jet fuel?

Mr. ELWELL. Well coal-to-liquid fuels is one area of alternative fuels being looked at. And the initiative I had mentioned in my testimony, CAAFI, or Commercial Aviation Alternative Fuel Initiative, is dedicated to the furthering for the proposal for alternative fuels that have a net decrease in greenhouse gas emissions. So to the extent to which coal to liquid can achieve that, then yes, we will be for it. But there is, as you are well aware, sequestration issues and life cycle issues.

The CHAIRMAN. Now, the Virgin Atlantic and Continental are testing the biofuels in their planes, and is even funding research into biofuels. What work is being done to support biofuel development at your agency aside from a biofuels demonstration test flight?

Mr. ELWELL. Again, as part of our central participation in CAAFI and in the aviation climate change research initiative and our partnership program for lower emissions, we are intricately involved both in centers of excellence with university research, again CAAFI and ACCRI in all aspects of alternative fuel research.

The CHAIRMAN. Mr. Meyers, as you point out in your testimony, EPA's decision on whether to regulate greenhouse gas emissions from aviation sector under section 231 of the Clean Air Act depends on an identical determination as Massachusetts versus EPA as to whether the emissions cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. We know from EPA's staff depositions to Congress that EPA finished the endangerment finding for motor vehicles and found that, indeed, EPA did believe that these emissions are dangerous.

Since you have concluded that these emissions are dangerous when they come out of vehicles that drive on the roads, would it not be arbitrary to conclude that these emissions are not dangerous when they come out of vehicles that fly in the skies?

Mr. MEYERS. Mr. Chairman, thank you for the question.

I think I might say that the documents that you are referring to are draft documents we have had that correspondence with the committee with respect to these documents. So as draft documents, any use in documents would not be conclusions.

The CHAIRMAN. If you do formally conclude that greenhouse gas emissions from motor vehicles are dangerous, is there any reason that EPA did not conclude that emissions coming from aviation are not also as dangerous?

Mr. MEYERS. I learned a long time ago not to engage in hypotheticals. In that hypothetical I am not available to give you a detailed answer. I would say very clearly the endangerment language in 231 is very similar to that with the act to petition in the section 202, and when we looked at greenhouse gasses, we understand which pollutants they are and they are emitted from both mobile sources on road as well as offroad as well as aircraft.

The CHAIRMAN. And do you plan on including the text of the endangerment finding you already completed for vehicle emissions in the advanced notice of proposed rule?

Mr. MEYERS. Mr. Chairman, we are just initiating work now on the ANPR, so decisions regarding final documents and final support documents have not been made at this point in time. I think as I related to the committee and other committees on the Hill indicates that we plan to utilize the work that was performed by EPA over last year in response to the greenhouse gas petition and with reference to the President's 20-in-10 initiative.

The CHAIRMAN. I thank you. The Chair now turns and recognizes the ranking member, the gentleman from Wisconsin.

Mr. SENSENBRENNER. No questions.

The CHAIRMAN. The Chair recognizes the gentleman from Missouri, Mr. Cleaver.

Mr. CLEAVER. Thank you Mr. Chairman. Mr. Elwell, do you see a conflict between some move to reduce emissions and a strong safety record? Is there a conflict between trying to reduce greenhouse gas emissions and safety?

Mr. ELWELL. Mr. Cleaver, if you are asking are they mutually exclusive, clearly not. We can pursue both and we clearly have. We are currently in the safest period that we have ever seen. And we also are just wrapping up a decline in fuel burn despite the fact that we have carried more people and freight. So I think the record is clear that we can do both.

Mr. CLEAVER. I raise the question only because there was discussion about planes falling. And I thought it might be important for us to just get that on the record. The committee is not saying ignore public safety and concentrate on greenhouse gas emissions.

What is the future, based on your analysis, in the aviation industry with regard to reducing greenhouse gas emissions? And I am not sure whether, who does the, whether FAA or whoever would look at the other atmospheric emissions and whether there is a difference there than on Earth. Do you have any thoughts about that or knowledge about whether that has ever been looked into or whether you believe that it ought to be looked into?

Mr. ELWELL. We certainly believe it needs to be looked into. In my written testimony, I go through the pillars of our plan go forward, and the first pillar is a better understanding of the impacts

of the various emissions that combustion produces. One thing we know for sure is that CO_2 is not altitude dependent, so there is no multiplying effect of CO_2 wherever it is emitted. And we believe and it has been posed before that the other pollutants have some magnification at altitude. As recently, the IPCC is actually most recently said that the science is so uncertain as to that "multiplier" as to them not giving one actually. And so our involvement in ACCRI, Aviation Climate Change Research Initiative, is focused on exactly those issues.

Mr. CLEAVER. Thank you, Mr. Chairman I yield back the balance of my time.

The CHAIRMAN. The gentleman's time has expired. The Chair recognizes the gentleman from New York State, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman, and thank you to the witnesses. Mr. Meyers, I want to ask you, in your written testimony you mentioned the Fischer-Tropsch synthetic which was produced by the Nazis for various fuels including aviation fuel I believe during World War Two. And the Fischer-Tropsch reaction is apparently—I believe there are a couple of studies I have heard about that are going on now to pull carbon dioxide out of the air, process the carbon in it into a liquid fuel, upon which combustion releases a similar amount of carbon dioxide back into the air in a carbon neutral process which would provide us, if one uses, in parts of the country and parts of the world, where the sun shines almost constantly or where the wind blows almost constantly using those renewables as the energy to drive the Fischer-Tropsch reaction. Are you aware of any studies along those lines? And what are your thoughts?

Mr. MEYERS. I would be happy to get back to the record on the specific studies to be aware of. My office is primarily a regulatory office out of EPA and we have an Office of Research and Development. But generically, obviously, it is going to depend, Fischer-Tropsch is a process that will depend on feedstocks. You can use Fischer-Tropsch with coal and has been done for some time, as you mentioned, both in World War II and in South Africa in more recent years. So I would say it is probably theoretically possible but I would have to get back to the record for more specifics.

Mr. HALL. I am curious about this because I have been hearing about it. If you do an Internet search for Fischer-Tropsch, a lot of sites show up with different things on them and you can't believe everything you read on the Internet, but wouldn't it be nice if it were true.

Mr. Elwell I don't know if you want to comment to this. Since Mr. Meyers referred to you on that part his testimony and I have one other question also.

Mr. ELWELL. And no to the Fischer-Tropsch. It is out of my realm.

Mr. HALL. It seems to me that using an existing carbon fuel like coal obviously is something we know how to do with that process to create liquid fuels. But we also know, so far anyway, that we are faced with either sequestering massive amounts of carbon dioxide or using a fuel that could already be used in other ways, whereas storing solar or some other renewable—the big problem people always say about the sun and the wind is you can't always predict

when it is going to shine and you can't always predict when it is going to blow. But if you could store it and basically use the liquid as a battery or use hydrogen as a battery in a similar way by separating water into hydrogen and oxygen, and then burn the hydrogen, that is not something I am advocating for airplane fuel, but it is something that can be used for generation of electricity.

But this is a similar thing for Fischer-Tropsch if a carbon dioxide neutral process could be developed using it. The other question I had, you mentioned continuous descent as part of NextGen, and I sit on the Aviation Committee of Transportation and Infrastructure, and I've been very interested in that because particularly in my district we have a couple of towns, the Town of Pound Ridge and the town of Warwick in the 19th congressional district that are being affected or feel that they are being affected already by the New York air space redesign, and they are hearing that stepping down of planes going from descent to hover to descent to hover as they wait to be cleared for the next 2,000 foot drop. And of course the engines have to rev up to hold altitude and then rev down to descend, and once they can get on to continuous descent, they hopefully will be less noticed.

They might be making as much noise sort of on average, but it is that change in pitch that I think is especially noticed by people out in the country, and where they are used to the peace and quiet. Is this something that can be done in any parts of, for instance, in New York air space before full implementation of NextGen?

Mr. ELWELL. NextGen, before full implementation, it can be done, in fact, over 25 percent of the approaches right now in L.A. are using CDA. And we are putting it in where we can. Obviously, probably one of the most difficult places to do it consistently is in the northeast sector which is why the redesign is so important. But once, as you mentioned, once NextGen is fully implemented, our hope is to have CDA be the norm and step down arrivals would be the exception.

And you are right. The ability to go to idle from altitude and bring up your power half a mile from the threshold huge emissions benefits and below 6,000 feet about a 30 percent reduction in overall noise.

Mr. HALL. So it is good both for noise and for CO_2 emissions and that is what we are after. My time is done. Thank you, Mr. Chairman.

The CHAIRMAN. Mr. Elwell, if you wanted to do a great job on NextGen, what kind of resources would you need for Congress to give you?

Mr. ELWELL. A little bit over a year ago, the FAA, the administration proposed our NextGen reauthorization bill, and it offered some financing reform initiatives that would we believe allow us to pay for and implement NextGen as quickly as we are able. It had some dedicated funding for NextGen. Obviously, that legislation has lagged some. But we absolutely need your cooperation and partnership, Congress, and the proper and timely funding for the capital expenditures for NextGen and for——

The CHAIRMAN. Can you give me a number?

Mr. ELWELL. We had in our proposal a plan to spend $4.6 billion over 5 years just on NextGen. And the President's budget supports that. So that is what we are asking for.

The CHAIRMAN. Okay, great. Thank you. And Mr. Meyer, in January, the select committee sent you a letter asking about the EPA's commitment to aviation emissions and climate change. Your reply which we received 2 days ago stated that ANPRN has not taken a formal stance on the effects of aviation on climate change.

When will you address this issue? And will it be separate from an endangerment finding?

Mr. MEYERS. We will be addressing these issues as well as other issues effecting climate change in the context of an ANPRN.

The CHAIRMAN. So you will be doing it in the context of the announcement that you made last week?

Mr. MEYERS. Right.

The CHAIRMAN. Okay. That is helpful to us. Does the gentleman from Missouri have any other questions?

Mr. CLEAVER. Mr. Chairman, one other question. I was intrigued by Mr. Hall's comment about the airport in his district. Is that something, for either of you, is that something that you believe to be possible and if so, is it something that you would encourage where airports would move toward becoming carbon neutral, at least in the ground operation with renewable fuels and so forth?

Mr. ELWELL. Absolutely encourage it. In fact, we have a program called VALE, Voluntary Airport Lower Emissions program, in which we allow airports to spend money on electric vehicles and tank refuelers as opposed to using trucks. All of the things that were mentioned by your colleague. Electric, plug into airplanes for fueling, cooling so that they don't need to turn on the engines. So yes, the short answer is absolutely.

Mr. CLEAVER. Is there any, do you have any material and documentation, that we would need that I would be able to look at?

Mr. ELWELL. Yes, we do, sir.

Mr. CLEAVER. I would really like to see that. That is very intriguing.

The CHAIRMAN. Just so I can clarify, is it possible, Mr. Meyers, that when the advanced notice of proposed rulemaking comes out that there won't be something in there? Is one of the options a consideration of the endangerment finding or there won't be an aviation component? Is that also possible?

Mr. MEYERS. We are in the process of drafting, so I think I should probably allow for any possibility during that process of drafting an interagency review.

But as the letter indicated that was sent to your committee and others, we were looking at the ANRPN as a vehicle to address—we not only have two aviation petitions, we have five other petitions covering off road and marine.

So traditionally under our process when we get petitions of this sort, as we did last year when we had a petition with regard to leaded aircraft general aviation aircraft gasoline, we solicited the information we needed to address the petitions through an ANPRN. So that would be our intent with respect to the aircraft petitions.

Relative to your question on endangerment, as I think we have referenced in the letter, that we would be looking both at the science and climate change and that relationship to endangerment finding that would occur, and that would be in the context of the ANPRN also.

The CHAIRMAN. Is it possible that it will come out without any actual proposal of either endangerment or regulations for any sector?

Mr. MEYERS. Well, fairly much by definition of advance notice, does that normally conclude with a proposal? It is meant as an advance notice of proposed rulemaking, not as a formal notice of proposed rulemaking.

The CHAIRMAN. But you are saying it doesn't necessarily mean that either the endangerment finding or something on——

Mr. MEYERS. Well, I think what we tried to indicate was during the course of our consideration over the last year, and as the committee knows, there was a lot of work done with reference to not only vehicle emissions but the endangerment issue, and also not covered by the act of petition of the fuels.

We look very heavily at the fuels. As the Administrator has testified in respect to previous hearings, we had the passage of the energy bill to take into consideration in December.

So in the context of our letter, an explanation of our plan going forward was to examine the interconnections of the Clean Air Act that occurred both between the mobile and stationary sources. Obviously with respect to the Massachusetts vs. EPA decision, the context of regulatory decisions are essentially channeled through a follow-up of endangerment finding in accordance with the opinion and in accordance with the structure of the statute.

The CHAIRMAN. So at the pace at which this is proceeding, it is possible that the President could leave office, President Bush could leave office without any decision actually having been made on endangerment and without any decision actually having been made in this one hearing—a focus on the role of aviation and a solution to the problem?

Mr. MEYERS. Well, I think the path for the Administrator's outline is to issue an ANPRN this spring, allowing for a public comment period. Then at the end of that process, we would consider on the basis of that information how best to respond to the Massachusetts vs. EPA case and its implications throughout the act.

The CHAIRMAN. How long is the comment period?

Mr. MEYERS. That has not been established traditionally in this area. One would look at—it is a substantial notice, a substantial issue, so normally 60 days would be a rough minimum time.

The CHAIRMAN. So 60 days for the advanced?

Mr. MEYERS. I want to be clear. We have not determined the period of actual public comment. I won't determine that, the Administrator will determine that when he would sign the advance notice.

Just normal practice in order to give sufficient notice on large issues—and certainly the large issues with respect to Massachusetts vs. EPA, normally is 16, and perhaps a 9-day process would be appropriate. I just want to emphasize that is a decision that the Administrator will make at the time the document is prepared.

The CHAIRMAN. I guess from my perspective there has been a lot of time to think about these issues since the decision, and my request to you would be to consider making this as brief a period of time as possible. I think people are ready to comment.

Mr. MEYERS. I appreciate that, Mr. Chairman, and we will certainly convey that to the Administrator. I think the balance here on any public comment period is between having a fulsome comment and the ability of all parties to provide information, as well as the desire to move expeditiously.

The CHAIRMAN. I agree with that. That has to be balanced in that the EPA is just running out the clock on the Bush administration and actually will not have a decision before the President leaves office. So in that context at least, these decisions are being made about the length of time that is going to be given for comment as opposed to action.

So that is just the legality of it, I understand. But I caution that that will be, perceptually, how you would, given the length—given thus far to think about the issue.

My time has expired.

The Chair recognizes the gentleman from Washington State, Mr. Inslee.

Mr. INSLEE. Thank you.

Mr. Meyers, was your Agency, was EPA involved at all in the Air Force procurement decision about the new tanker? The Air Force decided to buy a tanker that uses 24 percent more fuel per mile of product than another aircraft that uses 24 percent more efficient; therefore, has 24 percent less CO_2 emissions.

Were your agencies involved in that at all?

Mr. MEYERS. I will be happy to check on that. I have no memory of any involvement by the Office of Air and Radiation.

Mr. INSLEE. I doubt the Office of Air and Radiation, but I just wonder if the EPA in general would have been involved in that?

Mr. MEYERS. I will need to check with the other offices, and we would be happy to provide that for the record.

Mr. INSLEE. The reason I ask is that this is kind of a new issue to me, but it seems to me one thing we need to start thinking about in our Federal procurement, when we are buying aircraft to think about the CO_2 emissions.

We had one product that reduces CO_2 emissions by a full quarter, and we didn't buy it. We bought a competitor, which also happened to be significantly produced in Europe, which is another issue.

Do you have any guidance on that? I would be appreciative, because it seems to me that is something we ought to be thinking about.

Mr. Elwell, I am told that the FAA's budget requested $300 million for environmental stewardship but the primary goal of those were noise pollution abatement, while only about $10 million was for research in new aircraft technology to help reduce emissions.

Is that the situation, and is that really adequate to the task if we really want to reduce emissions?

Mr. ELWELL. Well, as I mentioned, noise—or in my written testimony—noise remains the major concern for local communities and

local airports. And the money that you are talking about is spent for insulation for noise—for infrastructure noise mitigation.

I think the stewardship of every dollar that we get for research, particularly in developmental research for design, engine and airframe, is spent primarily—we leverage every dollar, I should say, with our Center of Excellence, with the MIT-administered partner program.

So we can always do more with the challenges we have budgetarily. I think we do the best with what the Agency has.

Mr. INSLEE. I am sorry, 90 percent of that is used then for infrastructure. Whose infrastructure improvements are you referring to?

Mr. ELWELL. Do you mean the 300 million?

Mr. INSLEE. Yes. You said the bulk of it goes to infrastructure improvements, insulation and the like. Whose infrastructure are you are talking about?

Mr. ELWELL. We are talking about residents and inhabitants within the noise-affected area of airports.

Mr. INSLEE. Well, we certainly would encourage you to think more aggressively on trying to embrace these new technologies because we think they are happening.

Boeing has a new airplane. The 787 has 20 percent more fuel efficiency than any other plane on the market. There are great things going on.

By the way, I was talking to somebody yesterday, just by happenstance, about turboprop technology that may be looked at. You may have talked about this already. Do you have any thoughts about that? Or is that something that you are supporting?

Mr. ELWELL. Yes.

Mr. INSLEE. I am told that it has markedly better fuel efficiency if we can get over some of the noise issues.

Mr. ELWELL. I have read some of the same things and don't know much more other than what you are saying, other than there are some advancements being made in turboprop technology, quieter turboprop engines, more fuel-efficient turboprop engines. Again, anything that reduces noise and emissions we are in favor of.

Just to add to your comment about the money that we are spending, we do—as I mentioned earlier before you came in, about our reauthorization proposal—have significant increases in funding for this fundamental—or the developmental research for engines and airframe.

Mr. INSLEE. Well, we will look forward to that. Thank you.

The CHAIRMAN. Great. The gentleman's time has expired. I don't know if the gentleman from Missouri has any other questions.

Mr. CLEAVER. No, thank you, Mr. Chairman.

The CHAIRMAN. We thank you for your testimony. We look forward to working with both of you in the next several months.

We are going to be, obviously, paying very close attention and escalating our level of attention to these issues. I would ask both agencies to move quickly. The urgency of the problem is in Washington, and I think the public and the world is looking to us to find answers to the questions in a timely, telescoped time frame way. We thank both of you for your testimony.

Our second panel, if they would move up as soon as the first panel—while you are doing that, I will mention that both Virgin

Atlantic and Boeing have submitted testimony for the record, and I ask unanimous consent to include the testimony of Boeing and Virgin Atlantic at some point.

[The information follows:]

Virgin Atlantic's response to the Congressional Hearing of the Select Committee on Energy Independence and Global Warming regarding aviation emissions and global warming – 2 April 2008

1. **Why did Virgin Atlantic decide to run a jet biofuel demonstration flight and how long did the planning take?**

Virgin Atlantic is committed to becoming a more sustainable airline and takes a three pronged approach to addressing the environmental impacts of its operations. We have committed to reducing those impacts over which we have a direct control, both our aircraft operations and our ground facilities, and have set ourselves ambitious targets in our Environmental Policy[1]. For those impacts over which we do not have direct influence, e.g. airspace management, aircraft technology design and airport management, we are committed to challenging the rest of the aviation industry and other stakeholders to achieve common solutions. Lastly, Virgin Atlantic believes it has a role in engaging and educating our staff and passengers in addressing the climate change challenge.

In September 2006, Virgin Atlantic's President, Sir Richard Branson, announced that profits from the Virgin Group's travel and transportation interests (anticipated to be a total of around $3 billion over ten years) would be invested in renewable fuels and other alternative technologies with environmental benefits. It was at this stage that Sir Richard first mentioned his intention for Virgin Atlantic, at some later date, to operate an aircraft using a biofuel.

The following April, Virgin Atlantic launched an ongoing environmental partnership with the Boeing Company, coinciding with the announcement of an order of 15 fuel efficient Boeing 787 "Dreamliners". A key element of this environmental partnership was a commitment, together with engine maker GE, to operate a demonstration flight using biofuel sometime in 2008.

The actual demonstration flight took place less than ten months later, on 24 February 2008. This followed several months of work to identify a shortlist of biofuel suppliers which could produce sufficient quantities of biofuel for the demonstration flight, to the standards (when blended with traditional jet fuel) required by the industry's internationally recognised fuel specifications.

Once the preferred fuel had been identified - a blend of babassu nut and coconut oil, produced through transesterification by Imperium Renewables in Seattle, WA – it then went through several further stages of testing by Boeing, GE and NASA Glenn. Only when all project partners were satisfied that the biofuel, when blended with normal jet fuel at a 20:80 ratio, would perform to the required standards without any negative impacts on the engine or the onboard fuel systems, did we give the final go ahead for the demonstration flight. In the 48 hours before the flight itself, the blended fuel underwent further laboratory and operational testing using the aircraft selected to operate the flight itself. These tests, and the subsequent "return to service plan" for the aircraft after it had completed its demonstration flight and before it could return to normal passenger operations, were all developed in consultation with the UK Civil Aviation Authority and EASA (the EU aviation certification body).

Preparations for the demonstration flight required the input of significant resources – in terms of expertise and man hours, as well as financial – on the part of all project partners. Virgin Atlantic, like the rest of the Virgin Group, is built on an ethos of innovating and challenging accepted practice. The biofuel demonstration flight, part of a strategy to move Virgin Atlantic and the rest of the aviation industry towards sustainable and renewable alternatives to traditional jet fuel, represents one potential opportunity for aviation to address its climate change impacts.

2. **What does Virgin Atlantic believe this flight will accomplish toward demonstrating an aviation emissions reduction strategy? Does Virgin Atlantic plan to continue these demonstration flights?**

Virgin Atlantic's primary goal was to demonstrate that it is possible to fly an aircraft using a substantial proportion of biofuel in one engine. This was the first flight ever by a commercial aircraft using a biofuel. It therefore represented a significant milestone towards developing sustainable renewable fuels for the aviation industry. Subsequent biofuel demonstration flights, by airlines such as Continental and Air New Zealand, will add to the shared knowledge base on biofuels.

Whilst we recognise that the exact fuel type used for our demonstration flight (a first generation processing technology using feedstocks which would be difficult to scale up to the production levels needed by the industry) is unlikely to be adopted by the industry in the longer term, it was the best fuel available at the time of the flight – both in terms of its performance in a jet engine and its sustainability criteria. By demonstrating that there is a new potential market for biofuels going forward, Virgin Atlantic hopes to catalyse investment in research and development of sustainable second generation fuels and feedstocks such as algae and jatropha.

Virgin Atlantic believes that truly sustainable biofuels – economically, socially and environmentally – could represent a significant opportunity for emissions reductions for the industry in the medium term. Drop in fuels, which can be gradually introduced without requiring any modifications to the aircraft or fuel distribution infrastructure, will be more easily and quickly adopted by the industry. Although Virgin Atlantic, through membership of groups such as the UK's Sustainable Aviation Strategy[ii], will continue to push for more fuel efficient technologies, it may take many years for these new aircraft and engine types to be integrated into airlines' fleets worldwide. Sustainable biofuels, which could be produced on a regional basis using whatever feedstock is best suited to the local climate and natural resources, would allow airlines all over the world to achieve emissions reductions over a shorter timescale.

It is anticipated that within the next decade the production of second generation biofuels from sustainable feedstocks could make a significant contribution towards aviation's global fuel requirements. And, as crude oil becomes increasingly scarce and jet fuel prices continue to rise, the economic viability of efficiently produced biofuels is more certain. With the additional cost associated with carbon dioxide emissions under the European Union's proposal to include aviation in its Emissions Trading Scheme, the business case for moving towards lower life-cycle carbon biofuels becomes even more attractive.

3. **Does Virgin Atlantic support the European Union's efforts to include aviation under an emissions trading scheme?**

We have long supported the inclusion of aviation in an EU Emissions Trading Scheme. A well-structured global emissions trading scheme, combined with the industry's own target (through investment in new technologies and improved operational efficiencies) of a 50% reduction in CO2 emissions for new aircraft entering into service from 2020 compared with 2000 levels, will enable the aviation industry to meet its environmental responsibilities and maintain a robust overall cap on emissions, whilst allowing the industry to continue to grow. It is our view that the European Commission should maintain its focus initially on establishing an effective intra-EU Emissions Trading Scheme to serve as a model for the rest of the world. In parallel with this, other countries around the world should be encouraged to sign up to a truly global Emissions Trading Scheme.

Virgin Atlantic does have some concerns about the detail within the current proposal from the European Commission, particularly around how flights into and out of the EU would be included in the emissions trading scheme. We believe that including international flights in a regional scheme could have impacts on the scheme's efficiency and effectiveness. It would negatively impact on competition between EU and third country carriers serving the same routes, leading to serious distortion of the aviation market. And the inevitable legal challenges to the Commission's proposal will detract attention from creating an effective intra-EU scheme, and potentially delay its introduction.

Whilst there has already been considerable emphasis in the UK and at EU level in setting aviation on the path towards sustainability, addressing the environmental impact of aviation is not an issue that can be solved unilaterally by the UK, or indeed by the Europe Union. International air travel, by its very nature, transcends national boundaries. It is our view that the best approach is to adopt a fully global ETS, which would more successfully address aviation's impact on climate change. We would hope that the United States would join such a scheme at an early stage.

A global scheme would maximise the aviation industry's incentive to develop more fuel-efficient technologies and viable alternative fuel sources, as well as accelerating take-up of these new technologies in the fast growing aviation industries of the developing world. Furthermore, it would minimise competitive distortion between markets and allow aviation to continue to drive economic development worldwide.

4. **Should aviation be subject to a mandatory emissions cap worldwide?**

International aviation should be dealt with like other carbon intensive industries, under a comprehensive global emissions cap in a post-Kyoto framework. Virgin Atlantic supports a pragmatic approach to emissions reductions; if other sectors can achieve greater emissions reductions more cost effectively than aviation, aviation could (through a market based mechanism such as an international emissions trading scheme) effectively fund those emissions reductions allowing aviation to continue to grow whilst maintaining a robust overall cap on emissions.

5. **What government programmes or assistance would be useful in your efforts to reduce emissions in the air and on the ground?**

It is essential that governments maintain a consistent approach to tackling the environmental impacts of aviation. In the past, the focus for regulatory action has been on reducing noise from aircraft – particularly during the landing and take off cycles. New aircraft are now substantially quieter than previous generations. The Boeing 787 for example is some 60% quieter than the Airbus 340-300s it will replace in our fleet. This focus on noise has, however, been at the expense of some potential reductions in CO2 emissions. Current airframe and engine technology mean that it is impossible to optimise both fuel efficiency and noise reductions concurrently. As an aircraft can be in operation for up to 40 years, it takes some time for new technologies to work their way throughout the global fleet, in addition to the years of development by the manufacturers before the aircraft or engine even enter into service. By maintaining governmental emphasis on improving fuel efficiency and therefore reducing CO2 emissions, the industry will able to focus its efforts on addressing aviation's primary contribution to global climate change.

Climate change policies also need to generate behavioural change by industry if they are to reduce carbon emissions effectively. An international emissions cap and trade scheme is attractive because it motivates behavioural change by companies and would result in real reductions in overall carbon emissions and therefore should be supported by all governments. Taxes or charges, conversely, are blunt instruments that impact negatively on the overall economic competitiveness of the industry, penalising passengers rather than motivating change on the part of airlines.

A co-ordinated global approach by governments to improve efficiencies in air traffic routeings would have a real impact in terms of environmental benefits, and reduce congestion and delays. For example, by flying more direct air traffic control routeings over Europe, the European air industry could achieve emissions reductions of some 12%. We believe that there are further efficiency gains that could be made in other regions around the world, including the USA. For example, we anticipate that Virgin Atlantic alone could save several thousand tonnes of CO2 each year through efficiency gains achievable in the airspace over the Atlantic seaboard of the US, without negatively impacting on airspace capacity.

Governments should also ensure that airports and Air Traffic Control providers are encouraged to provide suitable infrastructure and services that would assist airlines to minimise their emissions output, e.g. by minimising taxiing delays and providing suitable electrical ground power and air conditioning provision to reduce the time that an aircraft engine is in use.

Equally it is important that governments should support airlines that take a proactive approach to reducing their own carbon emissions. By developing policies that support the development of new technological solutions, for example lower carbon sustainable second generation biofuels, governments will help their industries achieve long-term environmental sustainability whilst maintaining the essential social and economic benefits that aviation brings.

[i] Copy of Virgin Atlantic's Environment Policy enclosed. For more information, please see http://www.virginatlantic.com/en/gb/allaboutus/environment/index.jsp

[ii] http://www.sustainableaviation.co.uk/

Written Statement of
The Boeing Company
Submitted for the Record to the
House Select Committee on Energy Independence and Global Warming
Hearing "From the Wright Brothers to the Right Solutions:
Curbing Soaring Aviation Emissions"
April 2, 2008

The Boeing Company takes its environmental responsibilities very seriously and is aggressively working to improve the environmental performance of its products and the environmental footprint of its facilities.

The 787 is just one example. The 787 represents a 20% reduction in fuel use and CO_2 emissions over the airplane it replaces. It also has a 60% smaller noise footprint and emits 28% less NOx.

Another example is the 747-8, which will produce similar improvements in emissions and which will enter service just one year after the 787, now scheduled for first delivery in 2009.

These are hard-won improvements. On the 787, eight percent of the improved fuel efficiency comes from the engine; three percent comes from reduced weight; three percent comes from improved aerodynamic design; and the final six percent comes from overall system improvements. Together these improvements are the result of an aggressive research program that involves Boeing, the engine manufacturers and many Boeing suppliers.

While the improvements in the 787 and the 747-8 are particularly significant steps forward in environmental improvement, they also represent the continuation of a longstanding trend in aviation. Reduced fuel consumption and therefore reduced CO_2 emissions have been primary objectives of aircraft design for decades. As a result, between 1960 and today there has been a 70% improvement in fuel efficiency/CO_2 reduction in jet aircraft. Delivering aircraft with an environmentally progressive performance (using improved manufacturing techniques) has long been a top priority at Boeing.

But it's important to note that aircraft are only one part of the aviation environmental picture. Aircraft operations, next-generation biofuels and other things are equally important.

<u>One Challenge --- Many Solutions</u>

As you may be aware Boeing just completed a biofuel demonstration with Virgin Atlantic about a month ago. We have already announced two additional alternative fuel demonstrations, one with Continental Airlines and one with Air

New Zealand. While aircraft represent a unique challenge in the biofuels world, we believe that sustainable biofuels represent a solid opportunity to reduce emissions from current and future aircraft.

The aviation industry faces many challenges with biofuels. One challenge is to find fuels where the energy content per gallon of the biofuel is similar to current jet fuel. That way the aircraft can still fly the same distance. Another is finding a fuel that remains liquid at the wide ranges of temperatures encountered in flight. These are formidable challenges.

Boeing is fully committed to collaborating with airlines and fuel producers to identify future generations of biofuels that represent an overall lifecycle CO_2 benefit to the environment – and do not create other problems such as competition with food crops or deforestation. Development of these alternatives and the production of commercial quantities may still be many years in the making, but they hold great promise.

Another part of the solution -- and one that governments are uniquely situated to address --- are improvements to the air traffic management system. The CO_2 savings generated by billions of dollars in research on a new aircraft can be offset by air traffic control delays and airplanes circling over airports. The UN IPCC report states that improved air traffic management could net as much as a 12% improvement in efficiency and reduced emissions, but achieving that goal requires governmental actions and cooperation among governments.

Boeing is participating in a number of efforts with governments, airports and airlines. We are involved in a range of "tailored arrival" activities, including required navigational performance and continuous descent approaches that can reduce both CO_2 emissions and improve the noise footprint of airplanes. Trials have indicated that airlines can achieve fuel savings of between 400 and 800 pounds per flight, and reduce CO_2 emissions by 2,400 pounds per flight, using such procedures.

Another factor to consider is the truly international nature of the aviation business. More than 70% of Boeing's annual sales of commercial airplanes are to customers outside the United States. Our customers fly these aircraft all over the world and across many national boundaries. The commercial aircraft business is based on global standards set by the International Civil Aviation Organization. This is an integral part of our design and development process.

Aircraft that meet the global standard today are accepted worldwide. Unlike auto manufacturers that produce millions of units each year, the total production of Boeing and Airbus large commercial aircraft is approximately 1,000 units annually. It would not be feasible to design different versions of each aircraft to meet unique standards around the world as the design of a single new aircraft

represents millions of man-hours of research and testing. International standards must be maintained for large commercial aircraft.

Boeing is committed to continued environmental improvements in its aircraft and in its factories. We also support the efforts of our airline customers to find alternative fuels and further reduce aircraft emissions. And finally, we urge the government to move aggressively to improve air traffic management systems and further reduce both aircraft noise and emissions.

Boeing appreciates the opportunity to present this written statement for the record.

The CHAIRMAN. We welcome the second panel. The second panel will have as a lead-off witness Mr. Jim May, who is the President and CEO of the Air Transport Association. He was named the President and CEO in February of 2003. Prior to joining the ATA, Mr. May served as Executive Vice President for the National Association of Broadcasters. So our paths have been crossing since the beginning of time.

Mr. May's father was also a member of this body, of the United States Congress. It is obviously a place that you are very familiar with and comfortable with and we welcome you back. Whenever you are ready, please begin.

STATEMENT OF JIM MAY, PRESIDENT AND CEO, AIR TRANSPORT ASSOCIATION

Mr. MAY. Thank you, Mr. Chairman; albeit, as you point out, in a somewhat different context. It was my mother, actually, who served from the great State of Washington for a number of years.

The CHAIRMAN. Really. What years were they?

Mr. MAY. 1958 through 1972.

The CHAIRMAN. She was one of the very first Members——

Mr. MAY. One of the early Members and, of course, the great State of Washington has had a great a tradition of women serving in high elected positions. We are all very proud of that.

The CHAIRMAN. I thought it was your father all these years.

When you are ready, please begin.

Mr. MAY. Thank you, Mr. Chairman, and members of the committee. I want to emphasize, first, three points.

First, commercial airlines are extremely greenhouse gas efficient.

Second, we are proactively committed to further limiting greenhouse gas footprints and are actively and aggressively pursuing a comprehensive plan to achieve that outcome.

Third, I think there is a critical role for the Federal Government to play, not for the industry, not against the industry, but rather with it.

Commercial airlines are extremely greenhouse gas efficient. Aviation has a decidedly strong track record that I think is often overlooked or misstated. We contribute just 2 percent of domestic greenhouse gas emissions today compared to 25 percent for the balance of the transportation industry. I think this is no small achievement given that we are essential to the economy, support nearly 9 percent of U.S. employment.

Today's airplanes are not just smarter, they are quieter, cleaner, use less fuel than ever before. And we fly them smarter, as has been talked about today.

U.S. Airlines has been able to deliver more value by constantly improving fuel efficiency through fuel reinvestment in technology and efficient operations. We improved our efficiency over 100 percent between 1978 and 2006, resulting in 2.3 metric tons—2.3 metric billion tons of carbon dioxide savings, which is the equivalent—as the slide shows—of taking 17 million cars off the road in each of those years. While doing that we burned 4 percent less fuel in 2006 than in the year 2000, carried 12 percent more passengers, 20 percent more cargo.

Our greenhouse gas efficiency compares favorably to other sectors and modes. Today our planes are as fuel-efficient, as was testified by the FAA, as compact cars, and, at the same time, we are carrying more goods and people over six times faster. We are highly motivated to continue this trend.

Fuel is our largest cost center, averaging 50 percent of operating expenses, costing us $41.2 billion in 2007 and projected to grow to $55 billion in 2008.

The market is sending the commercial airlines the price signal that some call for in legislation. As demand for air service grows, some growth in aviation is predicted. But that is a good thing. We are key to driving a more environmentally efficient economy, optimizing global value change, and creating greater and social economic opportunities for people.

Let's keep growth in context. The Intergovernmental Panel on Climate Change has determined that under the most likely scenario, carbon dioxide from global aviation in 2050 will grow to about 3 percent of total man-made carbon dioxide emission from the 2 percent it is today.

Now, at the core of our efforts, carriers have made a commitment going forward to improve fuel efficiency by an additional 30 percent by 2025. That is roughly equivalent to taking over 13 million additional cars off the road each year. These improvements will come only from our continuing airlines' investments.

In fact, achieving our goal will require approximately a $730 billion investment between now and 2025, which is a high hurdle under any circumstances, but particularly in these difficult financial times.

Recognizing that today's carbon-based fuel supply can only take us so far, our airlines are also making extensive resource commitments to stimulate the development of commercially viable, environmentally friendly, alternative fuel through CAAFI, which has been talked about earlier.

Congressional leadership, however, is needed, and it is in four areas. First, we would hope that Congress would work to ensure that our outdated traffic control system is modernized to permit more direct routes, saving fuel and emissions. Studies show this will reduce emissions by 10 to 15 percent on top of the 30 percent that we are already projecting for fuel savings.

Next, we urge Congress to reinvigorate NASA and FAA and environmental aeronautics R&D programs. Additional revolutionary advances in engine and airframe technology can only come through the government-led R&D that serves to preserve America's leadership in aeronautics.

Third, we ask Congress to spur further commercial development of alternative and environmentally sensitive jet fuels.

Finally, we urge you to calibrate any climate change-related legislation so it doesn't work against our efforts. To continue our fuel efficiency and other advances, we have got to have the capital to invest. Any of the economic measures that siphon funds out of our industry would severely threaten that process.

Accordingly, while we don't believe a further economic measure such as cap and trade is necessary for aviation, if such a measure were to be applied, it should be carefully calibrated to take key con-

siderations into account. They include allocation of allowances to reflect aviation's fuel efficiency achievements to date, reinvestment of proceeds into aviation—very important—and accounting for the reality that aviation is a global business.

In closing, Mr. Chairman, the airlines have a great environmental track record and are committed to improving on that. Congressional leadership is needed. We are asking you not to work for us, we are asking you to work with us as we address the important environmental and energy concerns that we all have. Thank you.

The CHAIRMAN. Thank you, Mr. May.

[The statement of Mr. May follows:]

ATESTIMONY

The Commercial Airlines' Climate Change Commitment



Statement of James C. May
President and CEO
Air Transport Association of America, Inc.
before the
House Select Committee on Energy Independence
and Global Warming

April 2, 2008

AIR TRANSPORT ASSOCIATION

Thank you, Mr. Chairman. ATA airline members transport more than 90 percent of all U.S. airline passenger and cargo traffic.[1] Our airlines take their role in controlling greenhouse gas emissions very seriously and I appreciate the opportunity to appear before you today to discuss what we are doing to tackle this important issue.

INTRODUCTION AND OVERVIEW

In the broadest policy terms, the task before Congress and this Select Committee is how the nation can achieve reductions in greenhouse gas (GHG) emissions while maintaining its economic stability and enhancing energy independence. Commercial aviation has a vital role to play in this regard.

For generations, flying has contributed to a better quality of life in America. Commercial aviation has been essential to the growth of our economy, yielded breakthrough technologies and brought people together and transported critical cargo – all while achieving an exceptional environmental track record. Today's airplanes are not just smarter – they are quieter, cleaner and use less fuel than ever before – but we also fly them smarter. That's why our industry represents just two percent of all GHG emissions in the United States, while driving three times more economic activity. But we are not stopping there. The initiatives that we are undertaking to further address GHG emissions are designed to responsibly and effectively limit our fuel consumption and GHG contribution while allowing commercial aviation to continue to serve as a key contributor to the U.S. economy. I want to emphasize three points that are essential to moving this effort forward:

First, ***commercial airlines are extremely GHG-efficient.*** For the past several decades, commercial airlines have dramatically improved our GHG efficiency by investing billions in fuel-saving aircraft and engines and innovative technologies like winglets and cutting-edge route optimization software. Fuel is our largest cost center, creating an economic imperative to maintain our record of continuously improving GHG efficiency. And while commercial aviation accounts for only two percent of domestic man-made GHG emissions, we shepherd this to good use, driving a far larger percentage of economic activity, not only directly, but also indirectly, as a necessary element in the airport and tourism sectors and in all business sectors that rely on the rapid delivery of goods and human resources.

Second, ***ATA airlines are proactively committed to further limiting their GHG footprint*** through a set of measures that will simultaneously address climate change and energy independence while preserving economic stability and the opportunity to grow. At the core of these measures is the ATA carriers' commitment to an additional 30 percent fuel efficiency improvement by 2025 – improvement that only comes from the airlines' investment in new aircraft, new aircraft engines, navigation aids and enhanced operational procedures. In addition, we are dedicating ourselves to developing commercially viable, environmentally friendly alternative jet fuel, which could be a game-changer in terms of aviation's GHG output. Moreover, we are central stakeholders in partnering efforts to modernize the outdated air traffic management (ATM) system and to reinvigorate research and development in aviation environmental technology.

[1] ATA airline members include ABX Air, AirTran Airways, Alaska Airlines, Aloha Airlines, American Airlines, ASTAR Air Cargo, Atlas Air, Continental Airlines, Delta Air Lines, Evergreen International Airlines, Federal Express Corporation, Hawaiian Airlines, JetBlue Airways, Midwest Airlines, Northwest Airlines, Southwest Airlines, United Airlines, UPS Airlines and US Airways. Associate members are: Air Canada, Air Jamaica Ltd. and Mexicana.

Third, ***there is a critical role for the federal government to play***, not for the industry and hopefully not against the industry, but, rather, with it. While the ATA airlines' 30 percent fuel efficiency improvement target will be met purely through the airlines' investments and operating initiatives, the other measures in the package require a significant measure of congressional support. For example, although we are working with the Federal Aviation Administration (FAA) on plans to replace the antiquated ATM system – an upgrade that promises to bring 10-15 percent emissions improvement on top of the ATA commitment – congressional approval is needed before significant progress can be made in implementing this system. Further, the commercial airlines cannot stimulate the development of environmentally friendly alternative jet fuel and aircraft environmental technology on our own. Congressional support and funding and other incentives are vital to these research-intensive initiatives.

Just as we ask Congress to continue to work with us, we also urge Congress to calibrate any climate change-related legislation so it does not work against our efforts. To have the resources to continue our fuel efficiency and other advances, we must have the capital to invest in newer aircraft and other emissions-reducing measures. Punitive economic measures that siphon funds out of our industry would severely threaten that capability, as would unilateral efforts that do not take the international nature of aviation into account. A vibrant, competitive and growing aviation sector is a key part of the solution – not an impediment to ensuring a future where a strong economy, freedom from foreign oil and cleaner air are the order of the day.

Commercial Aviation Is Extremely GHG Efficient

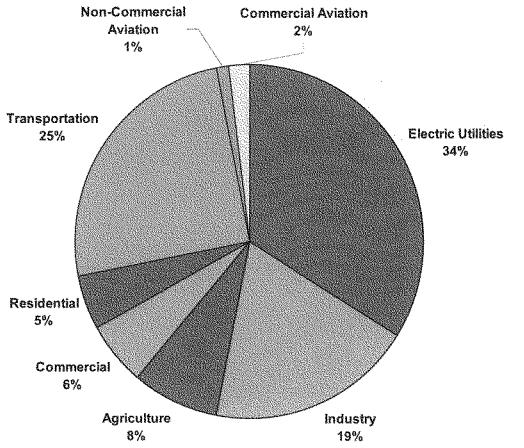
Recently, there have been reports from the press, many coming out of Europe, raising alarm bells about commercial aviation's contribution to climate change. In fact, the very subtitle of this hearing, "Curbing Soaring Aviation Emissions," picks up on such a theme. Let me set the record straight. U.S. commercial aviation contributes about two percent of domestic U.S. GHG emissions.[2] To put that into context, as illustrated in Figure 1, power plants account for over a third of domestic GHG emissions, and road transport accounts for over a fourth.[3] The picture is similar when viewed on a worldwide basis. On a

[2] According to the most recent United States Environmental Protection Agency (EPA) analysis of GHG emissions in the transportation sector, commercial aviation's contribution to the total GHG emissions in 2003 was 1.75 percent. EPA, *Greenhouse Gas Emissions from the U.S. Transportation Sector – 1990 -2003* (March 2006) at pages 5 and 21 ("transportation sources were responsible for about 27 percent of total U.S GHG emissions in 2003," "[a]ircraft produced about 9 percent of U.S. transportation greenhouse gas emissions in 2003," and "[c]ommercial aircraft produced 72 percent of U.S. aircraft GHGs in 2003.") The most recent general inventory of GHG emissions estimates total GHG emissions from "commercial aircraft" to be 158.1 teragrams of carbon dioxide equivalent (Tg CO2 Eq)., or about 2.2 percent of the nation's 7260.4 Tg. Eq., *EPA Inventory of Greenhouse Gas Emissions and Sinks*: 1990-2005, Table A-108 at A-123 and Table ES-2 at p, ES-6 (April 15, 2007). It is not clear what is included in the commercial aircraft category, but it is clear that the category has been expanded to include operations other than those conducted by carriers like ATA members. See note c to Table 3-7 at p. 3-9. EPA's draft 1990 to 2006 inventory further confirms that commercial aviation's share of the total in 2006 was two percent.

[3] EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005.*

global basis, worldwide commercial aviation contributes about three percent of man-made GHGs.[4] To put this into perspective, cattle and other livestock account for approximately 18 percent.[5]

Figure 1 – U.S. Aviation Greenhouse Gas Emissions
Two Percent of the Inventory



At the same time, commercial aviation is critically important to local, national and global economies, enabling a large percentage of U.S. economic output. A March 2006 study by the Campbell-Hill Aviation Group found that "the national economy is highly dependent on commercial aviation, which is directly or indirectly responsible for 5.8 percent of gross output, 5.0 percent of personal earnings and 8.8 percent of national employment."[6] The study further noted that this translated into $380 billion in earnings, 11.4 million jobs and $1.2 trillion in U.S. output in 2004. Placing our economic output side-by-side with our

[4] It is estimated that on a worldwide basis, commercial aviation accounts for approximately three percent of total GHGs, while at the same time contributing over eight percent of the world's economic activity. *See* International Air Transport Association, *Debunking Some Persistent Myths about Air Transport and the Environment.*

[5] United Nations, Livestock Environment and Development Initiative, *Livestock's Long Shadow – Environmental Issues and Options* (2006) at p. 271.

[6] The Campbell-Hill Aviation Group, *Commercial Aviation and the American Economy*, March 2006.

GHG output, it is clear that commercial aviation is an extremely GHG-efficient economic engine, bringing good "bang" for our GHG "buck."

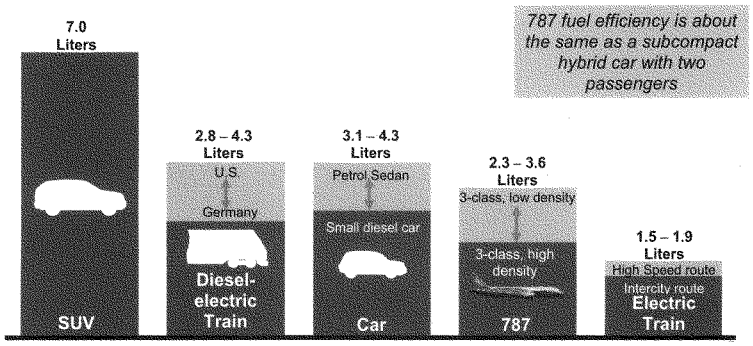
We have been able to deliver such strong economic output while reducing our emissions by continually improving our fuel efficiency through reinvestment in technology and more fuel-efficient operations. In fact, U.S. commercial airlines (passenger and cargo combined) improved their fuel efficiency by 103 percent between 1978 and 2006, which (given the one-to-one relationship between fuel consumption and carbon dioxide (CO_2)) has resulted in 2.3 billion metric tons of CO_2 savings – roughly equivalent to taking 17 million cars off the road each of those years. The improvement in recent years has been particularly dramatic. Bureau of Transportation Statistics data confirm that U.S. carriers burned four percent less fuel in 2006 than they did in 2000, resulting in absolute reductions in GHG emissions, even though they carried 12 percent more passengers and 22 percent more cargo.

Commercial aviation's GHG efficiency compares very favorably to other modes and other sectors. While commercial aviation improved its per-passenger fuel efficiency 4.7 times from 1990 to 2005, freight trucks showed the reverse trend, with GHG emissions growing faster than vehicle miles traveled.[7] EPA also has confirmed that passenger vehicles have lagged far behind aircraft in fuel and GHG efficiency.[8] (*See* Figure 2). Within the aviation sector, it is important to remember that different types of commercial aircraft have vastly different impacts on the environment. Commercial jets are five to six times more fuel efficient than corporate jets. The math is simple: carrying 200 people and cargo across the country in a single plane burns a lot less fuel than 33 separate corporate jets, each flying six people.

[7] EPA, *GHG Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005* at 3-8.

[8] *Id.* at 3-7.

Figure 2 – Among the Most Efficient Modes of Transportation,
But More Than Six Times Faster



- Computed per 100 passenger kilometers, assuming average modal load factors (1.6 passengers for SUV and cars, 38.7% for German diesel train, 70% for low density 787, 90% for high density 787 and 47.6% for electric trains). Load factor not available for U.S. train and based on total system wide energy consumption and passengers carried in 2000.
- CO_2 generated by each transportation mode converted to equivalent liters of diesel for comparative purposes.
- Comparable-basis subcompact hybrid car efficiency is 2.7 liters /100 passenger km.
- Diesel-electric train system predominantly diesel-powered.
- EU electric trains are assumed to have typical electricity generation factors, reflecting a mix of fossil fuels, nuclear and hydroelectric sources.

Copyright © Boeing 2007. All rights reserved.

U.S. airlines are highly motivated to continue this trend. Fuel, long one of the two highest costs for airlines, is now our largest cost center, averaging between 30 to 50 percent of total operating expenses and costing $41.2 billion in 2007. And contrary to popular belief, the airlines cannot pass on significant portions of these costs. Indeed, as illustrated in Figure 3, today's U.S. domestic air fares remain below 2000 levels, although fuel prices have tripled. While a slightly more robust international aviation market has allowed today's systemwide fares to increase approximately three percent above 2000 levels, this hardly makes up for the three-fold increase in fuel prices over the same period. (*See* Figure 4.) Thus, the market already is sending the commercial airlines a "price signal" that some call for in legislation. We have an unrelenting economic imperative to reduce fuel consumption; therefore, an economic win is an environmental win.

Figure 3 – As of Early 2008, Domestic Airfares Remain Below 2000 Levels, While Jet Fuel Prices Have Tripled

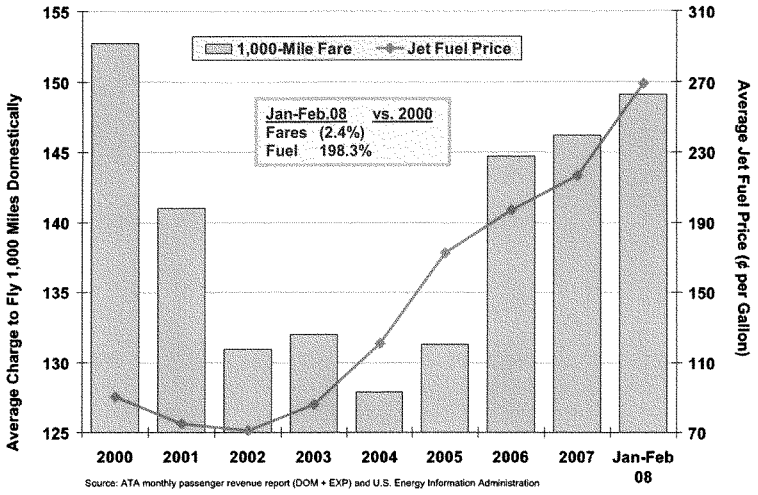
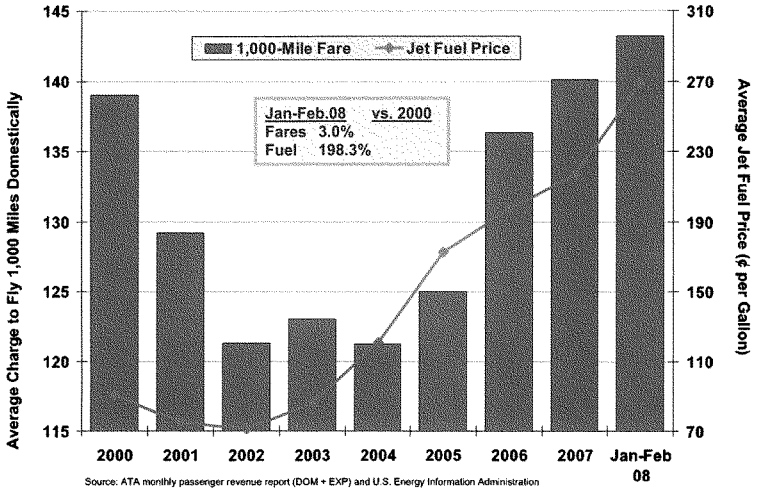


Figure 4 – As of Early 2008, Systemwide Airfares Just Above 2000 Levels, While Jet Fuel Prices Have Tripled

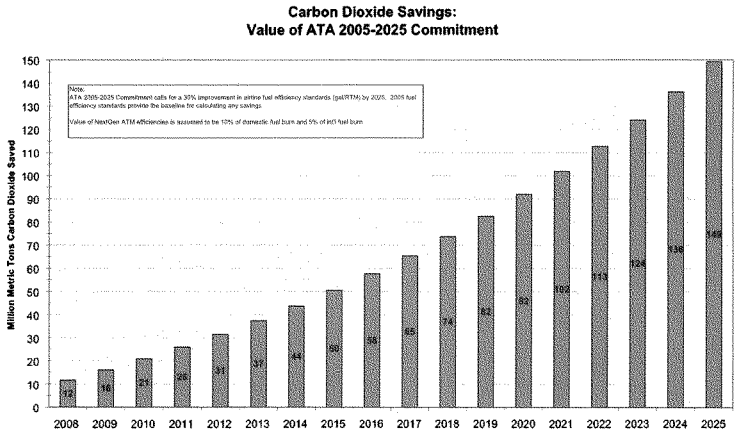


ATA's Airlines Are Proactively Committed to Further Limiting Their GHG Footprint

In the invitation letters for this hearing, the Select Committee noted its concern that the demand for air services going forward will lead to "soaring" GHG emissions. It is true that as demand for air passenger and cargo services grows, some growth in aviation emissions is predicted. However, the Intergovernmental Panel on Climate Change (IPCC), which is considered the authority on this issue, has determined that under the most likely scenario, CO_2 from global aviation in 2050 will account for only about three percent of total man-made CO_2 emissions and that aviation's overall GHG impact will be around five percent.[9] Yet even though those remain relatively small numbers, the ATA carriers are relentlessly pursuing measures to further limit their GHG footprint.

[9] IPCC, *Aviation and the Global Atmosphere* (1999) at 8.

Figure 5 – ATA's 30 Percent Fuel Efficiency Goal Will Translate Into CO_2 Savings



At the core of our efforts, the ATA carriers have made a commitment to achieve an additional 30 percent systemwide fuel efficiency improvement through 2025, on top of prior improvements. That equates to an additional 1.2 billion metric tons of CO_2 saved – roughly equivalent to taking over 13 million cars off the road each year. (*See* Figure 5). To accomplish this, our airlines will continue and step-up the tremendous investments in new equipment and in operational innovations that have allowed us to achieve such great fuel efficiency improvements in the past. We are leaving no stone unturned. Some examples of our efforts include:

- **Upgrading Fleets**. Even in the highly constrained financial environment we now find ourselves in, the ATA airlines are expending billions to upgrade their fleets through investments in new airframes and engines, removing less fuel-efficient aircraft from their fleets, installing winglets to reduce drag, altering fan blades and other measures aimed at improved aerodynamics. As a critical element of our commitment to achieve an additional 30 percent fuel efficiency improvement by 2025, Boeing estimates that the North American carriers will spend approximately $730 billion on new aircraft through 2026.[10]

- **Introduction of Innovative, Cutting-Edge Technologies**. Our airlines also are investing millions of dollars in technologies to make existing airframes more efficient. For example, the airlines have undertaken equipage for Required Navigation Performance (RNP) approach

[10] The Boeing Company (2008).

procedures, which provide navigation capability to fly a more precise path into an airport. The ATA airlines also have developed software to analyze flight paths and weather conditions, allowing aircraft to fly more direct, efficient routes (subject to air traffic approval).

- **Improved In-Flight Operations**. The ATA airlines are doing all they can within the existing ATM system to utilize systems to optimize speed, flight path and altitude, which not only reduces fuel consumption in the air, but avoids wasting fuel waiting for a gate on the ground. In addition to pursuing the use of RNP approach procedures at additional locations, the ATA carriers have worked with FAA to pioneer protocols for continuous descent approaches (CDAs), which reduce both emissions and noise, and we are doggedly pursuing implementation of CDAs where the existing ATM system allows.[11] Further, our carriers are implementing Automatic Dependent Surveillance Broadcast (ADS-B) satellite tracking technology, which avoids the circuitous routings that occur with today's radar-based systems. Demonstrating that the efforts extend to the smallest details of airline operation, our members also have worked on redistribution of weight in the belly of aircraft to improve aerodynamics and have introduced life vests on certain domestic routes, allowing them to overfly water on a more direct route.

- **Improved Ground Operations**. The ATA airlines also are introducing single-engine taxiing when conditions permit, redesigning hubs and schedules to alleviate congestion and converting to electric ground support equipment when feasible. They also are improving ground operations by plugging into electric gate power where available to avoid running auxiliary power units and using tugs to position aircraft where feasible.

- **Reducing Onboard Weight**. The ATA airlines continue to exhaustively review ways, large and small, to remove aircraft weight – removing seat-back phones, excess galley equipment and magazines, introducing lighter seats and beverage carts, stripping primer and paint and a myriad of other detailed measures to improve fuel efficiency.

Second, recognizing that improving fuel efficiency with today's carbon-based fuel supply can only take us so far, ATA and its airlines are making extensive resource commitments to stimulate the development of commercially viable, environmentally friendly alternative fuels. As a framework for doing this, we are a founding and principal member of the Commercial Aviation Alternative Fuels Initiative (CAAFI), a consortium of airline, government, manufacturer, fuel suppliers, airports and other stakeholders who hold the various keys to research, development and responsible implementation of alternative jet fuels. Developing alternative jet fuels is a "higher hurdle" than developing alternative fuels for ground-based units, as jet fuel must meet rigorous FAA specifications, which include reliability and stability at altitude and in greatly varying temperature and pressure conditions to ensure safety. Thus, absent a cooperative initiative like CAAFI, fuel providers almost certainly would not undertake the investments needed to clear this higher hurdle, opting instead for the surer payoff at ground level.

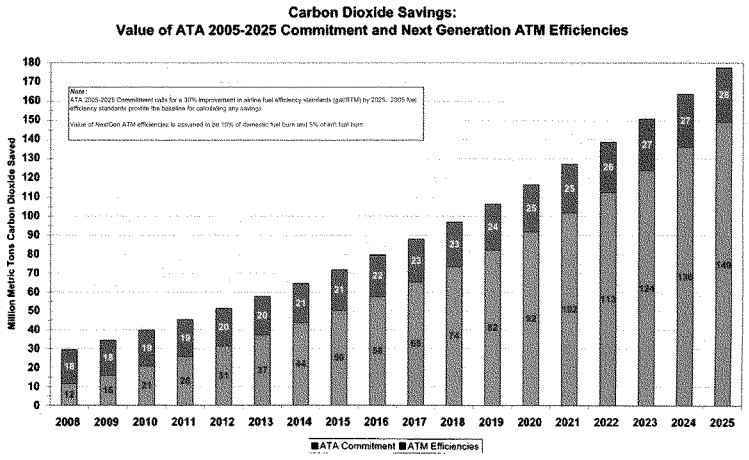
While each entity involved in CAAFI has a role to play, our airlines understand that – as end users of the ultimate product – they must not only make clear their specifications for alternative jet fuels, but also signal the market that we will financially back fuels meeting those specifications. Last week the ATA Board of Directors took another significant step in this regard, issuing the "ATA Alternative Fuels Principles Document." Among other things, that document stipulates that the ATA carriers require that

[11] For example, one of our carriers is achieving an average savings of 1300 pounds of CO_2 savings per flight for approaches into the Atlanta airport.

any future alternative jet fuel be more environmentally friendly, on a life-cycle basis, than the jet fuel available today. Through CAAFI and other partnerships, we are undertaking the work to be sure that tomorrow's alternative jet fuel meets that criterion. And accomplishing that will ensure the full decoupling of growth in aviation demand from growth in GHG emissions.

Third, while the ATA airlines are doing all that they can to promote efficiencies within the current ATM system, the limitations of that system account for between 10-15 percent of unnecessary fuel burn and resulting emissions. To address this, and to achieve much-needed modernization of our outdated ATM system, ATA and its carriers are working with FAA and other agencies on a fundamental redesign of the system through the Next Generation Air Transportation System (NextGen) project and on various regional airspace design initiatives. ATA is supporting this modernization initiative, which is bound up in the FAA reauthorization process that appears to be stalled in Congress, through our "Smart Skies" program.[12] However, congressional approval, including fair and equitable distribution of costs among all system users, is needed before significant progress can be made in implementing this system. Congressional authorization and implementation of this initiative will bring 10-15 percent additional savings on top of the ATA 30 percent commitment. (*See* Figure 6).

Figure 6 – CO_2 Saved Under ATA and NextGen Initiatives
(As if NextGen Implemented in X Year)



[12] "Smart Skies" is a national campaign led by ATA airlines, which advocates modernization of the U.S. ATM system and its funding mechanisms. For more on this initiative, see the Smart Skies Web site, at http://www.smartskies.org

Fourth, at the same time ATA and its members are pushing the envelope with existing technology, we continue to contribute to work that will advance new technology. For example, ATA participates in key, joint government/stakeholder initiatives, including the Steering Committee of the Partnership for AiR Transportation Noise & Emissions Reduction (PARTNER) and the Environment and Energy Subcommittee of FAA's Research Engineering and Development Advisory Committee. While additional evolutionary environmental improvements are in the pipeline as a result of such initiatives, revolutionary environmental breakthroughs can only come about through the reinstatement of significant federal investments in basic aeronautics research and development programs at NASA and FAA. Indeed, Pratt & Whitney's new geared turbofan engine, which offers both noise and emissions benefits, as well as many features of Boeing's more environmentally efficient 787 were spawned through such programs. As we have noted in other contexts, however, congressional funding to these agencies for aeronautics research and development – specifically including for environmental projects – has been cut significantly (by about 50 percent) in the past 8-10 years, compromising the public-private partnership for exploring and bringing to market products with significantly improved environmental performance.[13] Thus, we continue to urge Congress to provide this needed funding.

Congress Has a Positive, Partnering Role to Play

We are confident that the measures ATA is undertaking and supporting will continue to limit and reduce aviation's GHG footprint, such that commercial aviation will remain a very small source of GHGs, even as air traffic grows with the future improvements in the economy. However, Congress has a key role to play. First, as noted, congressional approval for implementation of a modernized ATM system is critical, as is reinstatement of funding for research and development programs to foster aviation environmental technology breakthroughs. Further, while Congress generally is supporting several alternative fuel research programs, specific support and funding should be provided for the development of environmentally friendly alternative jet fuels.

Just as we ask Congress to continue to work with us, we also urge Congress to calibrate any climate change-related legislation so it does not work against our efforts. To have the resources to continue our fuel efficiency and other advances, we must have the capital to invest in newer aircraft and other emissions-reducing measures. Indeed, FAA estimates that 90 percent of the fuel efficiency and emissions improvements that the airlines have achieved come through the airlines' own investments in technology. Punitive economic measures that siphon funds out of our industry would severely threaten our ability to continue that record.

---

[13] While later funding cuts were even more drastic, a 2002 study by the National Academy of Sciences observed:

> In constant year dollars, NASA funding for aeronautics research was cut by about one-third between 1998 and 2000, reducing the breadth of ongoing research and prompting NASA to establish research programs with reduced goals, particularly with regard to TRL (technology readiness level). This significantly reduces the likelihood that the results of NASA research will find their way into the marketplace in a timely manner, if at all. The ultimate consequence is that the federal expenditures are inconsistent with the long-term goal of support for an aviation enterprise compatible with national goals for environmental stewardship.

See National Academy of Sciences, Committee on Aeronautics Research and Technology for Environmental Compatibility, *For Greener Skies: Reducing Environmental Impacts of Aviation*, 44 (2002).

Against this backdrop, we are compelled to share our concerns about the apparent front-runner cap-and-trade legislation in the U.S. Senate, S. 2191, the "Lieberman-Warner Climate Security Act," in the hopes that the House of Representatives will craft its legislation to avoid or minimize those concerns.

First, the Lieberman-Warner bill would, in effect, impose a punitive emissions tax on aviation, which would not only harm the economy but also would be counterproductive. As drafted, the bill proposes to cover the transportation sector – including aviation – indirectly, through a cap-and-trade system "upstream," which would require fuel producers to acquire allowances sufficient to cover the GHG content of the fuel they sell to the transport sector. Fuel producers will incorporate the cost of these allowances into fuel prices, passing the costs on to fuel consumers (including airlines) – in effect, operating as a fuel tax on jet fuel and other transportation fuels. This would have significant economic repercussions on the airline industry and the economy, as every penny increase in the price of a gallon of jet fuel drives an additional $190-200 million in annual fuel costs for U.S. airlines.

It is not difficult to calculate the likely costs of application of the Lieberman-Warner bill to aviation. Unlike most sectors, commercial aviation is required to report all of its fuel consumption to the federal government, which compiles and reports this data. Based on this data, and factoring in FAA forecast information, the annual costs to the commercial airlines of the Lieberman-Warner bill in 2012 would be approximately $5 billion, assuming a $25 emissions allowance price. Using analysts' estimates that emissions allowance prices likely will be in the $40 range by 2020, the annual costs to aviation would escalate to almost $9 billion in that year, and would grow thereafter. These increased costs would diminish the airlines' ability to continue to realize the tremendous fuel efficiency improvements and emissions reductions we have achieved within the industry and, therefore, would be counterproductive. Indeed, it is difficult to imagine how we could handle a GHG-based surcharge on top of the exorbitant fuel prices we are experiencing.

Second, based on our fuel and GHG efficiency records and commitments, application of a cap-and-trade bill to commercial aviation simply is unnecessary. As noted, we already are incentivized by the market to minimize GHGs, without further market-based measures. However, if such a measure is to be applied to aviation, it should be carefully calibrated to take key considerations into account, which the Lieberman-Warner bill currently does not do.

One such mechanism would be to provide the commercial airlines with allowances up front, either directly or as a required pass-through from fuel providers, in recognition of the fuel efficiency achievements we have made to date and the importance of preserving the airlines' ability to continue to invest in new aircraft technology. As drafted, the Lieberman-Warner bill does not do this. In contrast, the bill would accord to several sectors – including to industries that do not come anywhere near our fuel and GHG efficiency record – a tremendous amount of free allowances, purportedly to cushion the economic blow and to allow them to invest in modernizing their equipment and facilities to reduce emissions. In effect, the bill would require our industry to subsidize future efforts of other industries that have done comparatively little to reduce their GHG profiles. The U.S. House of Representatives can avoid the inequity and public policy flaws in this approach in crafting its own legislation.

Another key calibration mechanism would be to take some of the proceeds generated from the auctioning of allowances and reinvest those proceeds into aviation. This could allow for additional funding of programs and technologies that promise to further reduce aviation GHG emissions. With a 10-15 percent GHG savings directly on the line, equipage for NextGen is perhaps the most significant candidate in this regard, but funding for aviation alternative fuel and aircraft environmental technology breakthroughs are also well-deserving candidates. A fundamental flaw of the Lieberman-Warner bill is that while it proposes

to rechannel proceeds from auctions into industries like automobile manufacturing, it does not include any provisions for reinvestment in aviation.

Further, any climate change legislation proposing to cover aviation should be crafted to take into account the international nature of aviation, not only that aviation is a global industry and that U.S. carriers must compete with the airlines of other nations on many routes, but also that the United States by treaty has agreed that the International Civil Aviation Organization (ICAO) has the authority to establish standards and policy for international flights.[14] Arguably, the United States should defer to ICAO for additional measures addressing aviation GHGs. At a minimum, however, we should ensure that any measures taken in the United States are compatible with our international aviation agreements.

As an additional example of the need to carefully calibrate any climate change legislation, it is important to recognize that policies that make flying more expensive can have the effect of pushing more people into their cars. This would result not only in increased GHG emissions from the less fuel-efficient ground transportation sector, but also in more GHG emissions and increased traffic deaths, as the highways are much less safe than the air. Again, the U.S. House of Representatives has the opportunity to factor such concerns into its work on this issue.

CONCLUSION

I close by asking you to note the achievements that commercial airlines have made in reducing fuel burn and GHGs, particularly when compared to other industries, and the actions that we are taking to continue our progress in this regard. While we are fully committed to working with Congress and are asking for congressional leadership and support in each of the areas I have described, we are not asking you to work for us, we're asking you to work with us in addressing this environmental and energy concern. We also are urging you to refrain from adopting policies that would work against our efforts. A vibrant, competitive and growing aviation sector is a key part of the solution – not an impediment to ensuring a future where a strong economy, freedom from foreign oil and cleaner air are the order of the day.

[14] This is pursuant to the Convention on International Civil Aviation, commonly referred to as the "Chicago Convention," to which 190 countries, including the United States, are parties.

The CHAIRMAN. Our next witness is Tom Windmuller. He is the Senior Vice President for the International Air Transport Association. He is a long-time veteran on these issues, and we welcome you before our panel.

STATEMENT OF TOM WINDMULLER, SENIOR VICE PRESIDENT, INTERNATIONAL AIR TRANSPORT

Mr. WINDMULLER. Thank you very much, Mr. Chairman.

We appreciate the opportunity to brief the committee on the steps the aviation industry is taking to reduce its environmental footprint. Let me begin by saying that we support and endorse everything that my colleague Jim May has already said.

Climate change is a big global program. The air transport industry is a small but significant part of that big problem.

The title of today's hearing signaled to me that it is important to put aviation emissions in perspective. The Intergovernmental Panel on Climate Change reports that aviation currently represents 2 percent of global carbon emissions and could reach 3 percent in the next 43 years.

More importantly, the air transport industry has an enviable record of significantly reducing its environmental footprint. Over the last 40 years, we have eliminated black smoke from aircraft engines while reducing noise and increasing fuel efficiency by 75 percent.

Since 1997 alone, IATA members have improved their fuel efficiency by a full 20 percent with a corresponding reduction in CO_2. I am not aware of any other industry with this green a track record.

However, the aviation industry is not resting on its record of success. We have set ourselves a target to improve fuel efficiency by an additional 25 percent by 2020, and we will reach this target by replacing old aircraft and retrofitting the remaining fleet.

I would note, as has already been said, that our American members, also represented here today by my colleague at the Air Transport Association, have set themselves an even tougher target of 30 percent better fuel efficiency by 2025, and their leadership will serve as an example for the rest of the world.

IATA has an aggressive four-pillar strategy in place to achieve carbon neutrality and, ultimately, zero carbon aviation emissions. We are confident that we will reach this greener future that we all strive for by investing in fuel-efficient technology, flying planes more effectively, building and using efficient infrastructure and developing and implementing positive economic incentives.

Some may doubt our ability to reach these goals. However, airlines have an enormous incentive to achieve these targets as quickly as possible.

Today, IATA airlines face a $156 billion fuel bill that represents 32 percent of their operating costs. Our only hope to survive as viable businesses is to increase our fuel efficiency. Greater fuel efficiency means less carbon. It is that simple.

In 2007, IATA worked with airlines and governments around the world to reduce our members' carbon emissions by $10.5 million tons through the implementation of more efficient air routes and flying smarter. We anticipate that the introduction of the Boeing

787 and similar equipment, along with promising work in alternative fuels, will result in significant additional savings going forward. However, we cannot reach our goal of carbon neutrality, let alone zero carbon emissions, alone.

Let me suggest to this committee what it can do and what it should not do to help us reduce and ultimately eliminate these emissions.

First, we need Congress to restore FAA and NASA funding of research into lighter materials, radical new aerodynamics and new algae-based fuels. Perhaps there is also a role here for the national labs.

Secondly, we need the Congress to fund the next generation of air traffic control in the U.S. and insist that the FAA accelerate its implementation.

Thirdly, we need you to pursue positive economic measures such as tax credits for airlines and manufacturers that invest in cleaner technologies.

Most importantly of all, we need this committee to avoid the temptation of imposing a barrier on the industry's achieving these challenging environmental goals that we have set. For example, if the U.S. Government were to pursue an emissions trading scheme that is as flawed as that being considered by the European Union, that would only postpone the day when we reach our ambitious environmental targets.

The European ETS scheme is green in name only. As currently designed, it will act as a carbon tax and reduce the resources airlines have to effectively address this challenge, thereby postponing our progress. It is an illegal unilateral scheme that proposes to address a global problem with a shortsighted, piecemeal approach. It is bad policy that will hinder rather than help us all reach our goal of carbon neutrality and ultimately carbon emissions.

We urge the committee to strongly consider the positive role it can play in advancing our shared goals of a carbon-free future and avoid the temptation of taxes and charges in the name of the environment that will only postpone the day we reach these goals.

We welcome the opportunity to work with this committee, going forward, to ensure that our shared visions become reality. Thank you for your consideration. I would be pleased to take your questions.

[The statement of Mr. Windmuller follows:]

Testimony of Mr. Thomas S. Windmuller
Senior Vice President, International Air Transport Association

"From the Wright Brothers to the Right Solutions: Curbing Soaring Aviation Emissions"
Select Committee on Energy Independence and Global Warming
United States House of Representatives

April 2, 2008

Mr Chairman, Distinguished Members of the Committee.

My name is Thomas Windmuller. I am the Senior Vice President of the International Air Transport Association (IATA), an Association organized under Canadian Law headquartered in Montreal, Canada, and Geneva, Switzerland.

We appreciate the opportunity to brief this Select Committee on the environmental record of the commercial air transport industry and its strategy and vision to reduce its future carbon emissions.

IATA represents two hundred and thirty-five carriers engaged in scheduled international transport of passengers, mail and cargo by air. Our members carry roughly 94% of such traffic. Our mission is to lead, serve and represent this industry. Among other things, we set many of the standards that make international air transport a seamless transport system. All of the U.S. network carriers are members of the Association.

Climate change is a global challenge. The air transport industry is a small but significant part of that challenge.

According to the United Nations Intergovernmental Panel on Climate Change (IPCC), aviation emits two percent of global CO_2 dioxide emissions. That contribution could reach 3% of global emissions by 2050 under a 'business as usual' scenario. Put differently, in 2007, commercial air transport emitted 672 million tons of CO_2, and would grow at less than 3% per annum if the industry were to continue on a normal path.[1] That is, if we take no action, commercial aviation will represent 3% of global CO_2 emissions in 42 years' time. Thus, while any growth in emissions is of concern, the suggestion that aviation emissions are soaring is simply not accurate.

The fact is that IATA and the industry it represents are aggressively addressing the growth of aviation emissions. We are very aware of and take very seriously our environmental responsibilities. We are justifiably proud of our industry's long history of environmental stewardship. Over the last forty years, the air transport industry has virtually eliminated black smoke from aircraft engines. It has

[1] This includes all scheduled and non-scheduled services of airlines in ICAO Contracting States. It does *not* include military and general aviation.

reduced its noise levels by 75%. Most importantly, it has improved its fuel efficiency by 75%, which represents a 70% reduction in CO_2. No other domestic or international industry has such a strong environmental record.

Our commercial interests and our environmental responsibility are perfectly aligned. Our fuel efficiency record has been driven in large part by our industry's continued focus on reducing its costs in order to continue to provide the critical service we offer our customers and the world as a whole. No government program, regulation or tax can serve as a greater incentive to the aviation industry to reduce our CO_2 emissions than the ever-increasing cost of oil. Quite simply, we cannot remain a viable industry without continuing to focus our attention and resources on reducing our fuel burn and, in turn, our CO_2 emissions.

There can be no doubt that this incentive to improve emissions is greater than ever in the history of commercial flight. Over the last 5 years, our fuel bill has increased 340% to $136B worldwide, which is equivalent to the size of the economy of Massachusetts. Every dollar increase in the cost of oil results in $1.6B in increased costs for airlines. Today, there is no alternative to kerosene-based fuels. We know of no other industry facing this type of challenge.

Our commitment to fuel efficiency and cleaner aviation has allowed us to decouple traffic growth from emissions growth. Worldwide, air transport has grown at a rate of approximately 5% over the last 20 years and is forecast to do so in the future. Our emissions are growing well below that rate at less than 3% per annum. At the same time, commercial aviation represents 8% of global Gross Domestic Product. Any effort to limit emissions by capping the growth of air transport will have a negative impact on the global economy.

However good our record is, we cannot afford to rest on past accomplishments. We must continue to find ways to reduce our fuel burn and our CO_2 emissions. We have a clear vision and a solid strategy in place to accomplish this task. In the near term we have committed to improve our fuel efficiency by another 25% by 2020, compared to 2005. This target is challenging, but our track record shows we can reach it. From 1997 to 2006, IATA members' fleets improved their fuel efficiency by 20%. We will reach our new target by replacing old aircraft and by introducing new technology. The tools exist. This 25% improvement is a global target. Our American members, represented here by our colleagues of the Air Transport Association, have set themselves an even tougher target: 30% better fuel efficiency by 2025. Their leadership will serve as an example to the rest of the world.

In the medium term, we strive to reach carbon-neutral growth, i.e. that our anticipated growth does not result in an increase in CO_2 emissions. In the longer term, we have offered vision of a zero-emissions commercial aviation industry. To that end, we aim to operate a zero-emissions aircraft in the next fifty years.

While the tools do not yet exist to reach our long-term vision, we are confident that we can get there. Our industry's track record on innovation is excellent. We moved from the first flight at Kitty Hawk to transatlantic flight in less than thirty years and from the first transatlantic flight to the first supersonic transatlantic flight in another forty years.

There are constraints, of course. Our focus is and needs to remain on the safety of our operations. There are also long timelines for the regulatory approval and implementation of any new technology. Despite these constraints, we believe that our vision is feasible, and we must spare no efforts in reaching this goal.

Our strategy for achieving carbon neutrality and, ultimately, zero CO_2 emissions is based on four pillars.

Our first and most important pillar is technology. We need cleaner and more efficient aircraft. Initial reductions in emissions will be achieved through new airframe and engine technologies. These advancements will come in the form of weight reduction, engine upgrades and better aerodynamics. Zero emissions can only be reached through radically different aircraft that are powered by radically new fuels. We are establishing a technology roadmap with the major airframe and engine manufacturers to make this possible.

Research into new, lighter materials and alternative fuels is essential. There have been two tests of alternative fuels in the first quarter of 2008 by Airbus and by Virgin Atlantic Airways. Air New Zealand is planning a third test for later this year, and Continental Airlines has announced its own test for early 2009. These pioneers are demonstrative of the industry's determination to come up with viable alternatives to kerosene. This is a promising start.

Technology innovation is an area where we need the help of the U.S. Congress. The development of these radically new technologies requires the right economic incentives. This must become a clear political priority. We are not asking for subsidies. We are asking the Congress to restore funding cut from NASA and FAA budgets so that potentially breakthrough research into lighter materials, radical new aerodynamics, and new fuels – such as third generation, algae-based fuels and hydrogen fuel cells – can go forward. This country has the best and brightest scientists. It has outstanding research bodies such as the National Laboratories. The United States is best placed to provide the technology breakthroughs that offer the highest potential for real emissions reductions. We count on your continued leadership to provide these talented people with the resources they need to develop these much needed solutions.

The second pillar of our strategy is infrastructure. We need more, better, and more efficient air traffic infrastructure around the world. Government action is also essential in this area. This Congress can show leadership by funding the Next Generation of Air Traffic Control, or NextGen, and by mandating that the

Federal Aviation Administration accelerate its implementation. Similarly, Europe can deliver on their long promised Single Sky project, which could deliver up to 12 million tons of CO_2 savings annually.

Governmental support is also needed to optimize air routes and to improve the use of airport terminals. In 2007 alone, IATA worked with governments around the world on over three hundred routes and eighty airports, thereby yielding a reduction of nearly four million tons of CO_2.

Our third pillar is operations. Airlines need to fly smarter and greener. IATA has deployed a network of 'green teams' that benchmark airline operations against best practices in the industry in order to save fuel and CO_2. In 2007, we identified efficiency savings of 6.7 million tons of CO_2 from operations and 3.8 million tons from infrastructure improvements. Our intervention yielded a 14% saving in fuel consumption in the case of one major international carrier.

Other measures offer opportunities for further emissions reductions, such as using electrical ground power units instead of on-board auxiliary power units when aircraft are parked at the gate, the use of continuous descent approach techniques into airports, and innovative taxiing procedures.

In the fourth and final pillar, our strategy identifies and seeks positive economic measures to cover any gap between the growth in aviation and the corresponding growth in emission that cannot be eliminated by the first three pillars. We need tax credits for airlines and manufactures that make the necessary investments in cleaner technologies. As already mentioned, we need funding for greater research and incentives for innovation. The U.S. Congress has the opportunity to set a global standard in pursuing these types of positive economic measures.

In contrast, the U.S. Congress must avoid the temptation of imposing negative economic measures in the name of the environment. Green taxes and charges do nothing to address emissions growth. Rather, these increased costs only reduce the opportunity for airlines to increase their fuel efficiency and decrease their CO_2 emissions. While some can gain political points by imposing green taxes on the airline industry, we are not aware of a single example of an environmental improvement being achieved by following this path.

This Committee is on record in support of emissions trading to address the growth in aviation emissions. Some have argued that emission trading is the only means to effectively curb our emissions, short of eliminating flying. IATA believes that a closer review of ETS will demonstrate that it is not the silver bullet that some have made it out to be.

As noted earlier, the aviation industry has made substantial strides in reducing its CO_2 emissions over the past 40 years, and oil prices remain the most powerful

incentive to continue to reduce our fuel burn. We are committed to achieving carbon neutral growth through our four-pillar strategy. By definition, carbon neutral growth makes ETS irrelevant.

If in the end we cannot achieve carbon neutral growth through positive economic measures, new technology and improved infrastructure, a properly designed ETS offers an option for bridging the gap between growth and emissions growth.

Any ETS must have the following characteristics to be this effective tool:

- **Global**: The commercial aviation industry is a global network. Airplanes fly in and out of multiple jurisdictions every hour. The standards used to calculate the emissions and their offsets must be the same for all airplanes everywhere on the planet, lest we create damaging distortions and unnecessary complexity. Regional or piecemeal approaches will not work, by definition.
- **Voluntary**: Under international law, no country may impose an emissions trading scheme on another one unless that country expressly consents. Any national or regional scheme with an extra-territorial side to it is bound to result in endless legal challenges, which will achieve nothing for the environment.
- **Under International Civil Aviation Organization (ICAO) auspices**: The drafters of the Kyoto Protocol recognized that the global nature of aviation (and shipping, for that matter) required special consideration and oversight by the UN body designed to address this type of transborder industry. In aviation's case, ICAO is best placed to come up with the necessary global solutions.
- **Open, easy to administer:** A global emissions trading scheme must also be simple to operate and must avoid unnecessary complexity and administrative costs. Some of the essential requirements are: agreed standards to calculate emissions from aviation and offsetting measures; a clear and globally accepted certification for offsets; and an emissions market open to trade with other economic sectors world-wide.

The European Emissions Trading Scheme does not meet this checklist of essential criteria. IATA has consistently opposed the European ETS because it is unilateral, extraterritorial and designed in a way to punish rather than to reward the aviation industry for its past and future commitment to emissions reductions. If implemented as currently contemplated, we believe it will achieve very little for the environment, while imposing significant costs and complexity on aviation.

The following illustrates why the European ETS is bad policy that should not be pursued by this Committee:

- **Legal foundation**: The European ETS violates the Convention on International Civil Aviation, known as the Chicago Convention, the

international law that has successfully served as the foundation for international civil aviation for the past 60 years. The first article of the Convention establishes the complete and exclusive sovereignty of each signatory over its own airspace. To this end, one country cannot impose taxes or charges on airlines for activities taking place in other countries. Yet, the European ETS, as it stands today, proposes to include charges for CO_2 emitted by flights over foreign territories and over international waters. This clear violation of international law will not withstand even the mildest scrutiny. Suggestions that Europe may exempt non-European operations under certain conditions – be they a 'de minimis' number of flights into the EU or 'equivalent' environmental measures on the other end of the route - have not yet been reflected in the legislation. It is also unclear what standards would be applied in determining whether another jurisdiction was "equivalent" and therefore warrants an exemption.

- **Tax:** One of the new measures being formally discussed in Europe is the obligation to buy permits for current emissions. In other words, you cap emissions, and then ask airlines to buy permits for emissions that happen below, not just above, the cap. Under this proposal, airlines would have to buy permits for all of their *current* emissions by 2020. Under this scenario, this cap and trade proposal becomes, in effect, a tax. Only a fraction of the monies paid to European governments via this tax will go to measures to address aviation emissions. The majority of the monies will compete with the multitude of other worthwhile government and societal needs. This tax will effectively eliminate any discretionary resources airlines have committed to addressing this challenge.

- **Consistency:** Any ETS has to be consistent in scope and application to be successful. It is very difficult to make different regional, national, or local schemes compatible with each other. Even inside the EU there is no agreement yet that the scheme should only apply to CO_2. Some countries would choose to apply their schemes to other gases as well or to apply multiplying factors based on loose science. Would they all count emissions the same way? Would they all accept the same emissions permits in return? The EU proposes to exclude general business aviation from their ETS. Other jurisdictions may consider this flawed public policy, as it is akin to taxing public buses and exempting private cars. All of these disparities are a challenge to the idea that different emissions trading schemes can easily live together. This is a global problem. Aviation is a global industry. The solution needs to be global.

Clearly, only ICAO has the right mandate and is the right forum for setting the global standards that should govern a scheme for our highly mobile and global business. Governments attending the 36th Assembly last September pledged to aggressively address aviation emissions. The ICAO high-level group on International Aviation and Climate Change (GIACC) managing this issue is due

to report to the ICAO Council in 2009. We are demanding that the Governments represented at ICAO step up to the challenge and deliver.

In conclusion, oil prices give the industry a perfect incentive to reduce our fuel burn and CO_2. However, even with this incentive, we need the support of Congress if we are going to reach our aggressive carbon reduction and elimination goals. We need this Committee to pursue positive economic incentives for the entire industry to identify and implement green solutions. The Committee must resist the temptation to impose unnecessary and counterproductive taxes that serve to reduce our opportunity to achieve these self-imposed mandates. We are confident in the path the industry has set for itself in this regard, and we look forward to working in close partnership with this Committee and with the U.S. Congress in general to reach our vision of a carbon free future. We cannot afford to fail.

Thank you.

The CHAIRMAN. Thank you, sir, very much.

Our final witness is Mr. Deron Lovaas. What is the name of the point guard for the Utah Jazz, do you know?

Mr. LOVAAS. Oh, Deron, that is right.

The CHAIRMAN. Same spelling.

Mr. LOVAAS. Very same spelling. You are exactly right. There is more than one of us. I think I am the only Deron.

The CHAIRMAN. So you are the point guy on this.

Mr. LOVAAS. Yes.

The CHAIRMAN. You are the Transportation and Energy Co-Director of the NRDC, the National Resources Defense Council, on these issues. We welcome you, sir, whenever you are ready to begin.

STATEMENT OF DERON LOVAAS, TRANSPORTATION AND ENERGY CO-DIRECTOR, NATURAL RESOURCES DEFENSE COUNCIL

Mr. LOVAAS. Thank you, Mr. Chairman, and members of the committee for giving me the opportunity to testify today.

Just referring back, launching the Apollo program to send a man to the Moon in the 1960s, President Kennedy made it clear that we do that not because it is easy, but because it is hard.

The CHAIRMAN. I wish Mr. Inslee could be here. Mr. Inslee has written a book. I wish he were here.

Mr. LOVAAS. That is right. Well, this is a similar situation with aviation which is central to the new choice which faces of aviation we are going to hew to a new path that cuts heat-trapping pollution, as well as oil dependence, or take a path towards dangerous climate change.

Government can and must step up to a leadership role if aviation is to thrive in a carbon constrained world by taking steps which will boost efficiency and develop cleaner energy alternatives.

Transportation will make up 28 percent of the U.S. energy demand in 2008. Jet fuel will account for 11 percent of that energy demand. However, it will only account for about 3 percent of total energy demand.

As of 2004, it accounted for about 12 percent of total heat-trapping carbon dioxide emissions in the United States, but heat-trapping emissions continued to grow because aviation is one of the fastest growing sectors in the economy, and those emissions are exacerbated by the fact that altitude enhances the climate forcing properties of pollutants in a plane's wake.

As the witness from the FAA stated, the science is still unclear, but it is clear there is an enhancement effect. The size of it, the magnitude of it is in question.

Unfortunately, a big entity, the Air Force, is in pursuit of alternative synthetic liquid fuels, specifically liquid coal. This is like the tale wagging the dog when it comes to fuel since the military uses less than 2 percent of transportation fuel and the Air Force is merely a subset of that.

Liquid coal as a substitute is fundamentally at odds with other national priorities such as fiscal responsibility and climatic stability. According to the Department of Energy, liquid coal produces double the warming emissions compared to conventional gasoline.

Even if CO_2 released by liquid coal plants is captured and stored, the emissions would still be higher from today's crude oil system. Launching this industry is an expensive proposition with each plant costing billions of dollars.

Some in aviation seem keen on other high carbon institutes. United and American Airlines have both gone on the record supporting the expanse of a pipeline system bringing tar sands, derived oil, to the Chicago region where refining of tar sands by ConocoPhillips is directly linked to O'Hare Airport. There is also renewed interest in carbon intensive oil shale development in the west, specifically from the Air Force.

Instead, what we need to do is make much more efficient use of jet fuel by taking these steps. Transition to more fuel efficient airplanes and engines, which includes exciting developments like the Boeing 787, which I know Mr. Inslee mentioned earlier—which uses 20 percent less fuel than comparable aircraft—improved air traffic control can also yield energy and CO_2 savings.

Here I will quote Jim May, who says rightly that studies consistently have shown that modernization of the air traffic control system will improve fuel efficiency and reduce greenhouse gas emission by 10 to 15 percent. But no matter how efficiently used, something needs to fill the tank. We should either stick with conventional fuel for aviation or look for substitutes that are lower, not higher in carbon intensity.

Biofuels show some promise, in partnership with Boeing and GE Aviation, Virgin Atlantic, as they say in their testimony, I imagine, already successfully tested the use a blend of jet fuel and biofuel in a flight from London to Amsterdam. Continental plans something similar in early 2009.

One possible source for aviation is algae, a net absorber of carbon dioxide and a source of energy rich oil that can be turned into fuel. Investments in intercity rail as an alternative—short home mode of transport and should also be part of this strategy. A full high-speed electric train emits between 1/10 and 1/4 of aircraft greenhouse gas emissions. Also the moral, while we save elsewhere in transportation, the lower the need for substitutes for aviation.

Indeed, energy, NRDC projects that new policies enacted, thanks to this Congress in 2007, will save almost 4 million barrels of oil a day nationally by 2030. That is a good start and Congress must go further by taking these steps.

First, do no harm. We need to protect and monitor implementation of section 526 of the 2007 energy bill, a Federal procurement provision that provides much needed backstop to insure the Federal Government does not use its purchasing power to buy fuels that produce more global warming collusion than conventional gasoline.

Second, NRDC has joined five States in the District of Columbia as well as four fellow organizations led by Earth Justice to petition the EPA to regulate emissions of heat-trapping pollution. EPA has regulated emissions from aircraft pursuant to the Clean Air Act, but not those that contribute to global warming.

As the Chairman said earlier to the EPA witness, we believe now is the time for that to change. Although there are improvements that should be made, thirdly, the Lieberman-Warner bill as passed

by the Senate Environment and Public Works Committee is a very strong start toward an economy-wide climate stabilization strategy. The bill includes a low carbon fuel standard, a technology neutral and performance based standard for transportation fuels.

Fourth, again, to quote Jim May, Congress should ensure that our outdated if inefficient air traffic control system is modernized. The solution, as the Energy Security Leadership Council called for in 2006, is for Congress to require the FAA to improve commercial air traffic routing.

Last but not least, we agree with the ATA on the need to reinvigorate NASA and FAA environmental aeronautical research and development programs. For aviation, big breakthroughs in structures in engines as well as low carbon energy substitutes are hard to come by. The Federal Government must help spur leaps forward in technology as it did with the Apollo Space Program.

Thank you so much, Mr. Chairman.

[The statement of Mr. Lovaas follows:]



Testimony of Deron Lovaas
Transportation and Energy Project Co-Director
Natural Resources Defense Council

Hearing to Examine Aviation's Impact on Global Warming

House Select Committee on Energy Independence and Global Warming

April 2, 2008

Thank you for the opportunity to testify today on the subject of aviation and its impact on global warming. My name is Deron Lovaas. I am co-director of the Transportation and Energy Project of the Air and Energy Program at the Natural Resources Defense Council (NRDC). NRDC is a national, nonprofit organization of scientists, lawyers and environmental specialists dedicated to protecting public health and the environment. Founded in 1970, NRDC has more than 1.2 million members and online activists nationwide, served from offices in New York, Washington, Los Angeles and San Francisco, Chicago and Beijing, China.

Launching the Apollo program to send man to the moon in the 1960s, President Kennedy made it clear that America should do it "not because [it is] easy, but because [it is] hard...because that challenge is one that we are willing to accept..." The nation now faces a similar challenge with climate change, and more specifically with aviation.

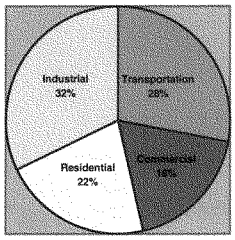
Aviation is central to the choice we face as a nation: Whether we will hew to a path that cuts heat-trapping pollution as well as oil dependence, or a path of less resistance but more carbon dioxide emissions and therefore dangerous climate change. Aviation, while dwarfed in pollution by its counterparts such as cars and trucks, plays an outsized role in the global warming challenge due to the dangerous allure of high-carbon substitute fuels and the difficulty of achieving leaps in efficiency via technology. Government can and must step up into a leadership role if aviation is to thrive in a carbon-constrained world, by taking the steps -- and others as necessary -- that will boost efficiency and develop cleaner alternatives as outlined at the end of my testimony.

www.nrdc.org 1200 New York Avenue, NW, Suite 400
Washington, DC 20005
TEL 202 289-6868 FAX 202 289-1060

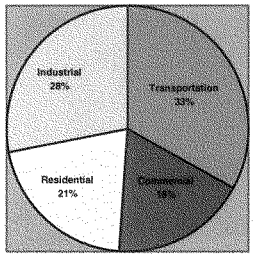
NEW YORK • LOS ANGELES • SAN FRANCISCO

Aviation plays an important role in the U.S. economy, and is also responsible as part of our nation's transportation sector for a growing percentage of our heat-trapping pollution. In fact, according to the Energy Information Administration, transportation will make up 28 percent of U.S. energy demand in 2008. Jet fuel will account for 11 percent of transportation energy demand and just three percent of total U.S. demand.[1] In the U.S. as of 2004 jet fuel accounted for roughly 12 percent of heat-trapping carbon dioxide (CO2) emissions from the transportation sector.[2] The graphs below show the 2008 estimates of energy consumption and CO2 from EIA:

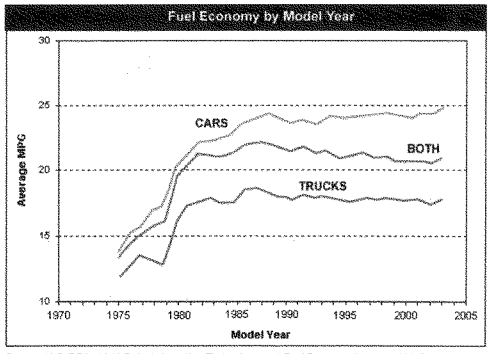
Energy Consumption by Sector



U.S. Carbon Dioxide Emissions by Sector



Reducing carbon emissions from transportation therefore requires a policy focus on our vehicle fleet. The policy which applies, the Corporate Average Fuel Economy program (CAFE), was enacted more than three decades ago to great effect.[3] However, as the graph below shows, light-duty vehicle fuel economy stalled after that initial boost due federal inaction coupled with growing incomes coupled and low petroleum prices. Stalemate in Congress on this important public policy and low oil prices yielded a trumping by other attributes (weight, size, power and accessories) of auto efficiency gains.[4] The net result was that fuel economy for the private vehicle fleet actually declined slightly over time as shown in the graph below.



Source: U.S. EPA, *Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2003*

Thanks to the wisdom of this Congress, which wrote the Energy Independence and Security Act of 2007, this trend line will look different as automakers adjust to a 40 percent increase in the fleetwide average by 2020.

By Contrast: A History of Efficiency Gains for Aviation

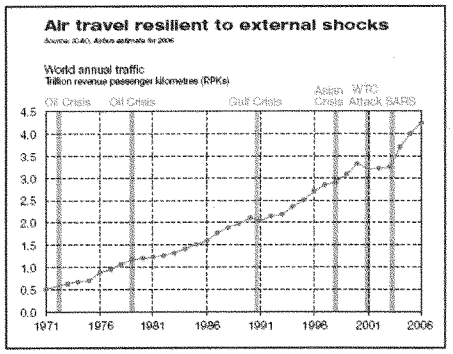
On the other hand, sensitivity to prices – fuel costs have always -- has pressured the industry to increase fuel economy of air travel.[5] Historically it has responded by boosting efficiency by 70% from 40 years ago and 20% from ten years ago, carrying more goods and passengers with less fuel used per mile of travel, in stark contrast with light-duty vehicles where that trend line has been flat since the late 1980s.[6]

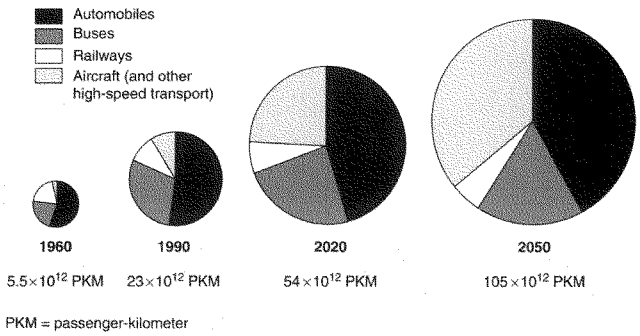
As summed up by the EPA in their new domestic greenhouse gas inventory:

CO2 from the domestic operation of commercial aircraft increased by 2.7 percent (3.7 Tg) from 1990 to 2006, well below the growth in travel activity (passenger miles traveled grew by 69 percent from 1990 to 2005, the most recent year of available data). The operational efficiency of commercial aircraft improved substantially because of a growing percentage of seats occupied per flight and steady improvements in the fuel efficiency of new aircraft. [7]

In the Greenhouse: Rising Travel Demand, Other Factors Outpace Efficiency Gains

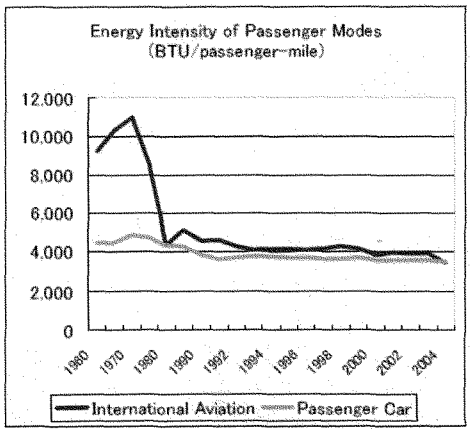
In spite of these trends, heat-trapping emissions continue to grow because aviation is one of the fastest growing sectors of the world economy. Historically, and looking forward, growth in air travel resembles other growth industries – especially compared to other transportation modes – as shown in the graphs below.[8]





A continuation of these trends means that efficiency gains will still be swamped by growth in travel, as projected by the IPCC which found that "projected annual improvements in aircraft fuel efficiency of the order of 1-2%, will be surpassed by annual traffic growth of around 5% each year, leading to an annual increase of CO2 emissions of 3-4% per year."[9] In short, although it is much smaller in absolute terms, greenhouse gas emissions from aviation are projected to increase more than 50 percent faster than surface transportation from now to 2030, growing about three percent per year in spite of efficiency improvements.[10]

And while the energy intensity of this mode of transportation was reduced substantially in the 1970s and early 1980s, that global trend has flatlined since as shown in the graph below from a recent report. [11]It should be noted that the trend line for U.S. airlines has continued its downward slope, but much more gently than the 1970s.[12] Plummeting energy intensity was in part driven by prices, which due to the oil crises of the 1970s, were as much as whopping 65 percent of U.S. airline operating costs and aircraft purchase prices.[13]Due to the remarkable activity in the oil markets in recent years, fuel costs are also high at present, making up 30-50 percent of operating costs.[14]If history is any guide, aided by policy as described below, this should press intensity of this important mode of transportation down further. Unfortunately, prices are a double-edged sword and are spurring interest in high-carbon substitutes as well (again pointing to the need for new policy).



Last but not least, altitude greatly enhances the climate-forcing properties of pollutants emitted from the combustion of jet fuel. In other words, the effect of pollutants generated during the burning of jet fuels at altitude is approximately double the effect on the ground.[15] Contrails – trails of water vapor and other chemicals in the wake of aircraft -- and oxides of nitrogen leading to ozone formation may contribute more than 60 percent of the total effect, according to the IPCC.[16] However, while altitudinal variations in CO2 effects are well-established, with respect to processes such as cirrus cloud formation, the effects of other pollutants in contrails on climate forcing are still being studied.[17]

Wagging the Dog: Aviation Considers High-Carbon Substitutes

Demand aside, compared to surface transportation aviation faces a daunting challenge as military and industry experts consider substitutes for liquid jet fuels derived from conventional oil sources.[18]Gasoline can be displaced by biofuels (specifically ethanol) and/or electricity (in plug-in hybrids), with both technologies providing hope for addressing the intertwined energy security and climate challenges posed by America's oil addiction.[19]

Substitutes for jet fuel, however, must perform under intense physical circumstances: At various altitudes, at various temperatures, and in aircraft engines. And all without unacceptable safety, range (ethanol, for example, has lower energy content and so reduces the range of a plane) and economic trade-offs. These stringent criteria have sparked interest in a hierarchy of three substitute types, as summed up in a recent paper from the International Civil Aviation Organization:

3.2 Of the current options, synthetic liquid fuels manufactured from coal, biomass or natural gas are viable, nearly identical replacements for kerosene, and in fact are in limited use today. The U.S. DoD is embarking on an aggressive program to promote synthetic fuels manufactured from domestic sources and conducted several successful tests with synthetic jet in the summer and fall of 2006. The DoD is working with manufacturers to procure significant quantities of jet fuel made from alternative sources. As military jet fuel is essentially identical to commercial jet fuel, the DoD efforts could stimulate alternative aviation fuel viability for the commercial sector.
3.3 Bio-jet – jet fuels made from agricultural oil crops – are deemed a midterm option but are handicapped by limited production capacity. Ethanol is not a good option for long haul aircraft but may be relevant to regional, short haul and general aviation. However, the interest of Virgin Airlines in renewable fuels may stimulate innovation and accelerate the introduction of these fuels.
3.4 Hydrogen is a very long-term option dependent on technological developments and potentially prohibitive infrastructure investment.[20]

The Department of Defense, specifically the Air Force, is in pursuit of synthetic liquid fuels, specifically derived from coal via the Fischer-Tropsch (FT) process.[21]Most recently, the Air Force actually certified the use of a 50-50 blend of jet fuel and synthetic kerosene for use in the B52H, and next up is the C-17.[22]By 2016, the Air Force's goal is to acquire at least half of its domestic-use fuel from domestic sources.[23]

To get there, the Air Force also proposes to build a coal-to-liquids facility at its Malmstrom base in Montana, an investment of substantial acreage and up to $5 billion.[24]This is likely to be one in a series, and Assistant Secretary William Anderson is clear on the intent: "With the Air Force

paving the way, Anderson said the private sector would follow -- from commercial air fleets to long-haul trucking companies. 'Because of our size, we can move the market along,' he said..."[25]

This is a bold statement. While the military is the biggest single user of fuel in the United States, it still represents less than two percent of the total transportation fuel use, of which the Air Force is a subset.[26]As a report commissioned by the Department of Defense (DoD) itself found, "DoD is not a sufficiently large customer to drive the domestic market for demand and consumption of fossil fuel alternatives, or to drive fuel and transportation technology developments, in general."[27]

The aviation industry's interest in other fuels may not be as aggressive (or blunt) as the Air Force's quest for liquid coal, but it is part and parcel of the trend nonetheless. Currently, jet fuel makes up approximately 10-15% of the refined product from Canada's tar sands derived oil, and the vast majority of this is used by commercial aircraft.[28] The Midwest and Rockies regions are major ones for refining of tar sands and NRDC is aware of specific refineries producing jet fuel. There are direct links between refineries refining tar sands- derived oil and major U.S. airports, from the Conoco Philips Wood River refinery in IL to O'Hare International Airport and to the Lambert-St. Louis International Airport, and from the Suncor Commerce City refinery complex in CO to Denver International Airport.[29] The Flint Hills Resources' Pine Bend refinery in MN is also a major supplier of tar sands-derived jet fuel to the Minneapolis-St. Paul International Airport.

Both United Airlines and American Airlines are on record supporting the expansion of the pipeline system bringing tar sands-derived oil to the Chicago region.[30] While liquid coal has yet to be commercially developed in the U.S., Jet Blue is on record supporting its development.[31]

The Costs and Consequences of Unconventional Fuel Production

Liquid coal is an unsound fiscal and national security strategy because it is fundamentally at odds with other national priorities. According to the Department of Energy, liquid coal produces double the global warming emissions compared to conventional gasoline. Even if the CO2 released by liquid coal plants is captured and stored, the emissions would still be higher than the emissions from today's crude oil system. The coal industry is seeking federal dollars to support the launch of a liquid coal industry in the country and this would clearly move us in the wrong direction. The United States has made considerable progress moving towards a national climate policy. Prior uncertainties about global warming have been resolved for some time now. There is clear public urgency on the issue. If we are to address climate change in a material way, there are some technologies which are simply incompatible and it makes little sense to invest in them now.

In addition to financial risks, liquid coal plants have a wide range of environmental disadvantages. Conventional air emissions from coal-to-liquids plants include sulfur oxides, nitrogen oxides, particulate matter, mercury and other hazardous metals and organics. While it appears that technologies exist to achieve high levels of control for all or most of these pollutants, the operating experience of coal-to-liquids plants in South Africa demonstrates that coal-to-liquids plants are not inherently "clean." If such plants are to operate with minimum emissions of conventional pollutants, performance standards will need to be written—standards that do not exist today in the U.S. as far as we are aware. In addition, the various federal emission cap programs now in force would apply to few, if any, coal-to-liquids plants.[32]

Coal mining - and particularly surface or strip mining - poses one of the most significant threats to terrestrial habitats in the United States. The Appalachian region[33], for example, which produces over 35% of our nation's coal[34], is one of the most biologically diverse forested regions in the

country. But during surface mining activities, trees are clearcut and habitat is fragmented, destroying natural areas that were home to hundreds of unique species of plants and animals. Even where forests are left standing, fragmentation is of significant concern because a decrease in patch size is correlated with a decrease in biodiversity as the ratio of interior habitat to edge habitat decreases. This is of particular concern to certain bird species that require large tracts of interior forest habitat, such as the black-and-white warbler and black-throated blue warbler.

The destruction of forested habitat not only degrades the quality of the natural environment, it also destroys the aesthetic values of the Appalachian region that make it such a popular tourist destination. An estimated one million acres of West Virginia mountains were subject to strip mining and mountaintop removal mining between 1939 and 2005.[35] Many of these mines have yet to be reclaimed so that where there were once forested mountains, there now stand bare mounds of sand and gravel.

The terrestrial impacts of coal mining in the Appalachian region are considerable, but for sheer size they cannot compare to the impacts in the western United States.[36] As of September 30, 2004, 470,000 acres were under federal coal leases or other authorizations to mine.[37] Unlike the East, much of the West– including much of the region's principal coal areas –is arid and predominantly unforested. In the West, as in the East, surface mining activities cause severe environmental damage as huge machines strip, rip apart and scrape aside vegetation, soils, wildlife habitat and drastically reshape existing land forms and the affected area's ecology to reach the subsurface coal. Strip mining results in industrialization of once quiet open space along with displacement of wildlife, increased soil erosion, loss of recreational opportunities, degradation of wilderness values, and destruction of scenic beauty.[38] Reclamation can be problematic both because of climate and soil quality. As in the East, reclamation of surface mined areas does not necessarily restore pre-mining wildlife habitat and may require scarce water resources be used for irrigation.[39] Forty-six western national parks are located within ten miles of an identified coal basin, and these parks could be significantly affected by future surface mining in the region.[40]

To develop another high-polluting alternative to conventional oil, industry is transforming millions of acres of Boreal forests and wetlands in Alberta, Canada to produce transportation fuel. The rush to mine and drill the tar sands is increasing greenhouse gas emissions – producing three times the CO2 per barrel as producing conventional oil -- and turning these pristine areas into a wasteland in order to supply the United States. The Boreal is a significant carbon storehouse and is the breeding ground for 30% of North America's songbirds and 40% of our waterfowl. Tar sands lying deep under the Boreal are composed of sand, silt, clay, water, and about 10-12% bitumen – a tarry substance that can be refined into synthetic crude oil. There are two ways to recover tar sands: open pit mining and drilling. The bitumen must then be upgraded before it can be refined into products such a gasoline, diesel, and jet fuel.

Last but not least, other high-carbon alternatives to conventional oil right here in the U.S. are attracting attention: Despite the huge risks and unknowns, the 109th Congress sought to rush the development of oil shale and tar sands on public lands in Colorado, Wyoming and Utah with the Energy Policy Act of 2005. Because of the arbitrary deadlines imposed by this law, the Bureau of Land Management has already issued a Draft Programmatic Environmental Impact Statement that would determine the fate of over 2 million acres of public land - even though there is not enough information to assess all of the environmental and community impacts that would result. We do, however, know that an enormous complex of coal-fired power plants would likely be needed to produce the energy required to develop these fuels. Producing one million barrels per day would require the energy equivalent of roughly ten giant power plants and five new coal mines. In

addition to air pollutants, producing and using oil shale fuel would create far more greenhouse gas emissions than conventional fuel. It also threatens water supplies and would completely destroy sensitive wildlife habitat.

The Alternatives: Saving Oil Across the Transportation Sector, and Low-Carbon Substitutes

Aviation Technology and Operations

The first and most obvious alternative to high-carbon substitutes is to make the use of jet fuel even more efficient. In spite of slow fleet turnover – cradle-to-grave time from technology development to retirement of aircraft is 45-65 years compared to less than half that for light-duty vehicles – due to rapid growth in the sector there are opportunities to deploy more efficient technology.[41]

For example, in its 2007 Current Market Outlook, Boeing predicts that by 2026 more than 80% of the world airplane fleet will be new and will be 'better for the environment, better for the passengers, better for airlines.' In total, the report notes that meeting increased demand for international air transport will require 28,600 new airplanes at a cost of $2.8 trillion, and that only 20% of today's fleet will remain in use by the year 2026. However, without a unified vision for achieving this goal, it seems unlikely that the majority of these planes will achieve the highest goals of sustainability and efficiency.

To achieve lower costs, airlines will use more fuel-efficient airplanes and implement more efficient operating procedures. As they do so, emissions will be lowered and noise levels decreased. The relationship between airline cost cutting and the environment provides benefits for both.[42]

Most technological improvements have been achieved by reducing weight and improving engine technology. Options for further reducing energy use in aviation include laminar flow technology, carbon fiber reinforced plastic, and blended wing bodies, all of which reduce air drag, and further engine improvements and weight reductions.[43] The blended wing body is an advanced aircraft body design that combines efficient high-lift wings with a wide airfoil-shaped body. This design enables the aircraft body to contribute to lift, thereby improving fuel economy. In the United States, winglets were installed on 737s and 757s to help reduce drag and increase range, an effort which has achieved estimated savings between 100,000 and 140,000 gallons annually per aircraft.[44]

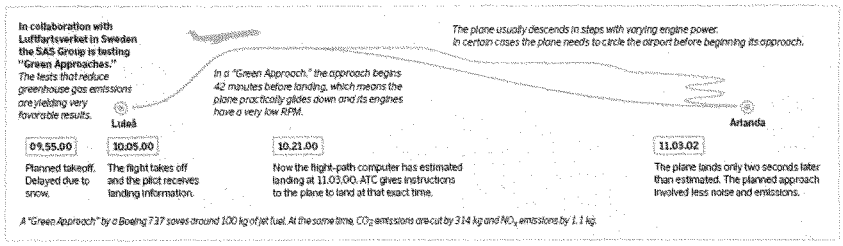
New engine designs offer promise as well. General Electric, for example, has recently announced the GEnx engine which promises a delivery of 15% better fuel consumption and designed to 'stay on wing 30% longer, while using 30% fewer parts.'[45] Pratt & Whitney have been developing geared turbofan technology for nearly 20 years, most recently they have release the two-spool Geared Turbofan to for the Mitsubishi Regional Jet which will enter commercial service in 2013.[46] In 2007, Rolls-Royce was selected by the US Air Force to produce a next-generation engine for military aircraft – the goal of which is to dramatically improve fuel efficiency and performance.[47]

More exciting still are new aircraft designs such as the new Boeing 787 Dreamliner, slated to use 20 percent less fuel. And Easyjet has proposed new planes that could cut carbon emissions by 50% and nitrogen by 75% per revenue passenger kilometers.[48] This next generation aviation model would use lower speeds, weight-reducing materials, and improved fuel efficiency.

Beyond technology, improved Air Traffic Control (ATC) can yield energy and CO2 savings. As Air Transport Association (ATA) CEO Jim May rightly pointed out in Congressional testimony last year: "Studies consistently have shown that modernization of the ATC system will improve fuel efficiency and reduce GHG emissions by 10 to 15 percent."[49]The most important change vis-a-vis aviation efficiency is the shift from a radar system to a satellite system. This transition would require substantive changes at all airports and control facilities in addition to all existing aircraft being fitted with GPS transmitting equipment.[50]

Referred to as ATM_cns (communications, navigation, and surveillance), as May states the potential aviation emissions reductions have been quantified in a variety of research studies. The International Air Transport Association IATA study Operational Measures to Improve Aircraft Fuel Efficiency and Reduce Emissions demonstrates that the accelerated introduction of ATM_cns could achieve a 9% improvement in global fuel efficiency by 2010. The IPCC has calculated that enhancements in air traffic management have the potential to reduce fuel burn by 6-12%, while 'operational improvements' can bring an additional 2-6% fuel saving.[51]

Improving air traffic management technology, infrastructure, and coordination will enable broader and faster adoption of fuel saving operational changes, including more efficient flight routes, continuous descent approach (illustrated below), and better coordinated overall flight patterns. Fuel savings from these efficiencies would also save serious money. Continuous descent, for example, could save $100,000 per year per aircraft.[52]



Source: SAS "Green Approach" Project as described in *Issues Concerning the Reduction of Carbon Dioxide in International Aviation*, Japan International Transport Institute, August 2007.

Low-Carbon Alternatives

In spite of the technical and cost hurdles, the nation should look past liquid coal for substitutes – if necessary, given that greater saving in much larger parts of the transportation sector could yield much bigger oil savings – that are lower in carbon intensity than jet fuel derived from conventional oil.

Biomass to liquids is a preferred option from an emissions standpoint, and it uses the same FT process used to liquefy coal. An additional candidate for alternative aviation fuel is biobutanol, a low-carbon fuel that might meet the needs of the aviation industry as it has higher energy content than ethanol. It is a high performance fuel produced from agricultural feedstock rather than petroleum, the feedstock can include sugar beet, corn, wheat, straw and corn stalks. Since 2003, DuPont and BP have been working together to develop advanced biofuels, biobutanol is the focus of these efforts.

Feedstock such as soybean may require significant area for growth, some estimates citing an area the size of Florida, to provide 15% of jet fuel. Another feedstock is algae, which is both a net absorber of carbon dioxide, and a huge source of energy-rich oil that can be turned into fuel. Aviation experts note that the world's fleet could be run on biomass to liquids using algae as a feedstock with a biojet fuel bioreactor the size of Maryland.[53] Commercial tests and estimates predict that this fuel switch option will not be available for at least a decade. To stimulate this next-generation biofuel, Chevron Corporation and the U.S. Department of Energy's National Renewable Energy Laboratory announced on October 31, 2007, a joint collaborative research and development agreement to study and advance technology to produce jet fuels using algae.[54]

The private sector is pushing the envelope on low-carbon possibilities. Last fall, for example, a 1968 Czechoslovakian jet dubbed "Biojet 1" flew for 37 minutes at altitudes up to 17,000 feet over Nevada on B100 – 100 percent biodiesel derived from canola oil, provided by a private company.[55]Since fighter jet technology differs from commercial craft, more applicable innovations are being tested by a partnership between Boeing, GE Aviation, and two airlines: Virgin Atlantic and Continental.[56]Virgin Atlantic already successfully tested the use of a blend of jet fuel and biofuel in a flight from London to Amsterdam, and Continental plans a similar experiment in early 2009.[57]

While it's becoming clear that "low-carbon" is a relative term for biofuels, depending on how they're processed, the feedstock, as well as direct and indirect land use effects of increased cultivation, these liquid substitutes can still play an important role in meeting transportation fuel demand, including from aviation.[58]

Planes to Trains: A Modal Shift for Short-Haul Goods and People Movement

Although not yet an option for passengers in the U.S., intercity rail transit should be a part of any strategy to reduce carbon heat-trapping emissions from aviation. The International Energy Agency included an alternative to oil and transport in its 2006 World Alternate Policy Scenario by identifying 1400 energy saving policies to reduce energy and greenhouse gas emissions. A projected cut in oil consumption by aviation of seven percent would be achieved in part via a gradual modal shift from aviation to high-speed rail where economically competitive and feasible, initially in Europe.[59] A full high-speed electric train emits anywhere between a tenth and a quarter of aircraft greenhouse gases.[60] International travelers on a return flight between London Heathrow and Paris Charles de Gaulle generate 122 kilograms of CO2, in contrast with 11 kilograms for the same journey by train.[61] And China is certainly investing in rail capacity, introducing a high-speed train service in April 2007 and by the end of the year is expected to increase operations from 140 trains to 257 trains.[62]

Domestically, should the U.S. also decide to enhance rail capacity, recent trends show there is growing potential shift of short-haul air traffic to surface transportation modes, as summed up by Reconnecting America and the Center for Neighborhood Technology in a recent analysis:

Short-haul flights -- those under 500 miles, and particularly those less than 300 miles -- have declined as a percentage of all flights, from 61 to 57 percent. The number of markets served in this category has dropped from 58 to 54 percent. This drop is in part the focus of "Legacy" airlines focusing their recovery [from the recent industry downturn particularly after 9/11] on the longer distance and international flights. Over 20 percent of returned air traffic is for flights less than 200 miles in length, short routes that can be effectively served by bus and rail service.[63]

The Dog Wags the Tail: Saving Oil in Other Sectors

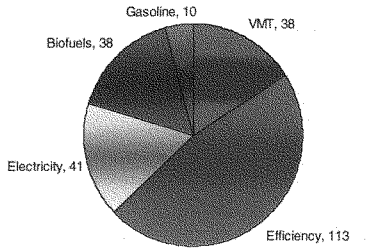
Thankfully, in the Energy Independence and Security Act of 2007, Congress enacted several policies that will have a much bigger effect on our oil consumption. Specifically, the bill includes the first major increase in light-duty vehicle fuel economy standards since the 1970s, a big boost to the renewable fuel standard including more and more reliance on ethanol derived more sustainably from the cellulose of plant matter, and a requirement that the Department of Transportation establish heavy truck fuel economy standards for the first time. NRDC projects that these new policies will save almost four million barrels of oil a day by 2030.

These new policies are a good start, and Congress should go further. The International Energy Agency pointed this out in respect to light-duty vehicle fuel economy in a recent assessment of U.S. policy:

The IEA commends the decision by the US government and Congress to pass the Energy Bill in December 2007, and with it the significant increase in CAFE (the corporate average fuel economy) standards. But it comes after almost two decades of inaction on this front, and the final standards will not be achieved before 2020. Given the technologies being implemented in vehicles today, it is doubtful whether such a long time-frame is really necessary to allow carmakers to adapt and it will leave consumers with vehicles that fall short of the technological possibilities.[64]

The potential to reduce demand for oil is greater in surface transportation, by demand-side reductions achieved via higher vehicle efficiency and reduced car traffic (shifting to alternatives such as rail transit) as well as substitutes such as biofuels and electricity (i.e., plug-in hybrid electric vehicles). In fact, NRDC projects that if we addressed this challenge aggressively we could virtually eliminate gasoline use by 2050 as shown in the scenario below.

Displacing 240 Billion Gallons of Gasoline Demand in 2050



The relevance to aviation, if not obvious, is this: The more oil we save elsewhere in the sector by eliminating gasoline use in the ground transportation sector, the lower the necessity to develop substitutes for aviation. This obviates the need for high-carbon substitutes such as liquid coal.

Putting New Policy in Place

Achieving a low-carbon transportation future will require serious, new public policy and investment. The aviation sector faces huge challenges such as high fuel prices, intense

competition and increased scrutiny for its environmental performance. With this backdrop, there are four policy areas where Congress can act.

First and foremost, aviation must be part of policymaking to reduce global warming pollution. I will point to two recent developments of interest to this Committee:

1) First do no harm: Section 526 of the 2007 Energy Bill (Public Law 110-140, the Energy Independence and Security Act) is a federal procurement law that provides a much needed backstop to ensure the federal government does not use its purchasing power to buy fuels that produce more global warming pollution than conventional gasoline. Now Representatives Hensarling and Conaway have introduced a bill to repeal this law and are circulating a Dear Colleague about it. This provision is of vital importance and ensures that American tax dollars are not used to incentivize fuels that make global warming worse.

2) NRDC has joined the states of California, Connecticut, New Jersey, New Mexico and Pennsylvania, the District of Columbia, as well as fellow organizations Earthjustice, the Center for Biological Diversity, Friends of the Earth and Oceana in petitioning the EPA to regulate emissions of heat-trapping pollution pursuant to the authority in Section 231(a)(2)(A):

The Administrator shall, from time to time, issue proposed emissions standards applicable to the emission of any air pollutant from any class or classes of aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare.

EPA has regulated emissions from aircraft in the past, but not those that contribute to global warming.[65]Now is the time for that to change.

3) In historic committee action on December 5, the Lieberman-Warner Climate Security Act (S. 2191) was approved 11-8 by the United States Senate Environment and Public Works Committee. Although there are additional improvements to the bill that should be made, the Lieberman-Warner bill as passed by the Committee is a very strong start. The bill includes another historic first: A Low Carbon Fuels Standard (LCFS) LCFS is a performance-based, greenhouse gas (GHG) pollution standard (grams of CO_2-eq per BTU sold) on the mix of transportation fuels sold in the U.S. As a technology-neutral and performance-based standard, it provides industry tremendous flexibility to innovate in order to find the most effective, lowest cost solutions.

We urge the House to take similar action on a mandatory carbon cap and fuel performance standard soon. Those two provisions would ensure that aviation, and the nation, hew to a low-carbon trajectory as we tackle our oil addiction. In fact, in testimony before the House Science and Technology Committee, Joseph Romm observes that in its assessment of the McCain-Lieberman Climate Stewardship and Innovation Act, EIA predicts allowance prices of $22.20 per ton of CO2 in 2020 and $47.90 per ton in 2030. Under these moderate prices, none of 15 CTL plants built in the EIA reference case come online. In the reference case, CTL plants consumer 109 million tons of coal in 2030. The market signals sent by any climate policy will undercut the financial viability of liquid coal development.

In addition to these important carbon-constraining policies, Congress should help reduce fuel use and therefore pollution by eliminating inefficiencies in air traffic control and developing breakthroughs in aircraft technology. Specifically, Congress can take two big steps:

1) NRDC agrees with Jim May of the Air Transport Association that "Congress should ensure

that our outdated, inefficient air traffic control [ATC] system is modernized... inefficiencies in the current ATC system are responsible for at least 10 to 15 percent of the GHGs from commercial aviation."[66]The solution, as the Energy Security Leadership Council called for in its 2006 recommendations for reducing oil dependence, is for Congress to require the FAA to improve commercial air traffic routing.[67]

2) NRDC also agrees with ATA on the need to "reinvigorate NASA and FAA environmental aeronautics research and development (R&D) programs."[68]Breakthroughs in technology in this sector are hard to come by, as evidenced by the fact that big improvements in energy efficiency were achieved pre-1970, and until Boeing announced the design of the new 787 use of composites in aircraft structures was nonexistent; they have been 90 percent metallic by weight for 35 years.[69]

The bottom line is that federal policymakers must take bold action which will inspire innovation in the public and private sectors alike. This will in turn spark investment in technologies like those being demonstrated by pioneers including Virgin Atlantic and Boeing. Government can and should help bridge the gap that lies between aviation and a cleaner future, by making an unwavering commitment to pollution reductions and public investment in cutting-edge technological breakthroughs.

---

[1] Energy Information Administration (EIA), Annual Energy Outlook 2008.
[2] EIA, Emissions of Greenhouse Gasses in the U.S. 2005.
[3] Greene, David L., *Why CAFE Worked*, Oak Ridge National Laboratory, November 6, 1997.
[4] Lutsey and Sperling, *Energy Efficiency, Fuel Economy and Policy Implications, Institute for Transportation Studies*, U.C. Davis, Transportation Research Board 2005.
[5] Cost index for all U.S. passenger airlines from 1971 to the present, data collected by U.S. DOT, is available at the ATA web site at www.airlines.org/economics/finance/Cost+Index.htm
[6] According to IATA
[7] Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2006 (February 2008), EPA.
[8] Airbus Global Market Forecast: The Future of Flying 2006-2025; Schafer A., Victor D. 2000, "The future mobility of the world population," Transp. Res. A 34(3): 171-205.
[9] Kahn Ribeiro, S., S. Kobayashi, M. Beuthe, J. Gasca, D. Greene, D. S. Lee, Y. Muromachi, P. J. Newton, S. Plotkin, D. Sperling, R. Wit, P. J. Zhou, 2007: Transport and its infrastructure. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
[10] Joyce E. Penner, David H. Lister, David J. Griggs, David J. Dokken and Mack McFarland (eds), Aviation and the Global Atmosphere. NY: Intergovernmental Panel on Climate Change, 1999.
[11] Felbinger, Claire L., et al., *Issues Concerning the Reduction of Carbon Dioxide in International Aviation*, Japan International Transport Institute August 2007.
[12] Lee, Joosung J., Stephen P. Lukachko, Ian A. Waitz, Andreas Schafer, Historical and Future Trends in Aircraft Performance, Cost and Emissions, Annual Review of Energy and the Environment, Vol. 26:167-200, 2001.
[13] Lee, Joosung J., et al.
[14] According to the Air Transport Association,
[15] Lee, Joosung J., et al.
[16] Penner, Joyce E., et al.
[17] For example, see Williams and Noland's Comparing the CO2 emissions and contrail formation from short and long haul air traffic routes from London Heathrow, Transportation Research Board 2006.
[18] Unconventional oil is defined by the Encyclopedia of Energy (Cleveland, Cutler J. and Christopher Morris, Elsevier Press 2006) as "oil that cannot be economically extracted by traditional methods such as well drilling; e.g., oil obtained from tar sands or oil shale, or from the conversion of natural gas to liquids or from biofuels."
[19] For more information see http://beyondoil.nrdc.org

[20] "The Potential Use of Alternative Fuels for Aviation," Information Paper from the International Civil Aviation Organization 1/24/07.
[21] As defined by the Encyclopedia of Energy, it is a "process used to convert natural gas or coal to liquid fuels that can be used in conventional vehicles. These processes primarily produce fuel suitable for use in compression ignition (diesel) engines. Such a process can used to convert biomass into fuel or to utilize associated gas at oil fields."
[22] Aviation Week & Space Technology, 8/13/07.
[23] Epstein, Curt, "Military expands testing of synthetic aviation fuels," AINonline, February 1, 2008.
[24] Brown, Matthew, "Air Force prod aids coal-to-fuel plans," Associated Press, March 22, 2008.
[25] Ibid.
[26] Dimotakis, Paul, et al. Reducing DoD Fossil-Fuel Dependence, JSR-06-135, JASON, The MITRE Corporation, McLean, Virginia, September 2006.
[27] Ibid.
[28] Based on EIA data, only a small proportion of jet fuel produced in Illinois is for military use. For example, in June 2007 the jet fuel production in Illinois, Indiana and Kentucky was 4, 037 barrels. Of this, 98.5 percent was produced for military use.
[29] Suncor supplies about a third of Colorado's gasoline and diesel fuel, and is a major supplier of jet fuel to the Denver International Airport, Suncor Energy, Inc., *About Suncor U.S.A. A Summary of Suncor Energy (U.S.A.), Inc.'s operations and strategies*, February 2006.
[30] Re: ICC Docket No. 06-0470. Letter of Support in Enbridge Energy Partners, L.P., and Enbridge Energy, Limited Partnership Application for Certificate in Good Standing, Frederic P. Brace, United Airlines VP and CFO, Enbridge Exhibit 1g, August 3, 2006.
[31] Re: ICC Docket No. 06-0470. Letter of Support in Enbridge Energy Partners, L.P., and Enbridge Energy, Limited Partnership Application for Certificate in Good Standing, John P. Rau, Managing Director, Fuels Management, United Airlines, Enbridge Ex. 1, Attachment J, August 22, 2006.
[32] The sulfur and nitrogen caps in EPA's "Clean Air Interstate Rule" ("CAIR") may cover emissions from coal-to-liquids plants built in the eastern states covered by the rule but would not apply to plants built in the western states. Neither the national "acid rain" caps nor EPA's mercury rule would apply to coal-to-liquids plants.
[33] Alabama, Georgia, Eastern Kentucky, Maryland, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.
[34] Energy Information Administration. Annual Coal Report. 2004.
[35] Julian Martin, West Virginia Highlands Conservancy, Personal Communication, February 2, 2006.
[36] Alaska, Arizona, Colorado, Montana, New Mexico, North Dakota, Utah, Washington, and Wyoming.
[37] Bureau of Land Management, Public Land Statistics 2004, Table 3-18
[38] See, e.g., U.S. Department of the Interior, Bureau of Land Management, 1985 Federal Coal Management Program/Final Environmental Impact Statement, pp. 210-211, 230-231, 241-242, 282 (water quality and quantity),, 241, 251, 257
[39] Bureau of Land Management. 3809 Surface Management Regulations, Draft Environmental Impact Statement. 1999
[40] National Park Service, DOI. "Coal Development Overview". 2003.
[41] Intergovernmental Panel on Climate Change. Aviation and the Global Atmosphere. Last viewed March 28, 2008 at: http://www.grida.no/climate/ipcc/aviation/092.htm#723
[42] 2007 Boeing Current Market Outlook, p.15.
[43] InterAcademy Council, "Energy Demand and Efficiency." P. 47.
[44] Business Week, "Making Every Gallon Count," May 6, 2006.
[45] GE Aviation, November 2, 2007. http://www.geae.com/engines/commercial/genx/
[46] Kjelgaad, Chris. "Japanese Airliner to Introduce PW's New Engine Technology." *Aviation*. October 9, 2007.
[47] "Rolls-Royce Selected for Advanced Technology Research Programme for US Military." August 11, 2007. http://www.rolls-royce.com/media/showPR.jsp?PR_ID=40529
[48] MSNBC, "EcoJet' Proposed to Halve Carbon Emissions." June 14, 2007.
[49] Statement of James C. May, President and CEO, ATA, before the House Transportation and Infrastructure Committee, May 16, 2007.

[50] Interview with Bruce Mahone, SAE Director of Washington Operations, Aerospace, October 29, 2007
[51] Air Transport Action Group. October 1, 2007.
http://www.atag.org/content/showissue.asp?level1=3&level2=474&folderid=474&pageid=1025
[52] The Economist, "Time to Land." June 14, 2007
[53] Gonzalez, Angel. "To Go Green in Jet Fuel, Boeing Looks at Algae." *The Seattle Times*. August 30, 2007. http://seattletimes.nwsource.com/html/boeingaerospace/2003858756_boeingenergy30.html
[54] "Chevron and National Renewable Energy Laboratory to Collaborate on Research to Produce Transportation Fuels Using Algae." October 31, 2007.
http://www.chevron.com/news/press/release/?id=2007-10-31
[55] Biello, David, "Biodiesel Takes to the Sky," *Scientific American*, November 30, 2007.
[56] Continental, Boeing, "GE to Partner on Biofuel Flight," Environmental Leader, March 15, 2008.
[57] Ibid.
[58] For more on the travails and advantages of biofuels as a low-carbon substitute, see my colleague Nathanael Greene's excellent blog at http://switchboard.nrdc.org/blogs/ngreene/
[59] International Energy Agency, *World Energy Outlook 2006*. p. 167.
[60] The Economist, "A High-Speed Revolution: European Railways form an Alliance to Promote Swifter International Travel." July 5, 2007.
[61]Eurostar, "Flights Generate Ten Times More Emissions than Eurostar." October 6, 2007.
http://www.eurostar.com/UK/uk/leisure/about_eurostar/press_release/press_archive_2006/02_10_06_environment.jsp
[62]Railway Gazette International, "China's High Speed Fleet Expands Steadily," August 1, 2007.
http://www.railwaygazette.com/news_view/article/2007/08/7738/chinas_high_speed_fleet_expands_steadily.html
[63] Reconnecting America, Center for Neighborhood Technology, *Missed Connections III: Executive Summary*, September 2005.
[64] IEA, Energy Policies of IEA Countries, The United States: 2007 Review
[65] See, for example, EPA Final Rule for Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures, 70 Fed. Red. 69,664, 69,666 (Nov. 17, 2005) (establishing new emission standards for oxides of nitrogen ("NOx") and discussing history of EPA's regulation of aircraft engine emissions).
[66] Statement of James C. May, President and CEO, ATA, before the House Transportation and Infrastructure Committee, May 16, 2007.
[67] Energy Security Leadership Council, *Recommendations to the Nation on Reducing U.S. Oil Dependence*.
[68] Jim May testimony.
[69] Lee, Joosung J., et al.

The CHAIRMAN. Thank you. Let me recognize the gentleman from Missouri for a round of questions.

Mr. CLEAVER. Thank you, Mr. Chairman. During the panel prior to your presence here, there was mentioned the fact that perhaps biofuels would be dangerous to airliners. Do any of you have any notion at some point that our technology would reach the point where biofuels could be used in aircraft?

Mr. MAY. Mr. Cleaver, I think we have had some experiments that have taken place already that show that biofuels have some very real promise. What we all need to be concerned about is the safety issue, in particular the exacting specifications required for aviation fuel that are driven in no small part by the realities of altitude and the realities of temperature.

So we are, through CAAFI, as others are, very committed to trying to find as many reasonable alternatives as possible to include biofuels but with the understanding and the recognition that we all have to be very sensitive to the exact specifications.

We recently, our board, adopted a set of specifications that we think are going to be important. We are very, very committed because, in addition to the fuel savings of traditional fuels, in addition to the savings for air traffic control and fuel, our alternative fuels become critical.

To buttress a point that my colleague said a minute ago from NRDC, we want to make sure they are net positive from an environmental standpoint.

Mr. CLEAVER. Yes. I think we do this as well. That is encouraging.

Now, Airbus and Boeing are manufacturing two passenger airplanes that are much lighter and much more costly. I am wondering how much longer do you think it would take to change our inventory to the lighter aircraft using far less fossil fuel?

Mr. MAY. I know Tom will have some comments on this as well, but between, I think—I will reserve judgment on the exact year, but over the last 4 or 5 years, we have spent an additional $33 billion on fuel. It is our number one cost center. That equates to roughly 330 aircraft.

So it is a function of the financing of this industry, and it leads me to the point that is central to my testimony, which is we want to be as green as anybody else in this world. We think we are doing a terrific job of doing that. We need to make sure that the legislative and regulatory environment permits us to continue to invest the multibillions of dollars in new aircraft, new avionics for use in the next generation air traffic control system, which I hope will be the now generation, not next generation, ATC, and development of fuels, et cetera. So it is a very expensive proposition.

Mr. WINDMULLER. I agree entirely with that. If I can put a slightly different spin on it, over the last 3 years, the airline community has ordered 6,000 new airplanes. Today there are about 19,000 commercial aircraft in operation, so about 30 percent of that 19,000 has been ordered new in the last 3 years. The production lines for some of these new models such as the A380, the Boeing 787 are sold out for the next several years.

As Jim said, our members have every incentive they need to be as fuel efficient as they possibly can be.

Mr. CLEAVER. Let me just say, Mr. Chairman, before I relinquish my time, it is refreshing to have you here before this committee. I went home somewhat depressed yesterday after having the oil executives here. They also talked about green but they talked about greening their pockets. So it is infinitely more refreshing to have you.

Thank you, Mr. Chairman, I yield back the balance of my time.

Mr. MAY. Mr. Chairman, may I comment on that last statement?

The CHAIRMAN. Yes, please.

Mr. MAY. I would note that Lieberman-Warner will cost this industry somewhere between $85 and $100 billion between now and 2025 because we would be of necessity forced to buy permits for our activities. The money goes, interestingly, to the oil companies under the current construct of that legislation. So I think it is somewhat ironic that we have got this hearing juxtaposed with the one you held yesterday.

The CHAIRMAN. I will talk to our committee about that. Thank you.

The gentlelady from South Dakota, Ms. Herseth Sandlin.

Ms. HERSETH SANDLIN. Thank you, Mr. Chairman, and thank you to the witnesses and the very insightful written statements you have submitted and for your testimony today. I must say, Mr. May, you have made some very commendable recent hiring decisions.

Mr. MAY. Thank you so much, and I apologize for that.

Ms. HERSETH SANDLIN. Mr. Cleaver pursued some of the area I wanted to go in the direction of jet biofuels.

But given how you described the investments that you want to make in the upcoming years and in addition to what you have already made, and I appreciate the comment you just made as to the economic impact of Lieberman-Warner and being in agreement on the out goals and what we can do between now and then economically within different sectors of the economy, but it is an expensive proposition, so are you aware of any support, financial or otherwise, that foreign governments or agencies are providing to non-U.S. airlines or to U.S. airlines with the goal of developing alternative jet fuels, including biofuels?

Mr. MAY. Tom, you may have an answer to that. I am not aware of foreign governments that are engaged in it, but you may.

Mr. WINDMULLER. The European Union has committed approximately 1 billion Euros to this type of research. But, frankly speaking, that amount of money is a drop in the ocean of what will be needed to accelerate the implementation of third generation biofuels that can actually have a real impact on the carbon footprint of this industry.

Ms. HERSETH SANDLIN. Which may go to the issue of the Air Force looking at some of the synthetic fuels that are more cost-effective right now. I have spoken with General Mosely about this, Mr. Lovaas, and we know there have been test flights using synthetic fuels or coal-to-liquid.

I would agree we want a net positive impact, and from an environmental perspective, my sense is the DOD is pursuing this because while you cited some percentages, for the DOD their largest line item in the Air Force budget is their fuel, from what I have been told, as it relates to their operating costs.

So I think we need to address this, sort of what are the short-term strategies for certain agencies versus the mid-range and the long term which was actually one of the reasonable things that we heard yesterday in yesterday's hearings in terms of the strategies that we have to pursue.

But I would just make note as a response to saying that the investment so far has been so minimal that we have to look at, again, mid-range and broad range, long range what we are going to be able to accomplish in making government investment in addition to what the private sector is doing.

The CHAIRMAN. Thank you. I think there are about 3 minutes left to go with the roll calls on the House floor.

I do have a number of questions for the panel that I am going to submit to you in writing. I would ask for your timely written response to these questions, but as a logistical reality right now, we will be out of session here for about half an hour anyway.

I just think probably out of courtesy to all of you rather than waiting through the afternoon it probably be better if we adjourned the hearing at this point in time. So with thanks of the committee, this hearing is adjourned.

[Whereupon, at 3:15 p.m., the committee was adjourned.]

5/23/08

Responses from Daniel K. Elwell, FAA Assistant Administrator, Office of Policy, Panning and Environment, to Questions for the Record following the April 2, 2008 Hearing on Aviation Emissions before the Select Committee on Energy Independence and Global Warming

1) We hear a lot of talk about how great Europe is in dealing with all manner of issues. Could you tell us as we compare aviation systems – ours to what is found in the EU – what is the difference of scale?

Response: The United States has the largest aviation system in the world. It remains more domestically oriented than the European Union. For example, domestic route passenger kilometers (RPKs) in 2006 in the U.S. exceeded intra-European RPKs by about 65%. In addition, our general aviation activity dwarfs Europe's. The United States has 18 of the busiest 25 airports in the world in terms of operations, compared to the European Union which has 5. The other significant difference is in terms of our air traffic system. The FAA is the only air navigation service provider in the U.S., with one operating system and 21 enroute facilities. Europe has 47 air traffic organizations (civilian and military), 22 operating systems, and 58 enroute facilities.

2) If the fastest way to reduce emissions is reducing the amount of fuel used, and airlines want to reduce the amount of fuel used to save money – we are already solving this problem through the marketplace, aren't we?

Response: The market is helping drive significant reductions in emissions. Fuel now accounts for up to a third of U.S. airline operating costs, and the high price of fuel continues to induce tremendous efforts to reduce fuel burn. The Air Transport Association (ATA) reports that U.S. carriers spent $16 billion on fuel in 2000 and estimate they will spend $60 billion in 2008 while buying less fuel. In contrast to automobile operators, the cost of fuel goes directly to an airline's survivability. Commercial aircraft purchase decisions are focused on safety, fuel efficiency and passenger comfort. Fuel is by far the single highest direct operating cost, so fuel economy is a major consideration.

For this reason, commercial jet aircraft fuel efficiency has greatly improved over the past 40 years without any technology forcing CO2 standards or regulation of fuel use. This was and continues to be driven by the importance to the airlines of reducing operating costs and the development of energy efficient innovations by the aircraft and engine manufacturers in response to their airline customer needs.

3) How does the efficiency of the air traffic control system affect the airlines' ability to cut down on emissions? Should we look at upgrading the system as a key component in improving aviation emissions?

Response: Air traffic management plays a significant role in the overall efficiency of air travel in the United States. Improvements in procedures and new air navigation capabilities through the Next Generation Air Transportation System (NextGen) are key ingredients to FAA's approach to reduce aviation emissions. NextGen will reduce traffic congestion, provide for more direct routings and fuel efficient operations, and make reduced noise and emissions arrival procedures the norm. When fully implemented in 2025, NextGen capabilities could provide 10-12% improvement in system efficiency.

4) Is it fair to say that the nature of airline travel requires that you not consider regulation in a vacuum – for example, that you can't look at greenhouse gas emissions without considering safety concerns, or fuel efficiency, or the air traffic control system?

Response: We are dealing with a complex system in which a positive step in one area may have a negative impact in another. As Congress itself recognized in the Clean Air Act, any emission standard for aviation, must consider potential impacts on both safety and noise.

Any solution to greenhouse gas emissions will bring multiple issues into play. These include aircraft performance, air navigation system capabilities, system capacity, and how these factors change across borders. In addition to safety and efficiency issues, interdependencies exist among different greenhouse gases. For example, a reduction CO2 could cause an increase in

NOx, or aircraft noise. For this reason, FAA is funding a number of endeavors to improve our scientific understanding and analytical models. We have launched research efforts under the Aviation Climate Change Research Initiative (ACCRI) to better understand the impact relationship among different greenhouse gases both on the ground and at altitude. We have been working on a number of NextGen modeling and analytical tools that will help us understand the interdependencies of different gases and their impacts at both the aircraft and system level. We are also responsible for the cost/benefit analysis of any proposed policy solution.

5) If the European Union were to incorporate aviation emissions into their ETS, how would U.S. carriers of international flights to and from the EU be affected? Would those corporations be responsible for purchasing offsets for the emissions and what would the total cost of that purchase be? Would these rules impact all international flights originating and landing in a European Union country?

Response: The current EU legislation has not been finalized. However, as proposed, the EU would expect U.S. carriers to offset emissions based on their consumption of fuel for any flight to or from the EU. This would include emissions in U.S. airspace and over international waters. It is difficult to estimate the full costs of the legislation at this point because different versions have different baselines and emission credit assumptions (baseline assumptions range from 75% to100% of 2004-2006 emissions, and auctioning ranges from as much as 25% to as little as 3%). Another critical issue is how "open" the system is (whether credits from other systems can be purchased). All this would translate into financial resources flowing out of the U.S. airline sector to EU governments to use for a variety of purposes. These proposed rules will impact all international flights that depart from or arrive in a European Union country.

6) What do you think is driving the EU to push to include aviation in their trading system if the US is declining in aviation emissions but the EU is increasing?

Response: Climate change in general is a very visible political issue within the EU. Rapid growth in intra-European air travel itself – fueled primarily by the advent of low-cost carriers – is a major predicate for the EU's actions. The EU has also had difficulty reforming its air traffic

system, and has long held a preference for regulatory action over market corrections. The EU has also complained that ICAO has not moved fast enough. Putting international aviation into emissions trading appears to have become an end in itself. The EU's legislation is less about results and more about political expediency.

7) The United States is not the only country to balk at airlines being included in the EU trading system is it? What other countries are currently opposed to forced participation in the EU ETS?

Response: At the ICAO Assembly in September2007, the issue of emissions trading guidance and how to include a foreign airline in another State's emissions trading system dominated the discussions. In the resolution adopted at the Assembly, all ICAO countries except European States agreed that international airlines should only be included in another State's emissions trading system based on mutual agreement between governments. The ICAO Assembly also created the Group on International Aviation and Climate Change (GIACC), a high level political group of 15 countries charged to develop a plan of action for the international aviation sector to address climate change. At its first meeting in late February, all non-European countries continued to voice opposition to the EU proposal.

8) Realistically, do you think that the EU states would suspend flights from the US if we don't participate in the ETS?

Response: This question can only be answered fully by the European Union. In discussions with EU officials over the last year and a half, they have consistently maintained their intention to mandate international airline participation, including developing countries with no mandatory reduction targets under the United Nations Framework Convention on Climate Change (UNFCCC). In the most recent draft of the legislation from the European Commission, there is a new provision which provides financial penalties and suspension of service for airlines that do not participate. Finally, in talking about the upcoming discussions to begin the second round of negotiations between the U.S. and EU to liberalize our air service markets, Transport Minister Barrot threatened action against U.S. airlines.

9) In your opinion, aren't there many other international agreements with the EU and its member states that come into play when it comes to allowing US Airlines access to their airport?

Response: The Chicago Convention – signed by both the U.S. and member states of the European Union – provides the basic framework for international civil aviation operations. Access to our respective markets is governed by the U.S.-EU Air Transport Agreement, which is being provisionally applied as of March 30, 2008. The U.S.-EU Agreement provides the framework that governs air services and dispute resolution among the U.S., the EC and its member states. Other laws might potentially come into play depending on particular measures that might be imposed on U.S. airlines.

10) In your view, are the Single Sky or NextGen projects meant to curb emissions or make the air travel system more efficient while possibly also helping to curb emissions? What hinders the roll out of these projects?

Response: Environmental stewardship is at the heart of NextGen development. We will not achieve the capacity gains we need to meet the air transportation demand of the U.S. unless we find ways to improve system efficiency and reduce aviation's environment footprint. The Joint Program and Development Office (JPDO) Environmental Work Group has led the way on incorporating environment into NextGen concept of operations and planning.

A variety of issues influence the adoption of new procedures. The Administration's FAA Reauthorization legislation proposed a number of new and innovative programs to address the environment. These provisions are designed to help accelerate development and implementation of operational and technology solutions.

The European effort – SESAR – and NextGen are both committed to increasing capacity, improving efficiency, and reducing environmental impacts. The U.S. and Europe are working together to enhance our efforts and ensure interoperability of our airlines to use environmentally

friendly procedures on either side of the Atlantic through endeavors such as the Atlantic Interoperability Initiative to Reduce Emissions (AIRE). We are also collaborating on research efforts with EUROCONTROL through our cooperative agreements.

11) What concerns are there about the impact of emission reduction actions on airline safety, on noise pollution, or on local air quality?

Response: Safety always comes first – there are no concerns with safety. There can be trade-offs between aircraft noise and air quality, but they depend on the particular solution. Traditionally, these interdependencies have not been dealt with explicitly. FAA is working on more advanced modeling and analytical capabilities to address these effects.

12) On March 3, 2008, the Office of the Inspector General issued a report on NAS system use (CR-2008-028) that concluded, in part, "...a tax based on fuel consumption is a better barometer of NAS activity than the current excise taxes because it would recover costs from users more in proportion to their system activity than excise taxes." In view of the environmental incentives that an increased fuel tax (in place of existing excise taxes) would have, is such a system a better way of financing FAA activities?

Response: One of our key goals for FAA financing reform is to make the financing structure significantly more cost-based than the current system. Ultimately, a cost-based funding structure will have positive environmental impacts by providing incentives for the efficient use of the aviation system and facilitating reliable funding for NextGen.

We agree with the Office of Inspector General (OIG) report's conclusion that a fuel tax is a better barometer of NAS activity than the current tax structure, which relies primarily on ticket taxes. Therefore, replacing the existing excise taxes with a fuel tax at the same rate for all users would be more cost-based than the current system. However, it is important to note, as the OIG report also did, that fuel consumption "neither measures whether ATC services are used nor distinguishes among the types and complexity of the services used." Therefore, while a universal fuel tax would be an improvement over the status quo, other funding mechanisms

would be even more cost-based and would likely have a greater positive environmental impact in the long run.

13) At the present time, it appears that FAA Reauthorization is stalled. In view of the fact that the Reauthorization legislation contains several significant environmental initiatives, would it be helpful if these provisions were reintroduced as part of other legislation to increase their chance of passage this year?

Response: Yes.

14) Should the United States Congress at this point await any conclusions of the newly formed ICAO Group studying aviation's impact on global warming before taking any unilateral actions? Should standards establishing aviation's responsibility in the global climate change area be set by ICAO and not individually by individual countries?

Response: In ratifying the Chicago Convention decades ago, the U.S. Congress agreed that the U.S. should be guided with respect to standards and recommended practices for international aviation by this Convention. In the case of environmental issues, this practice of working within the ICAO structure has proved very effective in ensuring global harmonization in standards and policy while making significant progress in reducing aviation's noise and emissions footprint. ICAO is the internationally preferred forum to propose and monitor harmonized approaches to reduce greenhouse gas emissions globally.

ICAO does not replace a state's sovereignty or right to action, but complements a country's responsibility with respect to international aviation matters by providing a framework to help harmonize and recognize sovereign actions. The Group on International Aviation and Climate Change (GIACC) offers an opportunity to craft a constructive and positive plan of action by critical aviation states around the world to address aviation and climate change.

15) Can you explain the FAA program to study the use of alternative fuels for jet aircraft?

Response: The FAA is a sponsor of the Commercial Aviation Alternative Fuel Initiative (CAAFI), together with the Aerospace Industries Association (AIA), the Air Transport Association (ATA) and the Airports Council International-North America (ACI-NA). CAAFI is a forum that brings together government agencies, U.S. and international aircraft and engine manufacturers, airlines, energy companies and researchers to build relationships, share and collect needed data, promote and guide research on aviation alternative fuels, and foster commercial implementation. In addition to enhancing the security of our energy supply, CAAFI seeks to promote the development of alternative fuel options that offer equivalent levels of safety, reduce environmental impacts, and compare favorably with petroleum-based jet fuel on cost. CAAFI's four teams – Research and Development, Fuel Certification and Qualification, Environmental Impacts and Business, and Commercialization—lead a multipronged effort to advance successful deployment of alternative jet fuels.

The FAA leads CAAFI fuel certification and qualification activities to develop a fuels approval process for emerging alternative jet fuels through the American Society for Standards and Materials (ASTM). FAA's Office of Environment and Energy has also led and funded activities that address the environmental impacts of various proposed alternative jet fuels. These have included alternative jet fuel engine emissions measurements and a study of the feasibility of multiple alternative jet fuels. FAA is concerned about life cycle emissions impacts and has funded a Life Cycle Analysis of alternative fuels—to inform future decision-making.

16) Have the environmental benefits of proposed operational changes been quantified? Is so, precisely what have we learned from the pilot programs in this area?

Response: We have quantified the benefits for some operational changes. In a pilot study at Louisville, KY, Continuous Descent Arrival (CDA) showed an estimated benefit of 4-6 decibel reduction in noise 6-15 miles from the airport and an average 12% fuel/emissions savings for the arrival segment of the flight. Given that arrival fuel burn is about 5% of the total flight, this results in a potential system-wide reduction in emissions of 0.6% per flight. Work is ongoing to calculate the emissions savings of other operational changes both in flight and at the airport. We are also presently quantifying the effects of ground and enroute operational changes.

17) Some critics of immediate action to curb aviation's impact on global climate change have claimed that we do not yet have enough factual information to craft the "correct" solutions. Do you agree? If so, what actions is the FAA or EPA taking to provide the ways of correctly measuring these impacts and providing tools that will enable policy-makers to determine what actions are necessary to counteract the measured impacts?

Response: There are impacts we understand well (such as CO2), but others that we do not. The industry can and is taking immediate action to reduce CO2 emissions through a reduction in fuel use via air traffic control improvements, operations, more fuel-efficient engines, reducing weight, gate electrification, fleet changes, etc. These actions have the additional benefit of reducing costs as well as emissions.

However, it is true that we need to better understand the climate impacts of other emissions at altitude before choosing other solutions. For example in the design of future engines there are tradeoffs between reducing fuel burn (CO2) and reducing Nitrogen Oxide (NOx) production such that if you improve one, you may exacerbate the other. We do not, to date, understand the climate impact of NOx emissions at altitude very well relative to CO2. In general, reducing emissions is good for the environment. This is why development of more fuel efficient engines is moving ahead. But, secondary and tertiary impacts of jet fuel combustion are not as simple. This holds true for some proposed operational solutions. One proposal for reducing contrail and cirrus cloud formation is for aircraft to fly at lower altitudes, but lower flight is less fuel efficient and generates greater CO2. FAA, NASA and NOAA are addressing the need for improved understanding of cirrus/contrail relationship and other effects through the Aviation Climate Change Research Initiative (ACCRI). ACCRI involves leading climate scientists in a research program to identify and address gaps in our understanding. ACCRI will produce data that can be applied to policy making tools being developed by the PARTNER Center of Excellence.

18) How do you account for the disconnect between the perception and performance on aviation emissions in the U.S.?

Response: Until recently, most of the focus on aviation greenhouse gas emissions growth has been in Europe. As discussions of this issue began to develop in the U.S., it appears various stakeholders incorrectly assumed U.S. and European aviation experience and performance were similar. We have been working to provide information to educate the public and press on the differences in structure, markets, and performance of the U.S. and European aviation systems with respect to greenhouse gas emissions. A contributing factor may also be that Americans still complain more about aircraft noise than they do about emissions. For example, the recent redesign of airspace in the Northeastern U.S. that would provide significant fuel burn gains (and net noise benefits) has garnered significant opposition from different communities due to noise concerns. That said, there is now clear recognition in the NextGen plan and among U.S. aviation stakeholders of the importance of addressing aviation emissions and the need to communicate effectively on this issue.

19) How much do you coordinate with the Federal Highways Administration or Federal Railroad Administration?

FAA's Office of Environment and Energy coordinates with the other modes of transportation on greenhouse gas emission activities through the Department of Transportation's Center for Climate Change and Environmental Forecasting (CCCEF), http://climate.dot.gov/. The FAA is actively involved in the Steering Committee and core staff activities of the Center.

20) What can Congress do to help make this coordination happen?

Response: Coordination already exists among the modal administrations within the Department—FAA, the Federal Highway Administration (FHWA), and the Federal Railroad Administration (FRA). No additional congressional action is needed for it to happen.

* * *

May 16, 2008

Dear Chairman Markey and distinguished members of the Select Committee:

Thank you for submitting additional questions for IATA to answer for the record on aviation emissions. Below, please find IATA's response following each of your questions.

Should you require any additional information, please do not hesitate to contact Matthew Jennings, IATA's Congressional Liaison, at (202) 628-9292.

Sincerely,

Tom Windmuller
Senior Vice President & Corporate Secretary
International Air Transport Association

1) You say that aviation emissions aren't soaring, but considering your anticipated growth of 3% a year on a "normal" path; China and India now planning for 100 new airports; decreasing emissions from other aspects of the transportation sector; and technologies that take decades to replaces, are you telling us that we should not expect aviation to occupy an increasing share of transportation emissions?

   A) The UN IPCC confirms that aviation CO_2 emissions were 2% of the global total in 1992 and were still 2% in 2000 – clearly emissions were not soaring during that period. Furthermore, the IPCC says that aviation emissions could grow to 3% by 2050. Therefore, yes, according to the IPCC, aviation's relative share would grow, but definitely not at a pace that one could describe as "soaring."

International Air Transport Association

601 Pennsylvania Ave., NW, Suite 300
Washington, DC USA 20004
Tel: +1 202 628 9292
Fax: +1 202 628 9448

www.iata.org

Submitted by Tom Windmuller (IATA)
May 16, 2008

2) You do not support the EU aviation cap and trade program, but you have indicated support for a worldwide aviation scheme established by the International Civil Aviation Organization. What work are you doing to support proposed regulations? How will you respond if and when other nations can no longer wait to have their own limits on aviation emissions?

   A) IATA has been a long-standing advocate of a global ETS under ICAO auspices. However, in ICAO, it is governments who take decisions, not the industry. In the same way, it will be governments that will respond to extra-territorial application of economic measures imposed on their airlines. IATA prefers to avoid these confrontations if at all possible and has consistently been calling for any regional ETS to respect the international legal principle of mutual agreement.

3) If a voluntary emissions cap or trading system is not an option, what kind of cap and trade system would be supported by your member organizations?

   A) It is probably useful to clarify that when IATA refers to a *voluntary* cap & trade system, it refers to a system that would be voluntary for governments to join. Once part of the ETS, clearly any targets and commitments would be mandatory under the system. In this sense, IATA reiterates the need for governments to abide by the international legal principle of mutual agreement. Extra-territoriality is not an option.

4) If the fastest way to reduce emissions is reducing the amount of fuel used, and airlines want to reduce the amount of fuel used to save money – we are already solving this problem through the marketplace, aren't we?

   A) Yes, we are in the unique position that – to a large extent - saving the environment goes hand in hand with saving fuel and fuel costs. However,

Submitted by Tom Windmuller (IATA)
May 16, 2008

the market place is an imperfect place where the cost of carbon hasn't been adequately reflected in commodity prices until now. ETS, once it becomes part of the market place for aviation, would change this.

5) What are the various management practices that airlines can use to curb their fuel use and thereby curb their emissions?

A) A wide range of management and operational practices exist and are being implemented as we speak to curb airline fuel use and emissions. They cover practically all aspects of flight operations, flight planning, aircraft maintenance and ground operations, and, most importantly, the following:

- Most accurate fuel planning (depending on actual payload, range, weather, etc.)
- Most effective use of sophisticated on-board systems (e.g. Flight Management Computer) for most economic operation (as far as ATM permits)
- Avoidance of unnecessary weight (e.g. water, paper)
- Reduced utilization of APU (auxiliary power unit)
- Taxiing with one engine off
- Regular engine wash
- Regular aircraft cleaning
- Structural repairs (avoid increase of drag/resistance)
- Towing of aircraft instead of taxiing
- Utilization of ground power operated on biofuel (instead of APU)

Submitted by Tom Windmuller (IATA)
May 16, 2008

6) What can be done to speed up the integration of new more environmentally friendly planes into the airline fleet without overly burdening the airlines with more government requirements?

A) First of all, airlines must actually be able to afford investments in new, cleaner equipment. Rather than siphoning money out of the industry through taxes and other punitive measures, ways must be found to reinvest revenues to accelerate development and deployment of cleaner equipment. Secondly, airlines rely on equipment and products delivered to the market by manufacturers and fuel suppliers. Rather than putting more pressure on airlines as the middlemen, regulatory pressure should focus on the upstream producers, preferably in a form of production standards. Such standards should reflect the required fuel efficiency of each aircraft type, favoring production and introduction of most efficient planes based on certified performance profiles. Simultaneous implementation of technologies and processes to reduce the cost of ownership would also help, as would support for the development and the certification of low emissions bio-fuels. These approaches would be more effective than strictly financial incentives, the cost of which would simply be passed on to the customers (i.e. the airlines) without generating any environmental benefit.

7) What is the effect of more taxes on an airline – say a carbon tax – would it encourage investment in new technologies or just hurt the airlines' bottom line? Would airline ticket prices go up?

A) In light of the massive oil and fuel price increases of the past years, it is very unlikely that a carbon tax would provide any additional incentive to invest in new technologies. Rather, the opposite would be true, as it would leave airlines with even less money in their pockets. Costs related to a carbon tax would certainly affect ticket prices, although perhaps to a

Submitted by Tom Windmuller (IATA)
May 16, 2008

lesser extent in fully competitive markets and to a larger extent in less competitive ones.

8) How do the profit margins of US airlines compare to the worldwide airline industry? Is there a fair comparison between the taxes and fees that US Airlines pay as opposed to their counterparts overseas?

% of operating revenues	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1997-2007 average
Operating profit margins												
US airlines	7.7	8.2	6.9	5.3	-8.9	-8	-1.8	-1.1	0.3	4.6	5.3	1.7
World airline industry	5.6	5.4	4	3.3	-3.8	-1.8	-0.4	0.9	1	2.9	3.4	1.9
Net profit margins												
US airlines	4.6	4.2	4.4	1.9	-7.2	-10.3	-2	-5.7	-3.8	1.8	2.9	-0.8
World airline industry	2.9	2.8	2.8	1.1	-4.2	-3.7	-2.3	-1.5	-1	0.7	1	-0.1

Source: ATA, ICAO
Note: Excludes US bankruptcy-related charges

A) Over an 11-year period (1997-2007 including 5 years of losses and 6 years of profit) the industry in both the US and globally has, on average, lost money at the net profit level. Heavy debt interest payments mean net profits (after tax and net interest payments) are much lower than operating profits. Even at the operating profit level, US airlines have, on average, only made a 1.7% margin on revenues. Since invested capital in airlines is close in size to revenues, the operating margin is close to the return on capital invested. On average the weighted average cost of capital faced by airlines globally has been 7-8%. The cost of capital is probably higher for US airlines because of poor credit ratings. It is clear that the US and the global airline industries have not been able to deliver returns on capital that even approach their cost. This is a good measure of how difficult it is for the airline industry to earn their cost of capital, which most investors would consider the minimum return expected in a competitive industry. The industry is not financially sustainable with this low level of returns.

It is hard to make a fair comparison of the fees and taxes paid by US airlines and their passengers compared with their counterparts overseas because of differences in methods of charging for infrastructure use. ATA

provides some useful illustrations of taxes and fees paid by US airlines and passengers, which can be found at http://www.airlines.org/economics/taxes/. IATA has examined the taxes and fees paid by airlines in several European countries. This study can be found at http://www.iata.org/NR/rdonlyres/1DC7A5D3-6F24-4853-8B27-0B48B5E7DBE1/0/890500_Aviation_Taxes_ChargesSummary_Report.pdf. The conclusion of the IATA study was that passengers and airlines in Germany, France and the UK pay taxes and charges substantially in excess of the cost of providing infrastructure. This contrasts with the low net charges paid by road users per journey and the subsidies received by the rail industry.

9) How much has the cost of aviation fuel increased over the last five years? And have airlines gone bankrupt in part because the high cost of fuel has been more than they could absorb?

Prices on May 9-11								Increase 2002-2008	
US$/gallon	2002	2003	2004	2005	2006	2007	2008	US$/gallon	%
Brent crude oil	0.63	0.6	0.89	1.08	1.68	1.54	2.93	2.3	465%
Refinery margin	0.05	0.11	0.29	0.39	0.46	0.47	0.85	0.8	1700%
Jet fuel	0.68	0.71	1.18	1.47	2.14	2.01	3.78	3.1	556%

Source: RBS, Platts, IATA

A) The cost of aviation fuel has increase by 532% over the past 5 years (2003-2008) and 556% since 2002. This is a much larger increase than the rise in crude oil, as refinery margins have increased 1700%. A gallon of crude oil cost $2.30 more in May 2008 than in May 2002. A gallon of jet fuel cost an additional $3.10 over the same period.

There are always combinations of factors causing bankruptcy. Nevertheless, the rise in the cost of jet fuel has increased this key-input from a global industry average of 13% of operating expenses in 2002 to, at May prices, a global average of over 50% of operating costs. In 2007

Submitted by Tom Windmuller (IATA)
May 16, 2008

fuel was an average of 29% of operating costs. Fuel hedging may dampen this increase. The average price for the year may be lower. Nonetheless the speed and scale of the rise in fuel costs will be very difficult for airlines to manage. In the previous two years, booming revenues and cost cutting (partly under Chapter 11) allowed airlines to absorb the rise in fuel costs, although this was at the expense of being able to repair balance sheets using the strong cash flow from revenues. Now the US economy has weakened revenues, which will not provide an offset to the rise in fuel costs. Many investment bank airline analysts (e.g. Morgan Stanley) are forecasting net losses of several billion dollars this year for the US airline industry. I would say the recent rise in fuel costs is more than airlines can absorb.

10) Some airlines have experimented with the concept of "carbon off-sets." Do you think that there is a huge group of travelers out there who want to buy these offsets when they travel?

A) Potentially, yes, although response rates will likely vary by region or even by route. If offset programs are part of overall climate strategies and are designed to be simple, transparent and effective, we believe they can be a powerful tool to engage customers in efforts to further reduce the environmental impact of flying. The advantage of offset programs is that they can be implemented quickly, are voluntary and generate real benefits for the environment. That's why IATA will not only be issuing a set of industry offset guidelines this Summer, but it will also roll out an industry offset program to enable interested airlines to implement their own offset facility as well.

Submitted by Tom Windmuller (IATA)
May 16, 2008

11)In your view are the Single Sky or NextGen projects meant to curb emissions or make the air travel system more efficient but possibly also help curb emissions? What hinders the roll out of these projects?

A) SES and NextGen are meant to make air travel more efficient – in every sense of the word - more operationally efficient in terms of time and capacity; more economically efficient in terms of unit costs; and more environmentally efficient in terms of burning less fuel and producing fewer emissions. Both projects require global coordination regarding the implementation of new technologies to avoid procedural and technological gaps. IATA is participating in both projects with a prime focus on the technological harmonization. There is a need for stronger coordination on the political side to ensure the required progress in cross-border alignments.

12)Do you support the ICAO process of working toward solutions for decreasing aviation emissions?

A) We strongly believe that ICAO should be the intergovernmental organization in charge of developing and coordinating international aviation standards and recommended practices, including environmental ones. We therefore support ICAO and the newly created GIACC and urge them to develop an ambitious, credible and effective action plan to address aviation climate change impacts in a timely fashion. We urge governments, who are ultimately responsible for ICAO's failure or success, to agree on appropriate solutions.

Submitted by Tom Windmuller (IATA)
May 16, 2008

13)Is there any disincentive for airlines to decrease their fuel consumption and thereby decrease their carbon footprint?

A) The largest disincentive is adverse results from political decision-making, including prohibitive and counterproductive taxes (e.g. APD and similar) and the standoff over much needed airspace restructuring.

14)You note in your testimony that "this Committee is on record in support of emissions trading to address the growth in aviation emissions." I would like to correct you on this point, only a little over half this committee supports that concept. The rest of us share your concerns. My question to you is do airlines actually need any climate legislation or trading scheme in order to reduce their aviation emissions?

A) It is true that the massive oil price increases in recent times provide plenty of incentive for airlines to do their utmost to reduce fuel use and emissions. However, despite these efforts our global emissions are projected to continue to grow in absolute terms, which is unacceptable. At the same time, there are limits to what the industry can do in the short term to further reduce its emissions. That leads us to believe that some additional measures – such as carbon trading or offsets – could be considered as one element of a broader policy package. Such measures should however be very carefully thought through and designed to ensure they are in fact cost-efficient and effective.

Submitted by Tom Windmuller (IATA)
May 16, 2008

15) In your testimony, you state that "the suggestion that aviation emissions are soaring is simply not accurate." But that isn't stopping airlines from working on their emissions is it?

A) That is absolutely right. Although not exactly "soaring," our emissions are projected to continue growing, which is unacceptable. Current developments on the fuel market create significant risks for airlines, forcing them to pursue all possible avenues to lower their fuel consumption and thus emissions. Airlines have emphasized that even more would be possible if infrastructure and global ATM became more efficient.

16) On Page 2 of your testimony, you state that over the last five years your members' "fuel bill has increased 340% to $136 billion, which is equivalent to the size of the economy of Massachusetts." Is there any reason at all your members would not want to cut this bill?

A) No, our members do everything they can to achieve this. However, we can't do it alone – we need manufacturers, fuel suppliers, air navigation service providers and governments to help us.

17) In my office, we tend to hear more concerns about aircraft noise and lost luggage than concern about greenhouse gas emissions. Do you think that is really different in other nations?

A) Other issues, like the ones mentioned, have not gone away. However, concerns about climate change are increasingly overshadowing these other issues in certain parts of the world.

Submitted by Tom Windmuller (IATA)
May 16, 2008

18) The United States is not alone in its concern about including aviation in the EU's Emission Trading Scheme (ETS) is it?

A) No, it is not. In fact, many (if not most) of the major economies outside Europe have expressed concerns about having their airlines included in the EU ETS without their prior and explicit consent. This was *inter alia* reflected in the September 2007 ICAO Assembly. The only supporters for the European ETS were the 43 States that form the European Civil Aviation Conference. All other ICAO member States expressed opposition to the EU's plans to impose its own solution unilaterally on them, without requiring their prior consent.

19) Are other countries looking at their Air Traffic Management systems to update the way they manage operations and thereby help reduce emissions?

A) Indeed, more or less all countries are looking to update their Air Traffic Management Systems. Beside "mega projects" like SESAR in Europe and NextGen in the US, numerous local or regional initiatives are underway (e.g. RVSM in China, new entry points in China, optimized ATM procedures over Canada, etc.). In 2005, IATA developed the Infrastructure Roadmap subsequently adopted by ICAO. Therefore more efforts are currently put into the monitoring and the identification of additional measures to speed up implementation.

20) Do you support the International Civil Aviation Organization (ICAO)?

A) See answer to Q12.

Submitted by Tom Windmuller (IATA)
May 16, 2008

21)Do you have any concerns about the Commercial Aviation Fuels Initiative?

A) CAAFI is an active group currently focused on the specification and certification of alternative aviation fuels based on the Fischer-Tropsch process. Since these fuels provide only limited improvement potential for emissions reduction, IATA is working with industry stakeholders on enhanced activities towards certification of sustainable bio-fuels. This work will be aligned with CAAFI as appropriate.

22)You note that there are long timelines for regulatory approval and implementation of any new technologies – would you say that the reason for this is to insure safety and protect the interest of the public?

A) The rather long timelines for regulatory approval and implementation of new technologies have several reasons and vary for different types of technologies. New technologies with potential safety impacts, for example, require extensive testing to ascertain a sufficient level of maturity before installation. Other technologies sometimes lack global standards for product certification, or they lack commonality or interchangeability causing relatively long product cycles in aviation compared to other industries.

Submitted by Tom Windmuller (IATA)
May 16, 2008

23)What tax credits do you support for making investments in cleaner technologies in aviation?

A) We would like to see governments invest directly in basic research (new materials, alternative fuels, etc.) The US can (and does) do this through NASA, FAA, DARPA, the National Labs, etc. In addition to the above, we would support three different types of tax credits:

- To airlines for investments in new, more efficient fleets (or possibly new engines, wing tips, and other measures that improve fuel efficiency)
- To manufacturers and oil companies for the applied research they conduct (e.g. figuring out how to use the new light-weight materials produced in basic research (as noted above) in aircraft)
- To Air Navigation Service Providers (ANSP) (possibly not relevant in the US where the ANSP is the government itself) for capital investments that produce more airspace capacity, more fuel efficient routes, etc.

THE SELECT COMMITTEE ON
ENERGY INDEPENDENCE AND GLOBAL WARMING

April 29, 2008

Dear Mr. Lovaas,
Following your appearance in front of the Select Committee on Energy Independence and Global Warming, members of the committee submitted additional questions for your attention. I have attached the document with those questions to this email. Please respond at your earliest convenience, or within 2 weeks. Responses may be submitted in electronic form, at aliya.brodsky@mail.house.gov. Please call with any questions or concerns.

Thank you,
Ali Brodsky

Ali Brodsky
Chief Clerk
Select Committee on Energy Independence and Global Warming
(202)225-4012
Aliya.Brodsky@mail.house.gov

1. In your testimony, you discuss a modal shift for certain trips towards intercity passenger rail. Have you done research into where this makes sense and how it should be done?

Short-distance corridors (under 500 miles) are where a modal shift makes the most sense. While there are plenty of international examples (France, Germany, Spain and Japan have very limited short-distance corridor air service but expansive passenger rail schedules), some critics to passenger rail development in the United States believe that we do not have the population density to sustain this type of modal shift. On the contrary, there are a number of markets within the United States that would be better served by short distance passenger rail that have the dual benefit of congestion relief and decreased carbon emissions. Where the federal government has invested in passenger rail service along the Northeast Corridor, the New York to Washington, DC air-rail market is considerably skewed towards passenger rail. Outside the Northeast, where states have made investments, several short-distance corridors are already beating air service, including Los Angeles to San Diego, Milwaukee to Chicago, and Seattle to Portland.

Additional federal investment is essential to developing short-distance corridors that will drive a modal shift from air travel to passenger rail, and to maintain the corridors that already beat the airlines. This shift is an essential part of the solution to reducing the transportation sector's carbon emissions. According to the Bureau of Transportation Statistics, nearly 40 percent of all domestic flights at the nation's largest airports are for destinations 500 miles or less. These corridors are ones that states already have planned, but not the capital to singularly fund. These corridors are all across the country – starting in California, San Francisco-Los Angeles, Los Angeles – Las Vegas, Oakland – Reno; in the Midwest, a hub-and-spoke system from Chicago to St. Louis, Chicago-Indianapolis, Chicago-Columbus, Chicago-St. Paul/Minneapolis; in the South, the Texas Triangle (Dallas/Ft.Worth, Austin/San Antonio, and Houston), Houston – New

Orleans, New Orleans – Mobile, New Orleans – Atlanta, Atlanta – Charlotte, Washington, DC – Richmond; and in Florida, Miami to Orlando.[1]

These passenger rail corridors should be developed at the state level, with considerable federal investment and commitment, much the same way the national highway system was developed.

2. What are your recommendations for how Congress can help make this shift occur?

It is essential for Congress to do two things to drive a modal shift to passenger rail from both aviation in some markets and to reduce the number of people taking car trips in short-distance (under 500 miles) corridors. The first is additional funds and the second is a policy change.

1) Congress must invest considerably more than current amounts to develop passenger rail. With just over $1 billion in federal funds annually, Amtrak and the states have been able to make a surprising impact in certain travel markets. However, developing this mode of transportation on the scale necessary to truly make an impact on the country's transportation sector's carbon emissions will require investments of the magnitude proposed by the National Surface Transportation Policy and Revenue Study Commission: $5 billion annually. This would have an added economic stimulus benefit since most of this country's rail industry suppliers are domestic companies.

2) Congress can help accelerate this shift by requiring that the evaluation of transportation plans, programs and projects take into account their carbon footprint, juxtaposing different modal alternatives, and include an accounting of emissions in standard analyses required of regions and states by federal transportation and environmental policy. Such accounting should then be tied explicitly to federal infrastructure investments. Aligning federal policy in this way should provide a powerful incentive for more rail construction as well as investment in development around rail stops, helping to boost ridership and therefore cost-effectiveness.

3. On page 5 of your testimony, you state, "The effects of pollutants generated during the burning of jet fuels at altitude is approximately double the effect on the ground." What evidence do you have to support this claim?

Personal discussions with Cambridge Systematics reveal that aircraft NOx emissions form ozone through a photochemical process. High altitudes, with more intense light exposure, facilitate formation of O_3. In general, the IPCC estimates that the effects of aviation's non-CO2 emissions are 2-4 times higher than CO2 alone.[2]

4. Is your real concern about the airlines that the alternative fuels they might find won't be the ones that you like best – for example they may decide that a coal to liquids fuel is the best one for them to use to maximize engine efficiency? Is there any other reason to think that the Commercial Aviation Fuels Initiative isn't working through the concerns and options for alternative jet fuels?

---

[1] I am indebted to Frances Bourne of Amtrak for her substantial contributions to the answers to questions 1 and 2.
[2] Michel Beuthe et al. Working Group Paper III, Chapter 5. IPCC. 2007.

NRDC's real concern is about the carbon intensity of the U.S. transportation fuel mix. Jet fuel is a small portion of this overall pool; it is dwarfed by gasoline and diesel use in the fleet of surface transportation vehicles. Viable substitutes for jet fuel, due to the demands placed upon it, are difficult to develop.

Given these premises – jet fuel is a relatively small part of the mix, and viable substitutes are hard to come by – a logical question arises. In a world where petroleum is a fungible commodity, why develop substitutes for it in this part of the transportation sector? Why not develop substitutes elsewhere in the sector – where promising options such as ethanol and electricity exist – and drive down dependence on oil in a less costly fashion?

This question has yet to be adequately answered by CAAFI. Instead, there is a rush – by CAAFI and others -- to research and develop substitutes for petroleum-derived jet fuel. I question the lack of skepticism about the need to develop substitutes for petroleum-derived jet fuel at all, given its modest role in the fuels market.

The narrowness of CAAFI's perspective is also evidenced by the lack of consideration of demand-side measures for reducing oil consumption. Increased energy efficiency (what some dub "the fifth fuel") is not assessed as a means to lower the baseline for jet fuel use, and neither is the shift of air traffic to other modes. This is a big shortcoming if the mission is to lower aviation's dependence on petroleum-derived energy.

Another concern about CAAFI is its membership. I am pleased that I have been invited to the CAAFI table, but I am the sole representative of an environmental NGO. The membership is dominated by government and industry representatives. This puts CAAFI's legitimacy as an entity that proposes to address lifecycle greenhouse gas emissions in serious doubt.

5. Do you agree that modernizing the air traffic management system would provide efficiency benefits and thereby help reduce carbon emissions for airlines?

NRDC believes that modernizing air traffic management systems can provide environmental benefits, but such benefits are not guaranteed. GPS-based air traffic systems will enable more direct flight paths as well more efficient approach and descent. Industry officials maintain that these will minimize congestion and fuel burn. We agree that routing and operations improvements are both desirable. However, we are also concerned that these improvements will simply facilitate denser air traffic without improving the sector's emissions profile. The Intergovernmental Panel on Climate Change reports that improvements in Air Traffic Management could reduce global fuel burn by 12%.[3] While the goal is worth pursuing, it should also be noted that one central goal of the Next Gen initiative is to increase air traffic capacity by three times. Absent other improvements, this increase in air traffic could overwhelm the benefits of improved system performance. In other words, we believe that Next Gen has potential but does not guarantee environmental improvements.

---

[3] IPCC. *Aviation and the Global Atmosphere.* 1999. Last viewed May 12, 2008 at http://www.grida.no/climate/ipcc/aviation/121.htm

6. Do you have any evidence that International Civil Aviation Organization (ICAO) is not working through aviation emissions issues appropriately?

Given the urgent need to cut greenhouse gas emissions indicated by science, pollution from this subsector in transportation must be addressed expeditiously. New policy will be needed to reduce emissions, yet ICAO's work appears to be stalled out in "study" mode. In 1997, the Kyoto Protocol tasked ICAO with addressing this issue. Yet, a full ten years later in its meeting in Montreal in September of 2007, the report of the ICAO Executive Committee summarizing the most recent discussion of this issue concluded that

> There was general consensus on and support for the notion that climate change was a global concern and that the global response should be given to it; for that reason ICAO should play a leadership role. The issue was not if something should be done about it but how it should be done. **A suggestion was made to establish an international task group to look further into that matter.** (Report of the Executive Committee on Agenda Item 17: Environmental Protection, p. 10, www.icao.int/icao/en/assembl/a36/wp/wp355_en.pdf, emphasis mine)

The track record of assessments such as the one charged to ICAO more than a decade ago is clear: Salience, legitimacy and credibility are crucial elements for success.[4]ICAO's sluggish progress on aviation undermines the first of these attributes. In many nations the climate policy debate is outpacing ICAO, making irrelevance a possibility should ICAO finally propose responsible policy for addressing aviation emissions.

What about legitimacy? Here too ICAO leaves much to be desired. Scanning the membership roster for the relevant committee charged with the climate issue (CAEP, see http://www.icao.int/icao/en/env/caepmem.htm), one finds a host of government representatives, seven industry groups, one scientific organization (the World Meteorological Organization), the UNFCCC and one environmental NGO. Governments and industry dominate the membership; this undercuts ICAO's legitimacy as an entity likely to develop robust climate policy recommendations.

Last but not least is credibility. Will the results of the ICAO process vis-à-vis climate policy recommendations be credible? This last question cannot be answered at this time. ICAO should submit results for review promptly, or the important duty of developing credible policy should be handed off to an entity that can do so.

7. Is there currently a proven, internationally accepted and widely produced alternative for kerosene jet fuel?

Jet fuel must adhere to demanding performance and safety specifications. Developing alternatives is extremely challenging at the moment. We do not know of any jet fuel alternative that is widely produced. However, some alternatives do have significant potential. Algae, for instance, absorbs carbon dioxide and provides impressive production potential. Research by Boeing indicates that algae could produce roughly 85 billion gallons of biojet per year from a

[4] Farrell, Alexander E. and Jill Jager, Assessments of Regional and Global Environmental Risks: Designing Processes for the Effective Use of Science in Decisionmaking, Resources for the Future 2006.

landmass the size of Maryland.[5] This would be enough to operate the global aircraft fleet. Even so, this technology is in the early research phase- it is not widely available.

The promise and the challenge of developing new alternatives underscore the need for consistent and sufficient federal research funding, and for questioning the need for substitutes at all. This is especially the case given concerns about high-carbon alternatives under consideration. Coal to liquids synfuel, for instance, has significantly higher lifecycle emissions than conventional fuel. Absent greenhouse gas regulation, coal could achieve growing acceptance as an alternative jet fuel feed stock, exacerbating the threat to the climate system.

[5] David L. Daggett et al. *Alternate Fuels for use in Commercial Aircraft.* Boeing. 2007.