



# Point-to-Point<sup>®</sup>

FINANCIAL TRENDS IN COMMERCIAL AVIATION

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## Aviation Confronts the Challenge of Climate Change

**Boeing embraces a leadership role in delivering sustainable aviation**

Climate change and global warming have captured the world's attention. News headlines regularly spotlight environmental issues. Demonstrators have clogged the roads at major airports. And public policy is beginning to reflect the level of concern.

In the financial community, airline equity analysts have begun to price the financial risk of potential environmental regulation into airline equity value calculations. And airplane appraisers are analyzing the impact of potential environmental regulation on aircraft residual values.

Pending EU regulation is driving "...a 10% discount to previous mid-cycle multiples for legacy carriers and a 15% discount for low-cost carriers."

— *European Airlines: 2008 Outlook, Deutsche Bank*

Boeing recognizes that climate change and global warming are a definitive challenge in the current era. We are actively engaged with aviation working groups to develop technologies and procedures—based on the best current scientific understanding and economic principles—to protect the environment, while preserving the undeniable benefits of air transport.

- Pioneering technologies
- Manufacturing
- ATM – operational efficiency
- Public policy



Boeing is leading efforts to reduce aviation-related carbon emissions through pioneering new aircraft technologies and services, continually enhancing environmentally progressive manufacturing methods, improving airline and air traffic management operational efficiency, and working for rational and effective public policy.

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## Aircraft Financiers Are Helping Shape Potential Environmental Regulation

By Scott Scherer

Late last year, the Aviation Working Group—comprising representatives from airplane and engine manufacturers, leasing companies, and financiers—unanimously supported creation of a subgroup focused on the impact of environmental regulation on aircraft financing.

Chartered to study regulatory approaches that preserve the economic benefits of commercial aviation, the group's first action was a detailed response to the European Union proposal to bring aviation into the EU Emissions Trading Scheme. The response affirms that global climate change demands global solutions—not conflicting regional efforts that would impede commerce and impose local fees or penalties without providing measurable environmental benefits.

Regulation based on disparate regional requirements would add complexity and volatility to airline businesses and increase uncertainty about aircraft values. The resultant increase in financial risk would raise costs for all stakeholders.

The group favors a global, multilateral aviation emissions management scheme. The ICAO Committee on Environmental Protection is the global organization chartered to address worldwide aviation environmental regulation. The AWG is seeking ICAO observer status to represent aircraft financiers in issues pertaining to environmental regulation of the aviation industry.

Specific policy mechanisms for addressing international aviation emissions remain to be determined. The AWG subgroup is committed to working with governments and policy makers to identify and promote reasonable environmental regulation that takes into account the efficiencies of modern aircraft and global aircraft financing infrastructure to achieve worldwide environmental goals for aviation.

Over the last 40 years, the aviation industry has improved environmental performance by 70% in terms of CO<sub>2</sub> emissions and 90% in terms of noise footprint. That is a record that no other transport industry can approach. Aviation is now coming together, through groups like the AWG and ICAO, to forge guidelines and standards that produce significant environmental performance improvements for us and future generations. ■



Scott Scherer, Boeing Capital's Vice President and General Manager for Aircraft Financial Services, helped found the Aviation Working Group, of which he is currently co-chair.

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## Managing risk, shaping opportunity

Individual nations—and even states and municipalities—have contemplated unilateral measures to tax or otherwise regulate airports and airlines. Regulation affects airline business models and the value of airplane assets, which are the fundamental building blocks for securing and structuring aircraft financing.

But environmental regulation need not be completely detrimental to airlines and the aviation financial community. Coordinated effort by manufacturers, airlines, governments, and the financial community offers significant opportunities.

For example, an efficient global carbon agreement would encourage reduction of CO<sub>2</sub> emissions through market forces that the aircraft financier community is well-positioned to manage effectively and profitably. Innovative airlines that proactively reduce emissions could transform regulatory mandates into competitive advantages. Of course the most important benefit of such a system would be a cleaner planet for ourselves and future generations.

## Meeting the challenge

Consistent with the Kyoto Accord, Boeing focuses primarily on CO<sub>2</sub> emissions. CO<sub>2</sub> stays in the atmosphere far longer than other greenhouse gases and is the best understood of human-caused atmospheric emissions. Reducing CO<sub>2</sub> emissions therefore offers the best opportunity for significant and long-lasting improvement.

Human activity is responsible for about 3% of the CO<sub>2</sub> that enters the atmosphere around the globe. Emissions from aviation represents only 2% of that human-caused CO<sub>2</sub>. Though 0.06% sounds like a very small percentage of the total CO<sub>2</sub> emissions, we recognize that the aviation industry must do its part, along with all other CO<sub>2</sub> producers, in reducing its carbon footprint.

Boeing has always regarded the reduction of CO<sub>2</sub> emissions as good business. The rising price of oil is rapidly making fuel the largest component of airline operating cost. It is currently second only to airplane ownership cost. Driving down fuel consumption makes our airplanes more attractive to airlines—and every pound of jet fuel saved is 3.1 pounds of CO<sub>2</sub> that doesn't go into the atmosphere.

## A history of environmental responsibility

Boeing has always pioneered technologies that cut emissions by reducing airplane weight, aerodynamic resistance, and energy requirements. Recent examples include the 787 Dreamliner's distinctively swooping wing, light-weight carbon composite structure, and electric systems, in place of bulky pneumatics that rob engines of thrust. Boeing also works with engine manufacturers to promote cleaner, quieter engines.

According to Billy Glover, Boeing managing director for environmental strategy, each generation of Boeing airplanes delivers significant improvements over previous models. "The 787 will use 20% less fuel and produce 20% lower emissions than comparable airplanes in today's fleet," says Glover. "In fact, today's airplanes achieve a 70% improvement in fuel consumption and a 90% reduction in noise, compared to the first generation of jetliners. This pace of improvement is unequalled in other industries."

Thanks to Boeing's continuing focus on efficiency, Boeing jetliners use less fuel per passenger kilometer than any competitor, in every category of seating capacity. But Boeing's approach to reduc-

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– Billy Glover

ing CO<sub>2</sub> emissions is by no means limited to business as usual.

Boeing is engaged with innovators in the aviation community to facilitate development of sustainable biofuels, environmentally responsible manufacturing methods, and more efficient operations for commercial aircraft, both in the air and on the ground.

## The promise of carbon-neutral fuels

Sustainable biofuels offer exciting and near-term opportunities to manage CO<sub>2</sub> emissions. Unlike alternative fuels that are derived from fossil fuel sources such as coal or natural gas, fuels derived from plants - biofuels - absorb CO<sub>2</sub> emissions as part of the life-cycle. As a result, burning biofuels results in a lower net CO<sub>2</sub>. Some energy is exerted in harvesting feedstocks and making biofuel, but the net increase in atmospheric carbon is much lower than fuels from fossil sources. Biofuels can be near carbon neutral and are more desirable from a climate change perspective.

More practical than more exotic alternative fuels such as hydrogen, biofuels can be delivered to airports using existing infrastructure and can be used on existing airplanes without significant modification of airplane systems.

Glover emphasizes that, though biofuels can be refined from a wide variety of feedstocks including corn and soybeans, Boeing is focusing on sustainable feedstocks. That is, feedstocks that do not compete for space with food crops or natural forests.



Producing enough oil from soybeans to meet future aviation fuel needs would require an area equal in size to the entire continent of Europe. Clearly not a sustainable solution. Algae can produce more than 150 times as much oil per acre than soy, so algae "farms" with a total area about the size of Belgium would suffice.

*“Crops like babassu, jathropa and, in the long term, algae can be cultivated in marginal environments that are fallow or otherwise unsuitable for food crops.”*

– Billy Glover

### **An environmentally sound solution close at hand**

The urgent need to take environmental initiative at a time when oil prices are well beyond \$100 per barrel has made biofuels economically viable at \$70 to \$90 per barrel. And the technology is maturing rapidly. For the past two years, Royal Caribbean Cruise Lines has powered its fleet of ships on 100% biodiesel provided by Imperium Renewables. The engine that powers the cruise line’s fleet is a GE turbine that is closely related to the CF6 aircraft engine that powers most of the world’s widebody fleet today.

In March 2008, Boeing, Virgin Atlantic Airlines, GE Aircraft Engines and Imperium Renewables demonstrated biofuel power on a flight between London and Amsterdam aboard a BCC-owned 747 under lease to Virgin Atlantic.



The future of biofueled jet flight is at hand, as Virgin Airlines demonstrated using a 747-400 leased from BCC in March 2008.

### **Environmentally responsible manufacturing**

Beyond its commitment to deliver environmentally progressive products, Boeing has undertaken to build airplanes in a more responsible manner. By the end of 2008, all major Boeing manufacturing facilities are scheduled to comply with ISO 14001, the international standard for environmental management of manufacturing processes and practices.

For a number of years, Boeing has pursued continual improvement in efficiency and waste reduction through Lean manufacturing techniques (see *Point-to-Point*, Quarter 4, 2007). Between 2001 and 2005 alone, these efforts have reaped a 42% reduction in hazardous waste, a 21% reduction in electricity use, a 9% reduction in water use, and a 41% reduction in factory footprint at the Renton, Washington, standard-body airplane production facility. With an eye to the entire airplane life cycle, Boeing is a founding member of the Aircraft Fleet Recycling Association (AFRA), which helps develop strategies for aircraft recycling.

### **Improving aircraft operations to reduce emissions**

Boeing is working with airlines, air traffic management authorities, and public agencies to develop and implement more efficient global airplane operations. We have developed comprehensive guidelines that could significantly improve fuel efficiency and reduce wasteful emissions in every phase of flight.

The International Panel on Climate Change (IPCC) attributes 12% of commercial aviation’s CO<sub>2</sub> emissions to inefficient management of air traffic. Other estimates range from 6% up to 18%. By these estimates, aviation-related emissions could be reduced by up to 18% using technology that is available today. As one airline CEO commented, “Today we have Jetsons technology in the cockpit and Flintstones technology on the ground.”

Political consensus will be required to realize the promise of today’s flight deck technologies. Boeing is demonstrating airplane flight deck technologies and efficient air traffic procedures around the globe to help build the required consensus. The demonstration programs are already yielding significant environmental implementation benefits.

### **Public policy that is part of the solution**

CO<sub>2</sub> doesn’t observe national borders. Effective and long-lasting climate-change solutions must be global, not regional. Taxes levied by regional authorities on international air traffic violate the principles of the Chicago Convention and distort the market.

The UN Framework on Climate Change and the Kyoto Accord, the only broad international agreement on climate change, support the need for global, rather than regional action, by recognizing the authority of the International Civil Aeronautics Organization (ICAO) as the appropriate body to govern international aviation with regard to greenhouse emissions.

The crucial role that aviation plays in the global economy makes airplane operations one of the most expensive places to impose punitive emissions charges. Boeing supports public policy that recognizes the global nature of the industry and provides incentives to reduce emissions.

According to Glover, aviation is making great strides in environmentally progressive technology. “The industry is coming together on this vital issue very quickly,” says Glover. “Our progress to date is already ahead of all expectations. But it will take coordinated effort of all stakeholders to develop public policy that both protects the environment and preserves the vital role of air transport in the global economy.”

The temptation to rush to solutions through regional regulation that singles out airports and airlines with punitive charges ignores the most immediate and effective means to reduce aviation emissions—improving the efficiency of air traffic management. Ironically, the improvement of air traffic management is the element of the solution over which governments and regulatory agencies have the most direct control.

Boeing is currently working with ICAO to develop solutions that balance the responsibilities and benefits of greenhouse gas reduction for the benefit of the whole planet and future generations. ■

# Noteworthy Developments

## Boeing Orders and Programs Update:

### 787:

- Boeing revises 787 first flight and delivery plans; adds schedule margin to reduce risks of further delays – first flight moves into 4Q 2008; deliveries to begin 3Q 2009
- Boeing moves 787 Dreamliner static test airframe to testing rig
- Boeing confirms Gulf Air's intent to purchase 787 Dreamliners
- Air Pacific orders additional Boeing 787 Dreamliners
- Boeing receives follow-on order for 787 from Privatair
- Boeing, Gulf Air close 787 Dreamliner deal
- Boeing, Air Europa of Spain announce order for eight 787 Dreamliners
- Final assembly begins on another Boeing 787 Dreamliner - second flight test airplane loaded into first position
- Boeing 787 Dreamliner successfully completes fuselage barrel test
- Alenia Aeronautica completes horizontal stabilizer ultimate load tests

### 777:

- First Boeing 777 freighter enters final assembly
- Boeing, Biman Bangladesh Airlines sign deal for 777s, 787s
- Lufthansa Cargo / DHL Express joint venture airline "Aerologic" to operate Boeing 777 freighters
- Boeing, Cathay Pacific Airways celebrate 777-300ER delivery
- Boeing delivers KLM's first 777-300ER
- Boeing, Garuda Indonesia announce 777 order
- Boeing delivers first 777-200LR for a U.S. Carrier to Delta Air Lines
- Boeing delivers 700th 777

### 747:

- Boeing delivers 1,400th 747 to GECAS for lease to Airbridge Cargo Airlines
- Boeing completes 50-percent design release for the 747-8 freighter

### 737:

- Boeing delivers first Next-Generation 737 to Norwegian Air Shuttle
- Boeing, Continental celebrate airline's first 737-900ER delivery
- Boeing receives order from Romanian carrier Blue Air for Next-Gen 737s
- Boeing, Lion Air celebrate 10th 737-900ER delivery
- Boeing, Aviation Capital Group announce 737 order
- Boeing, Lion Air announce order for 737s
- Boeing, Rak Airways sign deal for 737-800s
- Boeing confirms 737 order from Turkmenistan Airlines

### CAS:

- First 767-300 Boeing converted freighter takes flight
- Boeing helps Singapore Airlines e-enable for the future
- Boeing subsidiary Aviall to establish business operations in India
- Boeing to provide airplane health management system to Qantas

### Other:

- Boeing reports double-digit first-quarter earnings growth and record backlog
- Boeing sets third consecutive record for commercial airplane orders in 2007 - 1,413 net orders (1,423 gross) surpasses 1,044 net orders reached in 2006. Record orders for 787 Dreamliner, 737 program, Boeing freighters.
- Boeing, Virgin Atlantic and GE Aviation to fly first commercial jet on biofuel
- Continental Airlines, Boeing and GE Aviation announce plans for sustainable biofuels flight demonstration



## Boeing, Airbus Join to Improve Environmental Performance

Boeing and Airbus CEOs signed an agreement April 22 in Geneva to work together to ensure global interoperability in air traffic management as part of an effort to help reduce the impact of aviation on the environment. The companies will seek the acceleration of improvements to the world's air transportation management system in order to increase efficiency and eliminate traffic congestion. "Airbus and Boeing are great competitors, and this has been a critical element that has sharpened our focus and efforts toward making aviation more efficient," said Boeing Commercial Airplanes CEO Scott Carson. "While our approaches often differ, we are working towards the same goal - to reduce aviation's environmental impact."



## Boeing Flies Fuel Cell-Powered Airplane

In February and March, Boeing conducted three test flights of a manned airplane powered by hydrogen fuel cells. It marked a first in aviation history for manned flight powered by the technology. The tests were conducted in Spain by Boeing Research & Technology Europe using a modified Dimona motor glider. According to researchers, fuel cells potentially could power small manned and unmanned air vehicles. Over the longer term, they could be applied to secondary power-generating systems, such as auxiliary power units for large commercial airplanes.

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