The Boeing Company

Response to the European Commission Communication on "A sustainable future for transport: Towards an integrated, technology-led and user friendly system"

30th September 2009

Introduction

A key pillar of European Union's success and integration is the free movement of people, goods and services across the region. Continuing to support mobility is essential to helping Europe enhance its competitiveness on the world scene and reach its goals as set out in the Lisbon agenda. Air transport is a critical factor in achieving this goal. As a key sector of the European economy, and an essential part of modern life, air transport helps to drive economic growth and prosperity in Europe and beyond, and brings the people of Europe – and indeed of the world – closer together. Boeing welcomes the European Commission's review of its 2001 White Paper for Transport. Through this consultation response, we offer our views on what policy measures are needed to ensure a sustainable future for transport, and in particular, a sustainable future for air transport.

Trends and Challenges

We agree with the trends and challenges outlined by the European Commission in relation to a sustainable future for transport. However, one clear recent challenge not covered in this section is the economic crisis of last year. The crisis has had a serious impact on the growth of aviation. More troubling, it has also prompted a worldwide increase in protectionism, making the air transport business environment much more uncertain for market participants: a recent WTO report highlights 83 trade-restricted measures implemented by 25 economies. Although the industry has enjoyed a period of growth and liberalisation in recent years, such rising isolationist trends could forecast a prolonging of the global economic crisis, with negative implications for air traffic growth.

Additionally, we would like to highlight the challenge posed by emerging economies, which are competing in many different ways with established economies, also by means of an efficient, broad and modern transport network. In relation to transport, Europe cannot afford to lag behind by taking a self-limiting approach.

The environmental challenges that the air transport industry faces, coupled with an increasing scarcity of fossil fuels, are key drivers in the industry's research, development and gradual introduction of alternative fuel sources. We outline below how Boeing is tackling environmental challenges. On climate change policies, the focus should not be solely on regulatory constraints but rather on turning the challenge into an opportunity for growth and technology innovation.

Air transport, given its global nature, must be seen in its proper global context. Worldwide trends certainly pose both challenges but also opportunities for the air transport industry. As a global company, and from the transatlantic perspective, we would like to call for the establishment of an open dialogue and a cooperative spirit concerning solutions to transatlantic and global challenges, such as climate change and recovery in the wake of the global recession.

Policy Objectives for Sustainable Transport

In response to the challenges highlighted above, Europe must adopt policies that continue to enable investment in modernising and making more efficient the European air transport system, in order to leverage growth and jobs that will enable Europe to remain at the forefront of global competition, and most importantly, emerge from the economic recession more quickly. The EU should also continue to support mobility – a key priority for Europe's prosperity – through free movement of people, goods and services. Europe must promote further liberalisation of key European markets, including air services, in ways that benefit business and consumers and increase opportunities for competition and innovation.

As an aircraft manufacturer, Boeing's overarching goal is to provide a safe, secure and efficient air transport system. Safety is the underpinning objective of Boeing and, as such, it is important that enhancements and changes in the air transport system are based on data driven, risk-based analysis. In addition to the safety enhancements that drive air traffic management (ATM) solutions an additional goal exists of providing a more efficient system. A more efficient system is beneficial to the environment but also beneficial to the global economy. Boeing continues to push for policies that bring about global interoperability in ATM. Working with key partners in the EU Boeing wants to ensure a seamless transition from one airspace to the next. It is imperative that as we continue to focus on a safe, secure and efficient air transport system, we recognise that this can only be achieved through solutions that recognise the global impact of aviation and the need for global harmonisation.

Concerning the environment, Boeing believes that any policy objectives developed in light of the new White Paper on Transport must take the linkage between the environment and the economy into account. To that end, we support Commissioner Tajani's recent comments that "making European transport more environmentally sustainable must be a priority for a post-2010 EU transport policy" and that "there is no contradiction between economic and environment objectives when it comes to transport." Boeing supports a CO2 standard that can drive efficiency on new aircraft models. We need policy makers to focus on creating the kind of technology required to achieve the many CO2 reduction targets that are being set. A clear example of this is funding R&D and investments for a more efficient and sustainable transport, i.e. fleet renewal, sustainable biofuels, avionics and ATM. Transport can be a catalyst of technology innovation, creation of high skilled jobs and a driver of economic and social growth for Europe.

Policies for Sustainable Transport (Suggestions)

Overall, Boeing's own views for sustainable air transport and those of the Commission are comparable and complementary, although our emphasis differs in places. As the number one performing industrial company in the 2009 Global Carbon Disclosure Leadership Index, Boeing understands the need to carefully consider future policy options for sustainable air transport. In this section, we outline our policy recommendations, as well as some of the technologies we are pursuing, in order to address key challenges, in particular key environmental challenges.

1. Infrastructure: maintenance, development and integration of modal networks

The United Nations' Intergovernmental Panel on Climate Change (IPCC) states that 6-12 percent efficiency gains can be achieved through ATM improvements, thereby reducing CO2 emissions. We must accelerate the near- and medium-term solutions envisioned in the Single European Sky and its implementation programme, SESAR. Manufacturers are building more efficient aircraft and pushing back technology boundaries. However, it is also critical that governments implement operational procedures that allow for efficiency gains.

Boeing is currently developing its own ATM solutions that will allow the industry to continually adapt and transform, moving past the ceiling we have reached with the current airspace infrastructure. These new technologies are based on building blocks that can adapt to changes in the future. For example, since 2004, Boeing has partnered with the Dutch Knowledge and Development Centre Mainport Schiphol, Air Traffic Control the Netherlands (LVNL), KLM Royal Dutch Airlines, transavia.com and Eurocontrol's Maastricht Upper Area Control Centre to advance tailored arrivals. The current trials include the use of a ground automation tool, the Speed and Route Adviser (SARA), designed to enhance tailored arrivals. SARA will enable tailored arrivals in congested airspace by increasing predictability for air traffic controllers so they can allow smoother traffic flows into an airport with corresponding gains in fuel efficiency and reductions in environmental impact. Estimates suggest a possible fuel savings equal to 3,000 tons per year, with corresponding reductions in emissions of CO2 and NOx.

In understanding the future impact of climate change on ATM, the European Commission should also further address metrics and performance review. This is an area that the Commission has focused on in the past and can provide greater focus on in the future, in order to complete the picture of what

progress is really being made in ATM. Measurement of outcomes versus activities are important in determining whether progress towards transformation is being made and what further progress is required, especially in relation to external challenges, such as climate change. Boeing believes a yearly analysis of the measurements detailed below will provide a clear picture concerning the status of transformation and ensure that funding is being spent on projects that are improving the system, both now and in the future. Boeing advocates the same set of metrics in the United States. By committing to an objective set of metrics, the United States and Europe can better gauge where gaps exist and, therefore, also better plan for the future.

The metrics we advocate are:

- Safety: Reduction in annual fatal accident rates for commercial and general aviation.
- Flight Efficiency: Reduction in average actual and/or scheduled gate-to-gate travel times for a nationally representative set of city-pair routes.
- Runway Productivity: Increase in allowed operations per hour on individual runways at major airports.
- Runway Growth: Increase in the number of new runways at airports where added capacity is needed.
- ANSP Cost Efficiency: Annual decrease of overall FAA/ANSP unit costs per flight operation.
- Emissions: Reduction in CO2 emissions.

Given the broad future scope of this consultation, we would like to add a few words on unmanned aerial vehicles (UAVs). We expect UAVs to form an increasingly important role in the long-term future of the air transport system. Pressure to fly UAVs in civil national airspace will continue to mount. Acquisition costs, as well as life cycle costs, make them very attractive for dull, dangerous or long endurance applications, e.g. fire fighting, pipeline or crop monitoring and providing cell phone coverage (cell tower in the sky) for natural disasters such as Katrina. Some UAVs may take the place of manned aircraft but in general UAVs have the potential to dramatically increase the amount of air traffic that an ATM system will need to accommodate and so this should be factored into the future of ATM.

Since this Communication considers the full range of modes of transport, we would like to address the issue of modal shift – a theme that the Commission regularly refers to in its documents and initiatives – and underpinning this, the concept that some modes are 'greener' than others. We believe the Commission should address transport policy not on the basis of transport modes but rather on efficient transport. Modal shift is neither possible nor suitable in the large majority of traffic flows. The Commission must, therefore, encourage *all* transport mode providers to develop new technologies and concepts in order to address greenhouse gas emissions' reduction, focusing on modal connectivity first and foremost.

2. Funding: finding the right resources for sustainable transport

A range of funding mechanisms need to be considered in relation to supporting the future sustainable growth of air transport.

The unique requirements of aviation fuels need to be taken into consideration. Aviation does not have the benefit of being able to implement many of the alternative technologies available to other modes of transport, e.g. electric and hybrid systems. It is, therefore, essential to ensure that R&D resources are focused on addressing aviation's requirements, including measures to incentivise the commercialisation and scalability of sustainable aviation biofuels so that these biofuels have the opportunity to be developed alongside all the other alternative energy sources available for all industrial sectors. Sustainable biofuels, which do not compete with food or water resources, have been identified by the aviation industry as key to bringing about a low carbon future for air transport.

In relation to financing the air transport system, Boeing believes that a safe, secure, and efficient transport system is a public good and, therefore, that a need exists to find a stable funding source to ensure the aviation system can accommodate the increasing air traffic demand and support system efficiencies. In the United States, Boeing has supported a 'pay for what you use' concept. We believe that a funding source based on operations and movements rather than ticket prices is more stable and predictable.

A stable funding source should also consider the possibility of capital financing, such as bonding or a similar financial instrument, in order to help pay for the transformation of the air traffic system. Boeing does not believe that demand management constraints, such as congestion pricing or slot reduction, among others, are a solution to the capacity limitations of the air transport system. Boeing believes the focus should be on modernising the air transport system. Modernising the system is the only way to provide a safe, secure and efficient transport system, critical to the EU and the overall global economy.

It is imperative that policy solutions prioritise the continuation and acceleration of research funding that can help ensure these technological and operational solutions are developed and implemented. Boeing currently participates in the Sixth Framework Programme for Research and Technology on EU-US ATM interoperability. We would like to see continued support for such EU-US research efforts. However, Framework Programme funding should be faster and less onerous for businesses seeking to access R&D funding quickly and provide more opportunities for international cooperation. Innovation is a fast-moving activity – policies around funding need to be flexible enough to keep pace.

3. Technology: how to accelerate the transition to a low carbon society and lead global innovation

The Commission Communication states that "the most important policy instrument will probably be standard setting". Boeing supports the development of a CO2 standard for new aircraft and believes that this standard should be developed by ICAO, the standard-setting organisation for aviation. This standard is one of the proactive measures that the aviation industry has proposed as a set of solutions to address aviation's carbon footprint.

Boeing supports the Commission's focus in the Communication on technology as a key driver towards creating a sustainable transport system. Commitment to R&D is vital for a technology-driven enterprise like Boeing. We support R&D policies that advance basic research. The Commission also notes that for promising technologies, "ensuring interoperability will be required". Interoperability is very important for Boeing. We believe there is a need for policies to acknowledge technological interoperability in achieving an efficient transport system.

In relation to the environment, we believe that the reduction of greenhouse gas emissions is best achieved through investment in basic research for new technology, enabling emissions to be reduced at source, either through aircraft design, or through use of alternative sustainable energy sources. This, together with investment in modernised equipment and infrastructure, as mentioned above in relation to ATM, is the best way to achieve increased environmental performance in air transport.

While it is necessary to consider the future of transport and the environment up to 2050 and beyond, the Commission's priority, in terms of addressing climate change, must be to support the introduction of existing technology solutions. There are real near- and medium-term activities that, if implemented, can help increase efficiency and provide immediate environmental benefits.

3.1. Aircraft Design

We believe there are a number of particular challenges associated with greenhouse gas reductions in the aviation sector, including the long service life of aircraft and the complex integration of new aircraft design. However, aviation is one of the fastest-advancing technology sectors. Boeing has contributed to improving fuel efficiency of its airliners by 70 percent since their introduction.

Generally Boeing focuses on aerodynamic improvement, structural efficiency (weight), system efficiency (weight/power), materials, propulsion, and operational capability (flight deck ATM). Some of these ideas apply to new aircraft only and some have retrofit implications. This distinction is important: some aircraft will benefit from retro-fit; some from new design. As far as Boeing products are concerned, each new generation of commercial aircraft will be 15 percent more fuel- and CO2-efficient than the aircraft they replace. The 787 Dreamliner and the 747-8 Intercontinental are both designed to be more fuel- and CO2-efficient (respectively 20 percent and 16 percent) than the aeroplanes they replace.

Boeing has made enormous strides in reducing the environmental impact of its products and we continue to invest significant resources to reduce the environmental footprint of commercial aircraft. Advanced aircraft materials play a crucial role in reducing the environmental impact of aviation. New materials improving structural efficiency produce lighter weight materials and, therefore, a more fuel efficient design. Also wing aerodynamic improvements, such as winglets, can be a solution but only for retrofit. New aircraft incorporate raked wingtips, which have more structural efficiency than a winglet. In this regard, it is essential that the Commission, in its policy setting for the future of transport, supports innovation and technology: technology holds the key for sustainable air transport.

3.2. Alternative Energy

The Commission notes the "insufficient progress in reducing its energy and greenhouse gas intensity" from transport (paragraph 15). However, we would like to highlight the many proactive ways in which the aviation industry, including Boeing, is reducing the greenhouse gas impact, including introducing alternative energy sources for air transport.

3.2.1. Sustainable advanced-generation biofuels

We believe that alternative energy can bring significant environmental gains to the air transport industry. We would like to highlight that significant work is being undertaken across the supply chain to enable the commercialisation of next generation sustainable biofuels for aviation.

We would also like to note that, given the unique safety and other requirements of fuels that are used in aircraft, it is important to ensure that in the development of alternative fuel sources there are resources focused on developing alternative fuels that can meet those requirements. Utilisation of sustainable biofuels is expected to be the major path to achieve a low carbon future for the industry over the long-term.

Whilst industry sectors such as power generation and ground transport have viable alternative energy sources currently available – such as wind, hydro, nuclear and solar technologies for power generation, and hybrid, flexible fuel engines or electricity for cars and buses, and replacing diesel locomotives with electric-powered trains – such a wide variety of solutions are not viable for aircraft. The aviation industry has identified the development of biofuels as one of the major ways it can reduce its greenhouse gas emissions. Sustainable advanced-generation biofuels provide aviation with the capability to partially, and perhaps one day fully, replace carbon-intensive petroleum fuels. They will, over time, enable the industry to reduce its carbon footprint significantly.

Advanced-generation sustainably grown biofuels represent a significant opportunity to reduce aviation's greenhouse gas emissions on a lifecycle basis. Boeing is working with airlines, engine manufacturers, universities, and environmental groups to promote and enable the development of a portfolio of sustainable biofuels for use in commercial aviation. The approval of biofuels for use on commercial aircraft engines is on track to occur by 2010 and we foresee the market availability of sustainable biofuels for aviation within the next 3-5 years. To highlight the technical feasibility of using biofuels in a commercial airliner, Boeing has conducted a series of flight tests involving different airlines and each of the major engine manufacturers. Results from the flight tests show that sustainable biofuels performed as well *or better* than typical petroleum-based fuel. A summary of the results of the biofuel flight tests can be found at: http://www.safug.org/docs/biofuel-testing-summary.pdf

We would like to point out that Boeing supports the use of *only sustainable biofuels*. We continue to support lifecycle analysis to verify the sustainability of feedstocks that do not compete with food or fresh water resources, such as jatropha, camelina, halophytes, and algae. As part of our emphasis on sustainability, we are an associate member in the airline-led Sustainable Aviation Fuel Users Group (SAFUG), which was formed in 2008 and currently has 14 airline members (see www.safug.org for more information). While Boeing and the aviation industry are undertaking a significant effort to make the availability and commercialisation of sustainable biofuels a reality, government policies to enable this initiative are also a critical component of this breakthrough solution.

We would also like to point out that it is not only alternative fuel that will bring reductions to air transport greenhouse gas emissions but also the constant improvement of the ATM system. Sustainable advanced-generation biofuels are part of the greenhouse gas reduction picture.

3.2.2. Hydrogen fuel cells

There is interest in the development of enabling technologies for an all-electric aircraft (e.g. high-efficiency electric motors utilising superconducting materials) for use in combination with fuel cells and hydrogen fuel. Boeing is researching commercial and military hydrogen powered manned and unmanned aircraft.

In April 2008, Boeing flew, for the first time in aviation history, a manned aircraft powered by hydrogen fuel cells. Boeing Research & Technology Europe (BR&TE) in Madrid led the flight with assistance from European and US partners. A two-seat Dimona motor-glider with a 16.3 meter wingspan was used as the airframe, and then modified by BR&TE to include a Proton Exchange Membrane (PEM) fuel cell/lithium-ion battery hybrid system to power an electric motor coupled to a conventional propeller. Three test flights took place in 2008 at the airfield in Ocaña, south of Madrid, operated by the Spanish company SENASA. Also, in October 2007, Boeing successfully tested the hydrogen propulsion system of its High Altitude Long Endurance (HALE) unmanned aircraft using a Ford Motor Company-developed hydrogen engine.

4. The legislative framework: further promoting market opening and fostering competition

Liberalisation of the air transport market has dramatically opened up mobility in Europe and changed the face of European integration. Liberalising air travel directly benefits economies by increasing GDP, employment, travel and tourism, and exports. Increasing air travel also leads to significant gains in the quality and quantity of direct service to various communities both within Europe and worldwide. Putting in place transparent rules for an open market, and further opening up the European air service market, will benefit airlines and consumers alike and increase opportunities for competition and innovation.

5. Behaviour: educate, inform and involve

A balanced public debate based on a broader understanding of aviation's technological and operational achievements and challenges, as well as the role of aviation in the global economy, is essential. Government, in collaboration with industry, should seek to not only support further research and technological solutions but also to ensure that the public is well-informed of not only the environmental issues that the industry is addressing but also the social and economic benefits of aviation to the European and global economies. In the development of policy solutions, it will be important to involve all stakeholders.

6. Governance: effective and coordinated action

The industry has undertaken many proactive measures in relation to air transport and the environment. Boeing's aircraft are more fuel efficient than ever before, and the industry is continually looking for ways to make them more efficient. Governments and regional and international organisations need to remain proactive partners in this process. Furthermore, in relation to the concept of interoperability, we would like to reiterate the need for coordinated action, the importance of the Single European Sky, as well as the research component of SESAR, in achieving greater ATM efficiencies. As EASA takes on its new role in safety oversight of ATM, it will be important to understand and keep clear the institutional relationships between entities with some form of ATM oversight.

6.1. Standards and interoperability

The global nature of the aviation industry requires a global approach to address the impact of aviation and the environment. As a global organisation that is experienced in addressing the many issues and tradeoffs associated with aviation environmental standards and regulations, ICAO must lead the

approach for a global solution. Furthermore, having ICAO in a leadership role can help prevent a multi-layering of regulatory and market measures, which can have a counterproductive impact in terms of both economic growth or development and achieving real and sustainable environmental benefits. We would ask that the European institutions, in recognition of the global nature of air transport, take into account this dimension of the aviation sector by ensuring, at a minimum, harmonisation with global standards-setting entities for aviation (such as ICAO) and international interoperability of ATM solutions.

The work undertaken by both sides of the Atlantic on ATM transformation, through SESAR and NextGen, provides a near-term example of the benefits of interoperability and global coordination.

6.2. The external dimension: the need for Europe to speak with one voice

As previously noted, interoperability is key to a safe, secure and efficient ATM system. In addition it is an important contributor in ensuring the continued positive impact that aviation has had on the global economy. It will be essential for Europe to speak with one voice, in order for the EU to continue in a leadership role. Seamless operation and integration of ATM operations through the Single European Sky should be a priority for all 27 EU Member States, with the recognition that short-term growing pains will be largely compensated by longer-term gains.

Conclusion: What comes next?

To conclude, we would like to highlight that: (1) technology holds the key for sustainable air transport, and industry has made great strides in that area and continues to do so; (2) ATM improvements are essential and the technology is now available to provide immediate benefits and provide the foundation for transformation; (3) sustainable biofuels are the key for long-term, low carbon sustainable aviation; (4) aviation is global, and any standards-setting or other measures need to take into account the global nature of the industry. We hope that the European Commission can take into account these points when drafting policy measures for a sustainable future for transport.