

# ICAO

## ENVIRONMENTAL REPORT 2010



**AVIATION** and  
**CLIMATE CHANGE**



**ACT >>>**  
**GLOBAL**

ICAO: UNITING AVIATION ON CLIMATE CHANGE



Produced by the Environment Branch  
of the **International Civil Aviation Organization (ICAO)**  
in collaboration with FCM Communications Inc.

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**BAN Ki-moon**

Secretary-General of the  
United Nations

UNITED NATIONS



NATIONS UNIES

# FOREWORD

*International air transport has helped to bring our world closer together. From the goods we send, to the people and places we visit, air travel has shaped the quality of modern life and heightened awareness of our global society.*

*Yet, these advances have not been without cost. Looking forward, we must ensure that international aviation is as energy-efficient as possible and minimizes harmful impacts on our climate and ecosystems.*

*I commend efforts by the air transport sector to improve the efficiency of aircraft engines, as well as the industry's progress on developing and using sustainable fuels for aviation. I also welcome growing cooperation between governments and industry on a programme of action to reduce climate impacts from aviation emissions.*

*This second ICAO Environmental Report reflects and promotes cooperation among governments, industry and members of civil society. It also showcases ideas and best practices that can accelerate efforts towards the goal of a sustainable air transport industry.*

*Air travel has brought many benefits to modern life. Let us ensure that, from now on, it benefits both people and the planet.*

**BAN Ki-moon**

# MESSAGE FROM THE PRESIDENT OF THE COUNCIL OF ICAO



**Roberto Kobeh  
González**

President of the Council of the  
International Civil Aviation Organization  
(ICAO)

*The future of air transport as a catalyst for the economic, social and cultural development of our global society is directly related to our collective ability to reach and maintain the sustainability of civil aviation operations worldwide.*

*This will require substantial, sustained and coordinated efforts by the scientific community and the air transport industry, backed by the strong political will of ICAO Member States and the commitment of concerned stakeholders. Together, we need to better understand, assess and monitor the impact of flight operations on the environment, while developing green technologies, operational measures and related policies to ensure an optimum balance between the growth of aviation and the need to protect the environment.*

*Addressing the myriad issues involved in dealing with climate change as a whole obviously calls for an unprecedented level of cooperation. As the official forum for international civil aviation, ICAO has led the drive for arriving at globally-harmonized solutions and for creating dynamic relationships with appropriate United Nations agencies.*

*The last three years have been particularly productive. Since the publication of the previous Environmental Report in 2007, ICAO adopted the Programme of Action on International Aviation and Climate Change, which included the first and only global agreement on goals for addressing climate change from a sector, and we are further exploring more ambitious goals. Consensus on the essential role of alternative fuels for aviation, coupled with significant concrete achievements in that area, opened the door to new opportunities at that can bring significant contribution to the overall sustainability of aviation.*

*As we move ahead, ICAO will actively pursue the formulation of a CO<sub>2</sub> Standard by 2013 and new guidance to facilitate the implementation of operational measures with enhanced environmental benefits. Focus will also be placed on a global framework for market-based measures to reduce emissions – all initiatives undertaken with the support of ICAO's Committee on Aviation Environmental Protection (CAEP).*

*The impressive amount of work undertaken by ICAO, its Member States and the aviation industry showcased in this ICAO Environmental Report 2010 can serve as a basis for discussions and decisions on how best to move ahead in a number of related fields.*

*I wish to express my personal appreciation to the experts from various disciplines and organizations who have graciously provided the fruits of their labour, in some cases over many years, so that we may move forward with renewed vigour and confidence towards realizing our common vision of sustainable aviation in the decades to come.*

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# MESSAGE FROM THE SECRETARY GENERAL



**Raymond Benjamin**

Secretary General of the  
International Civil Aviation Organization  
(ICAO)

*This ICAO Environmental Report 2010, dedicated entirely to the topic of climate change, builds on the first edition published in 2007, in bringing together a vast array of authoritative ideas, solutions and new challenges to feed the global discussion on how best to deal with the impact of aviation on the environment.*

*It begins with the acknowledgement that air transport supports economic and social development worldwide, yet contributes to the production of greenhouse gases, roughly two per cent of CO<sub>2</sub> emissions from human activity.*

*While that proportion is relatively small, it does not exclude the sector from the responsibility of setting and meeting targets. The fact that emissions will inevitably increase with the anticipated growth of air transport makes it imperative that we act.*

*That is why ICAO is pressing ahead with developing measures and policies to ensure the long-term sustainability of aviation. A significant milestone was the ICAO Programme of Action on International Aviation and Climate Change, the first globally-harmonized agreement, as a sector, on a goal to address aviation emissions. Our work, however, is not complete and as an Organization we are actively pursuing more ambitious environmental goals and solutions for international aviation.*

*For their part, manufacturers have dramatically improved the energy efficiency of aircraft engines and aircraft design, notably through the use of lighter, composite materials, more aerodynamic designs, and advanced engine technologies. Operators and air navigation services providers have done their share through streamlined operational procedures, assisted in this effort by more modern air navigation aids and procedures.*

*ICAO also serves the public by delivering factual information, in transparent manner, such as with this report and through the ICAO Carbon Emissions Calculator, which allows passengers to assess the carbon footprint of a flight. ICAO is leading by example by working to reduce the carbon footprint from our operations. A number of States are developing action plans to reduce emissions from their aviation activities.*

*The rapid pace of development of sustainable alternative fuels offers the promise of even greater environmental benefits. Economic instruments and financing are rounding out the comprehensive approach to minimizing the impact of aviation on the environment and adapting to changes.*

*There are a host of other initiatives that can and will be taken in the future to protect the environment, OUR environment, for generations to come.*

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# ICAO ENVIRONMENTAL PROTECTION PROGRAMME



**Folasade Odutola**

Director of the Air Transport Bureau,  
ICAO

*A brief history of ICAO's involvement in aviation environmental protection since the late 1960s emphasizes the value of a common, coordinated and global approach to addressing the impact of air transport operations on noise and local air quality around airports, and the much broader challenge of climate change.*

*The Organization began tackling environmental issues before it became "popular" to do so in the 1990's amid public concerns about climate change. A first major step was the creation of the Committee on Aircraft Noise (CAN) in 1970, followed by the Committee on Aircraft Engine Emissions (CAEE) in 1977. These two committees were merged in 1983 to form the existing Committee on Aviation Environmental Protection (CAEP).*

*The environmental programme of ICAO grew larger in scope with the coming into force of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. This created a mechanism for ICAO to interact and cooperate with other UN bodies on greenhouse gas emissions issues, while continuing to deal with an expanding list of noise and local air quality issues.*

*Today, environmental protection is one of the Strategic Objectives of ICAO. The overall aim is to "Minimize the adverse environmental effects of global civil aviation activity notably aircraft noise and aircraft emissions through the following measures: develop, adopt and promote new/amended measures to:*

- **limit or reduce** the number of people affected by significant aircraft noise;
- **limit or reduce** the impact of aircraft engine emissions on local air quality; and
- **limit or reduce** the impact of aviation greenhouse gas emissions on the global climate."

*This mandate is carried out by the ICAO Environment Branch and through CAEP which, over the years, has evolved into a recognized international forum of environmental experts, from both regulators and industry, to deal with aviation and the environment. CAEP is tasked with the study and development of proposals according to four criteria: technical feasibility; environmental benefit; economic reasonableness and interrelationship between measures.*

*The ICAO Council reviews and adopts CAEP recommendations. It informs the Organization's Assembly which meets every three years and establishes policies on aviation environmental protection. The Organization also produces complementary studies, reports, manuals and circulars on the subject of aviation and environment.*

*The 2007-2010 triennium was particularly active in the area of aviation and climate change. ICAO multiplied its efforts in coordinating its activities with other UN bodies, States, and international organizations in this area and the UN itself also launched several initiatives related to climate change which necessitated yet more involvement of ICAO.*

*Environmental protection is a global problem that requires global solutions. The Organization is keenly aware of the leadership role conferred on it in this area by its 190 Member States and it is totally committed to meeting the challenge of environmental sustainability of the world air transport sector.*

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# REPORT OVERVIEW



**Jane Hupe**

Chief of the Environment Branch,  
in ICAO's Air Transport Bureau.

*Three years ago we launched the first ICAO Environmental Report, consolidating for the first time, in a single ICAO publication, information on scientific, technological, economic, political and regulatory aspects of aviation environmental protection. We covered a wide range of subjects related to aircraft noise and aircraft engine emissions, focusing on both local and global impacts of aviation operations. The 2007 report was very well received, and became a reference publication in the field. The fact that the report was made available free of charge and easily accessible from the ICAO public website greatly facilitated information sharing and outreach.*

*Building on the success of the 2007 Environmental Report, we decided to embark on a second report — this time, an edition entirely dedicated to climate change. Many reasons led us to this decision. Climate change is without doubt one of the most relevant issues of this century and a priority for the United Nations. It is a major challenge for the sustainability of air transport, and an area where tremendous technological advancements have taken place over the last three years. In addition, quality information is the basis of sound policy development.*

*ICAO Environmental Report 2010 – Aviation and Climate Change, consists of eight parts which will guide the reader through descriptions and the latest assessments of the impacts of aviation on climate change, as well as the possible measures to address them. It includes information on sustainable alternative aviation fuels, and other climate related topics such as adaptation and green financing. The Report also covers the cooperation of ICAO with UN bodies and other international organizations in this area.*

*Building upon the information provided in the previous report, the 2010 Report presents the outcomes of the eighth meeting of ICAO's Committee on Aviation Environmental Protection (CAEP/8, February 2010), the latest developments showcased during the ICAO Colloquium on Aviation and Climate Change (May 2010), as well **as the results of the 37<sup>th</sup> session of the ICAO Assembly on Climate Change.** Many of the featured articles summarize studies and reports by some of the foremost international experts and renowned scientists in their fields. Other articles highlight developments that have emanated from various UN fora such as the United Nations Framework Convention on Climate Change (UNFCCC).*

*Each part of the Report begins with a summary overview to bring readers up to speed on the topic discussed, followed by subject-focused articles by various experts. The document also contains advertorials which provide an opportunity for stakeholders to promote their own perspectives and activities related to climate change.*

*ICAO is firmly committed to ensuring that international civil aviation contributes its share to efforts to deal with climate change. As with all ICAO policies, those that address the environment are developed in keeping with the fundamental principle that aviation is a global industry and, as such, requires global solutions.*

## **Acknowledgements:**

*ICAO wishes to thank the authors from various countries and disciplines who have kindly shared their expertise, imagination and enthusiasm. We are truly grateful to them, for we believe that their collective insights will stimulate dialogue and contribute to defining sustainable climate change solutions. We also thank those States and Organizations that supported the publishing of this report. We look forward to comments and suggestions on how we can improve future editions of the Environmental Report.*

