



**UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE  
(UNFCCC)**

**The Thirty-first Session of the UNFCCC Subsidiary Body for  
Scientific and Technological Advice (SBSTA31)**

**7 to 18 December 2009 – Copenhagen, Denmark**

**GLOBAL FRAMEWORK ON INTERNATIONAL AVIATION AND CLIMATE CHANGE**

**(Submission by the International Civil Aviation Organization (ICAO))**

**1. INTRODUCTION**

1.1 The 36th Session of the International Civil Aviation Organization (ICAO) Assembly in September 2007 adopted Resolution A36-22: *Consolidated statement of continuing ICAO policies and practices related to environmental protection*. In particular, the Assembly recognized, *inter alia*, “the critical importance of providing continuous leadership to international civil aviation in limiting or reducing its emissions that contribute to global climate change”.

1.2 The Assembly requested that the Council “facilitate action by States by vigorously developing policy options to limit or reduce the environmental impact of aircraft engine emissions, developing concrete proposals and providing advice as soon as possible to the Conference of the Parties of the UNFCCC, encompassing technical solutions and market-based measures, while taking into account potential implications of such measures for developing as well as developed countries”. In order to achieve this, the Assembly requested the ICAO Council to:

- a) “form a new Group on International Aviation and Climate Change ... with technical support provided by the Committee on Aviation Environmental Protection, for the purpose of developing and recommending to the Council an aggressive Programme of Action on International Aviation and Climate Change”; and
- b) “convene at an appropriate time, taking into account the fact that the fifteenth meeting of the Conference of the Parties (COP15) of the UNFCCC will be held in December 2009, a high-level meeting to review the Programme of Action recommended by the Group”.

1.3 Furthermore, the Assembly “recognized the importance of research and development in fuel efficiency and alternative fuels for aviation that will enable international air transport operations with a lower environmental impacts”, and encouraged that the Council “promote improved understanding of the potential use, and the related emissions impacts, of alternative aviation fuels”.

**2. GROUP ON INTERNATIONAL AVIATION AND  
CLIMATE CHANGE (GIACC)**

2.1 In response to the mandate mentioned in paragraph 1.2 a) above, the Council established the Group on International Aviation and Climate Change (GIACC) comprised of 15 senior government officials reflecting equitable participation from developed and developing States, with

technical support provided by the Committee on Aviation Environmental Protection (CAEP). The Group held its fourth and final meeting in May 2009, developed a Programme of Action on International Aviation and Climate Change and submitted it to the Council for its consideration. The Council fully accepted the Programme of Action in June 2009 as a positive development to limit or reduce aviation's climate impact.

2.2 Areas for further work were identified, including more ambitious medium and long-term goals, the development of a CO<sub>2</sub> standard, a framework for market-based measures, and exploring of approaches to provide technical assistance in the reporting process for developing States.

### **3. HIGH-LEVEL MEETING ON INTERNATIONAL AVIATION AND CLIMATE CHANGE**

3.1 In response to the mandate mentioned in paragraph 1.2 b) above, the High-level Meeting on International Aviation and Climate Change was convened at ICAO Headquarters from 7 to 9 October 2009 to review the Programme of Action developed by the GIACC and accepted by the Council. The Meeting was attended by 339 participants representing 73 States (responsible for 94 per cent of the global international aviation traffic) and 26 international organizations.

3.2 The Meeting welcomed the decision of the ICAO Council to fully accept the GIACC's Programme of Action, and reaffirmed ICAO's leading role in matters involving international civil aviation. The Meeting successfully approved a Declaration as well as Recommendations regarding further work by the ICAO Council on international aviation and climate change.

3.3 In summary, ICAO and its member States:

- a) agreed on a global annual fuel efficiency improvement of 2 per cent for the medium-term (up to 2020) and an aspirational global annual fuel efficiency improvement of 2 per cent for the long-term (up to 2050);
- b) recognized that these goals are unlikely to deliver the level of reduction necessary to stabilize and subsequently reduce aviation's absolute emissions contribution to climate change, and that more ambitious goals will need to be considered to deliver a sustainable path for aviation;
- c) declared that ICAO and its member States, along with relevant organizations will keep working together to undertake further work on medium and long-term goals, including exploring the feasibility of more ambitious goals, including carbon-neutral growth and emissions reductions, for consideration by the 37th Session of the ICAO Assembly;
- d) agreed on the development of a global CO<sub>2</sub> Standard for aircraft;
- e) strongly encouraged wider discussions on the development of alternative fuel technologies and the promotion of the use of sustainable alternative fuels in aviation;
- f) agreed to facilitate the implementation of operational changes and the improvement of air traffic management and airport systems aiming to reduce emissions from international aviation;

- g) agreed that ICAO will establish a process to expeditiously develop a framework for market-based measures in international aviation;
- h) agreed to further elaborate on measures to assist developing States as well as facilitate access to financial resources, technology transfer and capacity building;
- i) in order to monitor progress towards reaching the goals, States are encouraged to submit their action plans, outlining their respective policies and actions, and annual reporting on international aviation CO<sub>2</sub> emissions to ICAO; and
- j) agreed that ICAO will regularly report CO<sub>2</sub> emissions from international aviation to the UNFCCC, as part of its contribution to assessing progress made in the implementation actions in the sector.

3.4 These texts strike a balance between the views of all member States and represent their collective will and determination to act in a coherent and cooperative manner to address international aviation and climate change. It is also a demonstration of the seriousness with which ICAO takes its responsibilities towards environmental protection.

3.5 It should be pointed out that the global annual 2 per cent fuel efficiency goal to 2020 is a very challenging goal for the sector. This is the first time that any sector comes forward with a global sector-wide target for sustained fuel efficiency improvements. Achieving it will require significant resources and investments from States and the air transport industry and will involve improvements in all aspects of the aviation sector.

3.6 In November 2009, the ICAO Council fully accepted the outcome of the High-level Meeting, including its Declaration and Recommendations approved by the Meeting, and decided on further action for consideration by the 37th Session of the ICAO Assembly in September 2010 and beyond. The Report of the High-level Meeting, including its Declaration and Recommendations as accepted by the Council (provided respectively in **Appendices A and B**) is available at: <http://www.icao.int/HighLevel2009/>.

#### 4. **SUPPORTING ACTIVITIES BY CAEP**

4.1 The Committee on Aviation Environmental Protection (CAEP) established in 1983 is a technical committee of the ICAO Council that has 24 members and 13 observers, and approximately 400 experts that are involved in the overall activities that are of a highly technical nature.

4.2 In parallel with the development of the Programme of Action, CAEP has continued to make progress on establishing medium and long-term fuel burn goals relating to technological development of airframe and engines, as well as those goals relating to operational measures such as the improvement of air traffic management. Utilizing the Independent Experts (IE) processes under CAEP, the projections on technological and operational improvements were incorporated into the environmental goals assessment for year 2016, 2026 and 2036 timeframes using prediction models. In response to the request from GIACC, the assessment was extended to include the year 2012, 2020, 2025 and 2050 timeframes.

4.3 CAEP endorsed the use of the “Commercial Aircraft System Fuel Efficiency Metric (CASFE = Fuel Mass Consumed / Payload × Distance)” as the fuel efficiency metric for the environmental goals assessment, and agreed on further refinement of the metric by taking into account alternative fuels. Information was provided to GIACC and High-level Meeting in this regard.

4.4 CAEP is finalizing its technical work on the quantification of future CO<sub>2</sub> emissions trends and fuel efficiency improvements of the global aviation system for the period 2006 through 2050. The preliminary result shows that global aviation fuel burn is expected to grow from 190 Mega tonnes (Mt) in 2006 to the range of 280 to 1,430 Mt (likely 730 to 880 Mt) in 2050. Not accounting for the impact of alternative fuels, CO<sub>2</sub> is predicted to grow from 600 Mt in 2006 to the range of 890 to 4,520 Mt (likely 2,300 to 2,800 Mt) in 2050. The preliminary result was provided to GIACC and High-level Meeting for their deliberations, prior to the final consideration at the 8th meeting of CAEP in February 2010.

4.5 CAEP is also continuing its technical work on mitigation measures, including the increase of current NO<sub>x</sub> emissions stringency and, as recommended by GIACC and High-level Meeting, the development of a global CO<sub>2</sub> Standard for aircraft. Building upon ICAO guidance on Operational Opportunities to Minimize Fuel Use and Reduce Emissions (Circular 303), which identifies and reviews various operational opportunities and techniques for minimizing fuel consumption and hence CO<sub>2</sub> emissions in civil aviation operations, CAEP is developing new guidance material to be finalized in February 2010. This guidance material will contain new and updated information on current initiatives relating to fuel burn reduction.

4.6 On the subject of market-based measures to reduce aviation CO<sub>2</sub> emissions, ICAO developed a template in 2004 for voluntary agreements between aviation industries and public organizations, and collected and shared information on voluntary actions to reduce aviation GHG emissions by member States and various stakeholders in 2007. In the same year, ICAO also published guidance for States for incorporating international aviation emissions into their trading schemes (*Guidance on the Use of Emissions Trading for Aviation*, ICAO Doc 9885).

4.7 CAEP developed a study on linking open emissions trading systems involving aviation. With the implementation of different emissions trading schemes throughout the world, the increased harmonization of features and processes may facilitate the linkage of such schemes, thus enabling the creation of a global scheme. CAEP also developed a study on the potential for carbon offset measures to mitigate the impact of aviation on climate change, recognizing its potential for implementation in the short term. Both studies will be presented for approval at the 8th meeting of CAEP in February 2010.

## 5. AVIATION AND ALTERNATIVE FUELS

5.1 In response to the mandate mentioned in paragraph 1.3 above, ICAO organized a Workshop on Aviation and Alternative Fuels in February 2009 to explore potential options, challenges to development and deployment as well as initiatives to promote international cooperation in sustainable alternative fuels for aviation. The workshop featured 39 presentations from policy makers, regulatory and certification authorities, international airlines, NGO's, aerospace and fuel industry representatives and served as a preparatory event for the Conference on Aviation and Alternative Fuels in November 2009. All of the presentation materials are available on the workshop website (<http://www.icao.int/WAAF2009/>).

5.2 There was general agreement following the workshop that aviation alternative fuels can be a win-win solution for reducing aviation's dependence on fossil fuels and a key element to help reduce the impact of aviation on climate change. It was also noted that alternative fuels should be part of a comprehensive aviation energy strategy that includes technological, operational and market-based measures.

5.3 ICAO held a Conference on Aviation and Alternative Fuels in November 2009 (<http://www.icao.int/CAAF2009/>) as an important step by ICAO to promote improved understanding of the potential use and emission effects of sustainable alternative fuels and to facilitate its

development and deployment. The Conference endorsed the use of sustainable alternative fuels for aviation, particularly the use of drop-in fuels in the short to medium-term, as an important means of reducing aviation emissions.

5.4 The Conference noted that the introduction of sustainable alternative fuels for aviation will help address issues of environment, economics, and supply security. Today, there is very limited availability of qualified alternative fuels for aviation. It has been demonstrated that sustainable alternative fuels for aircraft can be produced from a wide variety of feedstocks for use in global aviation, suggesting that many regions are candidate production locations. Those sustainable alternative fuels may offer reduced lifecycle CO<sub>2</sub> emissions compared to conventional aviation fuels.

5.5 The Declaration and Recommendations approved by the Conference affirmed the commitment of States and industry to develop, deploy and use sustainable alternative fuels to reduce aviation's emissions. To facilitate, on a global basis, the promotion and harmonization of initiatives that encourage and support the development of sustainable alternative fuels for aviation, the Conference established an ICAO Global Framework for Aviation Alternative Fuels. The Global Framework will be a living document that will be made available on the ICAO website and updated whenever new information is provided by member States and International Organizations. The Declaration and Global Framework approved by the Conference are provided respectively in **Appendices C and D**.

## 6. CONCLUDING REMARKS

6.1 Emissions from international aviation are global in nature and cannot be allocated to national or recognized geographic boundaries. Assigning international emissions is an extremely complex task at best and difficult to implement or enforce.

6.2 As a specialized agency responsible for the highest possible degree of uniformity and harmonization among its member States and stakeholders on international aviation matters, ICAO has been working actively and aggressively for a global framework to address GHG emissions from international aviation sector. The High-level Meeting and Conference on Aviation and Alternative Fuels convened by ICAO reached the first globally-harmonized agreement, as a sector, on the way its member States intend to reduce aviation's impact on climate change.

6.3 ICAO will continue to exercise its leadership in all matters related to international aviation, including the limitation or reduction of GHG emissions, which shall be addressed under a globally harmonized framework, with all member States working further through ICAO towards "concrete actions, tangible global results".

-----

## APPENDIX A

### Declaration by the High-level Meeting

The High-Level Meeting on International Aviation and Climate Change, convened by the International Civil Aviation Organization (ICAO) at its Headquarters in Montreal on 7 to 9 October 2009 was attended by Ministers and other high-level officials representing 73 States (responsible for 94 per cent of the global international aviation traffic<sup>1</sup>) and 26 international organizations:

*Whereas* the 36th Session of the ICAO Assembly requested the Council to convene a high-level meeting to review the Programme of Action on International Aviation and Climate Change recommended by the Group on International Aviation and Climate Change, taking into account that the fifteenth meeting of the Conference of the Parties (COP15) of the United Nations Framework Convention on Climate Change (UNFCCC) will be held in December 2009;

*Welcoming* the Decision of the ICAO Council to fully accept the Programme of Action on International Aviation and Climate Change, which includes global aspirational goals in the form of fuel efficiency, a basket of measures and the means to measure progress, as an important first step in the work of Member States at ICAO to address greenhouse gas (GHG) emissions from international aviation;

*Reaffirming* ICAO as the lead United Nations agency in matters involving international civil aviation, and *emphasizing* ICAO's commitment to provide continuous leadership in addressing international civil aviation matters related to the environment;

*Acknowledging* the principles and provisions on common but differentiated responsibilities and respective capabilities, and with developed countries taking the lead under the UNFCCC and the Kyoto Protocol;

*Also acknowledging* the principles of non-discrimination and equal and fair opportunities to develop international aviation set forth in the Chicago Convention;

*Reemphasizing* the vital role which international aviation plays in global economic and social development and the need to ensure that international aviation continues to develop in a sustainable manner;

*Acknowledging* that international aviation emissions, currently accounting for less than 2 per cent of total global CO<sub>2</sub> emissions, are projected to grow as a result of the continued development of the sector;

*Recognizing* that the international aviation sector must play its part to confront the global challenge of climate change, including by contributing to the reduction of global GHG emissions;

*Noting* the scientific view that the increase in global average temperature above pre-industrial levels ought not to exceed 2°C;

*Noting* the continuous efforts of the sector to minimise aviation's impact on climate change and the improvement in fuel efficiency achieved over the last 40 years, resulting in aircraft today that are 70 per cent more fuel efficient per passenger kilometre;

*Affirming* that addressing GHG emissions from international aviation requires the active engagement and co-operation of States and the industry, and noting the collective commitments announced by ACI, CANSO, IATA and ICCAIA on behalf of the international air transport industry to continuously improve CO<sub>2</sub> efficiency by an average of 1.5 per cent per annum from 2009 until 2020, to achieve carbon neutral growth from 2020 and reducing its carbon emissions by 50 per cent by 2050 compared to 2005 levels;

---

<sup>1</sup> expressed in Revenue Passenger Kilometre.

*Recognizing* the different circumstances among States in their capacity to respond to the challenges associated with climate change and the need to provide necessary support, in particular to developing countries and States having particular needs;

*Recognizing* that the aspirational goal of 2 per cent annual fuel efficiency improvement is unlikely to deliver the level of reduction necessary to stabilize and then reduce aviation's absolute emissions contribution to climate change, and that goals of more ambition will need to be considered to deliver a sustainable path for aviation;

***Declares that:***

1. The HLM endorses the ICAO Programme of Action on International Aviation and Climate Change as accepted by the ICAO Council;

2. In pursuing the implementation of the ICAO Programme of Action on International Aviation and Climate Change, States and relevant organizations will work through ICAO to achieve a global annual average fuel efficiency improvement of 2 per cent over the medium term until 2020 and an aspirational global fuel efficiency improvement rate of 2 per cent per annum in the long term from 2021 to 2050, calculated on the basis of volume of fuel used per revenue tonne kilometre performed;

3. Taking into account the relevant outcomes of the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change, and recognizing that this declaration shall not prejudice the outcome of those negotiations, ICAO and its Member States, with relevant organizations will also keep working together in undertaking further work on medium and long-term goals, including exploring the feasibility of goals of more ambition including carbon-neutral growth and emissions reductions, taking into account the collective commitments announced by ACI, CANSO, IATA and ICCAIA on behalf of the international air transport industry, the special circumstances and respective capabilities of developing countries and the sustainable growth of the international aviation industry, for consideration by the 37th Session of the ICAO Assembly;

4. Such fuel efficiency improvements or other aspirational emission reduction goals would not attribute specific obligations to individual States. The different circumstances, respective capabilities and contribution of developing and developed States to the concentration of aviation GHG emissions in the atmosphere will determine how each State may contribute to achieving the global aspirational goals;

5. ICAO will establish a process to develop a framework for market based measures in international aviation, taking into account the conclusions of the High-level Meeting and outcome of the UNFCCC COP 15 and bearing in mind relevant ICAO Assembly resolutions and the appendices with a view to complete this process expeditiously;

6. ICAO will regularly report CO<sub>2</sub> emissions from international aviation to the UNFCCC, as part of its contribution to assessing progress made in the implementation actions in the sector based on information approved by its Member States;

7. States are encouraged to submit their action plans, outlining their respective policies and actions, and annual reporting on international aviation CO<sub>2</sub> emissions to ICAO;

8. ICAO and its Member States will strongly encourage wider discussions on the development of alternative fuel technologies and the promotion of the use of sustainable alternative fuels, including biofuels, in aviation in accordance with national circumstances.

-----

## APPENDIX B

### Recommendations by the High-level Meeting

In addition to the recommendations from the GIACC as accepted by the Council, the High-level Meeting on International Aviation and Climate Change recommended, in order to progress the work leading to the upcoming 37th Session of the ICAO Assembly in 2010 and beyond, that the ICAO Council:

1. *Work* expeditiously together with the industry to foster the development and implementation of more energy efficient aircraft technologies and sustainable alternative fuels for aviation;
2. *Seek to develop* a global CO<sub>2</sub> Standard for new aircraft types consistent with CAEP recommendations;
3. *Continue* to maintain and update knowledge of the interdependency between noise and emissions in the development and implementation of measures to address GHG emissions from international aviation;
4. *Continue* to work with relevant organizations on the scientific understanding and on measures to limit the non-CO<sub>2</sub> climate impacts of aviation;
5. *Intensify* its efforts in further development of Standards and Recommended Practices for technological and operational measures to reduce international aviation emissions, with the support and expertise from technical panels and committees of ICAO, in consultation with other relevant organizations, in particular on the development of new guidance on operational measures to reduce international aviation emissions;
6. *Commit*, in cooperation with the industry, to facilitate the implementation of operational changes and the improvement of air traffic management and airport systems aiming to reduce emissions from international aviation sector;
7. *Further elaborate* on measures to assist developing States as well as to facilitate access to financial resources, technology transfer and capacity building including possible application of flexible mechanisms under UNFCCC, such as the Clean Development Mechanism (CDM), to international aviation;
8. *Encourage* States and international organizations to actively participate in the Conference on Aviation and Alternative Fuels in Rio de Janeiro in November 2009 (CAAF2009) to share their efforts and strategies to promote such measures, and bring its results to COP15;
9. *Identify* appropriate standard methodologies and a mechanism to measure/estimate, monitor and verify global GHG emissions from international aviation, and States support the work of ICAO on measuring progress through the reporting of annual data on traffic and fuel consumption;
10. *Request* States to continue to support the efforts of ICAO on enhancing the reliability of measuring/estimating global GHG emissions from international aviation;
11. *Consider* a de-minimis exception for States which do not have substantial international aviation activity levels, in the submission of action plans and regular reports on aviation CO<sub>2</sub> emissions to ICAO;

12. *Consider*, with due priority, the allocation of resources for environment-related activities under the next ICAO Regular Programme budget and analyse the possibility of establishing voluntary contributions;
13. *Explore* the relevance of the GIACC's fuel efficiency metric to international business aviation;
14. *Explore* approaches for providing technical and financial assistance in the reporting process to developing countries; and
15. *Invite* the international air transport industry to further elaborate the implementation framework and strategies for the collective commitment of the international air transport industry.

-----

## APPENDIX C

### **Declaration by the Conference on Aviation and Alternative Fuels Rio de Janeiro, Brazil, 18 November 2009**

*Welcoming* the Decision of the ICAO Council to fully accept the Programme of Action on International Aviation and Climate Change, which includes global aspirational goals in the form of fuel efficiency, a basket of measures and the means to measure progress, as an important first step in the work of the Member States of ICAO to address greenhouse gas (GHG) emissions from international aviation;

*Whereas* the High-Level Meeting on International Aviation and Climate Change recommended inter alia that States and international organizations actively participate in the Conference on Aviation and Alternative Fuels to share their efforts and strategies to promote such work, and to update the 15th meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP15) in December 2009;

*Noting* that the introduction of sustainable alternative fuels for aviation will help to address issues of environment, economics, and supply security;

*Noting* the very limited availability of qualified alternative fuels for aviation;

*Noting* that sustainable alternative fuels for aircraft can be produced from a wide variety of feedstocks for use in global aviation, suggesting that many regions are candidate production locations;

*Acknowledging* that sustainable alternative fuels for aviation may offer reduced lifecycle CO<sub>2</sub> emissions compared to the lifecycle of conventional aviation fuels;

*Acknowledging* that sustainable alternative fuels for aviation may also offer benefits to surface and local air quality;

*Acknowledging* that the technology exists to produce substitute, sustainable fuels for aviation that take into consideration world's food security, energy and sustainable development needs;

*Recognizing* that the production of sustainable alternative fuels for aviation could promote new economic opportunities;

*Recognizing* the need for a common definition of sustainability requirements at the international level;

*Recognizing* that aviation is a highly technology driven industry that is responsive to the development and introduction of new technologies;

*Recognizing* that industry has successfully demonstrated the technological feasibility of using sustainable alternative jet fuel blends in flight tests without affecting safety;

*Welcoming* the progress achieved through regional initiatives as a result of the cooperation among the major aviation sustainable alternative fuel stakeholders;

*Welcoming* the activities of the Commercial Aviation Alternative Fuels Initiative (CAAFI), initiated by the United States and the Sustainable Way for Alternative Fuels and Energy in Aviation (SWAFEA), initiated by the European Commission;

*Recognizing* that sustainably-produced fuel derived from sugarcane is already being used in piston engine aircraft in Brazil;

*Welcoming* the pace at which new alternative fuels for aviation are being qualified and in particular, the qualification of aviation jet fuels containing synthesized hydrocarbons;

*Recognizing* that the ICAO Council will further elaborate on measures to assist developing States as well as to facilitate access to financial resources, technology transfer and capacity building including possible application of flexible mechanisms under UNFCCC, such as the Clean Development Mechanism (CDM), to international aviation;

*Recognizing* the urgent need for measures to facilitate access to financial resources, technology exchange, and capacity building specific to aviation alternative fuels;

*Acknowledging* that the demand for sustainable fuels extends beyond international aviation, but that aircraft have unique fuel specification requirements;

*Recognizing* the need to encourage supply chain stakeholders to ensure that sustainable alternative fuels are made available to aviation;

*Acknowledging* that with sufficient incentive and supply, international aviation could deliver a substantial CO<sub>2</sub> reduction benefit from the use of sustainable alternative fuels for aircraft; and

*Recognizing* that due to its small network of fuel distribution points and its predictable demand international aviation is well suited to becoming a global first adopter of sustainable alternative fuels.

***Declares that:***

1. ICAO and its Member States endorse the use of sustainable alternative fuels for aviation, particularly the use of drop-in fuels in the short to mid-term, as an important means of reducing aviation emissions;
2. ICAO establish a Global Framework for Aviation Alternative Fuels (GFAAF) on aviation and sustainable alternative fuels to communicate what individual and shared efforts expect to achieve with sustainable alternative fuels for aviation in the future for consideration by the 37th Session of the ICAO Assembly. The GFAAF will be continually updated;
3. Member States and stakeholders work together through ICAO and other relevant international bodies, to exchange information and best practices, and in particular to reach a common definition of sustainability requirements for alternative fuels;
4. Member States are encouraged to work together expeditiously with the industry to foster the research, development, deployment and usage of sustainable alternative fuels for aviation;
5. Funding efforts that support the study and development of sustainable alternative fuels and other measures to reduce GHG emissions, in addition to the funding for research and technology programmes to further improve the efficiency of air transport, be maintained or improved;
6. Member States are encouraged to establish policies that support the use of sustainable alternative aviation fuels, ensure that such fuels are available to aviation and avoid unwanted or negative side effects, which could compromise the environmental benefits of alternative fuels;
7. ICAO Council should further elaborate on measures to assist developing States as well as to facilitate access to financial resources, technology transfer and capacity building;
8. There is an urgent need for measures to facilitate access to financial resources, technology exchange, and capacity building specific to sustainable aviation alternative fuels;
9. ICAO takes the necessary steps with the aim of considering a framework for financing infrastructure development projects dedicated to sustainable aviation alternative fuels and incentives to overcome initial market hurdles;
10. ICAO continue to facilitate efforts to develop a lifecycle analysis framework for comparing the relative GHG emissions from sustainable alternative fuels to the lifecycle of conventional fuels for aviation; and

11. ICAO and its Member States should strongly encourage wider discussions on the development of alternative fuel technologies and support the use of sustainable alternative fuels, including biofuels, in aviation in accordance with national circumstances.

-----

## APPENDIX D

### Global Framework for Aviation Alternative Fuels First Edition 2009

#### 1. FOREWARD

- a) Sustainable alternative fuels show promise of being an intrinsic part of an approach toward reducing the carbon footprint of aviation. As such, it is important to consolidate information about the many initiatives already underway to facilitate and accelerate the development and deployment of sustainable alternative fuels for aviation over the short, medium, and long term.
- b) The purpose of the Global Framework for Aviation Alternative Fuels is to showcase existing activities and communicate what the international community expects to achieve in the area of aviation sustainable alternative fuels.
- c) The Global Framework is envisaged as a living document, highlighting the work already accomplished and describing the objectives of future activities. An online version of the Framework will be updated, as new information becomes available, illustrating the status of key objectives and providing background and reference materials for relevant activities.
- d) The initial Global Framework was approved during the final day of the first ICAO Conference on Aviation and Alternative Fuels (CAAF/09) for communication to COP15 on the accomplished and projected activities related to the development and use of sustainable alternative aviation fuels as a part of the ICAO strategy for addressing international aviation's contribution to climate change.

#### 2. WHY SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION ARE IMPORTANT

- a) Engineering improvements, technology enhancements, and advanced operations (including efficiency improvements in air traffic management) all have a role to play to reduce aviation fuel use and associated carbon emissions. Significant progress has been made in establishing technology goals for reducing aircraft greenhouse gas emissions. On a per-flight basis, efficiency is expected to improve continuously through 2050 and beyond. ICAO is spearheading efforts to promote and harmonize worldwide initiatives for operational practices that result in reducing aviation's contributions to anthropogenic emissions. However, even under the most aggressive technology forecast scenarios, the anticipated gain in efficiency from technological and operational measures does not offset the overall emissions<sup>2</sup> generated by the expected growth in traffic. The gap between air transport emissions growth reduced by efficiency improvements and a chosen lower level of emissions represents a "mitigation gap" that must be closed using other strategies.
- b) A promising approach toward closing the GHG emissions mitigation gap is the development and use of sustainable alternative fuels for aviation. Today such fuels are not available in sufficient quantities to meet the overall fuel demand for

---

<sup>2</sup>"Aspirational Goals and Implementation Options". High-Level Meeting on International Aviation and Climate Change, 7 to 9 October 2009, Working Paper 5. HLM-ENV/09-WP/5.  
[http://www.icao.int/Highlevel2009/Docs/HLMENV\\_WP005\\_en.pdf](http://www.icao.int/Highlevel2009/Docs/HLMENV_WP005_en.pdf)

commercial aviation. Sustainable drop-in alternative fuels produced from biomass or renewable oils offer the potential to reduce life-cycle greenhouse gas emissions and therefore reduce aviation's contribution to global climate change. They could be an important tool in the efforts to close the mitigation gap while allowing the sector to respond to growing demand. Using these fuels may also offer reduced emissions of particulate matter, lessening aviation's impact on air quality, as the result of the significantly lower fuel sulphur content.

- c) Finally, as aviation is heavily dependent over a short- and medium-term horizon on drop-in liquid fuels, the development and use of sustainable alternative fuels will play an active role in improving the overall resource allocation and security of supply, stabilize fuel prices.

### 3. **THE OBJECTIVES OF USING SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION**

- a) Development of sustainable alternative fuels for aviation is an essential component of future aircraft fuel supply. ICAO has undertaken efforts to promote improved understanding of the potential use and emission effects of sustainable alternative fuels. It was noted in the ICAO alternative fuels workshop (Montreal, 10-12 February 2009) that aviation fuels could be a win-win solution for reducing aviation's dependence on fossil fuels and a key element to help reduce the impact of aviation on climate change. Given sufficient demand or incentive, significant supplies of jet fuel that offer a significant reduction in life-cycle CO<sub>2</sub> emissions could be available in the mid-term. Certification of alternative fuels for use in aviation is already underway.

### 4. **ICAO'S ROLE IN SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION**

- a) ICAO is facilitating on a global basis the promotion and harmonization of initiatives that encourage and support the development of sustainable alternative fuels for international aviation. The following summarize the key activities in which ICAO will be engaged in to promote this objective:
  - 1) **Activity A:** Providing fora for education and outreach on sustainable alternative fuels for aviation;
  - 2) **Activity B:** Providing fora for facilitating the exchange of information on financing and incentives for sustainable alternative fuels for aviation programmes working with the relevant UN and regional financial entities;
  - 3) **Activity C:** Facilitating development of standardized definitions, methodologies and processes to support the development of sustainable alternative fuels for aviation, taking into consideration the work that has been done so far in this area; and
  - 4) **Activity D:** Supporting a platform for access to research roadmaps and programmes.

## 5. SUMMARY OF ACCOMPLISHMENTS ON SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION

### 2008 - Accomplishments

#### Tests and Demonstrations

- Airbus flew its A380 test aircraft with one of its four engines running on a 40% blend of Gas To Liquid (GTL) fuel with conventional jet fuel on 1 February 2008
- Virgin Atlantic flew a Boeing 747-400 on 23 February 2008 with one engine operating on a 20% biofuel mix produced from babassu oil and coconut oil
- Air New Zealand flew a Boeing 747-400 with one engine on 50% jatropha derived Hydrotreated Renewable Jet (HRJ) biofuel and 50% kerosene on 30 December 2008

### 2009 - Accomplishments

#### Educational Forums/Outreach

- ICAO Workshop on Aviation and Alternative Fuels 10 to 12 February 2009
- Annual US/CAAFI Meeting 30 September to 1 October 2009

#### Fuel certification/Qualification

- ASTM D-7566 (Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons) approved September 1, 2009, first new jet fuel approval in 20 years

#### Tests and Demonstrations

- Continental Airlines flew a Boeing 737-800 with one engine using 50% jet fuel and 50% algae and jatropha mix on 7 January 2009
- JAL flew a 50% HRJ bio-fuel (derived from camelina, jatropha and algae) and 50% kerosene mix on a Boeing 747-300 on 30 January 2009
- Qatar Airways performed the first revenue flight with alternative fuel on October 12<sup>th</sup>, 2009. An A340-600 flew from London to Doha with its four engines running with a 48.5% blend of GTL with conventional jet fuel
- KLM flew a 50% HRJ bio-fuel (derived from camelina) and 50% conventional Jet A1 mix on a Boeing 747-400 on 23 November 2009

#### Policies, Methods and Processes

- European Union requirement lifecycle greenhouse gas emission savings from the use of biofuels shall be at least 35%
- ICAO High-Level Meeting on Aviation and Climate Change 7 to 9 October 2009
- Conclusions and Recommendations from CAAF 2009 (16 to 18 November 2009) on
  1. Environmental sustainability and interdependencies
  2. Technological feasibility and economic reasonableness
  3. Measures to support development and use
  4. Production and infrastructure.
- CAAF2009 declaration and global framework in conjunction with the outcomes of the High-Level Meeting on International Aviation and Climate Change (HLM-ENV) presented as the ICAO input to COP15 (7 to 18 December 2009)

### **2009 – Accomplishments (continued)**

#### **Standardized Definitions and Processes**

- CAAF/09 adopted the Fuel Readiness Level (FRL), developed by CAAFI, as a best practice;
- CAAF/09 defined: drop-in jet fuel blend, drop-in neat jet fuel;
- CAAF/09 recommended the use of life cycle analysis as the appropriate means for comparing the relative emissions from alternative jet fuels to conventional jet fuel;
- CAAF/09 endorsed the use of the existing industry qualification and certification processes as the appropriate means for approving a new alternative jet fuel;
- CAAF/09 took efforts to ensure the consideration of aviation alternative fuels within relevant international, regional and State efforts to develop sustainability criteria for all alternative fuels; and
- Roundtable on Sustainable Biofuels (RSB) published version 1.0 of Principles and Criteria for Sustainable Biofuel Production on 14 November 2009

#### ***Key ICAO activities related to sustainable alternative fuels for aviation in 2009***

##### **Activity A – Educational Forums / Outreach**

- Workshop on Aviation and Alternative Fuels;
- Conference on Aviation and Alternative Fuels;
- Articles in ICAO Journal Vol. 64, numbers 1 and 5
- ICAO High-Level Meeting on Aviation and Climate Change encouraged wider discussions on the development of alternative fuel technologies and the promotion of the use of sustainable alternative fuels, including biofuels, in aviation in accordance with national circumstances;
- ICAO High-Level Meeting on Aviation and Climate Change encouraged States and international organizations to share their efforts and strategies to promote alternative fuels for aviation, and to bring the results of CAAF/09 to COP15;

##### **Activity B – Facilitating Exchange of Information on Financing and Incentives**

- Initial discussions between ICAO and the World and Inter-American Development Banks regarding the financing of sustainable alternative fuel programmes for aviation.

##### **Activity C – Standardized Definitions and Processes**

- CAAF/09 adopted the Fuel Readiness Level (FRL), developed by CAAFI, as a best practice to govern communication of technology maturity as a pre-condition to qualification, production and, deployment readiness, including potentially different maturity levels of the fuel production chain, for example, feedstock, conversion technology and fuel qualification;
- CAAF/09 defined: drop-in jet fuel blend, drop-in neat jet fuel;
- CAAF/09 recommended the use of life cycle analysis as the appropriate means for comparing the relative emissions from alternative jet fuels to conventional jet fuel;
- CAAF/09 endorsed the use of the existing industry qualification and certification processes as the appropriate means for approving a new alternative jet fuel;
- CAAF/09 took efforts to ensure the consideration of aviation alternative fuels within relevant international, regional and State efforts to develop sustainability criteria for all alternative fuels;

##### **Activity D – Platform for Access to Research Roadmaps and Programmes**

- Plans and objectives presented during CAAF/09 were integrated into an ICAO Global Framework for Aviation Alternative Fuels.

6. **SUMMARY OF FUTURE OBJECTIVES ON SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION**

**2010 – Projected Activities**

**Educational Forums/Outreach**

- Annual US/CAAFI Meeting
- ...

**Fuel certification/Qualification**

- US/CAAFI anticipates HRJ qualification as a 50/50 blend with petroleum jet fuel
- ...

**Policies, Methods and Processes**

- ICAO 37th Assembly Meeting in September 2010
  - Programme for sustainable alternative fuels for aviation is presented for consideration
- ...

***Key ICAO activities related to sustainable alternative fuels for aviation in 2010***

**Activity A – Educational Fora / Outreach**

- ICAO Environmental Colloquium
- ICAO Environmental Report
- Articles in ICAO Journal Vol. 65

**Activity B – Facilitating Exchange of Information on Financing and Incentives**

- ICAO continues to facilitate access to financing for sustainable alternative fuels for aviation programmes.

**Activity C – Standardized Definitions and Processes**

- ICAO and its Contracting States continue efforts to develop a common lifecycle analysis framework for comparing the relative emissions from alternative fuels to conventional fuels for aviation working within national and international framework;
- ICAO continues to facilitate aviation's participation in ongoing efforts to develop a common definition of sustainability criteria for biofuels

**Activity D – Platform for Access to Research Roadmaps and Programmes**

- ICAO High-Level Plan on Sustainable Alternative Fuels for Aviation updated as required.
- ICAO future work programme on sustainable alternative fuels for aviation decided by the 37<sup>th</sup> Assembly.

**2011 - Projected Activities****Educational Forums/Outreach**

- SWAFEA International Conference
- Annual US/CAAFI Meeting
- ...

**Fuel Certification/Qualification**

- US/CAAFI anticipates neat Fischer-Tropsch (FT) fuel certification
- ...

**Policies, Methods and Processes**

- CAAF 2011
- Conclusion of the SWAFEA study for the European Commission
- ...

**2012 - Projected Activities****Educational Forums/Outreach**

- Annual US/CAAFI Meeting
- ...

**Fuel Certification/Qualification**

- US/CAAFI anticipates Fermented Renewable Jet (FRJ) blend research report
- US/CAAFI anticipates Pyrolytic Renewable Jet (PRJ) blend research report
- ...

**Policies, Methods and Processes**

- Alpha-Bird program complete
- ...

**2013 – Projected Activities****Educational Forums/Outreach**

- WAAF2013
- Annual US/CAAFI Meeting
- ...

**Fuel Certification/Qualification**

- US/CAAFI anticipates neat HRJ certification
- US/CAAFI anticipates FRJ blend certification
- US/CAAFI anticipates PRJ blend certification
- ...

**Policies, Methods and Processes**

- ICAO 38th Assembly
- ...

**2016 - Projected Activities**

**Policies, Methods and Processes**

- US/Consortium for Continuous Low Energy, Emissions, and Noise (CLEEN) goal that 20% of jet fuel available for purchase by United States commercial airlines and cargo carriers be alternative fuels
- ...

**2017 – Projected Activities**

**Policies, Methods and Processes**

- European Union requirement lifecycle greenhouse gas emission savings from the use of biofuels shall be at least 50%
- ...

**2018 – Projected Activities**

**Policies, Methods and Processes**

- European Union requirement lifecycle greenhouse gas emission savings from the use of biofuels shall be at least 60%
- ...

**2020 - Projected Activities**

**Policies, Methods and Processes**

- European Union target of 10% use of renewable energy sources in transport
- ...