

International Civil Aviation Organization

REPORT OF THE ICAO CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

Rio de Janeiro, Brazil
16–18 November 2009



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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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CONFERENCE ON AVIATION
AND ALTERNATIVE FUELS

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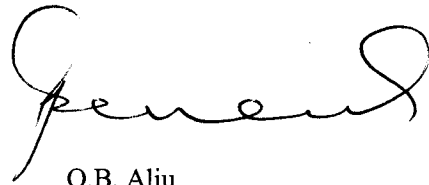
The Conference on Aviation and Alternative Fuels was sponsored by the
National Civil Aviation Agency of Brazil (ANAC).

LETTER OF TRANSMITTAL

To: President of the Council

From: Chairman, Conference on Aviation and Alternative Fuels (CAAF/09)

I have the honour to submit the Report on the work of the Conference on Aviation and Alternative Fuels (CAAF/09) held in Rio de Janeiro, Brazil from 16 to 18 November 2009.

A handwritten signature in black ink, appearing to read 'O.B. Aliu', with a large, stylized initial 'O' and a long, sweeping underline.

O.B. Aliu
Chairman
Conference on Aviation and
Alternative Fuels

Rio de Janeiro, 18 November 2009

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INTRODUCTION

Site and duration of the Conference

1. The Conference on Aviation and Alternative Fuels (CAAF/09) was convened at the Sheraton Hotel in Rio de Janeiro, Brazil from 16 to 18 November 2009.

Attendance

2. The following 30 member States of ICAO were represented at the Conference:

Argentina	Mexico	Sweden
Australia	Namibia	Tunisia
Brazil	Netherlands	Uganda
Cameroon	Nigeria	United Arab Emirates
China	Norway	United Kingdom
Dominican Republic	Poland	United Republic of Tanzania
Ecuador	Romania	United States
France	Russian Federation	Venezuela
Germany	Singapore	
India	South Africa	
Italy	Spain	

3. The following 5 Observer Delegations attended the Conference:

European Commission (EC)
European Civil Aviation Conference (ECAC)
International Air Transport Association (IATA)
International Coordinating Council of Aerospace Industries Associations (ICCAIA)
United Nations Framework Convention on Climate Change (UNFCCC)

4. A list of participants in the Meeting is given in Appendix A to this report.

Mandate

5. ICAO's work on Alternative Fuels responds to Resolution A36-22: *Consolidated statement of continuing ICAO policies and practices related to environmental protection*, which recognized the urgent need for more concerted and effective action to reduce the carbon footprint of international aviation and the importance of research and development in fuel efficiency and alternative fuels.

6. The ICAO High-level Meeting on International Aviation and Climate Change reaffirmed the need for this Conference by "*encourag[ing]* 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.”

Opening of the Meeting

7. Mr. Raymond Benjamin, Secretary General of ICAO, opened the Meeting with the following opening address:

Excellencies, distinguished delegates, ladies and gentlemen,

I am honoured to open this Conference on Aviation and Alternative Fuels. I would like to thank the Brazilian authorities and in particular the National Agency of Civil Aviation (ANAC) that kindly offered to host this Conference in the beautiful city of Rio de Janeiro. On behalf of ICAO, I would like to extend my gratitude to Ms. Solange Paiva Vieira, President-Director of ANAC and Lieutenant Brigadier Jorge Godinho Barreto Nery, Secretary of Civil Aviation of the Ministry of Defence who are joining me here today.

We are meeting at a very opportune time. The ICAO High-level Meeting was held last month in Montreal and the UNFCCC COP/15 meeting will be held next month in Copenhagen. Today’s meeting provides us with an opportunity to build on the foundation provided by the High-level Meeting in order to show the strong resolve of aviation stakeholders to COP/15.

The recently held ICAO High-level Meeting reiterated the commitment of the 190 ICAO Contracting States to address the climate challenge through efficiency improvements.

However, let me be clear, all data shows that efficiency improvements alone will not succeed in reducing in absolute terms the greenhouse gas emissions from aircraft. In other words, employing measures for efficiency improvement, which have worked so well for so long, will still leave a significant mitigation requirement. We must close this mitigation gap or it will be closed for us.

One option to close the gap is alternative fuels. The High-level Meeting strongly encouraged all stakeholders to explore the development of alternative fuel technologies and the use of sustainable alternative fuels, including biofuels, in aviation. The High-level Meeting recommended, in particular, that

States and international organizations attend this Conference to share their efforts and strategies to promote the use of alternative fuels and bring its results to COP/15.

Another element from the High-level Meeting that I must mention is the identification of a need to elaborate on measures to assist developing States as well as facilitate access to financial resources, technology transfer and capacity building. This will be essential in the development of a sustainable infrastructure, especially as it relates to aviation alternative fuels.

This Conference on Aviation and Alternative Fuels is our opportunity to come together and establish an internationally agreed high-level global roadmap to demonstrate our commitment to a sustainable air transport system.

We as the stakeholders of the air transport system have an obligation to reduce our impact on the climate. Not only is this a significant moral challenge, this may be the most significant technical challenge our industry will face this generation in what has already been a challenging era for aviation. Our success is essential to ensure we remain the premiere mode of transportation.

A key element of this new world must be sustainable production of aircraft fuels and with that, new jobs, new businesses associated with feedstock diversity and co-products, enhanced wealth, and effective use of local resources.

You may be asking, what is the role of ICAO in alternative fuels. After all, the fuel certification standards are being adequately addressed through standard setting organizations. Different States and regions have aggressive roadmaps and plans to develop and deploy alternative fuels. At this stage, how can ICAO help? I ask the same question.

As the Secretary General of ICAO, I can assure you that ICAO is here to help the progress. ICAO is the only recognized international organization for aviation issues. We aim to provide a forum for all 190 contracting States and all aviation stakeholders to come together; not only to agree on solutions, but to share lessons learned and coordinate activities. This conference and our endeavours in the arena of alternative fuels are no different.

At this Conference, we want to build on the success of the Workshop that was conducted in February 2009 in Montreal. Most of you were there and found a lot to share. We talked about technologies, pros and cons of different options, and started the discussions on coordinating efforts. We must take this discussion to the next level and establish an international high-level global roadmap on alternative fuels for aviation.

The promise of the future for sustainable alternative fuels for aircraft rests on three building blocks:

1. **Markets:** Airlines must confirm that the demand for alternative jet fuel is reliable, deep, and accessible. Without a predictable market, investments in new fuels will not be made or the fuels will supply other markets for transportation fuels such as trucking. Also, new markets for co-products of the fuel production process must be nurtured to ensure the financial viability of these processes. These markets may represent significant opportunities for the countries that develop them: new jobs, new businesses, and new prosperity.
2. **Infrastructure:** Fuel producers and suppliers must establish scalable links between production facilities and airports to ensure rapid, consistent, reliable fuel transport that meets airlines requirements. The new infrastructure must connect harmoniously with existing fuel delivery systems.
3. **Financing:** States must recognize that R&D requires significant support in the near term. Pilot and commercial scale facilities will need incentives and support to advance the speed of deployment.

Each of these considerations will be addressed during this Conference.

Different feedstocks and processes are suitable for different regions; some tropical, some temperate. This allows multiple solutions to the problem, each tailored to local capabilities and resources.

Regional development can be pursued for supplying airports within the area. Coincident with that are new business opportunities for co-products; reduced petroleum product imports; and increased employment.

Keeping in view the benefits cited, there is an urgent need to assist developing States as well as facilitate access to financial resources, technology transfer and capacity. I hope the presence of States' representatives, financial institutions, fuel producers, and aviation stakeholders can start this important discussion.

According to UN Secretary General Ban Ki-moon in reference to climate change, "We need the world to realize, once and for all, that the time to act is now and we must work together to address this monumental challenge. This is the moral challenge of our generation."

Coming out of this meeting, we hope that States and industry stakeholders will be prepared to work together to achieve our common vision on aviation alternative fuels.

If our collective efforts are successful we may one day look back on this meeting as a truly momentous occasion.

Secretariat

8. Ms. J. Hupe, Chief of the ICAO Environment Section, served as Secretary of the Conference, while Mr. T. Thrasher and Mr. G. Webb served as Assistant Secretaries. ANAC Liaison was carried out by Mr. F. Lima, assisted by Ms. M. Miguel. Document coordination was provided by Ms. A. Fuchs-Ledingham, distribution by Mr. L. Brettas, and printing by Mr. F. Antunes. Interpretation services were coordinated by Ms. J. Durana.

Election of the Chairman and Vice-Chairman of the Meeting

9. On the nomination by Argentina, as seconded by China, with support from Ecuador and Cameroon, Dr. O.B. Aliu, Representative of Nigeria on the Council of ICAO, was elected Chairman of the Conference, and Mr. C. Cotrut, Representative of Romania on the Council of ICAO, was elected Vice-Chairman of the Conference.

Agenda

10. The Conference adopted the following agenda, which had been approved by the Council and presented in CAAF/09-WP/01:

Agenda Item 1: Environmental sustainability and interdependencies of sustainable alternative fuels for aviation;

Agenda Item 2: Technological feasibility and economic reasonableness of sustainable alternative fuels for aviation;

Agenda Item 3: Measures to support development and use of sustainable alternative fuels for aviation;

Agenda Item 4: Production and infrastructure of sustainable alternative fuels for aviation.

Structure and rules of procedure

11. The Conference also adopted the organizational matters included in CAAF/09-WP/02. The rules of procedure were the *Standing Rules of Procedure for Meetings in the Air Transport Field* (Doc 8683).

Documentation

12. A list of the documentation associated with the work of the Conference is presented in Appendix B. All papers prepared for the CAAF/09 are available on the ICAO web site (<http://www.icao.int/CAAF2009/>).

13. In addition to working and information papers, the Secretariat prepared three documents (CAAF/09-SD/1, CAAF/09-SD/2, and CAAF/09-SD/3) containing summaries of the conclusions and recommendations arrived at through discussions during the Conference. These summaries provide a record of the key issues identified under each Agenda Item. These papers were agreed to by Conference participants.

Agenda Item 1: Environmental sustainability and interdependencies of sustainable alternative fuels for aviation

1.1. Documentation

1.1.1 The Conference reviewed the following working papers and information papers from the Secretariat, States and Observer Organizations:

Secretariat (CAAF/09-WP/03) set the scene for the conference, reviewing the need for the international aviation industry to reduce its greenhouse gas (GHG) emissions. The industry has committed to pursuing several strategies for mitigating its climate impacts, including improving the air traffic management system, using more efficient operating procedures, and improving the fuel efficiency of aircraft and engines. Yet, a significant mitigation gap would remain. Employing sustainable alternative fuels for aircraft could be a promising strategy for closing this gap. Based on a 2008 Energy Information Administration report, the world uses 3,917 Megatonnes (Mt) of liquid fuel annually, including approximately 0.02Mt of biofuel, very little of which is consumed by international aviation. The paper highlights the importance of States and other stakeholders working together and committing to share information on their progress toward developing sustainable alternative fuels for aircraft. An outline for a global framework for alternative fuels development was identified.

United States (CAAF/09-WP/04) offered the perspective that to ensure sustainable alternative fuels for aircraft deliver a climate benefit, it is necessary to account for GHG emissions throughout the fuel's lifecycle, including sourcing, producing, and using the fuels. This paper described the scope and use of lifecycle analysis for estimating GHG emissions from sustainable alternative fuels for aircraft. It also identified current and planned research efforts for extending and improving lifecycle analysis for aircraft fuels.

Secretariat (CAAF/09-WP/05) described how sustainable alternative fuels for aircraft would improve air quality in addition to reducing climate impacts. This is due to the reduced sulphur content of these fuels, which results in less sulphur oxide and particulate matter emissions upon combustion. The paper also noted that there are interdependencies among environmental effects related to sulphur removal. These effects should be further evaluated, although it is expected that sustainable alternative fuels for aviation will provide surface and local air quality benefits in addition to life cycle GHG emissions benefits.

ICCAIA (CAAF/09-WP/08 and IP/08) reviewed the advancements that have been made over time in aircraft fuel efficiency. Aircraft and engine manufacturers work in collaboration with research organizations and other stakeholders to develop innovative technology and design advanced products to provide the air transport industry with safe, cost-effective, and environmentally friendly aircraft. Over time, this approach has resulted in nearly continuous improvements in fuel efficiency, which manifests itself in reduced GHG emissions. These papers note that further improvements are expected in the future and sustainable alternative fuels for aircraft will further contribute to reduced lifecycle GHG footprint.

Secretariat (CAAF/09-WP/09) identified several terms related to sustainable alternative fuels for aviation that should be defined to ensure that communications are clear and that specialized terms have a common understanding. The paper defines “short-term,” “medium-term,” “long-term,” “conventional jet fuel,” “drop-in jet fuel blend,” and “drop-in neat jet fuel.” The paper also discussed the use of the term “generation” as being difficult to define clearly and suggests that it not be used in the context of sustainable alternative fuels for aviation.

ICCAIA (CAAF/09-WP/14) discussed the importance of sustainable alternative fuels for aircraft. They noted that the market for aviation fuels may be well suited for these fuels since it is large enough to be attractive to fuel producers, yet small enough for the producers to have a meaningful presence in the market as they scale up. The paper expressed the need for developing a fuel supply chain that is technically capable, economically reasonable, and environmentally beneficial.

Brazil (CAAF/09-WP/20) described the ethanol fuel industry, from sugarcane growth to the production of ethanol, to the storage and distribution of the final product. Use of ethanol as a vehicle fuel for automobiles as well as agricultural piston-engine aircraft is also described.

ICCAIA (CAAF/09-WP/26 and IP/11) reviewed the efforts of engine and aircraft manufacturers along with supporting governments to assess the impact of alternative fuels on engine performance and emissions. Engine emission and performance measurements have been made on several aircraft engines with neat and blended drop-in alternative jet fuels. Data from the tests was presented to demonstrate the viability of drop-in alternative fuels and confirmed significantly reduced particulate emissions.

United States (CAAF/09-WP/27) described the development of the Commercial Aviation Alternative Fuels Initiative (CAAFI), a coalition of airlines, manufacturers, airports, government agencies, research organizations, fuel developers, and other stakeholders. CAAFI focuses the efforts of commercial aviation to engage the emerging alternative fuels industry. The organization enables participants to build relationships, share and collect data, identify resources, and direct research, development, and deployment of alternative jet fuels.

Secretariat (CAAF/09-IP/01) presented the scope and findings of the ICAO Workshop on Alternative Fuels, which was held in February 2009. A detailed summary of the meeting is presented in the appendix to the paper.

United States (CAAF/09-IP/06) reviewed the elements for conducting an assessment of life cycle GHG emissions of jet fuel. The paper identified challenges in acquiring reliable data, assessing alternative production pathways, evaluating land use impacts, and quantifying other inputs, such as water, that should be considered when comparing sustainable alternative fuels for aircraft with conventional jet fuel. Many steps and detailed analyses are required to confirm that alternative fuels are indeed sustainable.

Brazil (CAAF/09-IP/07) described research that is underway among a consortium of technology and educational institutions evaluating the use of algae as a feedstock for producing biojet fuels in Brazil. Researchers are evaluating several steps in the process, from feedstock production to oil processing. An objective of the analysis is to identify

important geographical, technical, and financial risk factors to guide further study and evaluation.

ICCAIA (CAAF/09-IP/09) evaluated various policy approaches to improve investment in innovation and technology development to ensure the sustainability of alternative aviation fuels. The paper proposed several factors that are important considerations such as legality, life cycle improvements, human and labour rights, rural and social development, local food security, inputs and wastes, and land rights among others.

Inter-American Development Bank (CAAF/09-IP/15) presented the IDB Biofuels Sustainability Scorecard. The Scorecard is a web-based tool that allows users to assess the level of sustainability of a biofuels project. The Scorecard was designed to be useful for project developers, financial institutions, private investors and environmental and social safeguard reviewers. It can be used at multiple stages of the project lifecycle: in project development, project screening, initial analysis, and then again through due diligence and investment approvals. By using the Scorecard at multiple stages, users can identify areas that can be improved and then measure the tradeoffs associated with changes in different areas, thereby resulting in more sustainable biofuel projects.

1.2 Discussion

1.2.1 All States expressed their congratulations to Dr. Aliu on his election as Chairman. Also, they congratulated ICAO for convening a conference on alternative fuels and expressed their pleasure for the opportunity to work with ICAO.

1.2.2 The Conference noted the effects on air quality from the use of alternative fuels and agreed at the suggestion from a State that it is more accurate to refer to “surface and local” air quality, which would include the impact of cruise emissions at ground level, as opposed to “local” air quality, which would only consider the effects of emissions released below the mixing height.

1.2.3 During the discussion of CAAF/09-WP/03 regarding the statement that “very little [biofuel] is consumed by international aviation,” States noted that this statement could lead to those unfamiliar with the subject to draw the wrong conclusion, since there are currently no biofuels certified for use in commercial jet aircraft. The Secretariat clarified that ethanol is being used in piston powered aircraft in some regions. States appreciated the clarification and noted that sustainable alternative fuels are also used in ground equipment at airports. The conference agreed that biofuels are not widely used or approved for use in aircraft, but that the industry will be an enthusiastic supporter of their use as they become available. The Chairman noted that a State Letter issued by the Secretariat will be required to fulfil recommendation in paragraph 5.1, d) in CAAF/09-WP/03.

1.2.4 The Conference agreed that the information presented to COP15 should reflect the achievements that have been made while recognizing the work that remains to be done.

1.2.5 The presentation of CAAF/09-WP/09 resulted in substantial discussion over the proposed definitions. However, the conference recognized that some of the terms were defined by the Intergovernmental Panel on Climate Change (IPCC) and that the definition of “generation” was not intended to be used after the conclusion of the conference.

1.2.6 The Conference agreed that States and Organizations should cooperate in the development of sustainable alternative fuels for aviation through CAAFI and other bodies.

1.2.7 The Conference agreed that ICAO should identify and work with the appropriate international bodies on the development of sustainability criteria for alternative aviation fuels.

1.2.8 In reference to CAAF/09-WP/08, the Conference cautioned that regulators may require simultaneous reductions of noise, emissions that affect local/surface air quality, and greenhouse gas emissions.

1.3 Conclusions

1.3.1 From the documentation and ensuing discussion during the first meeting on environmental sustainability and interdependencies under Agenda Item 1, the Conference concluded the following:

- a) the world today uses 3,917 Mt of liquid fuel annually, of which 0.02 Mt is biofuel. Noting the limited number of qualified biofuels for aviation, very little of this biofuel is used by international aviation;
- b) international aviation could need a substantial contribution from sustainable alternative fuels for aircraft in order to reduce its overall GHG footprint;
- c) climate change is a global problem requiring a global approach for international aviation and ICAO's initial activities to facilitate global efforts for implementing sustainable alternative fuels for aircraft are welcomed;
- d) sustainable alternative fuels for aircraft may provide surface and local air quality benefits in addition to their life cycle GHG emissions benefits;
- e) there are interdependencies between the removal of sulphur from conventional aviation fuels and the climate impacts of aircraft emissions;
- f) CAAFI and other regional initiatives have proven to be an effective means of sharing information and coordinating efforts to research, develop and deploy alternative fuels for aviation;
- g) the ability to compare the life cycle GHG emissions from alternative aviation fuels is an essential element of a global assessment of GHG emissions from international aviation;
- h) GHG emissions associated with both direct and indirect land-use change may result from the production of alternative jet fuels. Further research is needed to better understand these interdependencies;

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- i) there are multiple research efforts ongoing within the U.S., Europe and other States to estimate the life cycle GHG emissions from conventional and alternative jet fuels, as well as from ground transportation fuels;
 - j) a peer reviewed, consistent approach to estimating life cycle GHG emissions that covers all sectors is needed;
 - k) the supply chain that involves the life cycle of sugarcane ethanol produced in Brazil, and the inherent characteristics of the product – renewability and low carbon content – could make sugarcane ethanol an environmentally sustainable product for concentration in other regions, which needs to be confirmed with further detailed analysis;
 - l) the manufacturing industry believes that alternative fuels that are fully compatible with existing aircraft, engine and distribution systems can be utilized as soon as supply is available;
 - m) the manufacturing industry believes that carbon life cycle of more than 50% reduction, as compared to typical petroleum-based aviation fuel, can be demonstrated for some types of renewable alternative aviation-capable fuels;
 - n) large transport aircraft require a very high energy source, and unlike other transport modes, no technology exists to decouple such aircraft from liquid fuels;
 - o) considerable work must be done to develop a supply chain able to deliver fuel that is technically capable, economically reasonable, and environmentally beneficial;
 - p) timely and appropriate establishment of acceptability criteria is required to ensure that new fuels are environmentally beneficial;
 - q) the development and use of sustainable renewable alternative fuels for aviation is an important opportunity to reduce aviation emissions;
 - r) as a result of permanent fleet modernization, fuel burn has been reduced by about 70% over the last 40 years;
 - s) there are interdependencies associated with environmental improvements when dealing with the design and development of future products;
 - t) significant progress has been made in testing aircraft engines with various types of alternative fuels;
 - u) the work performed by the engine manufacturers shows the viability of using blends of drop-in alternative fuels as a substitute to jet fuel;
 - v) the manufacturing industry has tested drop-in alternative fuels and the results show no adverse impact on performance of aircraft engines. While having little impact on

gaseous emissions, the drop-in alternative fuels show significant reduction in smoke emissions; and

- w) more research is needed to determine the impact of alternative fuels on areas such as materials compatibility, chemical composition, density, and to fully derive correlations between alternative fuel properties and particulate and gaseous emissions.

1.4 Recommendations

1.4.1 From the documentation and ensuing discussion during the first meeting on environmental sustainability and interdependencies under Agenda Item 1, the Conference adopted the following recommendations:

- a) States work together expeditiously with the industry to foster the development and implementation of sustainable alternative fuels for aircraft;
- b) States actively participate in further work on sustainable alternative fuels for aircraft;
- c) ICAO endeavour to facilitate active participation by States in further work on sustainable alternative fuels for aircraft;
- d) ICAO update the 15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP15) in December 2009 with the results of CAAF2009 on the development and deployment of aviation and alternative fuels;
- e) ICAO be informed by States in advance of the 37th Session of the ICAO Assembly of their initiatives related to sustainable alternative fuels for aircraft. ICAO Secretariat to issue a State Letter to collect this information;
- f) States take into account the surface and local air quality benefits associated with the use of sustainable alternative fuels for aircraft when making policy decisions on their use;
- g) ICAO further explore the environmental benefits and trade-offs of sustainable alternative fuels with reference to surface and local air quality;
- h) note that the definitions in CAAF/09-WP/09 are used exclusively for the purposes of the Conference on Aviation and Alternative Fuels;
- i) recommend that the definitions for drop-in jet fuel blend and drop-in neat jet fuel be incorporated into ICAO Doc 9713 “ICAO Vocabulary” in the next update of the document;

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- j) note the effectiveness of the efforts to date of the Commercial Aviation Alternative Fuels Initiative (CAAFI);
 - k) encourage Members and Observers to participate in the activities and efforts of CAAFI;
 - l) recommend the use of life cycle analysis as the appropriate means for comparing the relative GHG emissions from alternative jet fuels to conventional jet fuel;
 - m) acknowledge the potential for use of sugarcane as well as other feedstocks for development of sustainable biofuels;
 - n) acknowledge that Brazil's efforts in the areas of (a) research, (b) technological development, and (c) public policies for evaluation of the use of ethanol in piston engine aircraft may be applicable to other member States;
 - o) ICAO should encourage the development of policy actions by Member States to accelerate the appropriate development of sustainable renewable alternative fuels for aviation;
 - p) ICAO should undertake efforts to ensure the consideration of aviation alternative fuels within relevant international, regional and State efforts to develop sustainability criteria for all alternative fuels;
 - q) ICAO should undertake efforts to ensure the consideration of aviation within evolving recommended practices and processes on sustainability criteria to ensure consistency with that for all sustainable fuels;
 - r) take note and acknowledge the past record of improvements that the air transport industry achieved over the past decades as explained in CAAF/09-WP/8 and associated IP/08;
 - s) note the challenge of interdependencies associated with environmental improvements when dealing with design and development of future products;
 - t) recommend that the opportunity of sustainable alternative fuels for aviation be further studied as a new possibility to further reduce emissions from aviation;
 - u) recommend 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;
 - v) recommend that funding bodies support further research into engine research using alternative drop-in fuels, while still maintaining funding levels for technology research; and

w) promote the production of drop-in alternative fuels for aviation.

1.4.2 The Chairman presented these conclusions and recommendations in CAAF/09-SD/1, which was approved by the Conference.

Agenda Item 2: Technological feasibility and economic reasonableness of sustainable alternative fuels for aviation

2.1 Documentation

2.1.1 The Conference reviewed the following working papers and information papers from the Secretariat, States and Observer Organizations:

Secretariat (CAAF/09-WP/12) describes how sustainable alternative fuels for aircraft may develop in the short, medium, and long terms as production expands, the lifecycle GHG footprint of these fuels improves, and the fuels become more cost effective. The paper also notes that sustainable alternative fuels for aircraft may be well suited for regional and local production in countries around the world in light of the variety of potential feedstocks. Communities may also be able to develop new businesses or other sources of income out of co-products from alternative fuel production. In light of the variety of options for feedstocks, co-product uses, and fuel markets, only those that attract significant investment are likely to achieve a market presence. This reemphasized the need for investing in R&D, conducting fuel tests, and incentivizing production plant construction.

United States (CAAF/09-WP/07) presented a scale that measures the technical and production maturity of candidate sustainable alternative fuels for aircraft under the name Fuel Readiness Level. The proposed scale is based on risk management processes and scales long used by the aircraft and engine producers called the Technology Readiness Level.

ICCAIA (CAAF/09-WP/10 and IP/12) reported on several flight tests that have been conducted using sustainable alternative fuels for aircraft. The flights covered a wide range of available aircraft-engine combinations as well as fuels from several different feedstocks. The flight tests not only demonstrated that commercial aircraft can fly using sustainable alternative fuels but also provided data that supported the publication of ASTM D7566 – Specification for Aviation Turbine Fuels Containing Synthesized Hydrocarbons. Additional flight tests as well as component tests are expected in the future.

Brazil (CAAF/09-WP/16) described the country's experience developing an ethanol fuel industry. Ethanol is produced from sugarcane and used in a wide range of applications, including as a fuel for piston-engine aircraft used in the agricultural industry. The production of ethanol from sugarcane has grown steadily and is forecast to continue to grow in the future. Studies are now underway to evaluate the production of biokerosene and potentially biojet fuel.

Brazil (CAAF/09-WP/19) reported the country's experience certifying an aircraft (Embraer/Neiva EMB-202A Ipanema) to operate on ethanol. To accomplish the certification, substantial modifications to the fuel system were required, largely related to materials compatibility. Extensive fuel quality checks were conducted, as were engine bench tests. The successful use of ethanol has avoided the need for using lead additives, a pollutant of concern associated with the use of aviation gasoline.

United States (CAAF/09-IP/03) illustrated the research and development roadmaps used by CAAFI to identify achieved and anticipated milestones in the development and deployment of alternative aviation jet fuels. The roadmaps are used to track overall progress in alternative jet fuel efforts and to identify gaps in activities to which research and resources can be channelled as needed. The roadmaps also distinguish between work that has been accomplished, is currently planned for execution, or has been identified as an unmet need. CAAFI's R&D roadmaps are included in the appendix to the paper.

2.2 Discussion

2.2.1 States noted that the task of maintaining a website that synthesizes information from other regions on the subject of alternative fuels for aviation may result in unintentionally distributing misinformation and could require significant resources. The Secretary General noted the pedagogic role of ICAO requested by the Council and the experience of the Secretariat in developing such a website. He used the ICAO Safety Management website (<http://www.icao.int/anb/safetymanagement/>) as an example. With that clarification, there was support for the development of the website proposed in CAAF/09-WP/12.

2.2.2 The Conference noted that while ethanol is not suitable for use in large jet aircraft, research is underway to develop a jet fuel based on the processes used to create ethanol from sugarcane.

2.2.3 The Conference agreed that the existing jet fuel storage and distribution infrastructure should not be shared with fuels that are not qualified for use in jet aircraft. States also agreed that flight tests may no longer be required in the near future as new fuels have progressed further in the qualification process.

2.2.4 The conference supported the proposed global fuel readiness level protocol presented in CAAF/09-WP/07.

2.3 Conclusions

2.3.1 From the documentation and ensuing discussion during the second meeting on technological feasibility and economic reasonableness under Agenda Item 2, the Conference concluded the following:

- a) the development of new sustainable alternative fuels for aircraft production processes could be able to reduce costs of fuels to compete with conventional jet fuel in the mid-term;
- b) 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;

-
- c) recognise that sustainable biofuels for aircraft can be produced through a range of processing routes some of which could be suitable for local scales;
 - d) the by-products or secondary products from sustainable alternative fuels for aircraft production could be valuable inputs to local economies;
 - e) sustainable alternative fuels for aircraft can be produced from a wide variety of feedstocks and processes, yet, only those that attract sufficient investment will achieve a market presence
 - f) the supply chain that involves the life cycle of sugarcane ethanol, its renewability and low carbon content, make sugarcane ethanol potentially an environmentally sustainable product;
 - g) the production of sugarcane ethanol in tropical climates enjoys an extremely favourable net energy gain;
 - h) using sugarcane ethanol as a fuel offers both technological feasibility and economic viability under certain conditions;
 - i) there is availability for sustainable expansion of sugarcane plantations in various countries, including Brazil. This offers potential for the creation and expansion of the biofuels industry;
 - j) various countries already have the infrastructure needed for large-scale production of sugarcane;
 - k) sugarcane-based technologies being developed have the potential to work with the existing biofuels production infrastructure and have the potential to produce drop-in replacements for petroleum-derived fuels;
 - l) there is potential for the use of sugarcane as feedstock for the development of other sustainable biofuels;
 - m) there is technical feasibility of using alternative drop-in fuels as blends with conventional fuels as demonstrated in CAAF/09-WP/10 and in CAAF/09-IP/12;
 - n) the Fuel Readiness Level (FRL) scale has been developed by CAAFI sponsors and modified in consultation with a key energy supplier, an original equipment manufacturer (OEM) stakeholder, and a fuel process technology developer. It provides a gated process to govern communication of technology maturity leading to qualification, production, and deployment readiness;
 - o) the FRL is appropriate for managing and communicating research status and development needs for R&D investors;

- p) the FRL is appropriate for managing and communicating the readiness for airworthiness authorities and appropriate timing for complementary and required environmental assessments;
- q) the FRL is appropriate for managing and communicating the practicality of deploying fuels for use in production aircraft, engines and aviation infrastructure; and
- r) the FRL is appropriate for use as a process for aviation fuel development and deployment risk mitigation.

2.4 Recommendations

2.4.1 From the documentation and ensuing discussion during the second meeting on technological feasibility and economic reasonableness under Agenda Item 2, the Conference adopted the following recommendations:

- a) States inform ICAO of any plans to establish alternative fuel production facilities in the short, medium, and long-term;
- b) those plans be incorporated into the High-Level Roadmap on Aviation and Alternative Fuels;
- c) ICAO establish a web site to facilitate the exchange of information between States and International Organizations interested in advancing sustainable alternative fuels for aircraft;
- d) States and International Organizations share best practices and techniques that can apply to the development and scale up of sustainable alternative fuels for aircraft production through ICAO;
- e) acknowledge that Brazil's efforts in the areas of (a) research, (b) technological development and (c) public policies for evaluation of the use of ethanol in piston engine aircraft may be applicable to other member States;
- f) acknowledge the importance of international standardization for an "aviation ethanol" fuel specification with specific consideration given to aircraft range;
- g) encourage States to develop technology and feedstock independent policies based on performance criteria both in production and in use;
- h) acknowledge the potential for use of sugarcane, as well as other feedstocks for development of sustainable drop in biofuels;
- i) encourage qualification of new drop-in fuels that result in the broadest spectrum of feedstocks and refining processes;

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- j) encourage governments to establish public policies that promote and protect the use of existing fuel infrastructures for drop-in certified aviation bio drop-in fuels (trucks, pipelines, airports, etc.);
 - k) encourage governments to establish public policies that create appropriate investments and incentives for alternative drop-in fuels;
 - l) encourage governments to establish public policies that accelerate R&D and commercial scale production of alternative drop-in fuels;
 - m) encourage governments to establish public policies that specifically target alternative drop-in fuel use for civil aviation;
 - n) recommend that ICAO support the overall process already engaged in the study, development and approval of alternative drop-in fuels for aviation; and
 - o) recommend that the Fuel Readiness Level (FRL) be adopted 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.

2.4.2 The Chairman presented these conclusions and recommendations in CAAF/09-SD/1 and CAAF/09-SD/2, which were approved by the Conference.

Agenda Item 3: Measures to support development and use of sustainable alternative fuels for aviation

3.1 Documentation

3.1.1 The Conference reviewed the following working papers and information papers from the Secretariat, States and Observer Organizations:

Secretariat (CAAF/09-WP/25) gave an overview of requirements for facilitating access to financial resources, technology transfer, and capacity building as they related to sustainable alternative fuels for aviation. It was perceived that in order to overcome the initial market hurdles, substantial incentives and investment might be necessary to promote the use of aviation alternative fuels. A financing framework to promote development and deployment of infrastructure projects dedicated to aviation alternative fuels and incentives to overcome these hurdles was deemed to be required. Developing States were identified as in special need of such financing arrangements. The Secretariat requested consideration of the establishment of a group involving key States, financial institutions, fuel producers, and operators leading to a framework for financing infrastructure development projects dedicated to aviation alternative fuels.

Brazil (CAAF/09-WP/6) discussed its experience with ethanol certification for use in piston engine aircraft used in the agricultural sector. Brazil has a process in place to certify engines and their associated aircraft to use ethanol. The Brazilian certification basis is RBHA 21.101, which in turn is based on US FAA AC21.101-1. For certification, an applicant performs a range of tests needed to demonstrate compliance with a list of requirements associated with material compatibility, ignition properties, power increase, corrosion, cold start, and endurance for engines. For aircraft, requirements are related to material compatibility, structure and components corrosion, high and low temperature operation, engine overcooling, ice protection, flight characteristics, and operating limitations. Additional requirements may be determined by ANAC. A certificate is issued with the successful conclusion of each process.

Brazil (CAAF/09-WP/11) reviewed the need for sustainable alternative fuels for aviation to address fuel price volatility, supply security, and environmental mandates. It also recapped the important characteristics of jet fuel that need to be considered when producing an alternative fuel. In this context there are new biotechnology-based production processes being developed to produce alternative jet fuel using sugar cane as a feedstock.

ICCAIA (CAAF/09-WP/13) provided a snapshot of current knowledge and past experiments associated with non drop-in fuels and advanced aircraft system power technologies with the aim of demonstrating that the requirements for drop-in fuels are actually based on sound technical arguments and data. Non drop-in fuels have proved most useful for use other than in aircraft main engines, for example using hydrogen in a fuel cell to provide energy for on-board electrical supply. It was realized that current commercial aviation is highly dependent on oil to produce the appropriate fuel (kerosene) that matches the requirements necessary to support air travel. Before the current

economic crisis, the oil price increase and the growing awareness of environmental considerations led the industry to start focusing on alternative sources of energy. ICCAIA emphasized that while work was actually being carried out in industry programmes and there was a need to carry out further research in other types of energy, a positive outcome was more likely for other applications than for aircraft propulsion.

United States (CAAF/09-WP/15) described the process being used by the aviation industry in the United States to qualify and certify new classes of aviation fuels. The concepts were presented as lessons learned since they might be applicable to other CAA (Civil Aviation Authorities) and fuel specification-writing organizations. Industry fuel specifications such as D1655 and DEF STAN 91-91 are used by aviation fuel industry stakeholders to standardize and control the properties and quality of aviation fuel as it travels through the distribution system. The airworthiness authorities also rely on fuel specifications to ensure the safety of aircraft operations. USA highlighted the benefits and advantages of using existing industry qualification and certification processes as the appropriate means for approving new sustainable alternative fuels for aviation.

Sweden (CAAF/09-WP/17) outlined the most relevant policy measures in the European Community to support the exploration and development of new aviation fuels. It described the context of the general policy on biofuels and concluded with some recommendations for activities at the international level. ICAO was encouraged to work with the appropriate fora on the development of consistent sustainability criteria for the production of biofuels and the development of schemes to certify that the production of biofuels meets those standards. Contracting States were urged to work together, to exchange information and best practices, and in particular to reach a common definition of sustainability requirements, taking into account existing criteria and the work in relevant international bodies.

European Commission (CAAF/09-IP/04) summarized sustainability criteria for the use of biofuels in the European Union. It included the international context and reflections on life cycle assessments.

European Commission (CAAF/09-IP/05) provided a snapshot of measures in Europe supporting greener aviation and providing incentives to deploy sustainable alternative fuels in transport. This information is presented in the context of the European research and development programmes and the 10% target for the use of renewable energy sources in transport.

Brazil (CAAF/09-IP/10) describes bio-derived jet fuel as a key element of the aviation industry's strategy to reduce its GHG emissions. It explores alternative options for funding the development of a biojet production industry and uses development of algae feedstock for input to bio-refineries as an illustrative example.

ICCAIA (CAAF/09-IP/13) presented a snapshot of current knowledge and past experiments associated with non drop-in fuels and advanced aircraft system power technologies. It does not identify an exhaustive list but shows that the requirement for drop-in fuels is based on technical arguments and data.

3.2 Discussion

3.2.1 It was recognized that the development and deployment of alternative fuels in aviation, especially biofuels, constitutes an attractive option for the sustainable growth of the aviation sector, insofar as technical requirements, including safety aspects and sustainability criteria are fulfilled. However, the application of sustainability criteria may not be consistent across the world. The Conference identified the need of a common definition of sustainability requirements, taking into account existing criteria and the work in relevant international bodies, with the ultimate aim of development of schemes to certify that the production of biofuels meets those standards.

3.2.2 The Conference also agreed that policy measures should have the objective to avoid unwanted and negative side effects that may compromise the environmental benefits of alternative fuels for aviation.

3.2.3 The Conference appreciated the effort of the industry fuel specifications such as ASTM D1655 and DEF STAN 91-91 which are used by the aviation fuel industry stakeholders to standardize and control the properties and quality of aviation fuel as it travels through the distribution system. The aviation fuel community through voluntary-consensus based standards/specification writing organizations has developed qualification and certification concepts and procedures to approve an alternative fuel for operation on the existing fleet. It was emphasized that there was no need to evaluate or re-engineer this process. It was acknowledged that Civil Airworthiness Authorities (CAAs) also rely on fuel specifications to ensure the safety of aircraft operations.

3.2.4 While the potential for alternative fuels to reduce the environmental impacts of aviation is clear, the Conference emphasized that research on efficiency improvements and other types of energy must be pursued. The States were encouraged to continue funding technologies that result in efficiency improvements and reduction in reliance on traditional fossil fuels, whether for propulsion or for other aircraft needs while on the ground or in the air.

3.2.5 The Conference noted that in the development of sustainable alternative fuels for aviation, the developed world is in a position to learn from the developing world and that the developed world would benefit most from technology transfer in this area. The Conference supported convening a separate meeting to discuss the financing of infrastructure development projects dedicated to aviation alternative fuels and incentives to overcome initial market hurdles.

3.3 Conclusions

3.3.1 From the documentation and ensuing discussion during the second meeting on measures to support development and use under Agenda Item 3, the Conference concluded the following:

- a) background information has been presented on global aviation fuel industry qualification processes;
- b) certification procedures and technical measures have been identified for the evaluation and approval of ethanol for use in piston engine aircraft;

- c) the benefits and advantages of cooperation among civil aviation authorities and voluntary consensus standards organizations facilitate the approval of new alternative fuels;
- d) as a result of these different experimentations, and due to the global characteristics of the air transport sector, the requirement for drop-in fuels as alternative fuel candidates has become obvious;
- e) research in other types of energy should be carried further, and work is actually being carried out in some industry programmes, but a positive outcome is more likely for other applications than for aircraft propulsion;
- f) various experimental flight tests with non-drop in fuels proved to be applicable with low (or no) potential for commercial aviation;
- g) the development and possible future use of alternative fuels, in particular including biofuels, in aviation constitutes an attractive option for the development of the aviation sector, provided that technical requirements, including safety aspects and sustainability criteria are fulfilled;
- h) policy decisions with respect to alternative fuels should be based upon a comprehensive assessment, including studies, development and testing of the technical feasibility, the environmental and social-sustainability dimension and economic aspects;
- i) policy measures should have the objective to avoid unwanted and negative side effects which compromise the environmental benefits of biofuels;
- j) sustainability criteria for aviation biofuels should be consistent with any general sustainability criteria for biofuels; and
- k) global harmonization of sustainability criteria is needed.

3.4 Recommendations

3.4.1 From the documentation and ensuing discussion during the second meeting on technological feasibility and economic reasonableness under Agenda Item 3, the Conference adopted the following recommendations:

- a) endorse the urgent need for measures to facilitate access to financial resources, technology exchange, and capacity building specific to aviation alternative fuels;
- b) request ICAO to organize a meeting of States, financial institutions, fuel producers, feedstock producers, aircraft manufacturers, and operators to consider a framework for financing infrastructure development projects dedicated to aviation alternative fuels and incentives to overcome initial market hurdles;

- c) endorse the use of the global industry qualification process as the appropriate means for approving a new drop-in alternative jet fuel;
- d) recommend that the development of drop-in alternative fuels for aviation must be further pursued;
- e) recommend that fuel cell technology be pursued with the aim of providing energy for on-board electrical supply and/or on ground operations;
- f) the ICAO Council and member States build their policy decisions and roadmaps on a comprehensive analysis of environmental, social and economic sustainability aspects, also taking into account technical requirements, including safety aspects;
- g) Member States to 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, taking into account existing criteria and ongoing work; and
- h) promising perspectives for biofuels should not lead to any relaxation or reduction of efforts related to other measures to reduce the environmental impact of aviation.

3.4.2 The Chairman presented these conclusions and recommendations in CAAF/09-SD2, which was approved by the Conference.

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Agenda Item 4: Production and Infrastructure

4.1 Documentation

4.1.1 The Conference reviewed the following working papers and information papers from the Secretariat, States and Observer Organizations:

Secretariat (CAAF/09-WP/22) gave an overview of the need for sustainable alternative fuels for aviation to be produced economically, efficiently, and in significant quantities. It described the use of cost benefit analysis (CBA) as an appropriate tool to support assessment and development studies needed to advance new fuels production. CBA can be tailored as an aviation-specific methodology using assumptions and input data that reflects the external costs of aviation and complex benefits that result from mitigating aviation's GHG emissions. Using such an approach will allow projects to be fairly assessed in support of effective investment. Broadly disseminating CBA as a best practice for assessing projects to produce sustainable alternative fuels for aviation would be an important contribution to developing these fuels.

IATA (CAAF/09-WP/18) described how using sustainable alternative fuels for aviation could support the aviation industry in achieving its GHG emissions mitigation goals. It identified a number of technical requirements these fuels must meet and noted that they must provide full lifecycle carbon reduction benefits. The paper also summarized flight tests that have been conducted to date using biofuel blends in commercial aircraft, which meet the technical and lifecycle requirements. The paper noted the need for financial incentives to aid industry in achieving commercial production of sustainable alternative fuels for aviation.

Secretariat (CAAF/09-WP/23) outlined a Global Framework for Aviation and Alternative Fuels (GFAAF). The GFAAF summarized key developments and projected activities identified in papers submitted to CAAF/09. It is envisioned to be a living document that will be used initially to update the 15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP15) in December 2009. It was proposed that the document be made available on the ICAO website and updated whenever new information is provided by member States and International Observer Organizations.

Secretariat (CAAF/09-WP/24) compiled the Declaration of the Conference and related Recommendations on all agenda items based on discussions and decisions taken by CAAF/09. The Declaration of the Conference and Recommendations are to be an important element of an update to the 15th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC COP15) in December 2009. They will also be used to inform the 37th Session of the ICAO Assembly in September 2010.

United States (CAAF/09-IP/02) summarized lessons learned in facilitating sustainable alternative aviation fuels deployment. The paper described challenges such as gaining the attention of energy producers, the unique requirements of aviation, and tight credit markets due to the economic crisis and presents work in progress and lessons learned in

facilitating aviation alternative fuels deployment by the Commercial Aviation Alternative Fuels Initiative's (CAAFI) Business and Economics team.

Brazil (CAAF/09-IP/14) discussed the potential for developing an algae-based biofuel production industry in Brazil. The paper explores research objectives, resource requirements, and production possibilities based on a defined set of assumptions.

4.2 Discussion

4.2.1 The Conference agreed that cost benefit analysis is an appropriate methodology for guiding investments into the development and production of alternative fuels, but some States questioned whether special methodologies were needed. The United States shared that they found that with the development of the Aviation Environmental Portfolio Management Tool (APMT) it was difficult for detailed methodologies intended to assess specific environmental aspects to have broad applicability, therefore supporting the use of tailored methodologies.

4.2.2 The Conference agreed that sustainable alternative fuels offer the ability to reduce aviation's life cycle CO₂ emissions and that States should support measures to facilitate the commercialization of sustainable alternative fuels for aviation.

4.3 Conclusions

4.3.1 From the documentation and ensuing discussion during the second meeting on production and infrastructure under Agenda Item 4, the Conference concluded the following:

- a) acknowledge that cost benefit analysis is an appropriate methodology for effectively guiding investments into the development and production of sustainable alternative fuels for aircraft;
- b) conclude that best practices for cost benefit analysis (CBA) methodology that can be tailored to sustainable alternative fuel production, using assumptions and input data that specifically reflect the external costs of aviation and the complex benefits that result from mitigating aviation's GHG emissions, can ensure that projects are fairly assessed and investments are made most effectively;
- c) the use of sustainable alternative fuels, in particular biofuels, is a promising way of effectively reducing aviation's life cycle CO₂ emissions;
- d) candidate alternative aviation fuels need to meet stringent technical and operational requirements, in particular the "drop-in" requirement. They are acceptable only if they meet carbon lifecycle and other sustainability requirements according to generally accepted criteria and meet sufficient supply requirements;
- e) there are a variety of candidate fuels expected to meet these requirements, some of which have been successfully flight and ground tested as a demonstration for the

feasibility of using alternative fuels in aviation. It is very likely that several fuels will be used simultaneously in future operational practice; and

- f) development of feedstock growth and production facilities is now needed urgently to reach sufficient production quantities. A worldwide spread of production would ease logistics and offer new opportunities for developing countries. Substantial financial investments are needed for a successful deployment of sustainable alternative fuels for aviation at a competitive price from the beginning.

4.4 Recommendations

4.4.1 From the documentation and ensuing discussion during the second meeting on production and infrastructure under Agenda Item 4, the Conference adopted the following recommendations:

- a) ICAO facilitate the dissemination of best practices for cost benefit analysis which are appropriate for evaluating sustainable alternative fuels for aircraft;
- b) States consider measures to support aviation alternative fuels research and development, investments in new feedstock cultivations and production facilities, as well as measures to stimulate commercialization and use of sustainable alternative fuels for aviation to help reduce aviation CO₂ emissions; and
- c) ICAO, in its position for UNFCCC COP15 in Copenhagen, highlights the significant importance of the CO₂ reduction potential from sustainable alternative aviation fuels and seeks support from States at COP15 for the development and implementation of these fuels by considering *inter alia* the measures outlined above.

4.4.2 The Chairman presented these conclusions and recommendations in CAAF/09-SD/2, which was approved by the Conference.

CONFERENCE CONCLUSION

Global Framework for Aviation Alternative Fuels, Declaration, and Recommendations

1. As the Conference approached its conclusion, States urged ICAO to highlight the significance of the CO₂ reduction potential from sustainable alternative aviation fuels in its position for COP15.
2. A working group composed of the Chairman, Vice Chairman, and representatives from Brazil, China, France, South Africa, Sweden, Tunisia, United Arab Emirates, United Kingdom, United States, the European Commission, IATA and ICCAIA, and the Secretariat prepared a Declaration and Recommendations (CAAF/09-WP/24) presented in Appendix C; and a Global Framework for Aviation Alternative Fuels (CAAF/09-WP/23), presented in Appendix D.
3. The Conference unanimously welcomed the efforts of the group who prepared the papers and adopted these two documents in their entirety. Members of every delegation congratulated the Chairman and Vice Chairman on a successful Conference, thanked Brazil for their generosity as hosts, and appreciated the efforts of the Secretariat.
4. The Chairman expressed his sincere appreciation and attributed the success of the Conference to the participants and those who provided support to it. He recognized the host State of Brazil for providing excellent facilities and professional support. The Chairman thanked the Secretariat who in a very efficient and professional manner worked closely and tirelessly with Brazil to ensure that the Conference proceeded smoothly. He was grateful for the language service staff that provided interpretation in seven languages and overnight translation, without which the Conference would not have been possible. The Chairman especially noted the assistance of the Vice Chairman throughout the Conference.
5. The Conference concluded on Wednesday, 18 November 2009.

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PUNTARULO	L. J.	DELEGATE

AUSTRALIA

MILCZAREK	M.T.	CHIEF DELEGATE
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NASH	P.	OBSERVER
HERMANT	E.	OBSERVER

UNFCCC

CASTELLANOS	F.	OBSERVER
SILVEIRA		

WORKING PAPERS

CAAF WP	Agenda Item	Title	Languages	Presented by
1	---	Annotated Agenda	E,F,S,R,A,C	Secretariat
2	---	Meeting arrangements and tentative timetable	E,F,S,R,A,C	Secretariat
3	1	The Need for Alternative Fuels for Aviation	E,F,S,R,A,C	Secretariat
4	1	Estimating Life Cycle Greenhouse Gas Emissions from Alternative Fuels	E,F,S,R,A,C	US
5	1	Additional Local Air Quality Benefits from Sustainable Alternative Fuels for Aircraft	E,F,S,R,A,C	Secretariat
6	3	Engine and Aircraft Certification for use with Ethanol	E,F,S,R,A,C	Brazil
7	2	Proposal to Adopt a Global Fuel Readiness Level (FRL) Protocol	E,F,S,R,A,C	US
8	1	Continuous Improvement in Aircraft Efficiency	E	ICCAIA
9	1	Definitions	E,F,S,R,A,C	Secretariat
10	2	Flight Tests and Associated Results	E	ICCAIA
11	3	Alternative Aviation Jet Fuel Production and Certification	E	Brazil
12	2	Types and Costs of Sustainable Alternative Fuels for Aircraft	E,F,S,R,A,C	Secretariat
13	3	Non Drop-In Fuel Experience	E	ICCAIA
14	1	Ensuring sustainability of Renewable Aviation Fuels	E	ICCAIA
15	3	Proposal to Adopt a Global fuel Qualification and Certification Protocol	E,F,S,R,A,C	US
16	2	Technical Feasibility and Economic Viability of Sugarcane Ethanol	E	Brazil
17	3	Policy Measures in Europe to support Development and use of Sustainable Fuels in Aviation	E,F,S,R,A,C	Presented by Sweden, on behalf of the EC and its Member States and by the other States Members of the ECAC
18	4	Framework from Implementation of Sustainable Alternative Fuels in Aviation	E	IATA
19	2	Sugar Cane Biomass and Aviation: The Embraer/Neiva “Emb-202a Ipanema Powered by Ethanol” Case	E	Brazil

CAAF WP	Agenda Item	Title	Languages	Presented by
20	1	Sustainability and The Production and Use of Sugarcane Ethanol in Brazil	E	Brazil
21	---	NO PAPER		
22	4	Using Cost Benefit Analysis for Alternative Fuels Investments	E,F,S,R,A,C	Secretariat
23	1	Roadmap	E,F,S,R,A,C	Secretariat
24	--	Draft Declaration and Recommendations	E,F,S,R,A,C	Secretariat
25	3	Facilitating Access to Financial Resources, Technology Transfer and Capacity Building	E,F,S,R,A,C	Secretariat
26	1	Impact of Alternative Fuels on Aircraft Engine Emissions	E	ICCAIA
27	1	The Commercial Aviation Alternative Fuels Initiative	E,F,S,R,A,C	US

INFORMATION PAPERS

CAAF IP	Agenda Item	Title	Languages	Presented by
1	1	Outcome of the ICAO Workshop on Alternative Fuels	E	Secretariat
2	4	Lessons Learned in Facilitating Sustainable Alternative Aviation Fuels Deployment	E	US
3	2	U.S. Research and Development Roadmaps for Alternative Aviation Jet Fuels	E	US
4	3	Sustainability Criteria for the Use of Biofuels in the European Union and Life Cycle Assessment	E	European Commission
5	3	Making Aviation Greener- A snapshot of European Measures for Sustainable Transport	E	European Commission
6	1	Comparison of Life Cycle GHG Emissions from Select Alternative Jet Fuels	E	US
7	1	Full Integration between Multiple Renewable Sources to Benefit from Symbioses	E	Brazil
8	1	Continuous Improvement in Aircraft Fuel Efficiency	E	ICCAIA
9	1	Ensuring Sustainability of Renewable Aviation Fuels	E	ICCAIA
10	3	Funding and Time are Drivers for Solutions	E	Brazil
11	1	Impact of Alternative Fuels on Aircraft Engine Emissions	E	ICCAIA
12	2	Flight Tests and Associated Results	E	ICCAIA
13	3	Non-Drop in Fuels and Advanced Aircrafts	E	ICCAIA

		System Power Technologies		
14	4	The Existing and Emerging Risks Regarding the Scale-up, the Renewable Energy Sources Availability, the Logistics and the CO ₂ Sourcing as Main Constraint Issue	E	Brazil
15	1	Biofuels Sustainability Scorecard	E	Inter-American Development Bank (IDB)

The Conference on Aviation and Alternative Fuels, convened by the International Civil Aviation Organization (ICAO) in Rio de Janeiro, Brazil from 16 to 18 November 2009 with the participation from States and industry adopted the following declaration and recommendations:

**DECLARATION OF 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 CO₂ 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 CO₂ 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.

RECOMMENDATIONS BY CAAF

The Conference on Aviation and Alternative Fuels has 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:

Present the CAAF2009 Declaration and Global Framework for Aviation Alternative Fuels (GFAAF) in conjunction with the outcomes of the High-level Meeting on International Aviation and Climate Change (HLM-ENV) as the ICAO input to COP15.

This input shall:

1. *Highlight* the significance of the CO₂ reduction potential from sustainable alternative aviation fuels in its position to COP15;
2. *Seek support* from States at COP15 for the development and implementation of these fuels;
3. *Encourage* Member States to inform ICAO of any plans to establish sustainable alternative aviation fuel production facilities in the short, medium, and long-term;
4. *Incorporate* those plans into the ICAO Global Framework for Aviation Alternative Fuels; and
5. *Promote* the production and use of sustainable alternative fuels for aviation.

Ensure that a programme for sustainable alternative fuels for aviation is presented for consideration during the next Assembly.

Input to the Assembly would:

6. *Encourage* Member States to develop policy actions to *accelerate* the appropriate development, deployment and use of such fuels;
7. *Encourage* Member States to 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;
8. *Encourage* Member States to work together expeditiously with the industry to foster the development and implementation of sustainable alternative fuels for aviation;
9. *Recommend* that policy recommendations and decisions considered by ICAO and individual States consider environmental, social and economic sustainability aspects, while also taking into account technical requirements including safety aspects;
10. *Encourage* Member States and *invite* industry to actively participate in further work on sustainable alternative fuels for aviation facilitated by ICAO; and
11. *Inform* the Assembly of initiatives by States and other organizations related to sustainable alternative fuels for aviation.

Promote the use of sustainable alternative fuels for aviation.

The ICAO Council:

12. *Resolves* that the use of sustainable alternative fuels for aviation is an important opportunity to reduce aviation CO₂ emissions;
13. While *noting* the past and ongoing efforts of the aviation sector in developing and deploying sustainable alternative fuels for aviation, and their potential for substantially reducing aviation's CO₂ emissions, *affirms* that the prospect of reduction in CO₂ emissions through sustainable alternative fuels should not lead to any relaxation or reduction of efforts related to other measures to reduce the environmental impact of aviation;
14. *Encourages* manufacturers to pursue fuel cell technology with the aim of providing energy for on-board electrical supply and/or on ground operations; and
15. *Encourages* relevant industry stakeholders to work with financial institutions and fuel producers to ensure that adequate supplies of sustainable alternative fuels for aviation are introduced expeditiously.

Facilitate exchange of information on financing and incentives for sustainable alternative fuels for aviation programmes working with the relevant UN bodies.

The ICAO Council:

16. *Commits* to further elaborate on measures to assist developing States as well as to facilitate access to financial resources, technology transfer and capacity building;
17. *Recognizes* the urgent need for measures to facilitate access to financial resources, technology exchange, and capacity building specific to aviation alternative fuels;
18. *Commits* to encouraging cooperation among stakeholders for the development and deployment of sustainable alternative fuels for aviation with the aim of ensuring adequate financing for the successful execution of those programs;
19. *Commits* to take the necessary steps with the aim of considering a framework for financing of infrastructure development projects dedicated to aviation alternative fuels and incentives to overcome initial market hurdles;
20. *Encourages* Member States to consider measures to support sustainable aviation alternative fuels research and development, investments in new feedstock cultivations and production facilities, as well as incentives to stimulate commercialisation and use of sustainable alternative fuels for aviation to accelerate the reduction of aviation CO₂ emissions; and
21. *Recommends* 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.

Facilitate standardized definitions and processes to support the development of sustainable alternative fuels for aviation.

The ICAO Council:

22. *Recommends* the use of life cycle analysis according to internationally harmonized methodologies as the appropriate means for comparing the relative GHG emissions from sustainable alternative jet fuels to conventional jet fuel;
23. *Encourages* Member States, working with industry, to develop an agreed methodology for determining the characteristics of blended jet fuels at the point of fuel delivery to aircraft operators;
24. *Considers* the use of the global industry qualification process as the appropriate means for approving a new drop-in alternative jet fuel;
25. *Adopts* the Fuel Readiness Level (FRL) as a best practice to govern communication of technology maturity leading to qualification, production and, deployment readiness; and
26. *Encourages* Member States to continue the development of sustainability criteria for sustainable aviation fuels that are consistent with any general sustainability criteria for fuels.

Facilitate the exchange of information regarding sustainable alternative fuels for aviation.

The ICAO Council:

27. *Facilitate* the dissemination of best practices for cost benefit analysis methodology appropriate for evaluating sustainable alternative fuels for aircraft;
28. *Directs* the Secretariat to establish a web site to facilitate the exchange of information between States and International Organizations interested in advancing sustainable alternative fuels for aircraft; and
29. *Recommend* that Member States and International Organizations share best practices and techniques that can apply to the development and scale up of the production of sustainable alternative fuels for aircraft through ICAO.

Facilitate research activities to expand the global knowledge base on sustainable alternative fuels for aviation.

The ICAO Council:

30. *Recommends* that ICAO further explore the environmental benefits and trade-offs of sustainable alternative fuels with reference to surface and local air quality; and

31. *Recommends* that ICAO actively monitor the overall process already engaged in the study, development and approval of alternative fuels for aviation.

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 emissions¹ 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

¹"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

fuels are not available in sufficient quantities to meet the overall fuel demand for 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 CO₂ 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:

Activity A: Providing fora for education and outreach on sustainable alternative fuels for aviation

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.

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

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 12th, 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 37th 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
- ...

— END —

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