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**WORKING PAPER**

# ASSEMBLY — 38TH SESSION

## EXECUTIVE COMMITTEE

**Agenda Item 17: Environmental Protection**

## SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION

(Presented by the Council of ICAO)

**EXECUTIVE SUMMARY**

In response to Assembly Resolution A37-19, which requests ICAO and its Member States to actively participate in further work on sustainable alternative fuels for aviation, ICAO undertook activities to promote and facilitate the emergence of sustainable alternative fuels in aviation. These activities include information sharing, promotion of dialogue between States and stakeholders, the maintenance of the Global Framework for Aviation Alternative Fuels (GFAAF), the convening of the ICAO Aviation and Sustainable Alternative Fuels Workshop in October 2011, the launch of the "*Flightpath to a Sustainable Future*" initiative in June 2012, on-going work on environmental trends, and the establishment of the Sustainable Alternative Fuels (SUSTAF) Expert Group in June 2012.

Dialogue and information sharing with States and stakeholders, recommendations of the SUSTAF Expert Group, work by ICAO on environmental trends, in particular through the work of the Committee on Aviation Environmental Protection (CAEP), and States' action plans, have allowed for the identification of challenges and issues that need to be addressed in order to quantify, further facilitate, and promote the emergence of sustainable alternative fuels in aviation.

The next priorities are to address initial economic barriers and to ensure sustainable commercial-scale deployment. Dedicated policies from States are needed, including supporting measures and provisions to ensure sustainability.

Further work is required to improve the way sustainable alternative fuels and changes in fuel life-cycle emissions will be reflected in the ICAO environmental trends assessments so as to allow for the evaluation of the contribution of such fuels towards achieving aviation's aspirational goals.

**Action:** The Assembly is invited to:

a) acknowledge the developments, as requested in Assembly Resolution A37-19, and support the continued work of the Organization in facilitating efforts of States and industry in the development and deployment of sustainable alternative fuels for aviation; and
b) consider the information contained in this paper for the update of Assembly Resolution A37-19.

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| *Strategic Objectives:* | This working paper relates to Strategic Objective C – *Environmental Protection and Sustainable Development of Air Transport.* |
| *Financial implications:* | The activities referred to in this paper will be undertaken subject to the resources available in the 2014–2016 Regular Programme Budget and/or from extra budgetary contributions. |
| *References:* | A38-WP/26, *Present and Future Trends in Aircraft Noise and Emissions*<br>A38-WP/32, *Environmental Protection – Developments in Other United Nations Bodies and International Organizations*<br>A38-WP/34, *Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change.* |

## 1. INTRODUCTION

1.1 In October 2010, the 37th Session of ICAO Assembly adopted Resolution A37-19 which requested Member States to develop policy actions to accelerate the appropriate development, deployment and use of sustainable alternative fuels for aviation, as part of a basket of measures to limit carbon emissions from international aviation.

1.2 Progress and achievements over the last five years have demonstrated that drop-in[1] alternative fuels are a technically sound solution that will not require changes to aircraft or fuel delivery infrastructure. Deploying these fuels in aviation as a means to limit carbon emissions is of particular relevance as aviation, unlike road-transportation for example, has no alternatives to liquid fuels for the foreseeable future. In addition, the concentration of aviation fuel distribution on a limited set of locations can facilitate the deployment of novel fuels for which the aviation sector has confirmed a strong interest.

1.3 Resolution A37-19 further requested ICAO and its Member States to work together to exchange information and best practices and to actively participate in further work on sustainable alternative fuels for aviation.

## 2. PROMOTION AND FACILITATION OF THE EMERGENCE OF SUSTAINABLE ALTERNATIVE FUELS FOR AVIATION

2.1 The Conference on Aviation and Alternative Fuels (CAAF) in November 2009 created the Global Framework for Aviation Alternative Fuels (GFAAF) as a means to consolidate and communicate information on existing aviation alternative fuel activities. The GFAAF, accessible through the ICAO public website[2] contains up-to-date news, announcements and activities related to alternative fuels for aviation, descriptions of ongoing projects and initiatives, as well as reference documentation and links of interest.

2.2 Following up on the work of the ICAO Conference on Aviation and Alternative Fuels in 2009, ICAO held the Aviation and Sustainable Alternative Fuels Workshop in Montréal, in October 2011, to promote dialogue between States, financial institutions, fuel producers and operators. It successfully brought together experts and organizations to address pertinent issues on the subject of alternative fuels for aviation and views were expressed on the need for global policies and measures to facilitate the deployment and for increased harmonization with respect to sustainability[3].

2.3 In June 2012, ICAO launched the *Flightpath to a Sustainable Future* initiative, in close cooperation with governments, operators, airports, fuel providers and air traffic management, which enabled four connecting flights, all operated with alternative fuels, from Montréal to the Rio+20 Summit. About 400 people collaborated in this initiative, which saved 47 tonnes of $CO_2$ overall on the longest international itinerary using biofuels (see A38-WP/32, *Environmental Protection – Developments in Other United Nations Bodies and International Organizations*) and carried the greatest number of passengers on commercial biofuel flights within 24 hours. A detailed presentation of the initiative has been published and is available on ICAO public website[4].

2.4 In June 2012, ICAO established the Sustainable Alternative Fuels (SUSTAF) Expert Group to develop recommendations to further facilitate the global development and deployment of

[1] A "drop-in" fuel is fully interchangeable with conventional Jet A-1 and fully compatible with existing systems.
[2] GFAAF Internet address: http://www.icao.int/environmental-protection/GFAAF/Pages/default.aspx
[3] Report available at: http://www.icao.int/environmental-protection/Documents/SUSTAF%20Review[2].pdf
[4] http://www.icao.int/environmental-protection/Documents/RIO+20_Flightpath_Review.pdf

sustainable alternative fuels in aviation. The Group focused on the identification of the major near-term challenges attendant to the deployment of sustainable alternative fuels for aviation and on the solutions to overcome them. In particular, the issue of sustainability was addressed and the Group focussed on identifying possible options that States might use to address the sustainability of such fuels. Areas where ICAO's involvement would be relevant were also identified. The outcome and recommendations of the SUSTAF Experts Group, are provided in the Appendix to this paper for information.

2.5 The ICAO Assistance for Action – Aviation and Climate Change Seminar and the ICAO Symposium on Aviation and Climate Change − Destination Green, held in Montréal in October 2012 and May 2013, respectively, were additional opportunities for ICAO to promote dialogue and exchange of information on sustainable alternative fuels development. Furthermore, a chapter of the Environmental Report is dedicated to this topic.

2.6 ICAO participated in the Alternative Fuels Pavilion at the June 2013 Paris Air Show to promote international cooperation in the development and deployment of alternative fuels in aviation and the celebration of the one year anniversary of the Rio+20 *Flightpath to a Sustainable Future* initiative, during which ICAO and its partners in the initiative highlighted the progress achieved since Rio+20.

## 3. ACCOUNTING FOR ALTERNATIVE FUELS IN TRENDS ASSESSMENT

3.1 Work has also been undertaken with a view to improve, in particular, the assessment of the $CO_2$ emissions from international aviation operations (see A38-WP/26, *Present and Future Trends in Aircraft Noise and Emissions*). The methodology was improved to account for the contribution of the different measures (i.e. technology, operations, alternative fuels, and market-based measures (MBMs)), separately. Although the quantification of alternative fuels has proven to be a major challenge, States' action plans provided one of the sources of information on the contributions of sustainable alternative fuels.

3.2 The Committee on Aviation Environmental Protection (CAEP) Modeling and Database Group tasked the Alternative Fuels Ad-Hoc Group (AFHAG) to include alternative fuels in the aviation emissions assessment, based on States' action plans as well as responses to State letter AN 1/17-12/59, Questionnaire on Alternative Jet Fuel Production, which requested specific input regarding States' targets for alternative fuels. The exercise highlighted uncertainties as to how to account for greenhouse gas (GHG) emissions changes. One such difficulty in compiling this information is the fact that, unlike technology and operations where $CO_2$ reductions are directly related to efficiency, and/or MBMs where reductions in other sectors can be accounted for in net emissions reductions, the contribution from sustainable alternative fuels is from a life-cycle perspective and adding net $CO_2$ reductions with life-cycle reductions is not a simple exercise. Difficulty was also encountered in projecting alternative fuels deployment as, to date, many projects or plans for future production are still in an early phase.

## 4. CHALLENGES

4.1 There has been great success in the early development of aviation alternative fuels and airlines have been proactive in demonstrating feasibility through over 1 500 commercial flights. However, in spite of this progress, operational use of alternative fuels remains limited and the commercial production of these fuels has not yet begun. The current price gap with conventional jet fuel remains a key barrier for commercial-scale adoption and deployment. Policy measures by States are still required to accelerate appropriate development, deployment and use.

4.2 Ensuring sustainable deployment is a second major challenge to be addressed by States' policies. Beyond GHG emissions reductions, this encompasses the management and control of the

environmental, social and economic impacts of a commercial-scale deployment, for which dedicated measures need to be included in biofuel policies.

4.3 When considering the challenges for deployment as well as the variety of options for States to address sustainability, the global nature of international aviation, needs to be taken into account. The emergence of disparate regional regulations could hinder commercial-scale deployment of alternative fuels for aviation and progress toward increased harmonization or mechanisms for mutual recognition would yield benefits.

## 5. NEXT STEPS

5.1 The SUSTAF Expert Group emphasized the need for, and benefit from, information sharing on progress, regulations and experience feedback in the development, deployment and use of sustainable alternative fuel and recommended the continuation of ICAO's supporting activities, in particular identifying and disseminating information on successful practices.

5.2 In connection with ICAO's central role in assessing the trends for future aviation emissions and progress towards the global aspirational goals, there is a need to develop a global view of future alternative jet fuel production. This could be accomplished through the collection of information on progress of alternative fuel deployment, including input that would be provided, on a voluntary basis, in States' action plans.

5.3 In order to enable the use of alternative jet fuel projections to evaluate progress toward meeting the global aspirational goals, work needs to be undertaken with States on ways to assess and account for changes in life cycle GHG emissions for conventional and alternative fuels.

5.4 Consideration should also be given to the best way to support States in working together on areas that would benefit from common approaches for further convergence or the definition of interoperability mechanisms. These areas include efforts to evaluate fuel sustainability and life cycle GHG emissions reductions among regions and States, as well as projections for biomass availability and use. Such common approaches should be consistent with approaches for other transportation modes and should be developed in concert with other relevant organizations.

## 6. CONCLUSIONS

6.1 There were significant achievements over the last three years for the emergence of sustainable alternative fuels. Their technological feasibility is proven, the fuel certification of a 50 per cent fuel blend is approved, and the use of alternative fuels has been demonstrated by a number of commercially scheduled operations. In moving forward, more work needs to be undertaken, including on dedicated policies from States to address the economic barriers to enable sustainable commercial-scale deployment.

6.2 Promotion, further information sharing and exchanges between States continue to be pursued through ICAO. ICAO also has a key role in including sustainable alternative fuels in future environmental trends, for which reporting of initiatives and methodological work on a harmonized way to account for life cycle emissions of the fuels are required.

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# APPENDIX A

# OUTCOME AND RECOMMENDATIONS OF THE SUSTAF EXPERT GROUP

## 1. INTRODUCTION

1.1 ICAO created in June 2012 the SUSTAF Expert Group to develop recommendations to further facilitate the global development and deployment of sustainable alternative fuels for aviation. The Group focused on the identification of the major near-term challenges attendant to the deployment of sustainable alternative fuels for aviation and on the solutions to overcome them. In particular, the issue of sustainability was addressed and the Group aimed to identify possible options that States might use to address the sustainability of such fuels. Further direction for ICAO involvement was also identified.

1.2 This led to recommendations of the SUSTAF Expert Group which were considered by the High-level Group on International Aviation and Climate Change (HGCC) established by the Council, as part of its work to develop policy recommendations regarding the elements of the 38th Assembly Resolution on international aviation and climate change (see A38-WP/34).

1.3 In the context of the SUSTAF Expert Group's work, "sustainable alternative fuels" are understood to be consistent with the environmental, social and economic pillars of sustainability and, in particular, to be fuels that have a lower life cycle greenhouse gas (GHG) footprint than conventional fuel. In agreement with ICAO's environmental goals, the use of sustainable alternative fuels, through continuous improvement, should result, in the future, in significant reductions of GHG emissions compared to conventional jet fuel.

1.4 The recommendations of the SUSTAF Expert Group are provided in the following paragraphs. Further information that supports the Group's recommendations are available on the GFAAF website[5].

## 2. ADDRESSING THE MAJOR CHALLENGES FOR COMMERCIAL-SCALE DEPLOYMENT OF SUSTAINABLE ALTERNATIVE FUELS

2.1 The SUSTAF Expert Group concluded that, while the availability of sustainable feedstock and the impact of their production is a significant challenge over the long term, overall economics are the main issue for the short term. Today, the most significant challenge is spurring capital investment to ramp up alternative fuel production.

2.2 In order to create the long-term market perspective required for the emergence of sustainable alternative fuels in aviation, States need to consider aviation within renewable energy policies and to set a stable regulatory and political context in the range of ten years or more to attract investors in the development and deployment of alternative fuels for aviation.

2.3 Therefore, the Group recommended that States' policies should:

[5] "The challenges for the development and development of sustainable alternative fuels in aviation"- GFAAF, section "Literature Review / Reference documents" - http://www.icao.int/environmental-protection/GFAAF/Pages/default.aspx

a) address the lack of price competitiveness compared to conventional jet fuel and the lack of incentives for the environmental benefits of using alternative fuels, which together with risks and market uncertainties, are dissuading investors from financing projects;

b) no longer disfavour the use of aviation alternative fuels relative to road transportation alternative fuels, which are in addition currently less costly to produce;

c) use grants, taxes incentives and other forms of assistance to support the development of the different steps of the value chain, including sustainable feedstock production, as securing long-term sustainable feedstock supplies at competitive prices is fundamental to developing sustainable alternative fuels; and

d) support research and development for accelerating commercial production by improving the efficiency and cost of the feedstock and fuel production to reduce the price gap with conventional jet fuel, including through the qualification and scale-up of additional production processes.

2.4 Developing and deploying alternative fuels in aviation is a multidisciplinary issue closely connected to other renewable energy policies as well as policies in the areas of agriculture and environmental and social sustainability. Therefore, the SUSTAF Expert Group recommended a coordinated approach between relevant ministries for biomass resources evaluation and planning, allocation of aviation share in renewable energy, implementation of policy as well as assessment of all the impacts of a commercial-scale deployment.

## 3. SUSTAINABILITY AND POSSIBLE OPTIONS FOR A SUSTAINABLE COMMERCIAL-SCALE DEPLOYMENT

3.1 The management and control of environmental, social and economic impacts are the three pillars of the successful sustainable development of aviation alternative fuels. GHG emissions associated with alternative fuels, such as other environmental, social and economic attributes, are directly impacted by the conditions of production of the feedstock and the fuel, the sustainability of which needs to be demonstrated.

3.2 The SUSTAF Expert Group recommended that the following general principles should be considered for the deployment of alternative fuels in aviation:

a) sustainable alternative fuels produced for aviation should achieve a net reduction of GHG emissions on a life cycle basis, compared to the use of conventional jet fuel, with particular attention to be paid to the carbon stocks of the land converted for the feedstock production and to continuous progress towards higher emissions reductions;

b) areas of high importance for biodiversity, conservation and ecosystem services[6] should be identified and preserved;

[6] Millennium Ecosystems Assessment: "Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as

c) sustainable alternative fuels produced for aviation should contribute to local social and economic development; and competition with food should be minimized;

3.3 Three complementary approaches have been developed to address the sustainability of alternative fuels: 1) the measurement of indicators to assess progress towards or away from a defined sustainable development path; 2) voluntary standards and certification schemes that certify production compliance with defined sustainability criteria; and 3) regulations that have been introduced by some States for alternative fuels in which compliance with sustainability criteria is required for the fuels to be recognized in the achievement of national targets for renewable energy or to benefit from supporting measures. Further information on these approaches for sustainability is provided in the supporting document available on the GFAAF website.

3.4 Each of these approaches responds to distinct needs and objectives and may require their combination. Based on such combination of existing approaches, provisions and measures to ensure the sustainability of fuels need to be part of the policy for the promotion of alternative fuels in aviation, including monitoring at the national level of the impacts of the commercial-scale deployment.

3.5 Additional measures may be required to ensure sustainable commercial-scale deployment. For example, commercial-scale deployment of alternative fuels could induce indirect impacts such as impacts on the global food market or land use change in another geographic area because of the displacement of previous cultures (a phenomena referred as indirect land use change and recognized as possibly inducing greenhouse gas emissions). Addressing these impacts could require additional policies and further methodological and research work.

3.6 Due to the nature of international aviation, the emergence of disparate regional regulations could hinder commercial-scale deployment of alternative fuels for aviation and recognition of these fuels in countries other than the country of production or uplift is expected to be regularly required. Progress toward increased harmonization or mechanisms for mutual recognition would yield benefits.

## 4. FUTURE WORK

4.1 The SUSTAF Expert Group agreed on the need for, and benefit from, information sharing on good practices in alternative fuel production and use, as well as on regulations, for which ICAO's supporting activities should be continued. Consideration should also be given to the best way to support States to work together on areas that would benefit from common approaches for further convergence or the definition of interoperability mechanisms, including efforts to evaluate fuel sustainability and life cycle GHG emissions reductions among regions and States. Such common approaches should be consistent with approaches for other transportation modes and should be developed in concert with other relevant organizations.

4.2 Furthermore, specific needs and useful initiatives were identified that would benefit from ICAO's action:

a) developing a global overview of future alternative jet fuel production, as well as identifying and disseminating information on successful practices, by collecting material on progress of alternative fuel deployment, including inputs that would be included, on a voluntary basis, in States' Action Plans;

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spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth" − Ecosystems and Human Well-being − A Framework for Assessment, http://www.millenniumassessment.org.

b) working together with States to provide information on means to account for changes in life cycle GHG emissions for conventional and alternative jet fuel such that future alternative jet fuel projections could be used to evaluate progress toward meeting international aviation environmental goals.

— END —