



## ASSEMBLY — 39TH SESSION

### EXECUTIVE COMMITTEE

**Agenda Item 20: Environmental Protection – Aircraft Noise**

**Agenda Item 21: Environmental Protection – Aircraft Engine Emissions affecting Local Air Quality – Policy, Standardization and Implementation Support**

**Agenda Item 22: Environmental Protection – International Aviation and Climate Change – Policy, Standardization and Implementation Support**

### PRESENT AND FUTURE AIRCRAFT NOISE AND EMISSIONS TRENDS

(Presented by the Council of ICAO)

#### EXECUTIVE SUMMARY

As requested by Assembly Resolution A38-17, this paper presents the assessment of the present and future impact and trends of aircraft noise and aircraft engine emissions.

The trends show that aircraft noise, aircraft engine emissions that affect local air quality, and aircraft emissions that affect the global climate, are expected to continue to grow in the future, but at a rate slower than the growth in traffic. In the case of aircraft noise, by 2030, aircraft noise may no longer grow with an increase in traffic, under an optimistic technology and operational improvement scenario.

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

- a) endorse the use of the ICAO global environmental trends as the basis for decision-making on environmental matters;
- b) request the Council to continue work in these areas with the support of States, with a view to providing the next ordinary Session of the ICAO Assembly with an updated global environmental trends assessment; and
- c) urge States to submit data to support the Assembly request of reporting on aviation emissions.

<i>Strategic Objectives:</i>	This working paper relates to Strategic Objective E – <i>Environmental Protection</i> .
<i>Financial implications:</i>	The activities referred to in this paper will be undertaken subject to the resources available in the 2017–2019 Regular Programme Budget and/or from extra budgetary contributions.
<i>References:</i>	<p>A39-WP/48, <i>Consolidated statement of continuing ICAO policies and practices related to environmental protection – General provisions, noise and local air quality</i> A39-WP/52, <i>Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme</i> A39-WP/49, <i>Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change</i> Doc 10069, <i>Report of the Tenth Meeting of the Committee on Aviation Environmental Protection</i></p>

## 1. INTRODUCTION

1.1 As requested by Assembly Resolution A38-17, this paper presents the assessment of the present and future impact and trends of aircraft noise and aircraft engine emissions.

1.2 This represents an update to the basis for the aircraft noise and aircraft engine emissions that affect local air quality trends, compared to what was presented to the 38th Session of the ICAO Assembly. The trends for aircraft emissions that affect the global climate include an update to the information on the potential contribution of sustainable alternative fuels, but otherwise remain unchanged from what was presented to the 38th Session of the ICAO Assembly. These environmental trends are fully documented in ICAO Doc XX, *Report of the Tenth Meeting of the Committee on Aviation Environmental Protection*.

## 2. TRENDS IN EMISSIONS THAT AFFECT THE GLOBAL CLIMATE

### 2.1 Trends in Aircraft Fuel Burn and CO<sub>2</sub> Emissions

2.1.1 As shown in Figure 1, international aviation consumed approximately 142 metric tons (Mt) of fuel in 2010. By 2040, it is expected that despite an anticipated increase of 4.2 times in international air traffic, fuel consumption is projected to increase by only 2.8 to 3.9 times over the same period.

2.1.2 The trends presented were developed in the context of a longer-term view. Short term changes in global fuel efficiency can be affected substantially by a wide range of factors such as fluctuations in fuel prices, and global economic conditions.

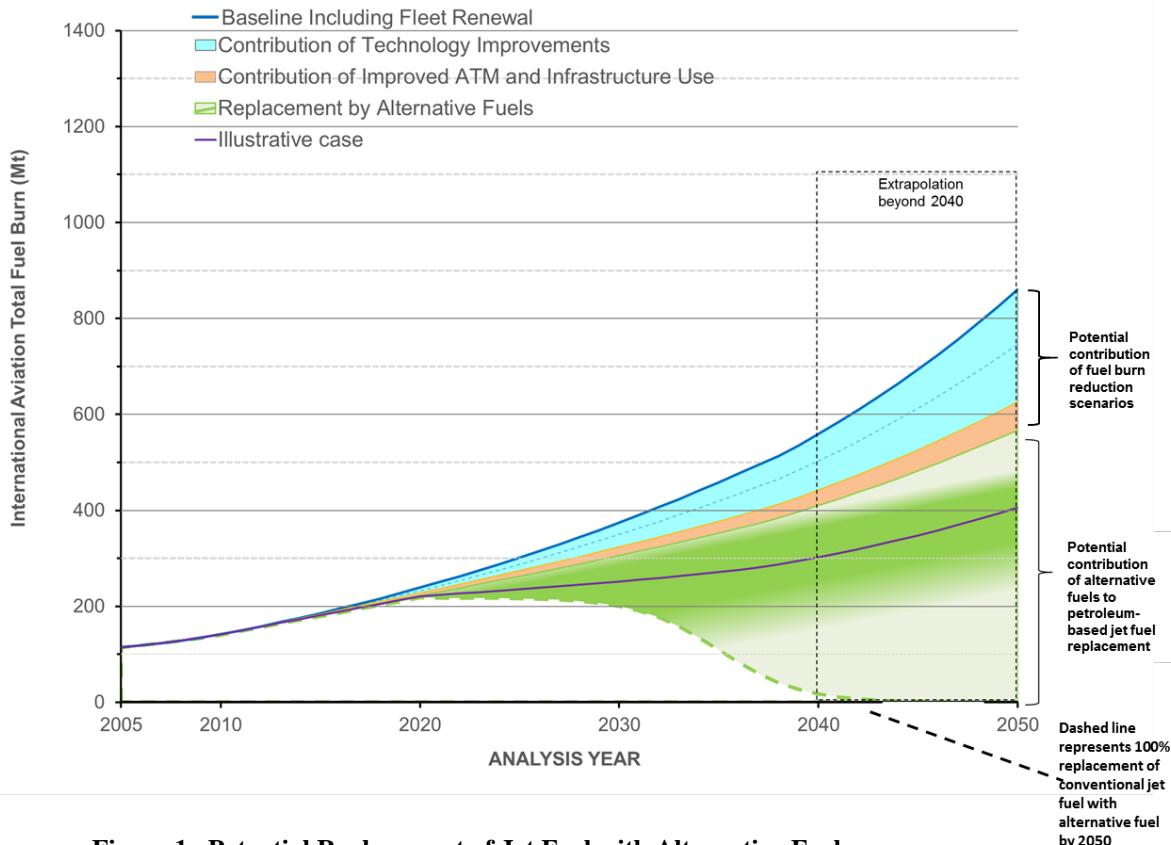
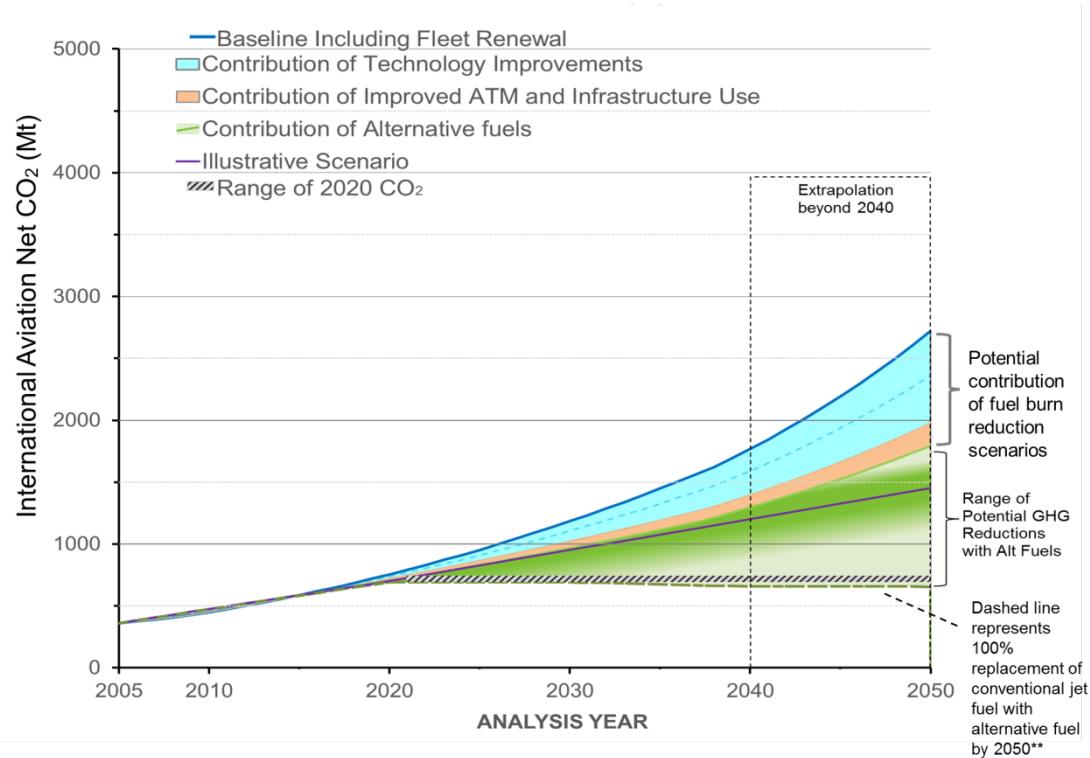


Figure 1. Potential Replacement of Jet Fuel with Alternative Fuels

2.1.3 It is estimated that up to 2 per cent of this fuel consumption could consist of sustainable alternative fuels in 2020. Significant uncertainties exist in predicting the contribution of sustainable alternative fuels in the long-term, however based on the scenarios evaluated by CAEP, it is possible that up to 100 per cent of international aviation jet fuel demand could be met using sustainable alternative fuels in 2050. The future development and use of alternative fuels will highly depend on the policies and incentives in place for such fuels, and also the ecological and economical effectiveness of their use. Based on the analysis assumptions, if enough alternative jet fuel were produced in 2050 to completely replace petroleum-derived jet fuel, it would reduce net CO<sub>2</sub> emissions by 63 per cent. The effect of such an expansion in the use of sustainable alternative aviation fuels on net CO<sub>2</sub> emissions is shown in Figure 2. This expansion would represent a large increase in the use of sustainable alternative aviation fuels.



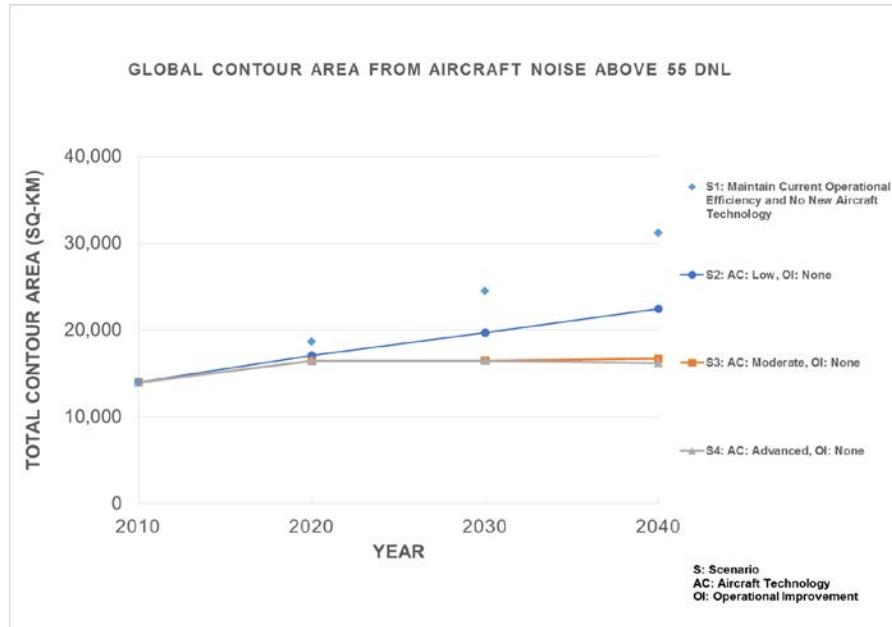
**Figure 2. Alternative Fuels Life Cycle CO<sub>2</sub> Emissions Reductions**

## 2.2 Trends in Aircraft Full-Flight NO<sub>x</sub> Emissions

2.2.1 Full-flight NO<sub>x</sub> emissions trends were evaluated in connection with their effect on the global climate. This is in addition to the NO<sub>x</sub> emissions associated with the landing and take-off (LTO) cycle shown in paragraph 4.1 that are presented in the context of their effect on local air quality. Based on the results, the 2010 baseline full-flight NO<sub>x</sub> value is 2.15 Mt. In 2040, the NO<sub>x</sub> value ranges from 4.81 Mt to 6.35 Mt, which represents a 2.2 to 2.9 times growth in NO<sub>x</sub> emissions over the period, which is less than the 4.2 times forecasted growth in traffic.

## 3. AIRCRAFT NOISE TRENDS

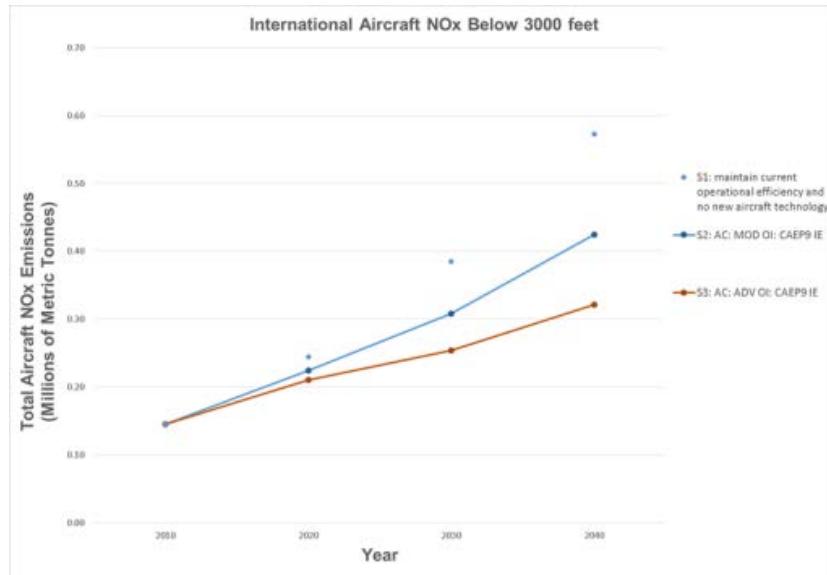
3.1 Figure 3 presents global aircraft noise contour area above 55 dB DNL. For the first time, a decoupling of growth in aircraft noise from air traffic can be observed. Of note is that under an advanced aircraft technology and moderate operational improvement scenario, from 2030, aircraft noise exposure may no longer increase with an increase in traffic. A number of ambitious actions would need to be carried out on the part of Member States for that scenario to be realized.



**Figure 3. Total Global Aircraft Noise Contour Area Above 55 dB DNL**

#### 4. TRENDS IN AIRCRAFT ENGINE EMISSIONS THAT AFFECT LOCAL AIR QUALITY

4.1 Figure 4 provides results for NO<sub>x</sub> emissions within the LTO cycle, that is, below 3,000 feet above ground level (AGL) from international aviation. The 2010 baseline value is approximately 0.15 Mt. In 2040, total NO<sub>x</sub> ranges from 0.32 Mt to 0.42 Mt, which represents a growth of between 2.1 and 2.8 times over the period and is less than the forecasted 4.2 times growth in traffic. The results for particulate matter emissions from international aviation below 3,000 feet AGL are not shown, but are similar to those seen for NOx.



**Figure 4. Total International Aircraft NOx Below 3,000 Feet**