International Civil Aviation Organization

Third Meeting of the Air Traffic Management Performance Measurement Task Force

(APM TF/3)
(Cairo, Egypt, 5 November 2016)

Agenda Item 2: Global and Regional developments related to operational improvements and environmental benefits

GLOBAL DEVELOPMENTS RELATED TO OPERATIONAL IMPROVEMENTS

(Presented by the Secretariat)

SUMMARY

This paper presents the global developments related to the environmental benefits accrued from the implementation of operational improvements.

Action by the meeting is at paragraph 3.

REFERENCES

- Global Air Navigation Plan (Doc 7950)
- 39th ICAO General Assembly

1. INTRODUCTION

1.1 Environmental Protection, to minimize the adverse environmental effects of civil aviation activities, is one of the five strategic objectives of ICAO.

1.2 With a view to minimizing the adverse effects of international civil aviation on the environment, ICAO formulates policies, develops and updates Standards and Recommended Practices (SARPs) on aircraft noise and aircraft engine emissions, and conducts outreach activities. These activities are conducted by ICAO, with technical support provided by the Committee on Aviation and Environmental Protection (CAEP). In pursuing its activities, ICAO also cooperates with other United Nations bodies and international organizations.

1.3 Significant advances have been made in reducing the amount of noise and emissions produced by international civil aviation. For example, significant technological progress has resulted in aircraft produced today being approximately 75 per cent quieter and 80 per cent more fuel efficient per passenger kilometer than in the 1960s.

2. DISCUSSION

Trends in Aircraft Fuel Burn and CO2 Emissions

2.1 International aviation consumed approximately 142 million 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:

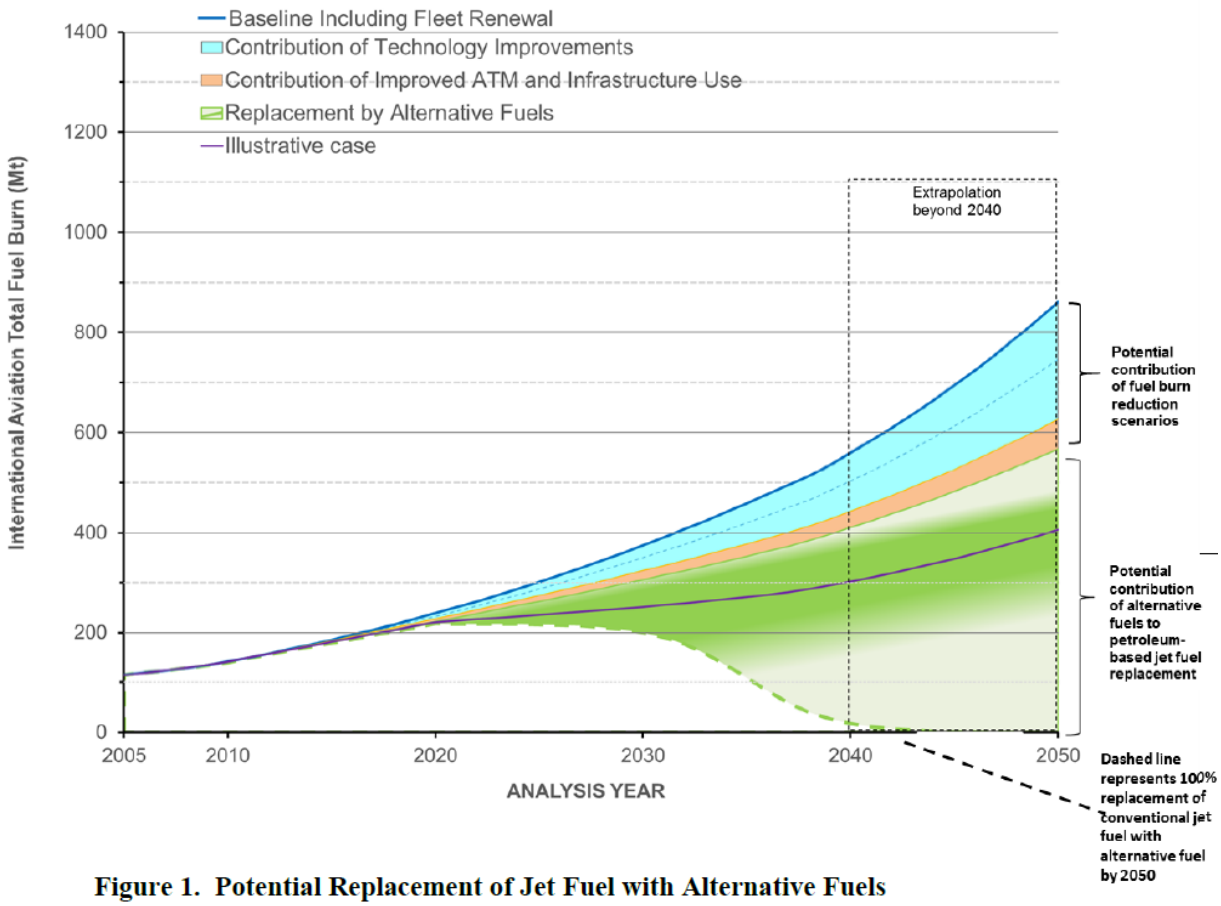

Figure 1. Potential Replacement of Jet Fuel with Alternative Fuels

Measures to reduce CO2 emissions from international civil aviation

A) Aeroplane CO2 Standard

2.2 Following six years of technical work by ICAO, during the CAEP/10 meeting, a recommendation was finalized on an aeroplane CO2 emissions certification Standard. This new Standard, the first global Standard for CO2 emissions of any sector, will apply to new aeroplane type designs from 2020 and to aeroplane type designs that are already in-production in 2023. This means that if an in-production aeroplane design is changed after 2023, the aeroplane would be required to comply with the CO2 emissions Standard. In 2028, there is a production cut-off, meaning that in-production aeroplanes that do not meet the Standard from 2028 can no longer be produced, unless the designs are modified to comply with the Standard. The new CO2 emissions Standard is recommended for inclusion in a new Volume to Annex 16 (Annex 16, Volume III – *Aeroplane CO2 Emissions*). ICAO is currently progressing the new Standard through the SARP adoption process which will conclude in early 2017.

B) Global Market-Based Measures (MBM) Scheme for International Aviation

2.3 ICAO has been developing recommendations for technical design elements of a global MBM scheme, namely on monitoring, reporting and verification (MRV) system, emissions unit criteria (EUC) and registries. ICAO, in coordination with CAEP, has also undertaken technical analyses on various approaches for distribution of offsetting requirements under a global MBM scheme. The work of ICAO on future emissions trends and alternative fuels also supported the development of design elements for a global MBM scheme.

C) Operational Improvements

2.4 The GNAP includes the Aviation System Block Upgrades (ASBU) global framework, developed by ICAO, to ensure that aviation safety will be maintained and enhanced, that ATM improvement programmes are effectively harmonized, and that barriers to future aviation efficiency and environmental gains can be removed at reasonable cost.

2.5 Recognizing that many of the improvements defined in the Global Air Navigation Plan (GANP) offer the potential to deliver fuel and CO2 emissions reductions, an analysis of environmental benefits from the implementation of the Aviation System Block Upgrade (ASBU) Block 0 was conducted. As shown at **Appendix A**, the analysis began with the identification of ASBU Block 0 modules that offer the potential to deliver fuel and CO_2 emissions savings and for which enough data and literature were available to quantify the benefits. These modules are not a comprehensive list of all Block 0 modules that will provide environmental benefits.

2.6 The current and planned ASBU Block 0 module implementation levels were identified through responses from States to ICAO State Letter 2014/56. In total responses were received from States more than 92% of global air traffic.

2.7 The analysis showed that between 2013 and 2018, fuel burn savings of between 55 and 107 kg per flight on average across the all ICAO regions are possible from the implementation of the ASBU Block 0 modules that were identified. Based on the current and planned implementation of ASBU Block 0, this corresponds to a range of 2.48 to 4.87 Mt (0.62 to 1.31 per cent) in global annual fuel saving in 2018 compared to 2013 baseline. These fuel savings amount to global CO_2 emissions saving of between 7.8 and 15.4 Mt.

2.8 The meeting may wish to recall that ICAO developed the Operational Opportunities to Reduce Fuel Burn and Emissions Manual (ICAO Doc 10013) and the Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes Manual (ICAO Doc 10031).

2.9 Furthermore, the Guidance on the development of State's Action Plan on CO2 Emissions Reductions Activities (Doc 9888) provides a description of tools available along with a set of rules of thumb for estimating the expected benefits for each of the measures/operational improvements.

D) Sustainable Alternative Fuels for Aviation

2.10 ICAO continued to support States and stakeholders in their effort to develop and deploy alternative fuels. This included regular updates to the Global Framework for Aviation Alternative Fuels (GFAAF). CAEP's work on alternative fuels Life Cycle Assessment (LCA) methodology supported the technical work on the monitoring, reporting, and verification (MRV) system of a global MBM scheme and the updated CO2 emissions trends.

E) Outreach

2.11 In September of 2014 and 2015, ICAO convened the Fuelling Aviation with Green Technology Seminar and the Global Aviation Partnerships on Emissions Reductions (E-GAP) Seminar, respectively. In addition, ICAO's fourth Environmental Report which focuses on the issue of aviation and climate change was published in July 2016 and it is available on the ICAO public website at: http://www.icao.int/environmental-protection/Pages/ENV2016.aspx

2.12 Figure 2 presents the mitigation measures selected by States according to their action plans:

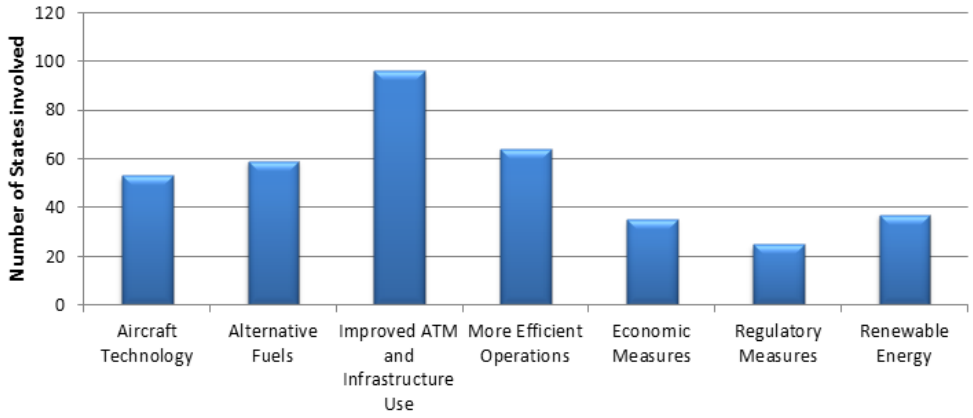

Figure 2. Mitigation measures selected by States according to their action plans

Aircraft Noise

2.13 The recommendations to amend Annex 16, Volume I - *Aircraft Noise* included general maintenance to keep the environmental SARPs up to date and relevant. ICAO is currently progressing the amendments to Annex 16, Volume I through the Standards and Recommended Practices (SARPs) adoption process. In addition, the Environmental Technical Manual (ETM) on the use of Procedures in the Noise Certification of Aircraft (Doc 9501) was updated and will be published as an amendment to the current Doc 9501, Volume I.

2.14 The important work continued on monitoring noise technology and understanding the progress towards the ICAO noise goals. This is part of the continued effort to ensure that the latest available noise reduction technology is incorporated into aircraft designs. ICAO also continued its work on the development of a new supersonic noise Standard for future aircraft, and understanding the current state of sonic boom knowledge, research and supersonic aeroplane projects. It is anticipated that the certification of a supersonic aeroplane could occur in the 2020-2025 timeframe.

ICAO Assembly 39 Resolutions

2.15 The meeting may wish to recall that the 39th ICAO General Assembly, Montreal, Canada, 27 September – 6 October 2016, agreed on the Assembly Resolution A39-1, A39-2 and A39-3 related to the Environmental Protection which superseded A38-17 and A38-18:

A39-1 Consolidated statement of continuing ICAO policies and practices related to environmental protection – General provisions, noise and local air quality

A39-2 Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change

A39-3 Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) Scheme

2.16 A provisional edition of the ICAO Assembly 39 Resolutions is available on the ICAO Website at:

http://www.icao.int/Meetings/a39/Pages/resolutions.aspx

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information provided in this working paper; and

b) encourage States and Users to use the guidelines provided in ICAO Doc 9888, Doc 10013 and Doc 10031 for planning of the implementation of operational improvements and estimating the expected benefits for each of the measures/operational improvements;

APPENDIX A

ASBU Block 0 Modules' Environmental Benefits

Module	Description	Benefits
Block 0-CDO: Continuous Descent Operations *Improved Flexibility and Efficiency in Descent Profiles(CDOs)*	Deployment of performance-based airspace and arrival procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous descent operations (CDOs)	Reduced fuel burn on arrival
Block 0-FRTO: Free Route Operations *Improved operations through enhanced en-route trajectories*	Implementation of performance-based navigation (PBN concept) and flex tracking to avoid significant weather and to offer greater fuel efficiency, flexible use of airspace (FUA) through special activity airspace allocation, airspace planning and time-based metering, and collaborative decision-making (CDM) for en-route airspace with increased information exchange among ATM stakeholders	Reduced in-flight fuel burn
Block 0-RSEQ: Runway Sequencing *Improved Runway Traffic Flow through Sequencing (AMAN/DMAN)*	Time-based metering to sequence departing and arriving flights	Reduced airborne holding and taxi-out time
Block 0-CCO: Continuous Climb Operations *Improved Flexibility and efficiency in Departure Profiles*	Deployment of departure procedures that allow the aircraft to fly their optimum aircraft profile taking account of airspace and traffic complexity with continuous climb operations (CCOs)	Reduced fuel burn during climb
Block 0-NOPS: Network operation *Improved Flow Performance through Planning based on a Network-Wide view*	Collaborative ATFM measure to regulate peak flows involving departure slots, managed rate of entry into a given piece of airspace for traffic along a certain axis, requested time at a waypoint or an FIR/sector boundary along the flight, use of miles-in-trail to smooth flows along a certain traffic axis and re-routing of traffic to avoid saturated areas	Reduced fuel burn in all phases of the flight including taxi
Block 0-TBO: Trajectory Based Operations *Improved Safety and Efficiency through the initial application of Data Link En-Route*	Implementation of an initial set of data link applications for surveillance and communications in ATC	Reduced in-flight fuel burn
Block 0-WAKE: Wake Turbulence Separation *Increased Runway Throughput through Wake Turbulence Separation*	Improved throughput on departure and arrival runways through the revision of current ICAO wake vortex separation minima and procedures.	Reduced taxi-out time and reduced in-flight fuel burn

Module	Description	Benefits
Block 0-ACDM: Airport Collaborative Decision Making *Improved Airport Operations through Airport-CDM*	Airport operational improvements through the way operational partners at airports work together	Reduced Taxi-out time
Block 0-ASUR: Alternative Surveillance *Initial capability for ground surveillance (ADS-B and MLAT)*	This module provides initial capability for lower cost ground surveillance supported by new technologies such as ADS-B OUT and wide area multilateration (MLAT) systems. This capability will be expressed in various ATM services, e.g. traffic information, search and rescue and separation provision.	Reduced in flight fuel burn
Block 0-OPFL: Optimum Flight Level *Improved access to Optimum Flight Levels through Climb/Descent Procedures using ADS-B*	The aim of this module is to prevent flights to be trapped at an unsatisfactory altitude for a prolonged period of time. The In Trail Procedure (ITP) uses ADS-B based separation minima to enable an aircraft to climb or descend through the altitude of other aircraft when the requirements for procedural separation cannot be met.	Reduced in flight fuel burn

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