WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3: **Enhancing the global air navigation system**
 3.2: **Flight and flow information for a collaborative environment (FF-ICE) and trajectory-based operations (TBO)**

TRAJECTORY-BASED OPERATIONS (TBO)

(Presented by Brazil)

EXECUTIVE SUMMARY

This paper supports the development of the global trajectory-based operations (TBO) concept by ICAO and highlights perceived benefits of TBO. The paper discusses the anticipated mixed-mode operation resulting from incremental deployment of TBO capabilities by members of the ATM Community. In addition, the paper points out the need for a secure network where all stakeholders are identified and the exchange of information is resilient to cyber threats.

Action: The Conference is invited to agree to the recommendation in paragraph 3.3.

1.   **INTRODUCTION**

1.1   The Brazilian SIRIUS Program, led by the Department of Airspace Control (DECEA), comprises several projects, such as system-wide information management (SWIM), controller-pilot data link communications (CPDLC), departure clearance (DCL), performance-based navigation (PBN), continuous climb operations (CCO), continuous decscent operations (CDO), ATS message handling system (AMHS), ATS interfacility data communications (AIDC), automatic dependent surveillance — broadcast (ADS-B), airport collaborative decision making (A-CDM), arrival manager (AMAN), aeronautical information exchange model (AIXM) and electronic flight bag (EFB), required to implement the capabilities described in the *Global Air Traffic Management Operational Concept* (GATMOC, Doc 9854) within the Brazilian area of responsibility (22 million square kilometers).

1.2   The gradual implementation of the SIRIUS Program will, within short, medium and long terms, ensure Brazil is continuously evolving its Brazilian air traffic management system to a safer, more efficient and environmentally sustainable reality, maintaining at the same time the agreed safety levels and preparing the system to accomplish the vision outlined in the GATMOC.

1.3   The GATMOC identifies significant changes as the ATM system migrates towards the envisioned ATM system to support future demands. One of these changes, the management by trajectory or trajectory-based operations (TBO), is described as follows, according to the stated in §1.9.2 of the GATMOC:

          "*Air traffic management (ATM) considers the trajectory of a manned or unmanned vehicle during all phases of flight and manages the interaction of that trajectory with other trajectories or hazards to achieve the optimum system outcome, with minimal deviation from the user-requested flight trajectory, whenever possible".*

1.4   In other words, the GATMOC presents the global concept for TBO as fundamental to accomplish the vision outlined in the Global ATM Operational Concept and this will not be possible without integrating concepts such as SWIM and flight and flow information for a collaborative environment (FF-ICE) and new capabilities for air-ground, ground-ground and air-air trajectory exchange.

2.   DISCUSSION

2.1   TBO is going to be subject to several large-scale global, regional and national plan developments and implementation programmes, and should occur in a consistent, harmonized and integrated manner (6th edition of the *Global Air Navigation Plan* (GANP, Doc 9750)).

2.2   It is going to affect many processes, procedures and information flows, impacting a variety of ICAO provisions, and will reduce the current limitations of today's operation to deliver benefits for all the ATM community.

2.3   For all stakeholders the main difference in relation to today's operation is that TBO is going to share trajectory information, providing access to the best information and eventually leading to a common and more accurate view of the trajectory. Additionally, it will be a common plan for the flight by providing a common intent to be achieved during the flight execution.

2.4   An important point that the DECEA has envisaged, is the need of mixed-mode operation considering what we have today and what we can achieve with TBO in the future. At this moment, a mixed-mode environment will likely last for a significant period of time, considering that it is expected that TBO should be deployed in gradual steps within an extended timeframe.

2.5   As a result, during the mixed-mode environment, air navigation services providers (ANSPs), such as DECEA, will have to manage mixed-equipage operations considering that the airspace users will be operating within ANSPs' areas of responsibilities having different levels of TBO implementation.

2.6   For this reason, for the TBO development ICAO should support a mixed environment and an occasional sunset date should be determined when sufficient experience with the initial implementation of TBO is gained, and all necessary tools and a minimum level of automation for deployment of full TBO are defined, validated and tested.

2.7   Moreover, to support such development, ICAO needs to address the number of issues mentioned and highlighted during the Global Air Navigation Industry Symposium (GANIS) and the Safety and Air Navigation Implementation Symposium (SANIS) – held in Montréal, from 11 to 15 December 2017 – and described in the AN-Conf/13-WP/7, prior to initiating the development of

necessary Standards and Recommended Practices (SARPs), procedures and guidance material and, as soon as possible, describe the key differences and similarities among   service delivery management (SDM), FF-ICE, SWIM, flight object (FO) and TBO for the whole ATM community.

2.8   Finally, the exchange of messages to support TBO will need to be performed in a secure environment to guarantee that all players have the same accurate information and no interferences exist from internal or external parties that can jeopardize the safety and/or efficiency of operations. And within this context, for the full realization of the TBO concept, a framework to guarantee the identity of all stakeholders is necessary and attention should be given to possible cyber threats to the exchange of information.

3.   **CONCLUSION**

3.1   The evolution of the air navigation system to improve safety and guarantee efficiency of the aviation system as a whole, considering new demands from the aviation community, is necessary and the concept of trajectory based operations (TBO) represent the needed step forward.

3.2   To the realization of the TBO concept it is necessary that new capabilities and concept of operations be developed considering that as the basis for the TBO realization, a strong system for information exchange which is necessary among all stakeholders through a trusted network.

3.3   Considering the information above, the Conference is invited to invited to agree to the following recommendation:

That the Conference:

a)   request States and International Organizations to support ICAO to continue the development of TBO concept;

b)   request ICAO to describe the key differences and similarities among SDM, FF-ICE, SWIM, flight object (FO) and TBO for all ATM Community;

c)   request the ICAO Regional Offices to actively cooperate with the States at the Regional Level "From Development to Implementation" of TBO;

d)   request ICAO to develop a concept of a secure network to exchange information where all stakeholders are identified and the information exchange system is resilient to cyber threats; and

e)   urge States and industry to support the threads and its related elements associated with TBO Implementation as described in the ASBU framework and being included in the 6th edition of the Global Air Navigation Plan (GANP).

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