



WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

Agenda Item 3: Enhancing the global air navigation system
3.3: Air traffic flow management (ATFM)

IMPROVING NETWORK OPERATIONS

(Presented by the Secretariat)

EXECUTIVE SUMMARY

The aviation system block upgrades (ASBUs) framework describes a series of operational improvements organized around key features of the air navigation system (threads) and scheduled in time of availability (blocks). The goal of this framework is to allow States and other stakeholders to progressively advance their air navigation system capabilities based on their specific needs. This paper focuses on the update of the network operations (NOPS) thread to take advantage of improvements in the area of communication, navigation and surveillance (CNS) as well as of experience from worldwide operations.

Action: The Conference is invited to agree to Recommendation 3.3/x: Network operations (NOPS) in paragraph 3.

<i>Strategic Objectives:</i>	This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	<i>Impact for the aviation community:</i> The activities described in this paper will have a significant impact on the way information is processed, exchanged and utilized. Benefits from other operational improvements should be taken into account when considering the business case for ATFM. <i>Impact for ICAO (relative to the current Regular Programme Budget resource levels):</i> The ICAO activities referred to in this working paper will continue over the next triennia, additional resources are required, both financial and human, to support ICAO's efforts in the highly specialized areas associated with air traffic flow management.
<i>References:</i>	Doc 9750, <i>Global Air Navigation Plan</i> Doc 9854, <i>Global Air Traffic Management Operational Concept</i> Doc 9971, <i>Manual on Collaborative Air Traffic Flow Management</i> Doc 10007, <i>Report of the Twelfth Air Navigation Conference (AN-Conf/12)</i> AN-Conf/13-WP/11, Improving the performance of the air navigation system through the aviation system block upgrades (ASBUs)

1. INTRODUCTION

1.1 Air navigation has significantly improved in recent decades and yet, a considerable portion of the global air navigation system is still limited by the need to use conceptual approaches designed in the twentieth century. These legacy air navigation capabilities limit air traffic capacity and growth and contribute to unnecessary greenhouse gas emissions. A fully harmonized global air navigation system, built on robust information sharing, modern performance-based procedures and technologies can assist in finding a solution to these concerns and support the safe growth of the air transport industry worldwide.

1.2 The Global Air Navigation Plan (GANP) is the strategy that guides States and stakeholders towards the interoperability of systems and the harmonization of procedures to achieve the vision outlined in the *Global Air Traffic Management Operational Concept* (Doc 9854) (GATMOC). As part of the development of the sixth edition of the GANP, the aviation system block upgrades (ASBUs) framework outlines elements and enablers that allow the achievement of operational improvements.

1.3 The fifth edition of the GANP describes network operations as a series of processes to manage flows or groups of flights to improve overall traffic fluidity in a large or complex airspace containing multiple airports and multiple flight information regions (FIRs). Those processes also include capacity management and planning, airspace design and management. Network operations (NOPS) build on collaborative decision-making (CDM) among stakeholders in real time to take advantage of more advanced system capabilities and adopt user preferences to assist air traffic flow management (ATFM) in making the most efficient use of airspace resources on an equitable basis.

1.4 The NOPS thread should be updated in order to reflect the latest developments in processes and the concept of operations in this area.

2. NETWORK OPERATIONS

2.1 The Twelfth Air Navigation Conference (AN-Conf/12, 2012) was made aware of cooperative activities addressed in a specific forum which would benefit from a more formal ICAO involvement. From 20 to 22 November 2017, the first ICAO ATFM global symposium was organized in Singapore with the theme *ATFM: together, making every destination closer*. It brought together more than 250 delegates from twenty four Member States and international organizations to advance the implementation of flow management in the Asia and Pacific (APAC) Region and worldwide. The three-day symposium was designed as an exercise in international collaboration and used innovative tools to manage real-time discussions with the audience. It allowed delegates to exchange views on the various implementation projects in the world (in APAC, Europe, North American, Central American and Caribbean Regions) and ask more than 280 questions on ATFM implementation. Among the key messages from the discussions were the importance of using the recently updated *Manual on Collaborative Air Traffic Flow Management* (Doc 9971) and the importance of information exchange for ATFM.

2.2 The importance of information exchange was emphasized in AN-Conf/12 Recommendation 4/1, *Efficient management of airspace and improved flow performance through collaborative decision-making*, which urged ICAO to include in its work programme the future standardization of all elements to support CDM processes underlying air traffic control (ATC) and ATFM integration, as well as technical exchanges between ATFM and ATC. The recent release of the third edition of Doc 9971 marked a milestone in this process. In parallel, extensive work is underway within ICAO to standardize the information exchange which supports ATFM implementation at national, regional and international levels.

2.3 Implementation of the operational improvements described in the ATFM thread, as recommended by AN-Conf/12 and subsequently reflected in the GANP, is well underway and should be

continued. The NOPS thread should be updated to reflect the increased use of ATFM to mitigate the consequences of disruptions, the growing importance of civil-military cooperation and the importance of standardizing and strengthening information exchange, specifically between ATFM systems in different States or regions of the world.

2.4 NOPS evolution

2.4.1 In a network operations environment, management tools are introduced to provide a wider and/or earlier perspective on actual and anticipated traffic disposition. They ensure that events and meteorological phenomena that affect traffic flows can be addressed. Key elements of the global strategy to manage existing and forecasted increases in air traffic include the efficient and effective design and management of airspace, combined with advanced flow and capacity management processes that fully utilize aircraft and ground system capabilities. By providing real-time access to flight and constraint information, the dynamic use of airspace can help to reduce congestion on trunk routes and busy crossing points, leading to an increased use of user-preferred profiles to adapt flight trajectories and resulting in reduced fuel burn and emissions.

2.4.2 ATFM regulates traffic flows, issues departure slots, manages entry rates and reroutes traffic to avoid congested areas. In terms of aerodromes, it builds on airport collaborative decision-making (A-CDM) structures where available. ATFM solutions already integrate capacity optimization measures, such as sector configuration selection or flexible use of airspace (civil-military).

2.4.3 Communication, navigation and surveillance (CNS) systems enhancements are improving the precision of data that will, in the future, become digitally available and shared through universally accepted exchange models. In particular, satellite technologies improve the precision and the availability of information on aircraft position. This will allow aircraft in remote areas to participate in flow management. Network operations need a performance-based navigation (PBN) compatible operational environment; PBN technology requirements will therefore also serve network operations.

2.4.4 In addition, the development and deployment of a system-wide information management (SWIM) will ensure the availability of high-quality and reliable information to support, among others, CDM applications for air traffic management. These applications will allow users to participate fully in managing competing demands and will provide a basis for the prioritization of complex ATFM solutions when the network, or its nodes (airports, sectors), are so congested that they can no longer provide sufficient capacity. The ability to develop advanced ATFM, airspace management (ASM), capacity management and CDM capabilities is therefore directly dependent on the development of SWIM and its information domains, namely meteorology, aeronautical and flight and flow information for a collaborative environment (FF-ICE). At the same time, the envisaged development of an internet protocol-based (IPv6) SWIM infrastructure should also support the anticipated needs of ATFM-related applications.

2.4.5 ATFM, capacity management and CDM processes will continue to evolve to take full advantage of this information-rich environment, as well as of enhanced aircraft position information. This will increase the predictability of the air traffic system while providing increased flexibility to airspace users. Drawing on increased autonomous capabilities of aircraft, it is also anticipated that CDM applications will allow air traffic management (ATM) to offer, or delegate to airspace users, the optimization of solutions to flow problems.

2.4.6 Avionics and flight management systems will have to support the increased reliance on assignment of multiple target times, as well as changes linked to the increased flexibility afforded to airspace users. They will also have to cater for the automation involved in the delegation of resolution of flow problems to airspace users.

2.4.7 Ultimately, 4D trajectory capabilities will allow individual trajectories to be optimized in a consistent and network-efficient manner, enabling the long-term vision of the GATMOC.

2.5 Implementation

2.5.1 Network operations can be deployed on a national scale. However, they will yield greater benefits if ATFM and the associated CDM processes are implemented at a regional level, as this will ultimately ensure that all flights, including long-haul flights, can share information and therefore participate in flow management and in capacity optimization. This is, however, predicated on the establishment of robust coordination (based on the availability of the required information to fully support ATFM applications) and arrangements between stakeholders, especially between different States and providers. For aerodromes, A-CDM can be a powerful enabler of coordination.

2.5.2 Any ATFM strategy should also include a set of performance indicators and performance metrics to allow stakeholders to verify the performance of the system and identify areas where improvements are necessary to fulfil the expectations of the aviation community. The indicators should cater for global applicability and allow performance to be measured at various levels (operational unit, State, region). Even though an ATFM strategy can be established without a complete set of indicators defined from the outset, indicators and implementation metrics enable performance-based decision-making and would therefore play an important role in implementation.

2.5.3 Detailed guidance on ATFM, CDM and A-CDM can be found in Doc 9971.

3. CONCLUSION

3.1 The aviation system block upgrades (ASBUs) framework describes a series of operational improvements organized around key features of the air navigation system (threads) and scheduled in time of availability (blocks). The goal of this framework is to allow States and other stakeholders to progressively advance their air navigation system capabilities based on their specific needs. The Conference is invited to agree to the following recommendation:

Recommendation 3.3/x: Network operations (NOPS):

That the Conference:

- a) urge States to implement collaborative decision-making processes in the provision of air navigation services;
- b) urge States, according to their operational need, to plan and implement operational improvements related to network operations; and
- c) request ICAO to develop further provisions and guidance on air traffic flow management (ATFM) in preparation for trajectory-based operations.

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