



WORKING PAPER

THIRTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 9 to 19 October 2018

COMMITTEE A

**Agenda Item 3: Enhancing the global air navigation system
3.1: System-wide information management (SWIM)**

SYSTEM-WIDE INFORMATION MANAGEMENT (SWIM)

(Presented by the Secretariat)

EXECUTIVE SUMMARY

This paper presents the system-wide information management (SWIM) developments to date and the work still to be done to improve the efficiency and safety of the aviation system through the application of globally harmonized information management leading to a seamless system. Towards that goal, it is envisaged to establish a robust foundation of global Standards and Recommended Practices, together with explicit guidance material to ensure the interoperability of systems and harmonization of procedures in the exchange of information.

Action: The Conference is invited to agree to Recommendation 3.1/x – System-wide information management (SWIM) 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> Considerable opportunities are associated with the implementation of a system-wide information management, and the aviation community at large will benefit from the development of the regulatory framework to support the safe and reliable exchange of information to support the global air navigation system. <i>Impact for ICAO (relative to the current Regular Programme Budget resource levels):</i> Since ICAO's current Standards and Recommended Practices (SARPs) development and implementation roll-out 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 system-wide information management.
<i>References:</i>	Annex 15 — Aeronautical Information Services Doc 9750, <i>Global Air Navigation Plan</i> Doc 9854, <i>Global Air Traffic Management Operational Concept</i> Doc 9882, <i>Manual on Air Traffic Management System Requirements</i> Doc 10039, <i>Manual on System-Wide Information Management (SWIM) Concept</i>

1. INTRODUCTION

1.1 The aviation community is increasingly interconnected and dependent on the information shared on a system-wide basis for making collaborative decisions to meet the operational needs of all stakeholders and to improve overall system performance. The Global Air Navigation Plan (GANP) recognizes the management, exchange and utilization of information for operational purposes as key to the evolution of an increasingly complex aviation ecosystem. It also recognizes that a global approach to system-wide information management (SWIM) is essential to ensure interoperability and harmonization across all information domains.

1.2 The aviation community expects fully interoperable systems based on openly available standards for the secure exchange of information, and that these information systems be capable of seamless information transfer throughout a cyber-resilient aviation system. To meet these expectations, the systems in place must keep to a minimum the efforts required to achieve interoperability (by means of gateways, adaptors, converters, etc.) for the exchange of information.

1.3 An advance edition (unedited) of the *Manual on System-wide Information Management (SWIM) Concept* (Doc 10039) is available on the ICAO Secure Portal. It defines SWIM as a set of standards, infrastructure and governance enabling the management of ATM-related information and its exchange between qualified parties via interoperable services.

2. DISCUSSION

2.1 The aviation community recognizes the benefits of managing and exchanging high quality digital information among all stakeholders and across all information domains. SWIM promotes that exchange within a cyber-resilient environment. In addition, the aviation community is beginning to reach consensus on a number of key aspects related to SWIM as listed in paragraph 2.2. These are based on the lessons learned through research and development programmes, as well as global SWIM demonstrations, test platforms and numerous other related activities around the world.

2.2 There is consensus among the information management experts that SWIM will become the global platform for the exchange of information and provision of information services via internet protocol (IP). That information can be categorized into four key information domains, namely aeronautical, meteorological, flight and flow, and surveillance/position; three of which have associated information exchange models. At the same time, an information reference model is required to ensure that common terminology and corresponding definitions are used across the different domains. It is also recognized that the scope of SWIM exceeds those key information domains and that information exchange models by themselves do not guarantee system interoperability; interoperability needs to be looked at from multiple perspectives, including those of architecture, systems, information and procedures.

2.3 One of the objectives of SWIM is to support increasing levels of automation and decision support systems and to foster machine-to-machine interaction. However, even in an increasingly automated environment, the human will always be part of the design and management of the system and should remain the ultimate authority in operationally significant decision-making processes. Enabled by SWIM, highly automated systems integrate and synthesize large amounts of diverse but well-structured information. SWIM must therefore build upon a necessary level of uniformity to foster interoperability among compatible information systems.

2.4 A multitude of information services ranging in complexity, composition, size and other vital information service characteristics will be required, rather than a single SWIM information service,

to enable trajectory-based operations, air traffic flow management (ATFM) or unmanned aircraft system traffic management (UTM), to name a few of the potential operational beneficiaries of SWIM. First potential applications of the SWIM concept for the exchange of information are beginning to emerge, including: operational meteorological (OPMET) information; flight and flow information for a collaborative environment (FF-ICE); the Global Aeronautical Distress and Safety System (GADSS); Runway Condition Report (RCR) as part of the new SNOWTAM¹ format; and aeronautical information management (AIM) digital data sets. These early candidates are awaiting specific guidance on how to become fully SWIM-compliant information services.

2.5 The transition from today's point-to-point, message-based paradigm to a networked information services-based SWIM environment will inevitably involve operating in a mixed environment with dual communications infrastructures (e.g. aeronautical fixed telecommunication network (AFTN)/ATS message handling system (AMHS) and Internet Protocol Suite (IPS)-based networks). During this transition period both have to be supported and maintained in parallel while interoperating via dedicated gateways. Furthermore, the associated legacy message products (e.g. METAR², SIGMET³, NOTAM, and FPL⁴) and their equivalent SWIM information services have to be developed and maintained in parallel, thereby negatively impacting the business case for SWIM.

2.6 At the Global Air Navigation Industry Symposium (GANIS) and the Safety and Air Navigation Implementation Symposium (SANIS) (Montreal, 11 to 15 December 2017), and in particular the session dedicated to information management, key international stakeholders, including industry, confirmed that current SWIM activities led by ICAO are adequately prioritized and are being addressed with urgency.

2.7 One of the main objectives of the current SWIM activities is to define Standards and Recommended Practices (SARPs), together with guidance material, that ensure global adoption and implementation of SWIM-compliant solutions to enable a seamless user experience both on the ground and in the air. The wide spectrum of compliance issues to consider range from: identifying technologies required to progress toward SWIM implementation; to specific quality requirements, naming conventions and exchange format considerations for the information under consideration; to a minimum set of metadata descriptors to permit global visibility of available information services. An implementation "toolbox" in support of SWIM-compliant solutions, including templates for basic information services or for a basic SWIM registry, may be useful for encouraging States and other stakeholders to start on the path towards SWIM-compliant information solutions.

2.8 Other SWIM activities relate to governance which encompasses the policy framework and procedures needed. The objective is: to ensure that mechanisms are in place so only authorized users can provide or consume information services; to ensure that these information services offer information from a single authoritative source to avoid potential duplication of information from multiple providers; to oversee the evolution of the exchange models towards even greater interoperability; and to promote a standard user experience for accessing information services via one of the globally interconnected SWIM registries, also known as federated SWIM registries.

2.9 SWIM is part of a rapidly evolving information technology industry. As such, it is challenging to devise a regulatory framework that provides a needed level of uniformity and stability while at the same time is flexible enough to accommodate the benefits that emerging technologies offer,

¹ SNOWTAM – special series NOTAM notifying the presence or removal of hazardous conditions due to snow, ice, slush or standing water associated with snow, slush and ice on the movement area, by means of a specific format

² METAR – aerodrome routine meteorological report

³ SIGMET – significant meteorological information

⁴ FPL – filed flight plan

such as a new lightweight data format, advanced message queueing protocol, or cloud computing. The adoption of a performance-based approach, building on openly available standards and specifications, will help to meet these requirements. To succeed, close collaboration and harmonization with other standards-making organizations such as EUROCAE, RTCA, SAE, ARINC, and ISO is essential.

2.10 The harmonization and possible integration of civil and military information exchange systems can benefit all stakeholders and result in more civil/military cooperation. In addition, close civil/military alignment presents an even stronger business case for SWIM, thereby further accelerating the global adoption of SWIM principles and practices.

2.11 As the global community moves toward a common understanding of SWIM concepts and principles, emphasis must be placed on regional awareness and training activities to communicate these concepts. Awareness and training activities will serve to not only educate the community on designing and implementing SWIM information services, but also to share unique State- or region-specific concerns and first experiences. Lessons learned can then be applied to the assessment of initial SWIM provisions and related guidance material. The goal is to facilitate smooth but rapid adoption of interoperable and harmonized SWIM solutions at the global level.

3. CONCLUSION

3.1 The aviation system is increasingly interconnected and dependent on the information shared on a system-wide basis for making collaborative decisions to meet the operational needs of all stakeholders and to improve overall system performance. SWIM is a key enabler for aviation to achieve the expected benefits of current and future operations.

3.2 Fully interoperable and harmonized SWIM information systems based on openly available standards for the secure exchange of information are necessary to achieve seamless information transfer throughout the aviation ecosystem. In addition, SWIM lays the foundation for future innovation.

3.3 The Conference is invited to agree on the following recommendation:

Recommendation 3.1/x – System-wide information management (SWIM)

That the Conference:

- a) request States to support the concept of system-wide information management (SWIM);
- b) request ICAO to progress the work on the development of provisions related to SWIM, including information services, technical infrastructure, registry and governance for information management, in the interest of globally seamless operations; and
- c) request ICAO in collaboration with States and industry to promote, through regional events, SWIM global concepts and principles as defined in the *Manual on System-Wide Information Management (SWIM) Concept* (Doc 10039) to ensure the interoperability of systems and harmonization of procedures among members of the aviation community.