



WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

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Agenda Item 3: Interoperability and data – through globally interoperable system-wide information management (SWIM)

3.1: Performance improvement through the application of system-wide information management (SWIM)

SWIM DEVELOPMENTS AND IMPLEMENTATION IN EUROPE

(Presented by the Presidency of the European Union on behalf of the European Union and its Member States¹; by the other Member States of the European Civil Aviation Conference²; and by the Member States of EUROCONTROL)

SUMMARY

This paper presents the European progress concerning SWIM developments and implementation; expresses support for the recommendations in working paper AN-Conf/12-WP/7; calls for increased SWIM open standards developments and calls for updating the ICAO SWIM working arrangements.

Action: The Conference is invited to agree to the recommendation in paragraph 6.

1. INTRODUCTION

1.1 The concept of system-wide information management (SWIM) in ATM (see its overview in AN-Conf/12-WP/7) first started to get mentioned in early 1998 when the European ATM Strategy 2000+ was drafted. The term quickly became popular and over the years started to appear increasingly often in other ATM related documents. However, apart from some initial conceptual studies, no comprehensive coordinated SWIM programme was set-up within Europe at that time. Nevertheless, specific activities such as D(igital)-AIM, Flight Object Interoperability Proposed Standard (FOIPS) Network Operations Portal (NOP), Pan-European Network Service (PENS) and SWIMSUIT made reference increasingly often to, and claimed to be part of SWIM, in their deliverables.

1.2 The European ATM Master Plan identifies the non-implementation of SWIM as one of the main risks for the successful implementation of the SESAR concept of operations. The Research and Development programme under the umbrella of the SESAR Joint Undertaking provided the opportunity to work on SWIM in Europe through cooperation among all relevant ATM stakeholders.

¹ Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. All these 27 States are also Members of ECAC.

² Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Croatia, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

2. EUROPEAN PROGRESS WITH SWIM

2.1 Within the SESAR work-programme two work packages (WP) are dealing specifically with SWIM: one on WP-Information Management, and the other on WP-SWIM Infrastructure.

2.2 The WP-Information Management develops a framework which defines seamless information interchange between all providers and users of shared ATM information. It concerns the governance structure for SWIM, including information management functions.

2.3 It also builds an ATM information reference model (AIRM) which provides an implementation and domain neutral definition of all shared ATM information, through a harmonised information model capturing the operational discourse and a consolidated logical data model used for derivation of compliant physical models serving specific implementation needs. The purpose of SESAR AIRM is to ensure that data models share the same semantics and to provide a reference to global data models such as AIXM, WXXM and FIXM. It provides ATM stakeholders with the tools needed to implement interoperable data exchange models across different domains, e.g. for Collaborative Decision Making applications.

2.4 A complementary reference model is the Information Service Reference Model (ISRM). This provides a taxonomy and logical definition of all required automated services and their behavioural patterns based on the definitions and data models covered by the AIRM. The ISRM aims at enabling reusability, loose system coupling and systems interoperability.

2.5 The WP-SWIM Infrastructure develops the SWIM Technical Infrastructure, which is the interoperable (runtime) technical infrastructure (ground/ground and air/ground) over which data and services will be distributed. It includes the SWIM common technical services required to physically exchange the information and is pre-dominantly based on mainstream IT technologies.

2.6 The SESAR SWIM activities undertaken so far have resulted in the availability of first deliverables. Of these, the following are particularly relevant and worth introducing in detail:

2.6.1 A SWIM Concept of Operations has been created which includes the SWIM Definition, SWIM principles, the rationale for change and the associated benefits. It also captures practical examples of SWIM pioneers that explain their gradual evolution towards SWIM. Some initial ideas on governance are described, covering the full lifecycle from participating in SWIM to providing or consuming services on SWIM. All this is documented with use-cases to better illustrate how SWIM works in practice.

2.6.2 There has also been significant progress with the implementation of a SWIM Registry pilot that acts as the trusted, managed, complete and consolidated source of references for information on the information services and the related rules including policies, standards, certifications, taxonomies, etc.

2.6.3 Since 2011, live SWIM demonstrations have been organised annually to demonstrate that the supporting technologies are sufficiently mature to make SWIM a reality.

2.6.4 Another demonstration of the start of the realisation of SWIM is the (SESAR) classification of the Network Manager NOP Business to Business (B2B) system as a SWIM Pioneer. This system provides web services across four domains, whereas most of the information exchanges facilitated by the B2B system are compliant with AIXM, later also FIXM:

- a) flight services (flight preparation, flight plan filing and management);
- b) airspace services (management & publication of airspace information);
- c) general information services; and
- d) flow services (flow & capacity management).

2.6.5 In an effort to truly engage with as a wide stakeholder community as possible, a more recent activity is the SWIM Masterclass. Its objective is to further develop and demonstrate the added value of state-of-the-art information technology for air traffic management. To date, the SWIM Masterclass has gathered the support of close to a hundred organisations and their experts and is striving to begin connecting the whole ATM community.

2.6.6 An important aspect of the SWIM developments is a fully integrated service orientated architecture approach which will use services as the mechanism to support the ATM stakeholders sharing, visualising and processing ATM information. The rationale for this principle is to decouple the producers of information from the consumers. This split makes it easier to delineate concerns and responsibilities and consequently increases the flexibility and agility of the ATM system in responding to business needs. SOA developments are already widely used by airports and airlines for their revenue generating customer oriented business units and operations.

2.7 Despite the good progress made, the work is far from being finished. The actual integration of SWIM into the different ATM components can only take place in an evolutionary manner and further maturing SWIM governance, compliance, and deployment aspects will still take a considerable amount of time and effort.

2.8 In terms of Pan-European stakeholder coordination and consultation, an AIM/SWIM Team has been established. The AIM/SWIM Team is a technical and operational, specialist advisory body, established within the framework of EUROCONTROL, which provides a direct means of consultation between all stakeholders involved in activities pertaining to performance and delivery aspects under the tactical (technical) development/deployment level for SWIM.

3. FURTHER CONSIDERATIONS

3.1 With the progressive development and implementation of SWIM it is evident that to ensure worldwide interoperability, ample consideration has to be given to standardisation and as such to close working with industry bodies such as EUROCAE, RTCA, ARINC, OGC, ISO, etc. Roles and responsibilities, data/information and services models, exchange mechanisms and associated technologies will all require specific considerations at the local, sub-regional, regional and global level. A prerequisite to this is the (re-)use of open industry standards and specifications whenever possible and the appropriate handling of these issues.

3.2 The integration of the SWIM Air/Ground element needs further discussion. First indications can be found in the communications domain with the development of the notion of high bandwidth air-ground “pipes” for the connection of the aircraft as an information node in SWIM enabling the participation of the aircraft in collaborative ATM processes with access to rich voluminous dynamic data including meteorological information. Using the same technology, commercially driven information services for companies and passengers can be implemented. In the particular case of military aircraft, the aim is to use current on board capabilities to fulfil SESAR ATM functions. A special “gateway” on ground is being investigated to integrate military aircraft in SWIM, without the need to install new equipment on board.

4. ICAO INVOLVEMENT IN SWIM

4.1 The ICAO *Global Air Traffic Management Operational Concept* (Doc 9854) makes indirect reference to SWIM: *“The ATM community will depend on information management, shared on a system-wide basis, to make informed collaborative decisions for best business and operational outcomes. Within the ATM system, based on this operational concept, it will be the information itself that will be of significance and not the technology that supports it”*. Although the SWIM expression is not explicitly mentioned, information management on a system-wide basis is an important component of the concept.

4.2 AN-Conf/12-WP/7 presented by ICAO introduces a next step building from the aviation system block upgrades (ASBU). ASBU Modules B1-31 and B2-31 provide good indications of the future ICAO SWIM ideas and concepts. Finally, the draft Global Air Navigation Plan (GANP) outlines the first concrete elements of an Information Management roadmap including the AIM, MET, Flight & Flow data domains.

4.3 These initiatives are much supported and their work should continue.

4.4 In terms of ICAO working arrangements, the ATM Requirements and Performance Panel (ATMRPP) has more recently started to take a more active role on SWIM and associated information management domains. References to and developments in the SWIM context can also be found in other groups, such as the AIS-AIM Study Group, the Meteorological Aeronautical Requirements and Information Exchange Project Team and the Aeronautical Communications Panel.

4.5 Given the growing importance and maturity of SWIM, and the potential proliferation of developments on SWIM and its components, there is clearly a risk that implementation will start to diverge at the global level. In particular it is at the utmost importance that global interoperability be safeguarded. Consideration should therefore be given by ICAO to set-up an overarching IM/SWIM group of experts supporting ICAO on the required global consolidation and harmonisation activities.

5. FURTHER INFORMATION

5.1 More information on the SESAR progress on SWIM can be found at www.sesarju.eu/swim including pages on the SWIM Masterclass, SWIM fact-sheets etc. Further information is available at www.eurocontrol.int/im and [Network management B2B](#).

6. RECOMMENDATIONS

6.1 The Conference is invited to:

- a) note the progress in Europe on SESAR SWIM developments and initial SWIM implementation;
- b) encourage appropriate international standards bodies to undertake activities to develop open SWIM relevant standards;
- c) encourage States to start preparing for SWIM;
- d) encourage industry to support the transition towards SWIM by providing appropriate systems supporting automation and the exchange of all relevant ATM data in a globally standardised manner;
- e) support the recommendations in AN-Conf/12-WP/7 as the basis for further work; and
- f) request ICAO to update the IM/SWIM working arrangements.