



International Civil Aviation Organization

**SIXTEENTH MEETING OF THE
COMMUNICATIONS/NAVIGATION/SURVEILLANCE AND
METEOROLOGY SUB-GROUP (CNS/MET SG/16) OF APANPIRG**

Bangkok, Thailand, 23 – 27 July 2012

Agenda Item 3: Aeronautical Fixed Service (AFS)

2) Support XML based information exchange and discussions on SWIM

SYSTEM WIDE INFORMATION MANAGEMENT UPDATE

(Presented by the United States of America)

SUMMARY

In 2007, the Federal Aviation Administration (FAA) established the System Wide Information Management (SWIM) Program to implement a set of Information Technology (IT) principles in the National Airspace System (NAS) and provide users with relevant and commonly understandable information. The principles behind the SWIM concept include the following:

- Separation of information provision and consumption in such a way that the number and nature of the consumers can evolve through time;
- Loose system coupling, in which each component has, or makes use of, little or no knowledge of the definitions of other separate components, allowing for extensibility in software design;
- Using publicly available open standards; and
- Using Service Oriented Architecture (SOA) implemented as a suite of interoperable services

This paper relates to –

Strategic Objectives:

A: Safety - Enhance global civil aviation safety

C: Environmental Protection and Sustainable Development of Air Transport - Foster harmonized and economically viable development of international civil aviation that does not unduly harm the environment

Global Plan Initiatives:

GPI-22 Communication infrastructure

Agenda Item 3 (2)

23/07/12

1. Introduction

1.1 SWIM maximizes the use of current infrastructure while allowing sharing of information between diverse systems enabling the Next Generation Air Transportation System (NextGen) to deliver the right information to the right places at the right time. The program achieves this by providing the IT enterprise infrastructure necessary for NAS systems to share and reuse information and increase interoperability. Its enterprise infrastructure will enable systems to publish information of interest to NAS users, request and receive information from other NAS services, and support NAS security requirements. Further, SWIM provides governance to NAS programs to ensure services are SWIM compliant and meet all FAA Service Oriented Architecture (SOA) standards. By providing this governance and the supporting enterprise infrastructure, SWIM will reduce the cost and risk of rework for NextGen programs to develop and deploy services. This approach allows software applications in the NAS to locate and interact with one another through information services that can be accessed without knowledge of an application's underlying platform implementation. This simplifies interface requirements to existing NAS systems and ensures new systems can be built with minimum technology (hardware, software, and data definition) constraints. SWIM also enables the transition to net-centric NAS operations, and from tactical conflict management to strategic, trajectory-based operations.

2. SWIM Implementation

2.1 SWIM is being implemented in segments. In each segment, a set of NAS Services is being developed and integrated via SWIM. Enterprise infrastructure is added to support the implementation capabilities associated with the segments. SWIM enterprise infrastructure will enable systems to request and receive information when they need it, subscribe for automatic receipt, and publish information as appropriate. This will provide for sharing of information among diverse systems.

2.2 SWIM Segment 1

2.2.1 SWIM Segment 1 takes a federated approach to the implementation of nine SWIM capabilities by seven SWIM Implementing Programs (SIPs). The SWIM Program provides Governance, standards, and software to SIPs in support of their development of reusable SOA services. The program also provides requirements, schedules, and funding to the SIPs and tracks their progress in formal monthly reviews. SWIM is not implementing a separate infrastructure for Segment 1, but is leveraging existing infrastructures, processes, resources, and logistics chains that are part of the program offices implementing the SWIM capabilities. This approach allows for the early integration of SOA services within the NAS in the FAA's transition to SWIM. SWIM Governance ensures use of common protocols and interfaces, assisted by using standardized commercial software.

2.2.2 At the conclusion of Segment 1, SOA services will be deployed to all Air Route Traffic Control Centers (ARTCCs), 39 Terminal Radar Approach Controls (TRACONs), the Air Traffic Control System Command Center (ATCSCC), the William J. Hughes Technical Center (WJHTC), and the Network Enterprise Management Centers (NEMCs).

2.2.3. SWIM Segment 1 commits to delivery of nine capabilities, eight of which are on track:

- Three capabilities are complete and operational:
 - Corridor Integrated Weather System (CIWS) Data Publication
 - Integrated Terminal Weather System (ITWS) Data Publication
 - Weather Message Switching Center Replacement (WMSCR) Pilot Reports (PIREP) Data Publication

- Three capabilities are complete and waiting for installation:
 - Aeronautical Information Management (AIM) Special Use Airspace (SUA) Automated Data Exchange, which demonstrated Initial Operating Capability (IOC) in December 2010
 - SWIM Terminal Data Distribution System (STDDS), which demonstrated IOC May 2012
 - Pre-Departure Reroute

- Two capabilities are on schedule and within budget allocations:
 - Flow Data Publication Service
 - Runway Visual Range (RVR) Data Publication

- One capability is being re-planned and will be presented to the FAA Joint Resources Council (JRC) in July 2012:
 - Flight Data Publication Service (FDPS)

2.2.4 SWIM Segment 1 includes the NAS Service Registry/Repository (NSRR), an online central repository to help users discover, use, and reuse (when possible) Web services. It allows information publishers to manage and store metadata (such as service descriptions, classifications, and access information) and service artifacts about their services in a single location. Information consumers are able to search the Registry to discover NAS services available for consumption and have access to the relevant metadata and service artifacts necessary to consuming a service. Consumers can then use this information to request services from the providers. The NSRR is used to ensure that publishers are in compliance with Governance policies and requirements and ensure contracts between publishers and consumers are created, negotiated, and enforced. In addition, the lifecycle of NAS services can be effectively managed and service changes can be efficiently approved and implemented via the NSRR.

2.3 SWIM Segment 2

2.3.1 SWIM Segment 2 continues and expands the provision of Governance, standards, and software to NAS programs begun under SWIM Segment 1. The three primary goals of this segment are as follows:

- Support data exchanges needed to satisfy NextGen Operational Improvements (OIs);
- Provide SOA infrastructure that was delegated to the SIPs in Segment 1 and facilitate the transition by those SIPs to the Segment 2 enterprise infrastructure;
- Build on Segment 1 Governance for all SOA-suitable NAS programs and provide support to NAS Programs developing and deploying services in this timeframe.

Agenda Item 3 (2)

23/07/12

2.3.2 In November 2010, SWIM Segment 2 received Authorization to Proceed (ATP) from the JRC. The ATP authorized 2 years of funding (FYs 2011 and 2012) for prototypes and work toward a Segment 2 Final Investment Decision (FID) in FY 2012. The JRC decided that SWIM will provide the enterprise SOA infrastructure within the NAS for individual programs to use. This approach enables programs to focus on providing the services that are critical to their missions, while minimizing the impact of becoming SOA-compliant. In addition SWIM will support FAA efforts to ensure that SOA Governance complies with NAS regulations.

2.3.3 The implications of the JRC SWIM Segment 2 decision are as follows:

- Programs will use the enterprise SOA infrastructure provided by SWIM and not develop their own redundant enterprise SOA infrastructure;
- SWIM will not govern SOA implementations that are internal to NAS programs;
- Programs will meet SWIM-compliance requirements, with disputes related to implementation of enterprise SOA resolved by the FAA Technical Review Board (TRB);
- Enterprise SOA infrastructure costs will be included in the SWIM Segment 2 baseline;
- Costs for developing SWIM-compliant services will be included in each program's JRC funding request.

2.3.4 The benefits of Segment 2 consist of avoided costs of each NAS Program individually developing infrastructure on its own and complying with SWIM and NAS standards on an ad hoc basis (i.e. without the Governance provided by SWIM).

2.3.5 Due to funding cuts in FYs 2013 and 2014, the Agency determined that the most cost-effective and timely way to implement the Segment 2 capability was for the FAA to introduce this function using current contractor support. FAA Telecommunications Infrastructure (FTI) will be used as the basis for providing the Segment 2 NAS Enterprise Messaging Service (NEMS). This approach allows for SWIM to have an enterprise messaging capability available when needed by programs such as NextGen Network Enabled Weather (NNEW) and AIM Modernization. SWIM will use task orders under the FTI contract to implement additional capabilities such as Domain Name Service (DNS) and Network Time Protocol/Precision Time Protocol (NTP/PTP), as well as to develop the NEMS capability, which will be based on a currently operational prototype.

2.3.6 The architectural approach for Segment 2 is expected to transition away from Segment 1's limited amount of shared SOA enterprise infrastructure. Specifically, in Segment 1, only the NSRR is provided as shared enterprise infrastructure and all other SOA infrastructure is implemented by SIPs. In Segment 2, resource sharing, especially SOA enterprise infrastructure, increases through consolidation. Consolidation in Segment 2 means that SOA enterprise infrastructure is developed, deployed and maintained by SWIM.

2.3.7 The move to increase the level of SOA enterprise infrastructure consolidation also opens the door to deploying certain other capabilities in a consolidated manner. The SWIM Program assumes new responsibilities for hosting all capabilities deployed to the SWIM consolidated infrastructure regardless of physical architecture. This includes all the normal responsibilities of a major NAS acquisition program.

2.3.8 The primary objective of the SWIM consolidated infrastructure is supporting enterprise-level interactions. That is, interactions among service consumers and service providers across the entire enterprise. The SWIM Segment 2 architectural approach allows additional SOA enterprise infrastructure capabilities to be provided outside the consolidated infrastructure, in accordance with specialized needs in specific domains.

2.4 Segment 2 Enterprise Infrastructure

2.4.1 SWIM Segment 2 enterprise infrastructure will be developed and deployed by the SWIM Program. The program will assume responsibility for all acquisition, management and maintenance activities for the hardware associated with enterprise infrastructure. Hardware associated with SOA capabilities federated outside the SWIM consolidated infrastructure will be the responsibility of the stakeholders hosting the federated capabilities. Each stakeholder will provide hardware support in accordance with their existing plans. This enterprise infrastructure provides a central point for access to NAS information. Key outputs of this include:

- Simplified Governance to promote greater insight and control of NAS information;
- Consolidated information that allows creation of “underlying tools to support the transformation to a performance-based organization”; and
- One-stop shopping to provide consumers with easier access to NAS information.

2.4.2 SWIM Messaging enterprise infrastructure will be provided by NEMS. NEMS fulfills NextGen’s need for NAS-to-NAS distribution of operations data by providing standards based message communication between SWIM-compliant NAS services. Any data product provisioned onto NEMS will be available from any other NEMS node to authorized users. Currently, there is an operational prototype performing some messaging functions: the Data Exchange (DEX) system. DEX nodes are deployed at the NAS Enterprise Security Gateways (NESGs) in Atlanta and Atlantic City, the FTI National Test Bed (FNTB) in Atlantic City, and the Research and Development (R&D) Domain in Atlantic City. In addition, more nodes will be installed in FY 2012 to be used for NAS-to-NAS distribution of SOA data products. Additional, FY 2012 plans for DEX includes the implementation of two-way SOA data exchange, allowing external producers to feed data into the NAS, and integration of NEMS with Active MQ message broker software. These capabilities are required by NEMS.

2.4.3 The SWIM Program is working with the FAA ATC Telecommunications Office to define the Service Provisioning Process. As part of the Service Provisioning Process, the SWIM Program conducts outreach to potential users to brief SWIM capabilities and architecture, actively reviews the JRC watch-list to identify potential SWIM users, identifies a program’s messaging needs and develop an architecture that depicts its integration with NEMS, and works with a program to create relevant deliverables and register its services in the NSRR.

2.4.4 DNS provides a database containing domain names and metadata about those names, as well as naming and name-to-address resolution services across the Enterprise. DNS uses a standardized naming scheme that will not be routable on the Internet. Use of DNS avoids hard-coding IP addresses, improving security and operational efficiency with a single Enterprise solution. SWIM deployed DNS in 2012.

Agenda Item 3 (2)

23/07/12

2.4.5 NTP/PTP provides time synchronization services across the enterprise, ensuring services are consistently in-synch with each other. SWIM will deploy NTP/PTP in summer 2012.

2.5 Segment 2 Governance

2.5.1 Part of the November 2010 JRC decision codified the SWIM Program's role in Governance. The JRC decided that SWIM will support FAA efforts to ensure that SOA Governance complies with NAS regulations. As depicted in Figure 3, SWIM will provide recommendations to the TRB through a SOA suitability assessment, but the final approval of SWIM-compliant NAS services will reside with the TRB. The goal of SWIM SOA Governance is to ensure functionalities are not needlessly replicated, leading to increased expense to the FAA. As a result of the decision, programs will use the enterprise SOA infrastructure that is provided by SWIM and meet SWIM-compliance requirements, as required by the TRB. SWIM Governance will build upon existing FAA Acquisition Management System policies and FAA standards as a way to minimize the impact to programs. SWIM will continue to conduct SOA suitability assessments on all programs early in their lifecycle.

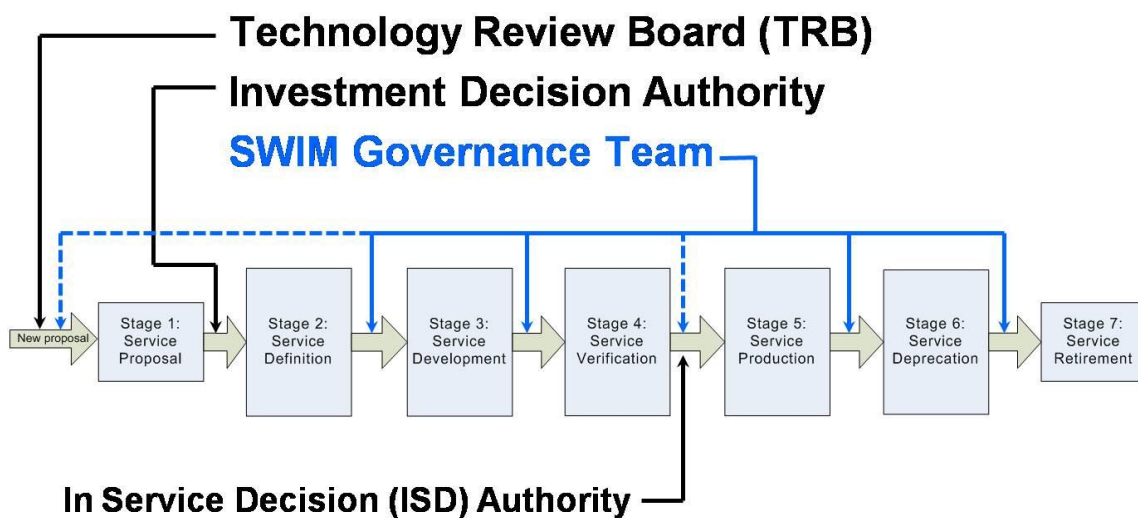


Figure 1: SOA Governance Process

2.5.2 Criteria used in the SOA Suitability Assessment include the following:

- Potential for existing SWIM service to be used or tailored to meet the requirement;
- Potential for other users to benefit from the information exchange;
- Potential hazards for exposing data through SWIM;
- Life-Cycle Cost of SWIM versus other solutions;
- System performance requirements;
- Safety/certification requirements;

- Information security requirements; and
- Existing architecture/vendor solution impacts.

2.5.3 As part of SOA Suitability Assessments, the SWIM Governance Team reviews a program’s documentation and interviews its management. After these steps, the SWIM Program rates the program’s suitability for SOA, based upon the program compatibility with a SOA architectural approach and their data management objectives over the next five years. A program that scores high on its SOA Suitability Assessment is a strong candidate to work with the SWIM Program to provide SWIM-compliant services.

3. Action by the Meeting

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matters as appropriate.
