International Civil Aviation Organization

The Ninth Meeting of the Asia/Pacific Aeronautical Information Services – Aeronautical Information Management Implementation Task Force (AAITF/9)

Pattaya, Thailand, 24 – 27 June 2014

Agenda Item 4: AIS-AIM Updates

THE FEDERAL AVIATION ADMINISTRATION (FAA) SYSTEM WIDE INFORMATION MANAGEMENT (SWIM) PROGRAM

(Presented by United States of America)

SUMMARY

This paper presents an update of the FAA Service Oriented Architecture and working examples of SWIM application in use today and the near future, including Service Oriented Architecture (SOA) Modification and Real Time Applications and Procedures for SWIM.

1. INTRODUCTION

1.1 Transformation to the Next Generation Air Transportation System (NextGen) requires programs with technologies that provide more efficient operations, including streamlined communications capabilities. The Federal Aviation Administration's (FAA) System Wide Information Management (SWIM) program is an integral part of that change. SWIM is an Information Technology (IT) infrastructure program that provides data to authorized users, thereby facilitating collaboration across National Airspace System (NAS) users. The principles behind the SWIM concept include the separation of information - provision and consumption - in such a way that the number and nature of consumers can evolve through time; loose system coupling, in which each system in an information exchange needs little or no knowledge of the environment of other systems; using publicly available open standards; and using Service Oriented Architecture (SOA) to provide a suite of interoperable infrastructure services.

2. DISCUSSION

2.1 Overview

2.1.1 SWIM will provide a flexible and secure information management architecture for sharing NAS advisory data to enable increased common situational awareness and improved NAS agility. SWIM will use Commercial Off-The-Shelf (COTS) hardware and software to support a loosely coupled Service-Oriented Architecture (SOA) that allows for the easier addition of new systems and connections. SOA technology allows software applications to locate and interact with one another through information services that can be accessed without knowledge of the other application's underlying platform implementation.

SWIM will implement SOA in the NAS by providing Enterprise Infrastructure services that include messaging, security, enterprise service management, and interface management. In addition, SWIM will provide governance to ensure adherence to standards, thereby allowing the FAA to create new system interfaces more quickly and cost-effectively. This, in turn, will expedite data-sharing – a NextGen requirement. Getting the right information to the right place at the right time facilitates common situational awareness as well as collaborative decision-making.

2.2 Service-Oriented Architecture (SOA)

2.2.1 SOA organizes technical capabilities in a standard way to allow for the flexible accomplishment of constantly changing needs and demands. It establishes 'services' as a mechanism by which needs and capabilities are brought together, and standardizes the necessary interfaces and behavior to support interaction. SOA provides an organizing and delivery paradigm that derives greater value by re-using existing software solutions rather than duplicating capabilities. SOA implementation leads to consistent service development, operation, and management across the enterprise. By following SOA standards and principles, SWIM will make services available on a network, enabling those systems on the network seeking services to invoke them without having to change or adapt to the underlying implementation of the service.

2.3 SOA Governance

2.3.1 Without a monitor and control mechanism, not only is implementation challenging, but SOA's open and distributed nature also invites chaos. Because of this, SOA needs governance. Governance assures that services are kept at a defined level of integrity, performance, reliability, currency, and security support for enterprise data and privacy within and across boundaries.

2.4 SOA Suitability Criteria

2.4.1 SWIM will employ a dual approach to its SOA Suitability Assessments of potential NAS services. From the NAS Enterprise View level, the potential for existing NAS services to be utilized or tailored to meet the requirement, the probability for other users to benefit from the information exchange, and the potential hazards for exposing data through SWIM (e.g., proprietary data, non-FAA user access) will be assessed.

At the Program level, SWIM will assesses the Life-Cycle Cost of SOA versus other solutions, the required system performance (such as latency, transmission rate, bandwidth, response time, overhead), related non-performance requirements (such as safety/certification and information security), and impact to existing architecture.

2.5 Types of Shared Information

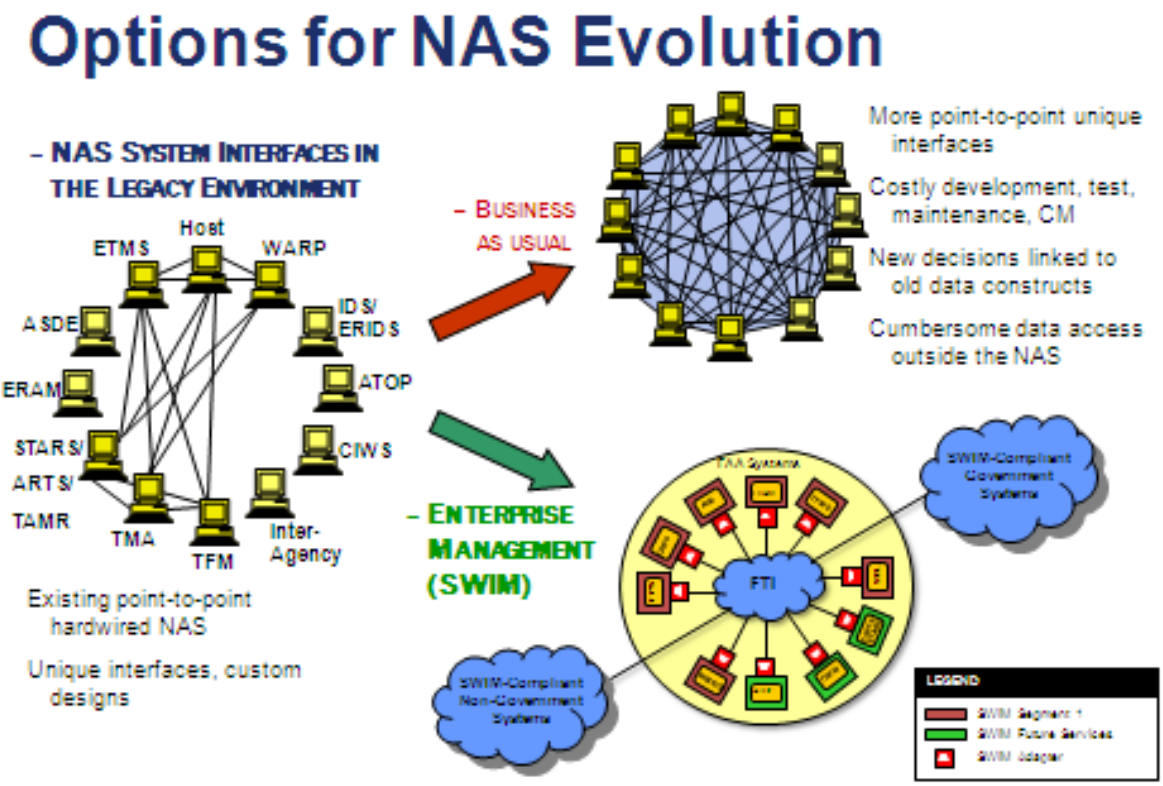
2.5.1 The following are examples of the types of information shared through SWIM: airport surface management information, weather data, flight planning data, air traffic flow management information, notices to airmen (NOTAMS), and special use airspace status.

2.6 Options for NAS Evolution

2.6.1 The FAA has many air traffic automation systems that have been developed over the years, using many types of software that were available at the time. Because of differences in software, developing interfaces between these systems has been very labor-intensive and time-consuming. Without SWIM, the additional interfaces needed for NextGen would lead to an unmanageable collection of unique, point-to-point interfaces. Instead, we hope to use SWIM to

simplify the development of standardized interfaces in the future, so that unique, point-to-point interfaces between systems can be minimized.

2.7 Segmented Approach to SWIM



2.7.1 The FAA will implement SWIM in two segments. In SWIM Segment 1, each program will be responsible for end-to-end messaging operations using SWIM-provided software. SWIM will ensure adherence to governance policies and processes that enable interoperability, among the federated services in the NAS. SWIM will provide requirements, schedule, and funding to other NAS programs; SOA services will be deployed to all en route Air Route Traffic Control Centers (ARTCCs), Terminal Radar Approach Controls (TRACONs), the Air Traffic Control System Command Center, the William J. Hughes Technical Center (WJHTC), and NAS Enterprise Management Centers (NEMCs). In SWIM Segment 1, there is no common infrastructure.

2.8 SWIM Segment 1 Enterprise Infrastructure and Tools

2.8.1 The NAS Service Registry and Repository (NSRR) is a resource that provides secure controlled access to data necessary for the implementation and governance of SOA projects. Potential consumers will search the registry to discover NAS services that are available for consumption. These potential consumers will have access to metadata and service artifacts, and they can use this information to request services from the providers. Publishers manage and store metadata and service artifacts about their services in a single location. This information includes:

– Service Description

– Classifications: Protocol Types, Service Category, Endpoints and Delivery Channels

– Access Information: Interface Requirements Documents (IRDs) and Web Service Definition Language (WSDL) files.

Currently, Eurocontrol and the Japan Civil Aviation Bureau (JCAB) have access to the NSRR.

The following tools have also been provided for use by developers of SWIM services:

- SWIM Commercial-Off-The-Shelf (COTS) Products Repository (SCPR): provides a single point from which service developers can retrieve COTS service implementation software, service test tools, and related artifacts (e.g., release notes).

- SWIM Wiki: provides a collaboration forum for developers and other members of the SWIM community.

2.9 SWIM Segment 1 Current Status

2.9.1 SWIM Segment 1 will deliver nine NAS business services or capabilities:

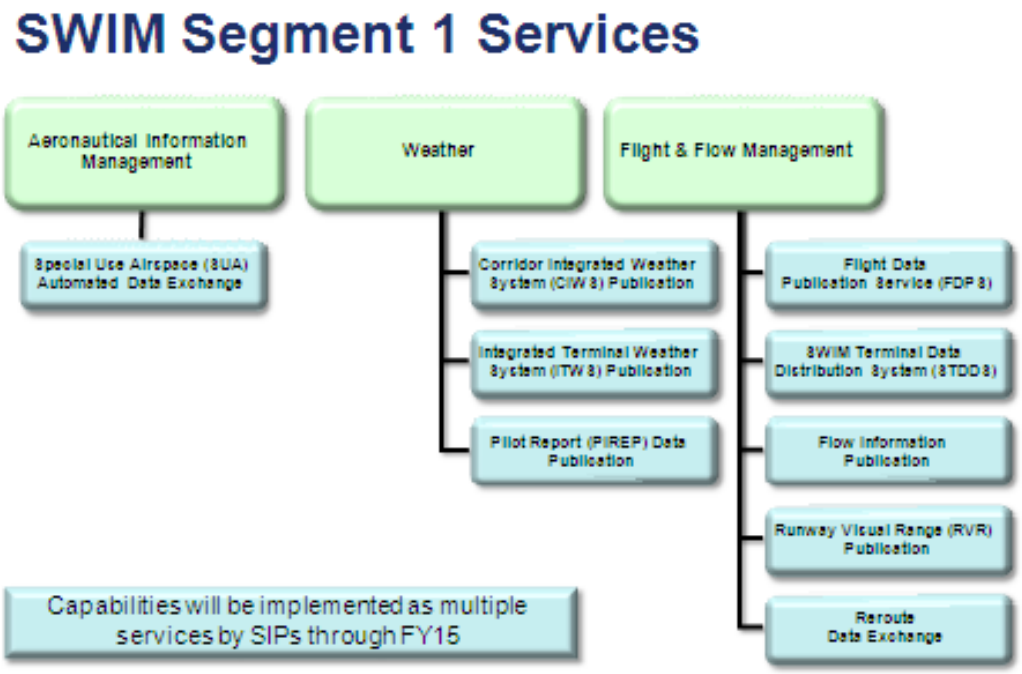
Seven capabilities are complete and operational:

- ✓ Integrated Terminal Weather System (ITWS) Data Publication
- ✓ Corridor Integrated Weather System (CIWS) Data Publication
- ✓ Weather Message Switching Center Replacement (WMSCR) Pilot Report (PIREP) Data Publication
- ✓ Aeronautical Information Management (AIM) Special Use Airspace (SUA) Automated Data Exchange
- ✓ Reroute Data Exchange
- ✓ SWIM Terminal Data Distribution System (STDDS)
- ✓ Runway Visual Range (RVR) Data Publication

Two capabilities are on schedule and within budget allocations:

- Traffic Flow Management (TFM) Flow Information Publication
- Flight Data Publication Service

Many of these services will be developed by other FAA programs, known as SWIM Implementing Programs (SIPs).



The SWIM Segment 1 services will provide the following data products:

Current SWIM Products

Capability	Products		
AIM SUA Data Exchange	• SUA data, dynamically provided in the AIXM standard • AIXM SAA definitions		
ITWS Data Publication	• Airport Lightning Warning • Configured Alerts • Forecast Accuracy • Forecast Contour • Forecast Image • Gust Front TRACON Map • Microburst TRACON Map • Precipitation 5nm • Precipitation Long Range • Precipitation TRACON	• SM SEP 5nm • SM SEP Long Range • SM SEP TRACON • Terminal Weather Text Normal • Tornado Alert • Tornado Detections Wind Profile • AP Indicated Precipitation • AP Status • Gust Front ETI • Hazard Text 5nm	• Hazard Text Long Range • Hazard Text TRACON • ITWS Status Information • Microburst ATIS • Runway Configuration • Storm Motion 5nm • Storm Motion TRACON • Terminal Weather Text Special • Wind Shear ATIS
CIWS Data Publication	• VIL Mosaic (1km resolution) • VIL 2-hr. Forecast • Echo Tops Mosaic (1 km resolution) • Echo Tops 2-hr. Forecast • Satellite Mosaic	• Storm Info: Echo Top Tags • Storm Info: Leading Edges • Storm Info: Motion Vectors • VIL Forecast Contours (Std. Mode) • VIL Forecast Contours (Winter Mode)	• Echo Tops Forecast Contours • Growth & Decay Contours • Forecast Accuracy: Echo Tops • Forecast Accuracy: Std. Precip • Forecast Accuracy: Winter Precip
PIREP Data Publication	• Transmission of voice PIREPs to WMSCR	• Stored PIREPs	• Altimeter settings
Reroute Data Exchange	• Pre-departure flight reroute information between Traffic Managers and Air Traffic Controllers		
ASDE-X/STDDS	• ASDE-X streaming data service	• Surface Movement Events (SME)	• Tower Departure Events (TDE)
Flow Information Publication	• Flow Constrained Area (FCA) • Airspace Flow Program (AFP)	• Ground Delay Program (GDP) • Ground Stops (GSs)	• Reroutes • Advisories
RVR Data Pub.	• Runway visibility data		
Flight Data Pub.	• Flight Data (Flight Plan and Track Data)	• Sector status, route status, altimeter settings (in the future, SAA status)	• General Information Messages • Operational Data

2.10 SWIM Segment 2

2.10.1 Segment 2 will provide a common messaging infrastructure for NAS programs to use. SWIM will be responsible for message delivery and Segment 1 services will start using the new

infrastructure. The provision of governance, standards, and SOA implementation software to other NAS programs will continue.

SWIM Segment 2 core services include:

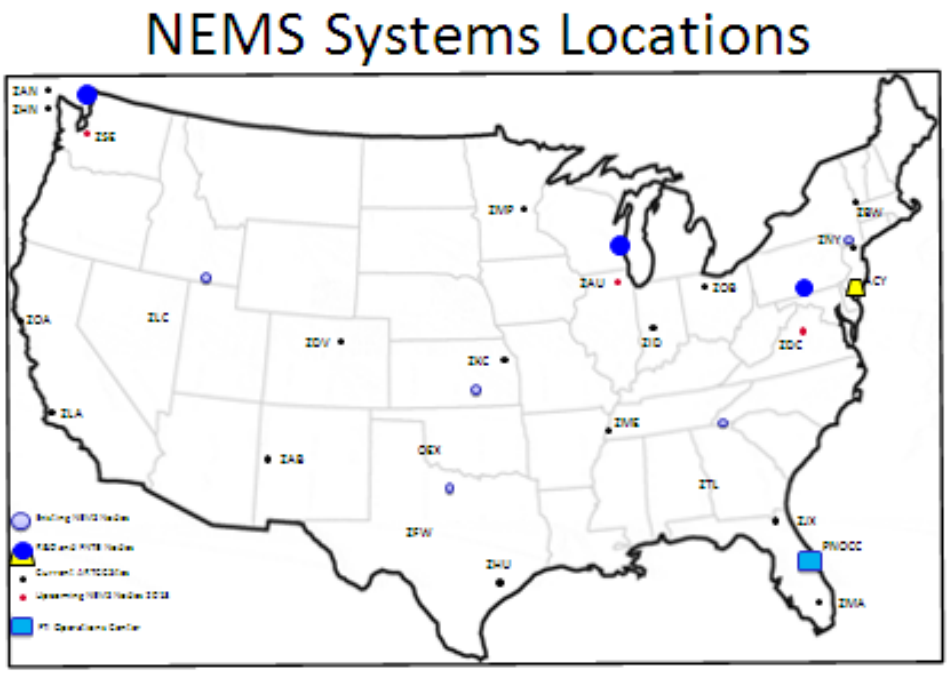
- Messaging – for web services (e.g. reliable messaging) as well as Java Messaging Services (publish/subscribe and request/response);
- Interface Management – interface specification, discovery and schema management;
- Security – authentication, authorization, and audit services; and
- Enterprise Service Management – service monitoring, service configuration, and system monitoring.

Segment 2 enterprise IT infrastructure includes:

- NAS Enterprise Messaging Services (NEMS) - provides the messaging service;
- Domain Name Service (DNS) - provides naming and name-to-address resolution services across the NAS; and
- Network Time Protocol/Precision Time Protocol (NTP/PTP) - provides time
- synchronization services across the NAS.

2.11 Segment 2 Infrastructure Locations

2.11 The following figure shows locations of NEMS messaging nodes, as well as the FAA Telecommunications Infrastructure (FTI) Operations Center and the FTI National Testbed (FNTB).



2.12 Future SWIM Services

2.12.1 The following figures show the status of SWIM services through 2015.

Producer	Consumer(s)	Product(s)	Cutover
Traffic Flow Management System (TFMS) (Airport Surface Detection Equipment-Model X (ASDE-X))	Airlines/ External Users	ASDE-X (Track reports)	April 2011
Weather and Radar Processor (WARP)	Operational and Supportability Implementation System (OASIS)	Harris Weather Data Service Products	Feb. 2012
WARP	CIWS (Massachusetts Institute of Technology (MIT)/Lincoln Laboratories (LL))	NEXRAD Products	March 2012
WMSCR (Phase 1)	NextGen Integration and Evaluation Capability (NIEC)	PIREPs and Altimeter Settings	June 2012
CIWS Data Distribution Service (CDDS) (Phase 1)	Time Based Flow Management (TBFM)/Traffic Management Adviser (TMA)	CIWS Products (Static)	Aug. 2013
TBFM Information Sharing (IS) Service	TFMS	Collaborative Arrival Planning (CAP) Data	Sept. 2013

Producer	Consumer(s)	Product(s)	Cutover
STDDS	TFMS	ASDE-X (Tracks), RVR, Electronic Flight Strip Transfer System (EFSTS), and Tower Data Link System (TDLS) Data	2014
WMSCR (Phases 2 and 3)	TBD	Web services for Requests for PIREPs and Altimeter Settings	2013
CDDS (Phase 2)	TBFM/TMA	CIWS Products (Dynamic)	2013
Enhanced Weather Information Network Server (WINS) Disseminations (EWD)	TBD	Weather Data	2013
AIM	TFMS	SUA Information	2014
ITWS	Airlines/ Other External	ITWS Products	2014
TFMS/FIPS	TBD	FIPS Products	2014
SWIM FDPS	TBD	FDPS Products	2015

2.12.2 To learn more about the FAA's SWIM program, please go to:
http://www.faa.gov/nextgen/swim

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.

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