System-Wide Information Management (SWIM)

Segment 2 Operation Services and Environment Definition (OSED)

Version 1.0

March 2, 2009

DRAFT

SIGNATURE PAGE

Mike Hritz, Swim Concepts and Evolution Lead Date

DRAFT

Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

DOCUMENT CHANGE HISTORY

Version	Date	Description of Changes
0.1	1/30/2009	Original Draft
1.0	3/2/2009	Updated draft from team comments

DRAFT

TABLE OF CONTENTS

1. INTRODUCTION 1

1.1 OSED Concept 1

1.2 SWIM Segment 2 OSED Scope 1

1.3 SWIM Segment 2 OSED Content 5

2. OPERATION SERVICES DESCRIPTION 7

3. POLICIES/PROCEDURES 10

4. HUMAN ELEMENTS 11

5. EQUIPMENT AND SOFTWARE 12

6. ENVIRONMENT DESCRIPTION 13

6.1 Overview 13

6.2 NextGen OI Analysis Summary 14

7. FUNCTIONAL ARCHITECTURE 16

7.1 SWIM Segment One Capabilities 16

7.2 Potential SWIM Segment 2 Capabilities 20

7.3 Preliminary Segment 2 Functional Architecture Definition 21

8. NON-FUNCTIONAL REQUIREMENTS 23

9. APPENDIX 28

DRAFT

1. Introduction

1.1 OSED Concept

This Operation Services and Environment Definition (OSED) provides the basis for the System Wide Information Management (SWIM) Segment 2 architecture and strategic direction. Generally, an OSED supports the Concept and Requirements Definition (CRD) activity in the FAA acquisition management process. It provides the basis for the identification and development of operational safety and performance requirements by documenting the intended functionality of the system under development, the intended environment under which the system will operate and other pertinent information which would influence those requirements. In the case of SWIM Segment 2, the OSED construct is being used as an artifact to provide segment specific information about NextGen, the NAS and the SWIM program which will help to define SWIM requirements and technical architecture to support the SWIM Segment 2 Final Investment Decision.

1.2 SWIM Segment 2 OSED Scope

This OSED is an artifact created by the SWIM Program Office to document the known information driving the definition of SWIM Segment 2. It will also endeavor to identify important issues and constraints relative to the definition of SWIM Segment 2. The Segment 2 acquisition timeframe is 2012-2016.

SWIM is part of the NextGen portfolio and critical to making sure that all the various pieces are communicating with each other. SWIM is implemented in segments. In each segment an appropriate set of NAS applications are developed and integrated into SWIM. Core services are added as needed to support the implementation capabilities associated with the segments. SWIM core services enable systems to request and receive information when they need it, subscribe for automatic receipt, and publish information and services as appropriate. This will provide for sharing of information among diverse services.

The contents (technical and operational) and architecture definition for SWIM Segment 1 were driven primarily by two activities: A Community of Interest (COI) integration team definition of operational capabilities and a Technical Architecture definition team development of a

DRAFT

corresponding architecture. The COIs' responsibility was to identify existing or planned information exchanges that could be made SWIM compliant with the least amount of impact possible. The resulting federated, SWIM Implementing Program (SIP) based architecture provided an opportunity to initiate Air Traffic Organization (ATO) business units into the concepts of Service Oriented Architecture, net-centricity, and enterprise services while balancing program control and risk for both SWIM and the SIPs.

SWIM's Segment 2 approach focuses on moving towards a shared services infrastructure that may be centrally managed but distributed across the SIP. The definition of that approach will be driven by several needs and constraints: The need to provide the core information management services to support NextGen initiatives implemented in the SWIM Segment 2 timeframe, the need to provide the most fiscally responsible corporate information management solution, and the constraint of alignment with the FAA Enterprise Architecture.

The content of this document results from activities associated with analyzing National Airspace System (NAS) information exchanges, requirements for net-centricity, and state-of-the-science in SOA and information management technology. While a COI based analysis would again be appropriate for the operational analysis of the NAS for appropriate SWIM Segment 2 initiatives, that function is being performed by several existing groups and teams already. It is the intention that the SWIM Segment 2 Definition team will leverage the following NAS planning initiatives:

- **Big Airspace Group (FAA and MITRE)** – Currently MITRE's Big Airspace group is defining requirements for Big Airspace Automation by analyzing the FAA's operational concept in relation to the plans and schedules of various NAS systems. The Big Airspace study team is tasked with finding viable alternatives for delivery of Flight Data Processor (FDP), Signal Data Processor (SDP), display and interface requirements to support "terminal" like operations through transition airspace to the runway. This automation alternatives analysis will help set requirements and include an option based on convergence of terminal and en route automation systems.
- **NAS Enterprise Architecture (ATO-P)** – The FAA NAS Enterprise Architecture (EA) group is currently updating the infrastructure roadmaps that lay out the FAA's plan for future decisions to be made and supporting activities on the path towards acquisition

DRAFT

decisions. The NAS EA aligns research, development, engineering, acquisition, integration, and implementation of systems which will improve NAS Operations and enable Next Generation Air Transportation System (NextGen) Operational Improvements (OIs) before, during, and after convergence. The EA is planning to be baselined in January 2009.

- **NextGen Mid-Term Automation Requirements Task (FAA and CSSI) –** The task is currently in progress and is planned to be complete by the end of summer, 2009. The outcome of the task will include identification of potential conceptual requirements and potential system requirements, consistent with all current concept of operations, the NextGen Implementation Plan, and the Joint Planning and Development Office (JPDO) Integrated Work Plan to name a few.
- **NextGen Convergence Working Group (NCWG) -** The NCWG will review the NextGen Implementation Plan, NAS EA documents related to the Automation Infrastructure Roadmap, and lower level concepts of Air Traffic Management (ATM) operations to comprehensively identify automation convergence aspects. One of the proposed methods to achieve convergence is through SOA concepts. The NCWG will leverage the following domain specific architecture planning analyses:
    - **Air Traffic Organization Terminal Services (ATO-T) –** The Terminal Automation Modernization and Replacement (TAMR) Phase 3 program has commenced planning and business case development for modernization/replacement of terminal automation systems at TRACONS that were not addressed by TAMR Phase 1 or TAMR Phase 2 programs. TAMR Phase 3 is expected to consider implementation of platform and functional convergence. ATO-T is also in the process of planning the evolution of existing tower automation systems and new functions into a system referred to as Terminal Flight Data Management (TFDM). It is expected that TFDM will be a phased implementation starting with basic capabilities referred to as TFDM 1 then evolving to TFDM 2 and beyond. This will present an opportunity to move to fewer systems, displays, and data entry devices in the terminal.

DRAFT

- **Air Traffic Organization EnRoute and Oceanic Services (ATO-E)** – The planning phase for Post En Route Automation Modernization (ERAM) Release 3 baseline has begun. This planning will involve defining the ERAM enhancements to be realized in approximately 2012 to 2015.

- **Air Traffic Organization System Operations (ATO-R)** – System Operations are planning for Collaborative Air Traffic Management (CATM) work packages 3 & 4, which will involve defining Traffic Flow Management (TFM) enhancements to be realized from 2010 to 2018. These enhancements are based on a SOA.

In addition to leveraging on-going NAS and NextGen analyses by other organizations the SWIM Program Office has undertaken several independent NAS and NextGen analyses to look specifically at how SWIM should support the NextGen OIs and how best to implement a net-centric, shared services environment in the NAS:

- MITRE/ Center for Advanced Aviation System Development (CAASD) is conducting a study of SWIM architecture evolution concepts, the primary purpose of which is to identify SOA Core Services architecture options for the SWIM Segment 2 timeframe. It may also encompass some Technical Infrastructure, Enterprise Governance, and Administrative Services architecture elements.

- MITRE/CAASD is developing an "Operational Concept for SWIM in the Mid-Term" which will identify candidate capabilities for SWIM Segment 2 Mission Services. This document will primarily address the evolution of SWIM flight and flow capabilities/operations throughout the Mid-Term and will include flight and flow mid-term capabilities contained in the NextGen solution sets that require net-centric services.

- Flatirons Solutions is also analyzing the NextGen OIs as described in the NextGen Implementation Plan (NGIP).

- Tech America (formerly ITAA-GEIA) has developed a SWIM Governance Best Practices white paper and a Seg 1- Seg 2 Transition White Paper with a proposed Segment 1 to 2 transition path.

DRAFT

1.3 SWIM Segment 2 OSED Content

This document will provide the basis for the SWIM Segment 2 architecture and strategic direction via the following framework:

1. Introduction - Description of the concept of this document, its scope and the contents by paragraph/section

2. Operation Services Description – High level description of SWIM objectives, capabilities. Brief discussion of the specific objectives of SWIM Segment 2. Introduction of the Enterprise Services framework for the NAS

3. Policies/Procedures – Discussion of need for policies and procedures required for maturation and implementation of SOA in the NAS. Especially addressing Governance initiatives for SWIM Segment 2.

4. Human Elements – Discussion of new human factors, personnel requirements associated with transition to SWIM Segment 2

5. Equipment and Software – Discussion of anticipated TYPES of equipment and software applicable to all alternative architectures for SWIM Segment 2.

6. Environment Description – Synopsis of Roadmap, EA, NGIP planning document analysis defining the Operational Environment for SWIM Segment 2 (i.e. the NAS capabilities in the 2012-2018 timeframe that SWIM will be required to support). Detailed results will be included in an attachment.

7. Functional Architecture – Description of SWIM SOA and Net-centric functional requirements. Identification of specific Enterprise Services functionality that will be allocated to SWIM.

DRAFT

8. Non-functional Requirements – All known requirements not covered in other sections including specific known performance requirements and characteristics.

DRAFT

2. Operation Services Description

The FAA is developing and modernizing many complex interdependent Air Traffic Management (ATM) systems using modern technologies, software methods and system architectures that provide fundamental support to the alteration of ATM operations. Concurrently, the emerging service-oriented computing paradigm leads to NAS interfaces being defined, developed and implemented in ways not previously executed within the NAS. This modernization is occurring alongside formulation of revolutionary new ATM concepts and the process re-engineering of every facet of operations (e.g., separation assurance, strategic flow management, dissemination of aeronautical and flight data, and airspace user interaction with NAS infrastructure). The JPDO, developing the Operational Concept for the NextGen, targeted the completion of this effort for the 2025 timeframe. Achieving NextGen requires a suite of Enterprise Services characterized by both the net-centric infrastructure providing the connectivity and universal access to information and by the services that provide the collection, processing and distribution of information.

The purpose of SWIM is to facilitate net-centric NAS operational improvements (including some proposed in the NextGen). SWIM capabilities apply state-of-the-art information management and exchange technologies to ensure information is available to SWIM-enabled systems as needed to allow more distributed decision-making and to improve the speed, efficiency, and quality of distributed decision-making. Information can be automatically provided to users with a known need and to new users as needs arise – with far less expense and complexity than current methods. SWIM-enabled systems have the ability to request and consume information when they need it, subscribe for automatic receipt and publish information and services as appropriate.

The SWIM Segment 2 technical solution seeks to provide the first instance of a shared service infrastructure, including Core Services. These Core Services, and the ability to share business services with members of a COI, will be managed centrally, but distributed across the SIPs. As currently envisioned, loose coupling will allow for each SIP to make services available to other programs or users. In addition, strict version control, interoperability testing, load and usability testing, as part of an overall governance regime, must be enforced to clearly delineate SIP business services.

DRAFT

As part of the development of an Enterprise Architecture for the NAS, ATO-P has developed a layered functional framework for Enterprise Services in the NAS. The Enterprise Services Framework identifies all functions that are delivered as services in the NAS at the enterprise and layers them to roughly correspond to the ISO/OSI 7 Layer communications model. "On the wire"/transport services are at the bottom and human interaction services are at the top. Figure 1 below introduces a simplified version of this framework.

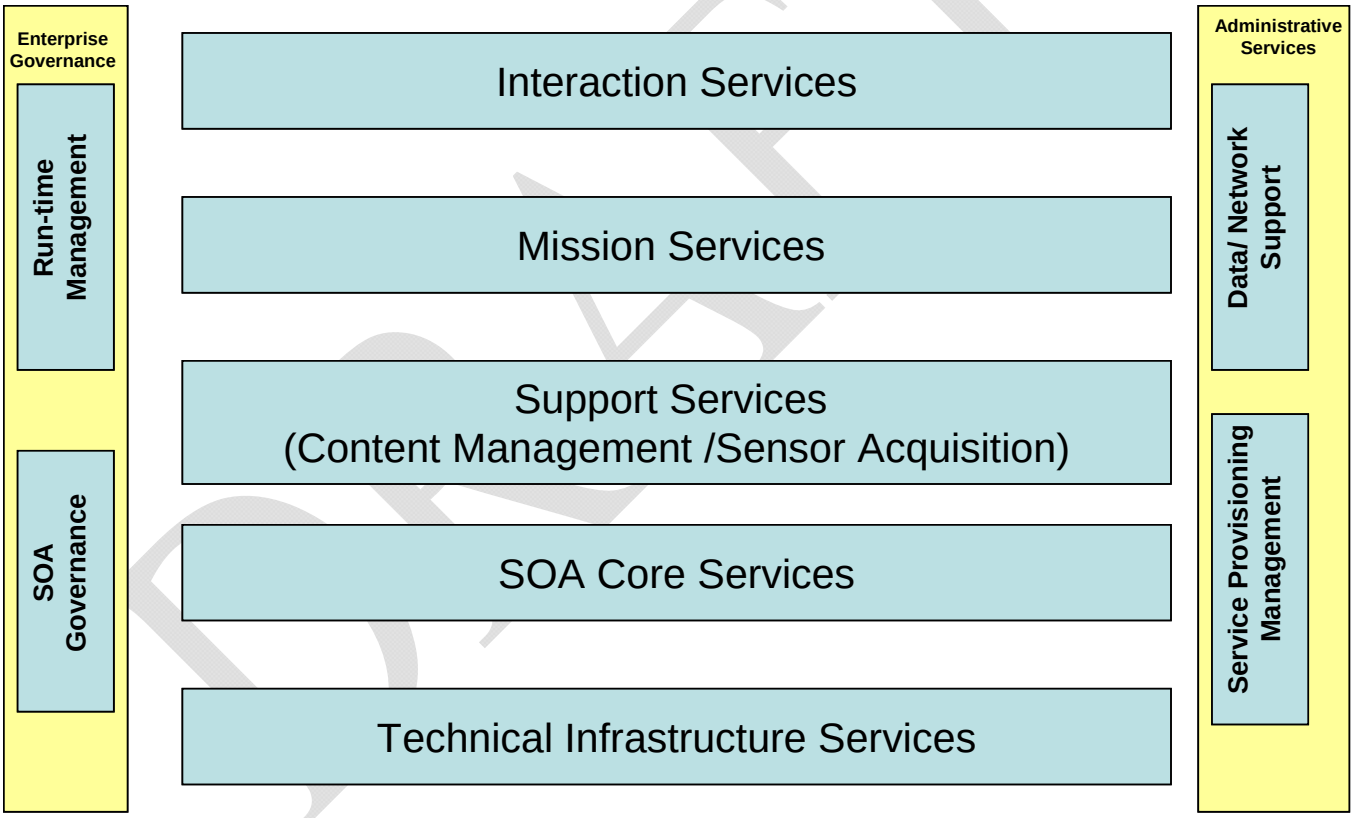


Figure 1 – Reference Model of NAS Enterprise Services

Table 1 below summarizes the layers with a brief description of each.

Layer	Description
Interaction Services	**Provides the human interface for the user or administrator of systems including client, portals and notification services**
Mission Services	**The operational application services residing in NAS systems that support air traffic operations**
Support Services	**The content management for NAS Mission Services and NAS sensor data acquisition services and systems**
SOA Core Services	**Runtime services and infrastructure that support the deployment, operation, management, and security of SWIM-based SOA services.**
Technical Infrastructure Services	**Includes the development and run-time computing platforms, data storage systems, network infrastructure, and enclave boundary and transport-level protection elements.**
Enterprise Governance	**Includes SOA governance (policy, service registration, auditing, Service Level Agreement (SLA) management, help desk, and security) and the run-time systems to administer governance and monitor services.**
Administrative Services	**Includes network and database administration services such as directory and identity services to support SOA services. Provides process and support services for Service provisioning management.**

Table 1 – Enterprise Services Layer Descriptions[1]

DRAFT

[1] NAS Enterprise Architecture, Draft 10-31-08 version 1.3

3. Policies/Procedures

To ensure a comprehensive and robust Segment 2 infrastructure several policy areas must be addressed. These policy areas include:

- Security
- Governance
- Verification and Validation
- Configuration Management
- Version Management
- Information Policy Management

The Segment 1 policy documents that address these areas will be updated to address new requirements as dictated by the Segment 2 architecture and strategy.

DRAFT

4. Human Elements

At this time there are not significant Human Elements issues anticipated with SWIM Segment 2 Implementation. Exceptions might include new Monitor and Control (M&C) responsibility associated with a newly developed SWIM Infrastructure. Additionally it is possible that human-machine interface elements associated with Interaction Service functionality will be required (e.g., if a browser is required for SWIM Segment 2).

DRAFT

5. Equipment and Software

It is anticipated that the following equipment, software and technologies may be required for the Segment 2 architecture.

- Service Container
- Registry
- Repository
- Enterprise Services Bus
- Java Message Oriented Middleware
- Simple Object Access Protocol (SOAP)
- SOAP Message Transmission Optimization Mechanism (MTOM)
- Web Services Description Language

DRAFT

6. Environment Description

The SWIM Program is largely defined as "an Information Technology (IT) infrastructure program that will operate in the background to provide data to authorized users". Therefore the SWIM "environment" is the operational environment in which providers and users will exchange data. For SWIM Segment 2, this environment is shaped largely by capabilities within the NextGen planning documents developed by JPDO (Integrated Work Plan (IWP)) and FAA ATO-P (NAS EA and NextGen Implementation Plan (NGIP)). In addition to the environment driven by NextGen in the SWIM Segment 2 timeframe, the SWIM Segment 1 technical solution also establishes key elements of the SWIM Segment 2 operating environment.

6.1 Overview

There are two overarching elements that shape the environment for Segment 2: the Segment 1 Mission and Core capabilities that are implemented prior to Segment 2 and the Mission and Core capabilities that are envisioned for implementation in Segment 2. Because the Segment 1 architecture will be part of the "as-is" NAS prior to Segment 2, it plays a role in determining the Segment 2 environment - at a minimum, with respect to reuse and transition strategy.

Segment 2 capabilities are driven primarily by the documented NextGen Operational Improvements (OIs) that have been designated for implementation in the 2012-2018 timeframe. These OIs describe broad, and often complex, capabilities that involve multiple elements of the NAS. From among all the OIs targeted for this time frame, certain ones have been determined to include Mission Services with characteristics consistent with the goals of SOA. These OIs are expected to decompose into discoverable services and so will require SOA infrastructure from SWIM. A final determination of all OIs linked to SWIM Segment 2 is on-going as part of the OI analysis. However, the Appendix identifies and describes several capabilities of interest. Some of the OI-driven infrastructure will be available as a result of SWIM Segment 1, but preliminary analysis of the OIs indicates some of the Segment 2 Mission Services will be defined to exhibit behaviors more advanced and complex than the Segment 1 Mission Services. The latter will indicate additional, or more advanced, SWIM Core Capabilities. Either or both may indicate the

DRAFT

need for changes to the implementation approach, e.g., functional allocation and overall architecture.

The fundamental objectives of the OI analysis include:

- Decompose the relevant OIs into functional units assignable to (conceptual) services
- Determine a preliminary mapping between the conceptual services and Segment One Core Capabilities
- Determine Segment 2 Core Capability needs that are unmet by SWIM Segment 1
- Determine the nature of the SWIM Segment 2 architecture, consistent with preliminary requirements

6.2 NextGen OI Analysis Summary

A preliminary, and thus far relatively cursory, review of the OIs has identified a number of OIs that warrant further functional analysis to derive nominal characteristics of the anticipated functional environment. These OIs describe new approaches to ATM such as:

- Collaborative ATM across NAS domains (e.g., En Route, Terminal, Surface, TFM) and with external users (e.g., airline operations, pilots).
- Novel approaches to collaborative ATM including 4-D trajectories for active and proposed flights, automation-aided clearance delivery
- Automated assistance in detecting and resolving ATC and ATM conflicts and constraints to include aircraft, airspaces, weather, capacity, etc.
- Ability to resolve conflicts through management of capacity (in addition to demand), e.g., reconfiguring airspace
- Automated assistance to maximizing throughput (or utilization of available capacity) including more flexible metering methods and integrated arrival and departure management

DRAFT

- Widely available, certified data, including the most current dynamic (e.g., flight) and static (e.g., aeronautical) data, exchanged via standard formats among ground-based and airborne systems to support ATM operations
- Reallocation of operational ATM control such that consumers of certain services can change logical or physical location
- Operational capabilities (services) exposed at the enterprise level for interoperability and reuse
- Far more comprehensive information security due to increased interoperability and more open exposure of systems/services within and outside the NAS.

The future NAS operational environment is fundamentally shaped by the addition of the many new NextGen capabilities. The future SWIM environment – and capabilities – depends on the operational activities resulting from one or more of these capabilities. The extent to which interactions occur among the operational entities (e.g., nodes, functions or services providing the capabilities), and the nature of those interactions, significantly influences the requirements for IT infrastructure that enables the interactions. In particular, the types of data needed by the operational entities and the timing, volume and control of the interactions providing data drive SWIM requirements.

Analysis is currently in progress to provide an understanding of the characteristics of the Segment 2 Mission Services functionality and the Core Services requirements to support the Mission Services. Preliminary analyses indicate that the 2012-2018 timeframe will include numerous types of complex interactions that involve many operational entities and occasionally include high data and interaction volumes. It appears likely that the timing and control aspects of predefined workflows and/or dynamic business processes indicate the need for architectural entities that help manage this complexity. Further analysis is required to validate this preliminary assessment. The Appendix contains a set of single page summary tables to facilitate an examination of how SWIM might support the related OI capabilities.

DRAFT

7. Functional Architecture

The Functional Architecture Section of this document describes the currently understood functional elements of the SWIM Segment 2 Program. These functional elements are based on analysis of the SWIM Segment 2 operating environment. This operating environment is primarily defined by the NAS NextGen capabilities that SWIM will support during the SWIM Segment 2 timeframe. The SWIM Segment 2 technical solution will have to also support and work seamlessly with the SWIM Segment 1 technical solution. This section will first describe the SWIM Segment 1 capabilities so that context for the current operating environment can be established. Segment 1 capabilities will be described using the NAS Functional Architecture framework (SV-4) for enterprise services. Next, the SWIM Core Services capabilities that will apply to the Segment 2 timeframe are identified and described. Finally, the SWIM functional capabilities are described in the context of the enterprise services Functional Architecture framework.

7.1 SWIM Segment One Capabilities

SWIM Segment 1 capabilities fall into two broad categories (ATM capabilities and core capabilities) which are documented in detail in the SWIM Final Performance Requirements (FPR) and SWIM Service Specification Description (SvSD). In general, the ATM capabilities do not push the envelope for ATM advancements like NextGen OIs are expected to do. The Segment 1 capabilities tend to use SOA technologies to enable data exchanges between one provider and one or a limited number of known (prearranged) consumers. Most but not all consumers are within the NAS. The services tend to be somewhat simple in terms of the function provided and do not involve complex workflows or sequential service execution patterns. The services are delivered using pub/sub and request/reply exchanges. There are few, if any, exposed services that are composed of multiple or reused services. While the services operate across domains, it is not expected that services depend on complex activity in an external domain to reach successful completion. That is, the basis for completion generally includes only simple message exchanges. Therefore the suite of SWIM/SOA core capabilities required is more limited than would be the case with more complex interactions and dependencies.

DRAFT

Segment 1 Core Capabilities are defined in four categories: Enterprise Service Management, Messaging, Security and Interface Management. Most of the core capabilities are being provided by COTS software within existing (or previously planned) SIP systems. The following is a brief synopsis of key Segment 1 Core Capabilities (based on SWIM FPR requirements):

Interface Management

- Design-time discovery of service information (definitions and interface information)
- Ability to manage service information
- Ability to create and manage subscriptions

Messaging

- Message routing between consumers and providers
- Message routing consistent with subscriptions
- Message and alert delivery consistent with SLAs

Enterprise Service Management

- Provide run-time QoS management (e.g., event monitoring, analysis)
- Infrastructure maintenance (e.g., failure detection, recovery)
- Design-time Governance (e.g., provide and maintain repository for policy, standards and process guidelines)

Security

- Runtime access management
- Security administration (e.g., policy management, detect and analyze security events at design time)
- Run-Time security support (e.g., monitor transactions, provide alerts)

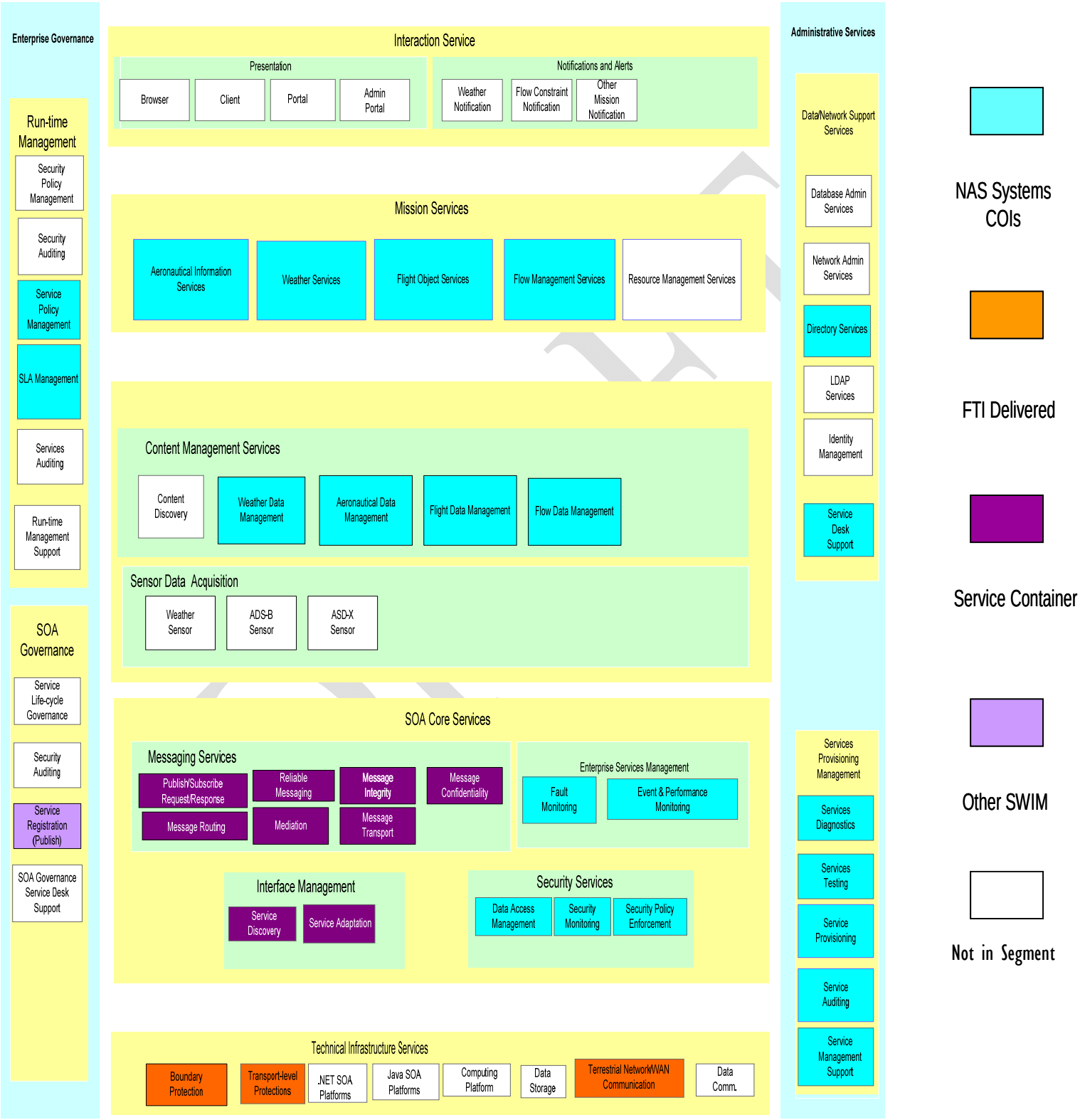
DRAFT

These capabilities (both ATM and Core) have the potential for reuse to support Segment 2 requirements. However, in most any foreseeable scenario, these capabilities will need to be extended or revised to suit the more demanding operational environment expected. In particular, while the potential for reuse is probably greater for the core capabilities, there are a number of additional and extended core capabilities that are likely to be required. Several such capabilities are described in the following subsection.

Figure 2 below shows the Architecture Framework for NAS Enterprise Services at a more detailed level, with color-coding indicating the elements included in Segment 1 and the allocation of included elements.

DRAFT

Figure 2 Architecture Framework for NAS Enterprise Services



7.2 Potential SWIM Segment 2 Capabilities

The following is a partial list of potential core capabilities applicable to the Segment 2 operational environment. Further analysis is required to determine the capabilities that will be required.

Interface Management

- Run-Time discovery of a service
- Run-Time discovery of certain content (e.g., a topic)
- Enhanced run-time and/or design time discovery
  - Multiple service requests to multiple service providers
  - Single service request to potentially multiple service providers

Messaging

- New Message Exchange Patterns, e.g.,
  - Bulk data retrieval
  - Extended, stateful dialogs
  - Single request with potential for multiple repliers
  - Broadcast messages
  - Multi-format response to a single request
- Enterprise Service Bus underlying all communications among SOA components
  - Data transformation
  - Message Routing
  - Operational awareness
- Complex Routing/Workflow, e.g.,
  - Itinerary-based routing (predefined)
  - Content-based routing (dynamic workflow)
- Service Orchestration
  - Very complex workflow routing managed by a separate process definition for stateful coordination of multiple services

DRAFT

Enterprise Service Management

- More extensive run time Governance

Security

- Enterprise-level security solutions

7.3 Preliminary Segment 2 Functional Architecture Definition

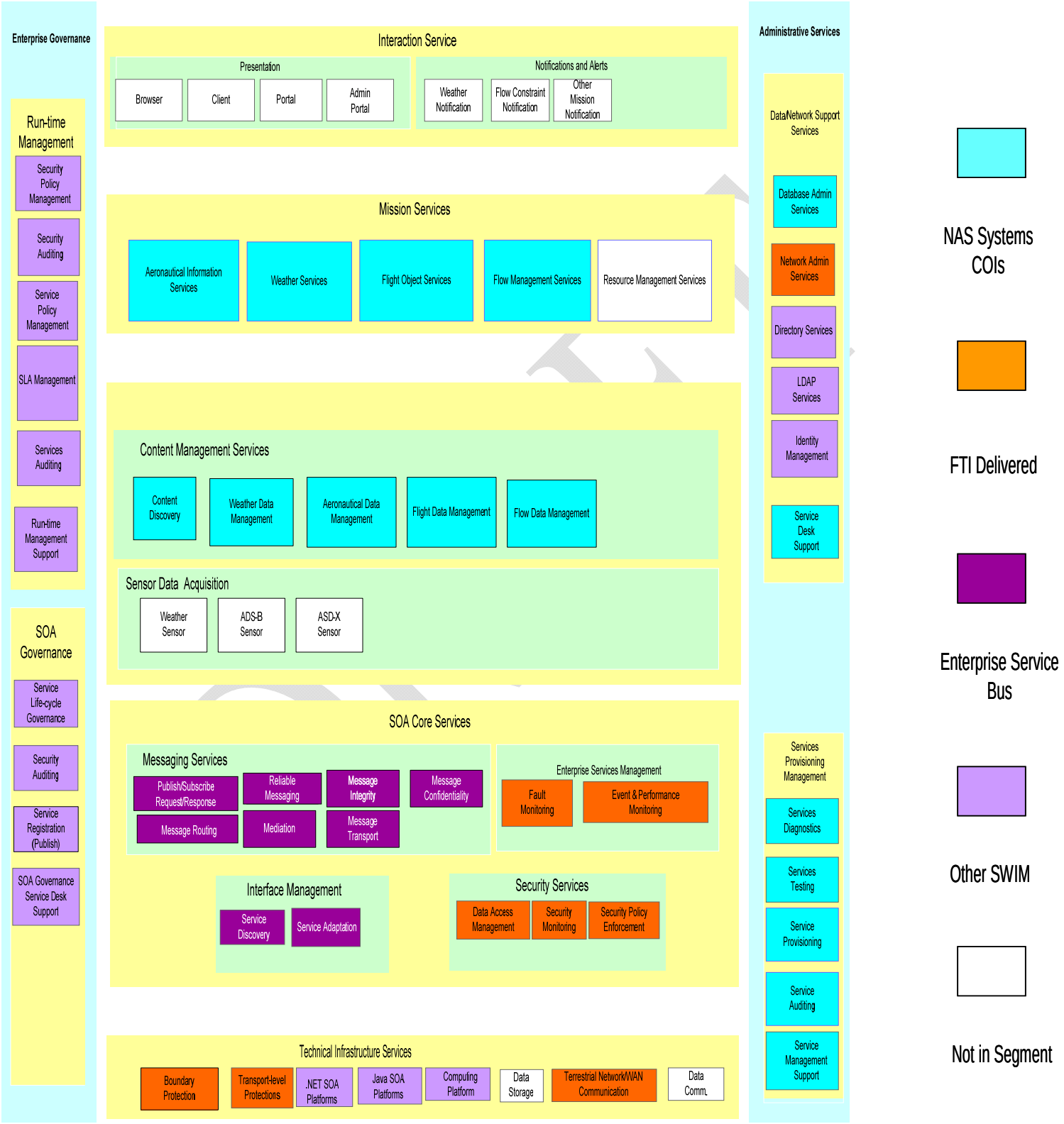
The fundamental nature of the Segment 1 architecture is highly distributed. All Mission Capabilities are provided directly to consumers by the SIP that is responsible for the function. In addition, with the exception of the registry, SWIM does not provide a centralized core infrastructure. Instead, the core infrastructure is embedded into the SIP's systems as necessary to comply with SWIM guidance and standards.

The area with the potential for the most architectural change in Segment 2 is the deployment of the Core Services. Although the Segment 2 definition analysis has not yet progressed far enough to define alternative architectures, a few preliminary observations can be made. For example, if an ESB is preferred to satisfy certain requirements, there are architectural options for its implementation. Because an ESB is more conceptual than physical, the ESB capability can be provided in a central or distributed capability. It is ideal for use in n-tier and peer-to-peer architectures. If a sophisticated orchestration engine is needed to manage Segment 2 business processes, the decision between centralized and distributed depends on the details of the required capability. However, one could argue that true agility can best be achieved by isolating this management process in a way that gives it maximum flexibility in service coordination – and in a way that allows the business processes to be redefined or adjusted without the need to make changes in multiple places.

Figure 3 below shows a notional Architecture Framework for NAS Enterprise Services for Segment 2 corresponding to the Framework for Segment 1, with color-coding indicating the elements potentially included in Segment 2 and the allocation of included elements.

DRAFT

Figure 3 Notional Architecture Framework for NAS Enterprise Services



8. Non-functional Requirements

The primary non-functional requirements anticipated for SWIM Segment 2 would be based on Architectural Definition decisions made during the Segment 2 Architecture Definition activities. Two architecture analyses provide the basis for preliminary architectural concepts which might drive non-functional requirements. ITAA-GEIA conducted a paper analysis of trends in SOA and Net-Centric architectures for the SWIM Program Office. This analysis was provided in the form of a white paper that reflected a consensus view of a cross section of Information Technology, Telecommunications and ATM System Integrator industry representatives. MITRE CAASD is currently in the process of developing a paper on SWIM Architecture Evolution Concepts which will discuss the ITAA-GEIA proposed architecture solution with the unique perspective of MITRE CAASD. Both of these analyses will provide a starting point for SWIM Program Office architecture analysis that will further include key FAA specific political, organizational, and technical aspects.

Figure 4 below outlines a one proposed Segment 2 transition based on the ITAA-GEIA SWIM Seg 1- Seg 2 Transition White Paper. This depicts a proposed transition from the current federated structure to a shared infrastructure. It is through these types of analysis that questions such as: will an ESB in required segment 2 will a service orchestration capability be needed in segment 2, and is there a need for a real-time service registry in segment 2 will be answered. The ITAA-GEIA report and FAA's view of the long-term architecture point to the same direction: a hybrid approach in which services are allocated on a case-by-case basis to be implemented and operated in a consolidated "core", or to be implemented and operated within domain-specific NAS systems.

At this point, the mid-term NAS services have not been identified and allocated for deployment to individual NAS systems or to the SWIM core. The analysis contained in Section 3 of this document, and the architecture evolution work being done in parallel, is intended to start this identification and allocation process, however this work is far from complete or definitive. Therefore, at this point the scope of the SWIM core is not known. At one extreme, it is possible that no services be allocated to the SWIM core, in which case the program can continue with the federated approach taken in SWIM segment 1. However, we such an outcome may be consistent with the NextGen vision of an agile, net-centric NAS. SWIM Segment 2 could include some services that are allocated to a consolidated SWIM core. These services should be selected to reduce cost and risk, maximize benefit, and provide a basis for building on success in subsequent segments.

DRAFT

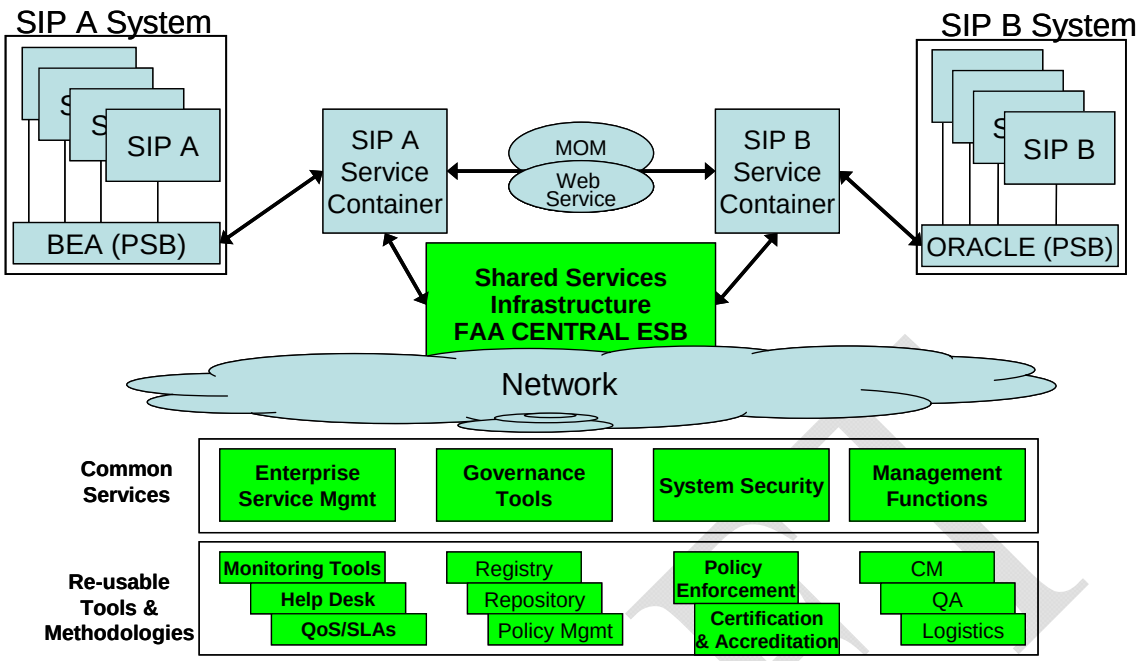


Figure 4 ITAA-GEIA SWIM Proposed Seg 1- Seg 2 Transition

The architecture implied by the allocation of at least some services to a consolidated SWIM core is being analyzed in a separate product; the salient features are:

- An Enterprise Service Bus which provides a common backbone for (at a minimum) basic messaging. It also may support higher level functions such as content-based routing, transformation, and service orchestration.
- A centralized core for enterprise service management which complements the SIP specific system management systems to provide an end-to-end management of services.
- Boundary protection security gateways and mechanisms to communicate with all non-NAS users.
- Security (and other) policy enforcement mechanisms within the SWIM core, as well as security (and other) policy enforcement within SIPs.

The introduction of consolidated services implies a paradigm change in the way SWIM capabilities are acquired and operated. This section describes this paradigm shift, which will be necessary if the hybrid approach is to be adopted.

DRAFT

As background, Figure 5 below provides an overview of the acquisition and operations concepts for SWIM Segment 1. In SWIM Segment 1, requirements were generated based on a process that included input from SWIM communities of interest (COIs) working towards the NextGen vision for net-centric capabilities. This process resulted in Joint Resource Council (JRC) approval of funding to implement a set of requirements for SWIM Segment 1 capabilities. The SWIM program has selected a common suite of software (the SWIM "service container") that provides as set of core capabilities (messaging, security, etc.). The SIPs are responsible for developing mission services (flight services, weather services, etc.), which can be built using the core capabilities provided by the SWIM service container software to interface to data and processing resources within the NAS systems (ERAM, TFM, etc.). These mission services, made accessible over the FAA Telecommunications Infrastructure (FTI) IP network, will allow NAS systems to interoperate and share data. The SWIM core capabilities, mission logic, and data services, are implemented by SIPs, and operated and maintained by the same staff that operate and maintain the individual NAS systems.

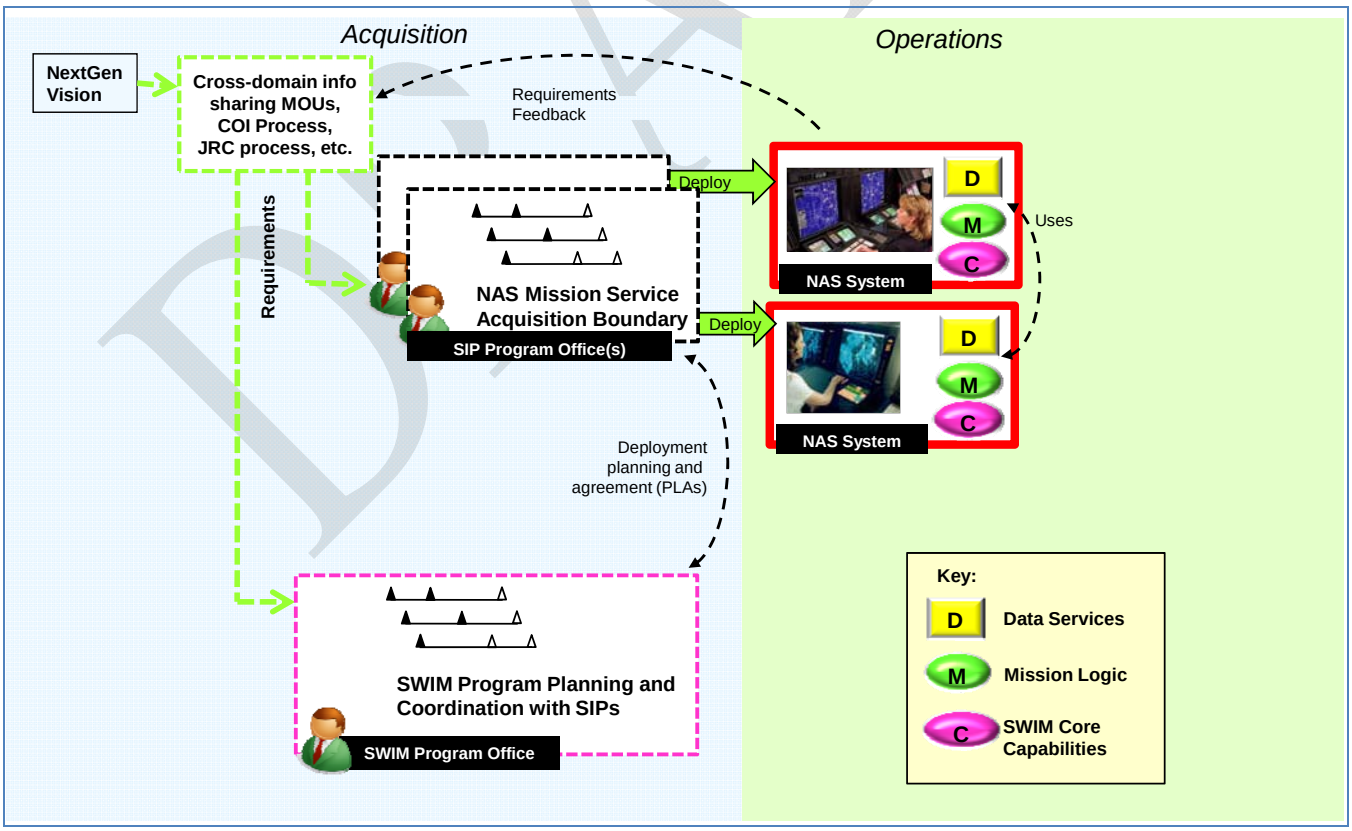


Figure 5 SWIM Segment 1 Acquisition and Operations Overview

DRAFT

In contrast, a notional overview of the SWIM Segment 2 concept for acquisition and operations is shown in Figure 6 below. The fundamental change in this concept is that the SWIM Program office now has responsibility to develop and deploy a "SWIM Core" containing a set of consolidated core services. NAS mission services providing NAS data services may continue to be acquired, deployed, and operated within specific NAS systems. However, in the hybrid model, some NAS mission services are assumed to be identified by a NAS portfolio requirements allocation process as appropriate to deploy to the SWIM core. In this case, these services would still be developed by a NAS system program office with the necessary NAS mission subject matter expertise. However, these services would not be deployed within an existing NAS system boundary; they would be deployed to the SWIM core, within which they would be operated and maintained by SWIM operations staff. The SWIM core will utilize underlying network services (e.g. FTI, LANs, etc.) supported by Technical Operations (ATO-W). Computing resources (e.g. servers) may be considered part of the SWIM core, to be operated and maintained by SWIM operations staff, or may also be considered underlying IT resources, to be provided and operated by separate IT infrastructure support staff.

Further analysis is required in defining non-functional requirements. The definition of clear non-functional requirements is preceded by the establishment of a preliminary functional architecture. However, preliminary analysis indicates it is likely that much more stringent performance requirements will be applied to Segment 2 compared to Segment 1 due to the pervasive support to real time operations that Segment 2 appears to include. There will also be much broader and more open involvement of non-NAS users, increasing the security concerns. The need for more adoption of, and adherence to, standards is highly likely. In particular, the use of common, standardized data structures is likely critical to reaching the desired level of interoperability, reuse and agility. The roles of Governance will shift markedly – most likely increasing, especially in run time.

DRAFT

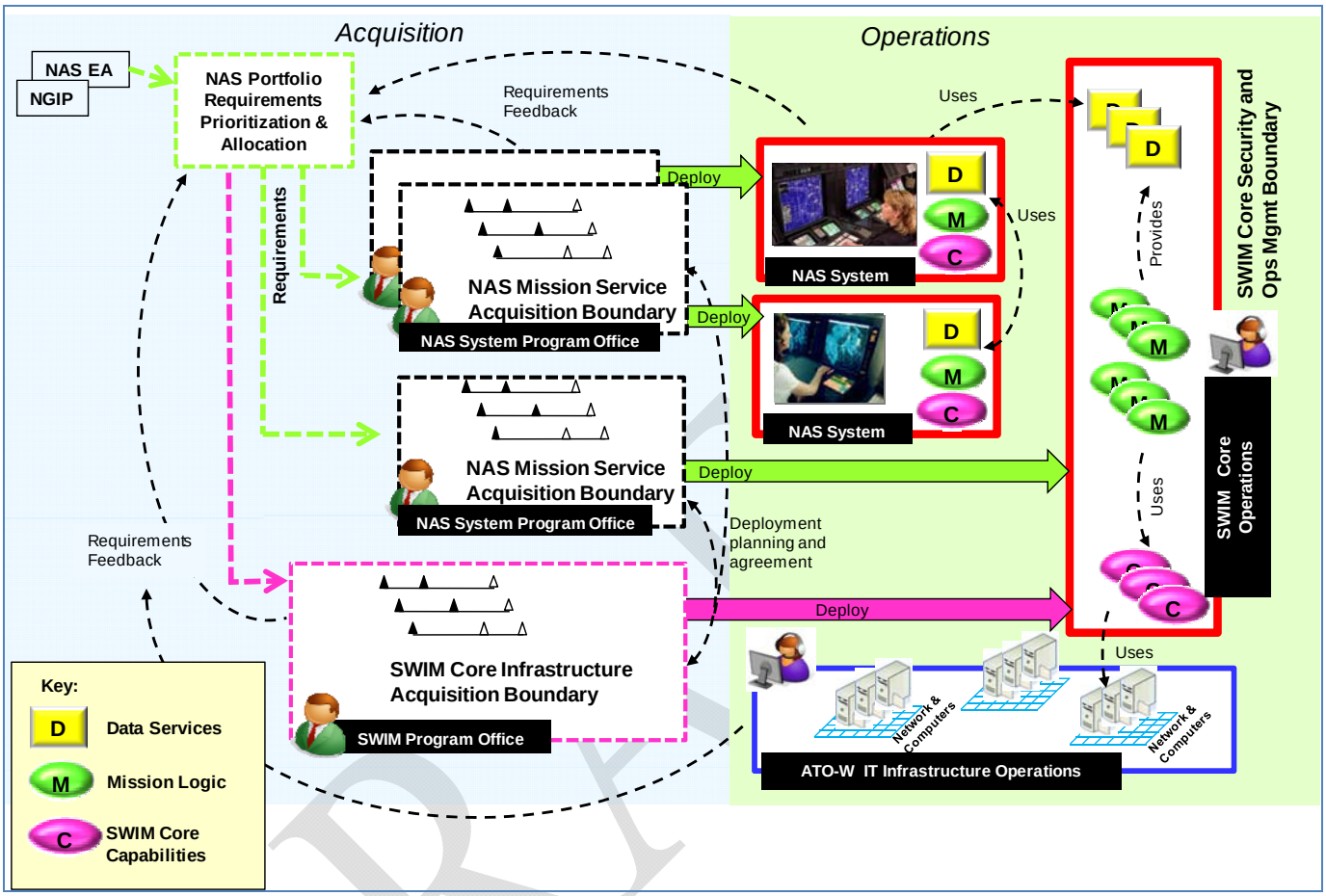


Figure 6 Notional SWIM Segment 2 Acquisition and Operations Concept

DRAFT

9. Appendix

We should note that the analysis presented in this Appendix is preliminary, and may be expected to be augmented by, or replaced by, ongoing enterprise architecture (EA) definition efforts. As operational and system views for the mid-term NAS EA are developed, these views are expected to show in more detail the information flows and the role of SWIM. However, at the time this document is being written, those EA artifacts (operational and system views for the mid-term) do not exist at a level of detail that can be used to support this analysis. Therefore, in order to provide a basis to guide the evolution of SWIM into Segment 2 and beyond, MITRE developed the following 16 tables documented in their draft report "Operational Concept for SWIM in the Mid-Term". These tables are based on the narrative operational concept descriptions. The information sources, mission logic, and information sinks shown in the tables are all based directly on material in the narrative descriptions. However, many subjective judgments were made when categorizing systems as sources, processors, or recipients of information, in order to keep each table to a single page and to facilitate an examination of how SWIM might support the capability. As might be expected for an enabling technology, SWIM was usually mentioned only very briefly in the narrative descriptions, therefore we used engineering judgment in proposing SWIM's role. Some of the factors that went into this judgment are described below:

- Consistency with NextGen Net-Centric Operations vision and goals. For example, in order to create loose coupling between producers and consumers, information flows should, in general, be mediated by SWIM rather than being sent directly between systems.

- Knowledge of the capabilities and best uses of the technology being used in SWIM Segment 1 and likely to be available for SWIM Segment 2. We have thorough knowledge of the capabilities of the SWIM Service Container software and other products in this technology space. We considered allocating to SWIM functions that would make the best use of this technology (messaging, service composition, etc.).

- Knowledge of best practices and other government and industry efforts with goals similar to SWIM. We have tried to apply the lessons of successful programs such Global

DRAFT

Combat Support System – Air Force (GCSS-AF), which provides a good example of how SOA technologies can be applied successfully.

- Mission logic that is highly specific to a particular NAS domain was not generally allocated to SWIM (although SWIM might be used to allow other NAS systems to provide inputs to, or receive outputs from, this logic).
- Mission logic that was highly resource intensive (for example, trajectory modeling, weather prediction algorithms) was considered more appropriate for being implemented internal to a specific system rather than being allocated to SWIM.
- Functionality that is already firmly slated for inclusion in NAS systems under development was not generally considered for allocation to SWIM. (However, this did not apply to functions currently only being explored in prototype systems – these were considered candidates for allocation to SWIM in the mid-term, where appropriate.)

It is expected that, as the EA work progresses, the information in these tables can be updated, or perhaps even integrated into the EA views.

DRAFT

Table A-1 Flexible Airspace Management

Capability: Flexible Airspace Management [NAS EA OI: 108206]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Pre-defined airspace sectorization alternatives	Created locally by ERAM, stored by AIM	Based on prediction and assessment of the factors that affect sector workload, reconfigure select high altitude en route airspace within a sector based on pre-defined configurations. Provide current sectorization information to affected ATC facilities and traffic managers Provide notification of changed sectorization to affected ATC facilities and traffic managers	ERAM: Define airspace sectorization alternatives AIM: Store and provide access to predefined sectorization alternatives TFMS: Predict congestion TFMS and ERAM (in collaboration): Make decisions to reconfigure airspace SWIM: - Provide input data message flows to TFMS and ERAM - Support TFMS and ERAM collaboration - Distribute sectorization information and change notifications to affected subscriber systems	Current airspace sectorization and status	TFMS ATC systems: ERAMs, TRACONs	Some triggers (e.g., weather) are typically TFM concerns. Therefore, the degree of automated coordination needed for TFM–en route ATC coordination needs to be determined. (Collaboration tools may be needed to support this coordination.)
Information to predict changes in sector workload (planned TFM flow constraints, airport status, weather, etc.)	TFMS TDDS Weather Systems					
SAA status (activation, deactivation)	ERAM, AIM					
Notification of changed state of sectorization	ERAM					

DRAFT

Table A-2 Initial Conflict Resolution Advisories

Capability: Initial Conflict Resolution Advisories [NAS EA OI: 102114]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Schedule times for SAAs	AIM	Clearances are provided to aircraft after analyzing flight conflicts consistent user-preferences, TMIs, and constraints.	ERAM: Perform conflict resolution, resulting in new clearances and flight plan amendments Voice or A/G Data comm.: Deliver clearances to aircraft SWIM: - Transfer TMIs, SAAs, Weather, etc. input information to ERAM - Distribute flight plan amendments to affected subscribers	Simple aircraft-specific resolution clearances (via voice and A/G Datacomm.	Aircraft	
Flow Management Time (FMT) information	TFMS automation such as TMA			Flight plan amendments	Downstream ATC facilities (ERAM, TRACON) and TFMS	
Traffic Management Initiatives (TMI)	TFMS				Airspace users (e.g. FOCs)	
Convective weather	Wx Systems (Wx cube?)					

DRAFT

Table A-3 Point-in-Space Metering

Capability: Point in Space Metering [NAS EA OI: 104120]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Route Preferences	Airspace users (see CATM)	Traffic managers designate flow managed resource points and the capacity of these points. (initially manual, later automated) Model trajectories, and determine optimal schedules for flights to utilize resource points. Publish results (flow managed resource definitions and schedules) to impacted systems and users.	TFM automation (e.g. TMA): Determine meter point fix schedules ERAM: Use TBFM defined schedules, whether for en route, arrival or departure fixes, to establish aircraft-to-meter point time problem detection and resolution. SWIM: - Provide facilities for airspace users to enter preferences and intended and filed flight plans (see CATM capability) - Distribute flow managed resource definitions and schedules to the appropriate consumers	Flow managed resource definitions and schedules for en route, arrival, or departure fixes	Airspace Users (AOC, GA) participating in CATM	TBFM is a conceptual capability and can be implemented in several ways. See the Collaborative Air Traffic Management with Full Flight Plan Evaluation capability for a discussion of exchange of TBFM information with airspace users.
Flight plans (intended and filed)	Airspace Users (see CATM), ERAM				ERAM – for aircraft to meter point problem detection and resolution	

DRAFT

Table A-4 Initial Surface Traffic Management

Capability: High-Density - Initial Surface Traffic Management (NAS EA OI: 104209)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Aircraft surface position data	ASDE-X	Aircraft surface position data is combined with flight ETAs and STAs to develop collaborative departure schedule to accommodate flight operator preferences.	SDSS, SWIM: Notionally, STBO logic could be implemented using SWIM core ESB capabilities	Aircraft surface position data	Gates and Ramps	SDSS is a functional capability which is planned for implementation without new automation. SWIM core may be an option for some mission logic.
				Departure schedule data	ATC: TFM automation, ERAM TRACONs, etc.	
				Flight data		
				Departure flow management capabilities (?)		
Departure schedule data	EFS			ETAs and scheduled times of arrival (STAs)		
Flight data	ERAM			Updated pushback times, parking gate assignments, predicted arrival times, etc.	FOCs Aircraft	
Departure flow management capabilities	TFM automation (TBD)					
ETAs and scheduled times of arrival (STAs)	TMA			Request for departure sequences and slot swaps	FOC	
Flight operator preferences	Flight operators					
Departure schedules	STBO capability					
Runway assignments	STBO capability					

DRAFT

Table A-5 Time-Based Metering Using RNP and RNAV Route Assignments

Capability: High-Density - Time-Based Metering Using RNP and RNAV Route Assignments [NAS EA OI: 104123]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Departure schedules for flights	EDC in TMA, also DSP and DFM prototype	Develop schedules to the runways based on the each aircraft's nominal runway assignment and associated RNAV and RNP route. Dynamically assign the aircraft to the runway (or even an alternative route) that maximizes the airport's arrival throughput (during any peak arrival periods.)	TMA: Determine metering schedules (FMTs), RNAV/RNP routing, and runway assignments for aircraft. ERAM: Determine aircraft specific conflict free descent profile based on meter point times and issue clearance. En route controller (with PARR): Control aircraft based on RNAV/RNP routes to meter points, and time based metering schedules. Air/Ground Datalink, Voice: Deliver clearances, runway assignments and RNAV/RNP routes to aircraft. SWIM: Deliver TMA runway assignments, routing, and meter schedules to consumers. Deliver departure schedules to consumers.	Aircraft-specific RNAV/RNP routing, meter point times, and FMT	ERAM	Runway assignment and associated RNAV/RNP routing data to aircraft may be safety critical, which might preclude use of SWIM. TMA will have a name change to Time Based Flow Management (TBFM) sometime in the near future
Runway capacity information	TBD			New runway assignment and associated RNAV/RNP routing data	TFMS (?) Terminal automation (?)	
Meter point locations	TBD			Departure schedules for flights	ERAM FOCs	
Nominal and alternate RNAV/RNP routes	TBD			New runway assignment and associated RNAV/RNP routing data	Aircraft (via voice or datalink)	

DRAFT

Table A-6 Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures

Capability: Wake Turbulence Mitigation for Departures (WTMD): Wind-Based Wake Procedures [NAS EA OI: 102140]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Wind measurements from local sensors	ASOS	Forecast when winds meeting WTMD criteria exist at the airport in the applicable departure region. Detect the loss of WTMD conditions sufficiently in advance that safe separation from wake turbulence is assured for all departing aircraft. Communicate to ATC when WTMD conditions exist and provide timely alerts prior to loss of these wind conditions.	Weather systems (TBD): Provide forecasting capability TFDMS (notional new system or capability): Determine when WTMD conditions do and do not exist SWIM: - Route wind data and forecasts to TFDMS system - Provide loss of WTMD conditions notifications to consumers - Provide WTMD status information to consumers	WTMD feasibility indications and alerts	Tower controllers and supervisors TRACONs (?)	Follow-on research will examine an evolution of additional applications including: • Wake Turbulence Mitigation for Arrivals (WTMA) • Wake Turbulence Mitigation for Single Runway Departures (WTMSRD) • Wake Turbulence Mitigation for Single Runway Arrivals (WTMSRA)
Rapid Update Cycle (RUC) winds aloft data	NOAA?			Status of WTMD at applicable airports	NAS users (not need for initial capability)	
Other weather data - TBD	Other weather sources - TBD					

DRAFT

Table A-7 SWIM Enhanced Surface Traffic Operations

Capability: Flex-Term - Enhanced Surface Traffic Operations [NAS EA OI: 104207]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Full route of flight and other flight data	ERAM	Add surface data (e.g., taxi ops, clearances) and events (e.g., OOOI data) to flight data received from ERAM and update departure clearance in flight data domain	TDFM SWIM: Deliver an initial set of tower or cockpit generated information (e.g., departure clearance status or runway assignment when available) to other NAS systems	Full route of flight and other flight data	TDLS (via TDDS)	This capability is not required but it is desirable (to the extent that it can meet requirements) to provide access to flight data and facilitate the evolution of the infrastructure towards NextGen.
Reroute plans & departure schedules	TFM			Reroute plans & departure schedules	TDLS (via TDDS)	
Departure clearances, runway assignment, & taxi route instructions	TDLS			Departure clearances & Taxi route instructions	Aircraft via data communications	
				Surface data (e.g., taxi ops, clearances) and events (e.g., OOOI data)	ERAM	

DRAFT

Table A-8 Improved Management of Airspace for Special Use

Capability: Improved Management of Airspace for Special Use [NAS EA OI: 108212]						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Definition of SAA geometric volume and characteristics.	Authorized users via web browser-based tools. (?) NASR database. National ATCAA database	Identify and authorize users. Provide web-based interface to allow authorized users to define and schedule SAAs, subject to review and approval workflows. Enforce lead-time requirements on SAA scheduling. Provide SAA product to consumers, combining information from all sources.	SWIM: - Host web based applications for SAA input and editing - Authorize users and systems for access to retrieve and update SAA information - Manage information distribution and notification to consumers SAMS: Maintain authoritative database information	SAA Information (definitions and schedules)	ERAM TFMS ANSPs and NAS users	The Aeronautical Information Management (AIM) Community will support adoption of the Aeronautical Information Exchange Model (AIXM) schema.
SUA definitions and schedules	MADE SAMS ERAM			SAA Status Updates (Activation/deactivation)	Airspace users ATC automation systems. Aircraft (via FIS-B for GA & commercial aircraft via FOC)	
Non-SUA definitions and schedules (MOA, Restricted Area, etc.)	AIM					

DRAFT

Table A-9 Provide Full Flight Plan Constraint Evaluation with Feedback

Capability: CATM - Provide Full Flight Plan Constraint Evaluation with Feedback (NAS EA OI: 101102)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
User preferences (routes, altitudes, and fleet priority)	FOC	Validate and accept intent information Validate and accept flight plans (and updates) Evaluate "What if" requests against conditions that would impact flights Detect changed conditions that would impact intended or filed flights and notify subscriber Route filed flight plans to ERAM system at departure ARTCC	TFMS: Perform trajectory modeling, "what-if" analysis, determine which events affect which flights SWIM: - Identify and authenticate users requesting analyses - Deliver input information to TFMS - Distribute file flight plans to the appropriate ATC (ERAM) facility - Determine which consumers need to be notified about an affected flight, and deliver notifications	Filed flight plans	ERAM	Most of the mission logic functionality would likely be allocated to TFMS, however some functionality may be allocated to SWIM core.
Intent information (and intent modification)				"What if" analysis: current and predicted information for flight along path	FOC	
Flight plan filing (and flight plan modifications)				Notifications of impact to filed or intended flight plans		
Weather	Wx systems?					
Traffic Management Initiatives	TFMS					
Airspace information SUA status	AIM					
Required a/c performance characteristics	AIM					
Restrictions (LOAs, SOPs, SAA)	AIM					
Terminal status	TDDS					
NAS Status	TB					

DRAFT

Table A-10 CATM - On-Demand NAS Information

Capability: CATM with On-Demand NAS Information (NAS EA OI: 103305)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Congestion predictions; planned TMIs	TFMS	Collect needed NAS static and dynamic data from ANSP authoritative sources Process collected data into NAS Status information in a standardized format Disseminate requested information to NAS User systems (based on security and privacy profiles) on the ground or to aircraft systems If the specific service request is human-readable information, transform information for display (?)	SWIM: Notionally, the bulk of this mission logic for assembling information and determining impacted subscribers could be allocated to the SWIM core, possibly utilizing services provided by TFMS (e.g. trajectory modeling) Air/Ground datalink: Deliver information to aircraft	NAS Status Data both static and dynamic as requested (in machine readable form)	FOCs, Other ANSPs	Both request/response and publish/subscribe exchange mechanisms have to be supported. It is assumed that all data/information is not safety critical. All users and user systems in this OI are external and will have to be screened as per pre-established security and privacy profiles for information access. Standard information exchange models such as AIXM are expected. For Wx information, Open Geospatial Consortium (OGC) services and standards are being considered.
Airspace constraints				NAS Status Data – dynamic	Aircraft with FMSs and datalink GA aircraft	
Facility outages and closures						
Current Wx constraints and SIGMETs	WX systems					
Facility outages and runway closures	Various					
Airspace (including SAA) and airway definitions; NAS facility locations; Inter-facility LOAs, MOUs, standard procedures, etc.	AIM					
SAA usage schedules	AIM					
SUA status	AIM					
Non-SUA status	ERAM					

DRAFT

Table A-11 Traffic Management Initiatives with Flight Specific Trajectories (Go Button)

Capability: Collaborative ATM with Traffic Management Initiatives with Flight Specific Trajectories (Go Button) (NAS EA OI: 105208)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Flight plans and user submitted preferences	FOC	Use flight plans, user preferences, available airspace congestion information, and location and trend of weather problems to analyze flight paths for affected flights Analyze and suggest Route Modifications for a group of flights. Upon decision to execute, probe route modifications for problems and suggest corrections and generate flight-specific clearances	TFMS: Determine to execute TMIs with Flight Specific Trajectories, suggest trajectories to ERAM ERAM: Probe route modifications suggested by TFMS. Suggest corrections if problems detected, otherwise coordinate with pilot, and issue new trajectory if accepted SWIM: - Route input information to TFMS - Route new proposed trajectories to ERAM for acception or rejection - Route new accepted flight trajectories to affected ATC facilities and NAS users Air/Ground Datalink: Provide new trajectories to aircraft	Execution of Flight-specific Route Modification TMIs	ATC personnel and NAS Users	
Route Modification TMIs – rerouting, MIT restrictions and altitude profile changes	TFMS			Flight-specific clearances	Aircraft	
Airspace congestion information						
SAA status	ERAM					
Near real time Weather	CIWS, ITWS					
Airspace and SAA information	AIM					
Decision on TMI initiative – modify, cancel, or execute	TFMS					
Flight-specific clearances	ERAM					

DRAFT

Table A-12 Trajectory Flight Data Management

Capability: Collaborative ATM with Trajectory Flight Data Management (NAS EA OI: 101202)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Intent information (and intent modification)						
Flight plan filing (and flight plan modifications)						
Weather	WX systems					
Traffic Management Initiatives	TFMS					
Airspace information SUA status	AIM					
Required a/c characteristics(RNAV/ RNP) for airspace	AIM					
Restrictions (LOAs, SOPs, SAA) and congestion information	ERAM					
Terminal status	TDDS					
In-flight position and state information	Flight deck (via A/G data comm., ADS-B)					

DRAFT

Table A-13 Trajectory-Based Weather Impact Evaluation

Capability: Trajectory-Based Weather Impact Evaluation (NAS EA OI: 103119)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Weather Data	Weather sensors and CIWS & ITWS	Weather data from multiple sources is combined to form a single authoritative source of Wx data for all domains	NNEW Decision Support Tools (potentially integrated into ERAM, TFMS): evaluate flight trajectories against the weather information to assist in providing safe operations SWIM: Role of SWIM core in implementing NNEW logical 4D weather cube is TBD ADS: Deliver weather information to aircraft	4D Weather Cube Information	TFMS DST ERAM DST FOCs	NNEW itself uses SOA to create a single authoritative source of weather info. Distribution of the 4D weather cube information to users is via SWIM.
Flight Plan information and user preferences on trajectories	Flight data authoritative sources via SWIM (See Trajectory Flight Data Management)			Improved trajectories considering Wx impact	FOCs	
				4D Weather picture	Cockpit (via FIS-B) Terminal operators Tower operators	

DRAFT

Table A-14 SSA & Information Systems Security (ISS) Integrated Incident Detection and Response

Capability: SSA & Information Systems Security (ISS) Integrated Incident Detection and Response (NAS EA OI: n/a)

Data/Service Provided	Likely Producer	Mission Logic	Possible Contributing Systems	Information Received/ Service Utilized	Receiver/ Consumer	Notes
Flight plans and proposed trajectories preferences	FOCs	Collect, correlate, and track NAS operational incidents from various domains Collect, correlate, and track NAS cyber-related incidents Both types of incidents are provided to the DoD, DHS, and others as needed	SITS: Manage operational incident information CSMC Security Information Management (SIM): Manage FAA cyber incident information SWIM: - Manage subscriptions to information and publish to subscribers - Perform individual user identification and authorization for access to information - Notionally, SWIM ESB capabilities could be used to create work flows to process incident information - Provide utilities to facilitate collaboration	Cyber-related security incidents	DoD Event Management Framework (EMF) DHS, others	Collection of information internally in the FAA can use SWIM. The definition of SITS is on-going and could be SWIM-centric. Connections to EMF need to be secure and may involve classified information. These can be SWIM or non-SWIM. If SWIM then there are requirements for carrying classified data. In the future, improved information sharing and collaboration capability will be developed across both air and cyber domains.
Surveillance Information	Sensors and surveillance integrators			NAS Operational Incidents	DoD Event Management Framework (EMF) DHS, others	
Cyber-related security incidents	DOT/FAA Cyber Security Management Center (CSMC)					
NAS Operational Incidents	Reported to FAA security personnel, who would provide the information via SITS.					

DRAFT

Table A-15 Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment

Capability: Operational Security Capability for Threat Detection and Tracking, NAS Impact Analysis and Risk-Based Assessment (NAS EA OI: n/a)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Possible Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
Flight plans and user preferences	FOC	Perform airspace security risk flight detection and monitoring functions based on (1) flight-specific risk information provided by DHS, and (2) by trajectory-based risk assessment algorithms that include probing against security element volumetric expressions. Plan and implement airspace security measures, taking into account NAS impacts. Perform post-event analysis capabilities. Exchange status and tracks of suspected flight deviations with mission partners.	ERAM: Provide trajectory modeling and probing services. ADAPT SITS AAFAS (NEO): Perform risk detection, plan and implement response. SWIM: - Identify and authorize mission partners for access to security risk information. - Route requests for risk detection trajectory modeling and probing services to appropriate ERAM facility - Orchestrate workflows to handle anomalous flights when detected - Distribute information to mission partners. - Provide collaboration services	Tracking of pre-identified flights and anomalous flight deviations from planned trajectories.	DHS, DoD and mission partners	Collection of information internally in the FAA can use SWIM. The definition of SITS is on-going and could be SWIM-centric. Connections to EMF need to be secure and may involve classified information. These can be SWIM or non-SWIM. If SWIM then there are requirements for carrying classified data. In the future, improved information sharing and collaboration capability will be developed across both air and cyber domains.
Flight-specific risk information	DHS			TFM Services ERAM Services (security related)	Operations Security (SITS)	
Flight-specific intended trajectories Other TMIs	TFMS					
En route flight data Deviations from intended trajectory	ERAM, SITS			Flight security information	ERAM, TFMS	
Airspace definitions including SAA and TFRs.	AIM					

DRAFT

Table A-16 Information on System Security and Surveillance Integration/Protection

Capability: Information on System Security and Surveillance Integration/Protection (NAS EA OI: n/a)						
Data/Service Provided	**Likely Producer**	**Mission Logic**	**Contributing Systems**	**Information Received/ Service Utilized**	**Receiver/ Consumer**	**Notes**
En Route Flight Data Information including tracks	ERAM	Surveillance data from existing primary and secondary radar tracks and those from ADS-B equipped aircraft is fused together. Associated flight information with the tracks in the integrated picture Share integrated surveillance picture with associated security information with others inside and outside the NAS based on security profile.	SITS: Create integrated surveillance picture SWIM: Disseminate picture to customers.	Integrated surveillance picture	Security mission partners such as DoD, DHS, law enforcement	SWIM Segment 2 may have to support a limited integrated surveillance network information/picture; more sophistication in Segment 3 The NAS Boundary protection may have to protect data and video transmission outside the NAS; video is a new requirement.
ADS-B tracks ADS-Rebroadcast	Aircraft and ADS-B integration and repeater systems					
Integrated radar tracks	Primary & secondary radars					
Cyber-related security information	CSMC SIM capability					

DRAFT