System Wide Information Management (SWIM)
Final Program Requirements
Segment 1

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1.0 BACKGROUND

Today's National Airspace System (NAS) comprises a myriad of systems developed over time for specific purposes. In general, they are connected discretely to support yesterday's decision making needs. Each of these interfaces is custom designed, developed, managed, and maintained individually at a significant cost to the Federal Aviation Administration (FAA). The Next Generation Air Transportation System (NextGen) relies upon a new decision construct that brings more data, systems, customers, and service providers into the process. Data will be needed at more places, for more purposes, in a timely manner, and in common formats and structures to ensure consistent use. The resulting decisions must then be distributed to the affected parties efficiently and reliably to support timely execution.

Based on these information needs, shortfalls were documented in the SWIM Mission Shortfall Statement (MSS), approved September 6, 2005 at the Investment Analysis Readiness Decision. The following identifies the improvements that SWIM will provide for each shortfall identified in the MSS. Appendix A provides traceability from the MSS to the SWIM Program technical requirements.

1. **Costs to develop, test, deploy and support new interfaces and applications are too high.** Costs of developing and maintaining custom point-to-point interfaces limits connectivity.

   SWIM enables:
   - Reusable, loosely coupled interfaces versus many point-to-point interfaces
   - Reduced time and complexity for building new applications and interfacing existing applications
   - Common shared services for information management replacing costly redundancies

2. **The NAS is not an agile air traffic system.** The NAS is difficult to dynamically adapt to special events, disruptions and changing NAS user business models.

   SWIM facilitates:
   - Greater independence of geographical facilities and operations
   - Easier and quicker system failure recovery
   - Special events planning and implementation
   - Automation and platform convergence consistent with the NAS Enterprise Architecture

3. **Data sharing in the NAS is labor-intensive.** Agility requires rapid, widespread and cost-effective dissemination of information. The current NAS infrastructure makes this cost prohibitive.

   - SWIM provides the conduit so that shared data can be published once and distributed electronically.

4. **Timely access to common data is lacking in the NAS.** A lack of shared situational awareness limits visibility into the current state of the NAS for NAS users and their customers.

    - SWIM makes published data available to all authorized users

5. **The underlying tools to support becoming a performance–based organization are currently lacking.** The information required to measure and monitor NAS performance is often not available; this limits the ability of the FAA to meet its goal to become a performance-based organization.

    - SWIM provides the mechanism so that published data can be mined for appropriate metrics.

2.0 OPERATIONAL CONCEPT

2.1 Operations

The FAA is a large producer, collector, consumer, and disseminator of information across the NAS. Because of the extent of the FAA's information activities, and the dependence of those activities upon stakeholder cooperation, the management of information resources is an issue of continuing importance.

The free flow of information within the NAS and between the FAA and its stakeholders is essential to NAS safety, capacity and efficiency. It is essential that the FAA minimize the cost of its information activities while maximizing information usefulness.

The operational concept for SWIM is to provide an open, flexible, modular, manageable, and secure information management and sharing architecture for NAS operational data. This includes but is not limited to aeronautical information, flight data, traffic flow management, surveillance, and weather information. To achieve this concept, the strategy for SWIM is to migrate NAS applications toward a loosely coupled, open distributed processing environment focused on information sharing (where loosely coupled systems tend to be highly scalable, robust and agile). These open architecture principles provide value by reducing costs, reducing risks, enabling new services, and extending and therefore adding value to existing services.

SWIM will be developed incrementally based upon the needs of various data communities, maturity of concepts of use, and segments that are right-sized to fit reasonable cost, schedule, and risk thresholds. To define Segment 1, SWIM system engineers collaborated with stakeholders (called Communities of Interest (COIs)) who possess the expertise to accurately describe how information is currently being used in the NAS, predict future NAS information needs, and discern how to best fulfill those needs using a net-centric solution. COIs currently include Aeronautical Information Management (AIM), Flight and Flow Management (F&FM), and Weather; others (e.g., Surveillance) will form as needed over time.

The COIs determined that there were nine services that SWIM Segment 1 will provide. An overview of the Segment 1 capabilities by COI is included in Appendix C. The nine services are:

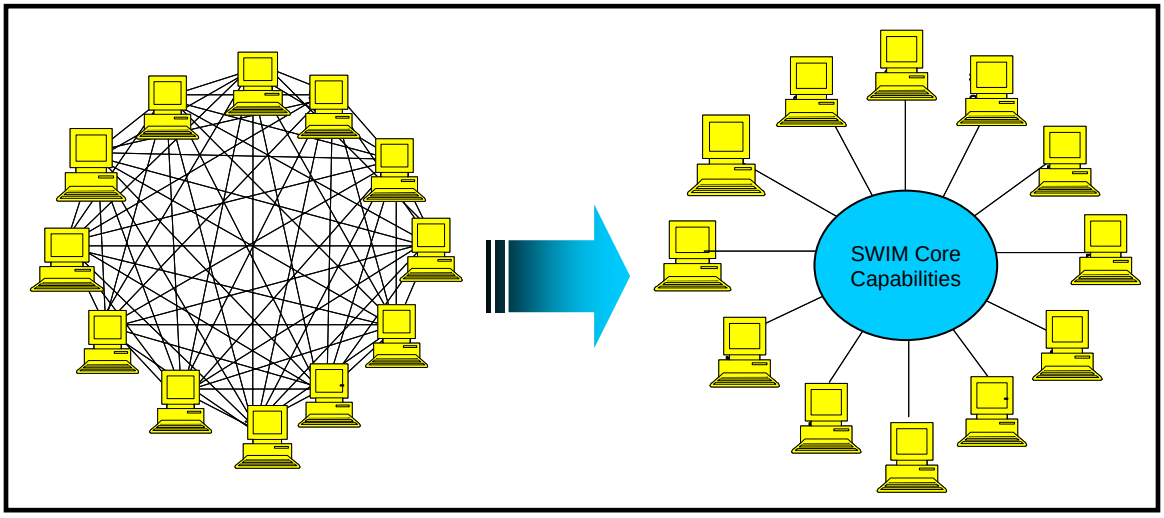
- F&FM COI:
  - Flight Data
  - Terminal Data
  - Flow Information
  - Runway Visual Range (RVR)
  - Re-Route Data
- AIM COI:
  - Special Use Airspace (SUA) Automated
- Weather COI:

- Corridor Integrated Weather Service (CIWS)
- Integrated Terminal Weather Service (ITWS)
- Pilot Report (PIREP) Data.

Rather than developing a separate infrastructure, the SWIM program will provide Government Furnished Equipment (GFE) Core Capabilities software to the NAS programs that provide the capabilities that comprise Segment 1 (referred to as the implementing programs). These implementing programs (such as En Route Automation Modernization (ERAM), Traffic Flow Management System (TFMS), AIM, CIWS, Weather Message Switching Center Replacement (WMSCR), and ITWS) will host the Core Capabilities software on their existing hardware, if available, or will procure hardware as part of a planned future release. These implementing programs will include configuration management, life cycle support, safety, and security for the Core Capabilities as part of their planned release upgrades, or as part of their new acquisitions.

The SWIM concept includes the ability to transform NAS application interfaces from a tightly coupled, point-to-point model into a Service Oriented Architecture (SOA) supporting loosely coupled (or minimally interdependent) services. This transformation is depicted in Figure 2-1. SWIM provides the flexibility to develop interfaces consistent with needs; it does not mandate a one-size-fits-all approach. The characteristics of each interface are determined based on the requirements and associated business case.

Figure 2-1 Point-to-Point Interfaces Transformed to SWIM

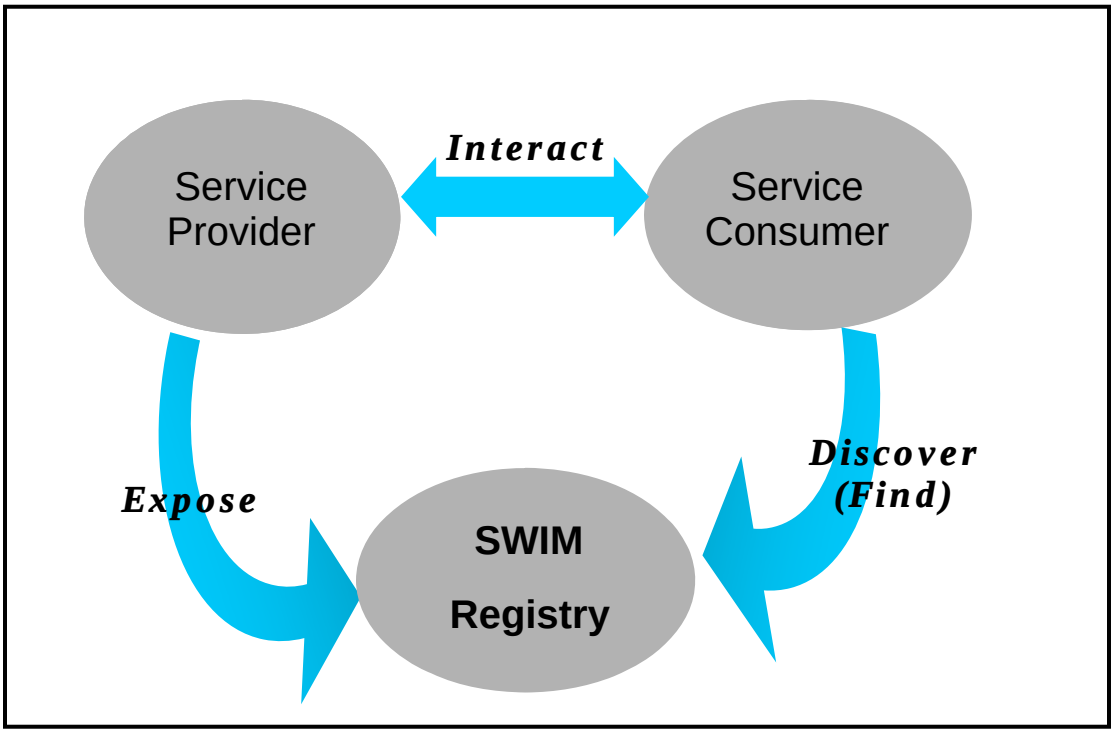


SWIM provides a set of Core Capabilities (described in Section 2.1.1) that facilitate development and execution of services on SWIM-enabled systems and the migration of NAS systems to SOA-based application. SWIM exposes a Service (Information or Application Service) for Service Providers and makes information about that Service available to known and potential users through SWIM Core Capabilities during Service development time. Service Consumers in turn use the Core Capabilities to locate and download information about the exposed services to generate and compile into

appropriate interface codes to consume and reuse the desired Service. The stated concept is the cornerstone of SOA-based integration. In the SOA environment, one method of service provision/consumption is the publish/subscribe model. Request/Reply is another SOA method, SWIM will support both approaches. A SWIM service in segment one is authorized for development with the allocated requirements through the SWIM program office and in the interest of the Community of Interest. Service development is preceded by Service Providers and Service Consumers resolving requirements and architectural issues through COIs as necessary. Each Service Developer (Service Provider/Service Consumer) develops service according to SWIM Policy and Guidelines (Section 2.1.3).

When development of a SWIM Service is completed, the service is deployed and monitored on a NAS System platform in the Run-time environment. During service execution, the approved platform provides service monitoring using SWIM provided GFE software, including monitoring the messages exchanged between the Service Provider and Service Consumer to capture and report any service execution anomalies. Figure 2-2 provides a top-level depiction of how the SOA service exposure and discovery activities, in concert with a service registry, can connect Service Providers and Service Consumers. A Service Provider exposes a service that is ready for use by providing information to the Registry. For example, a web service implementation could expose the service using Web Service Description Language (WSDL) for Design-Time purpose. The registry provides capabilities enabling searches (e.g., by service category). A Service Consumer can use the Registry to find and discover the characteristics of a service (e.g., using the registered WSDL) in the Design-Time. To consume a service in the Run-Time, the Service Consumer invokes the Service Provider using the pre-compiled Interface codes.

Figure 2-2 SWIM Service Oriented Architecture



2.1.1 Core Capability Descriptions

The following provides a top-level description of the SWIM Core Capabilities. The use of specific Core Capabilities is dependent on the business needs for each service. Every service will not necessarily require every Core Capability or the same capability level. Consequently, Core Capabilities will be subject to incremental implementation as requirements and programmatic priorities dictate. This document does not attempt to address potential increments. Furthermore, there is no intent herein to imply how or where Core Capabilities will be allocated in the system architecture.

Four types of Core Capabilities are described below. Core Capabilities isolate information technology (IT) concerns from business concerns, allowing developers to focus on applying service oriented principles to developing services without being distracted by IT issues. It also promotes re-use of existing services and the encapsulated infrastructure (Core Capabilities). This generates cost savings, mitigates much of the integration technology risk, and provides a point of control for implementing enterprise guidance and integration patterns.

Interface Management includes capabilities (Service Design-Time Environment) that enable Service Providers to expose services and Service Consumers to find services. It includes supporting capabilities such as descriptions of the services performed (typically, in a service registry) and data exchange requirements to assist in interface development. It also provides support for managing metadata such as the schemas that define the format and semantics of interface data elements.

Messaging includes mechanisms (Service Run-Time Environment) supporting a variety of service invocation styles (e.g., publish/subscribe, request/reply) and data exchange protocols. It enables message routing including the structures and metadata supporting routing and policy. Messaging capabilities can include delivery allowing service consumers to receive queued messages after reconnecting to the network. It provides Quality of Service (QoS) including priority and response time.

Security includes mechanisms (Service Design-Time and Run-Time Environments) to enforce security policies at the service and message level including providing authorization-based access to data and services. It ensures both Service Consumers and Service Providers can verify identities, authenticate themselves and assert access privileges via authorization; and ensures confidentiality of information exchanged while invoking and consuming services. It also protects information integrity, that is, guards against unauthorized modification of data and services. SWIM security is focused on application-level interfaces and messages consistent with enterprise SOA principles.

Enterprise Service Management (Service Design-Time and Run-Time Environments) includes Governance and Monitoring. Governance manages services across all service lifecycle phases based on conformance to SWIM Policies and Guidelines in Service Design-Time. Monitoring is how NAS system ensures the key requirements are met including the ability to capture, view, and report on service performance and usage. QoS and other performance metrics are defined and measured consistent with system and service requirements and address items such as throughput, reliability, availability, latency, response time, and fault data (e.g., for isolation and repair).

2.1.2 SWIM Service Lifecycle Descriptions

The nature of how SWIM Core Capabilities are used depends on the mode of operation. As mentioned above, Core Capabilities play a role in both development and execution of services. To clarify the discussion, two service lifecycle phases are defined: design-time and run-time. Design-time refers to the development activities preceding operational implementation of a service. Run-time refers to the activities during routine service operations.

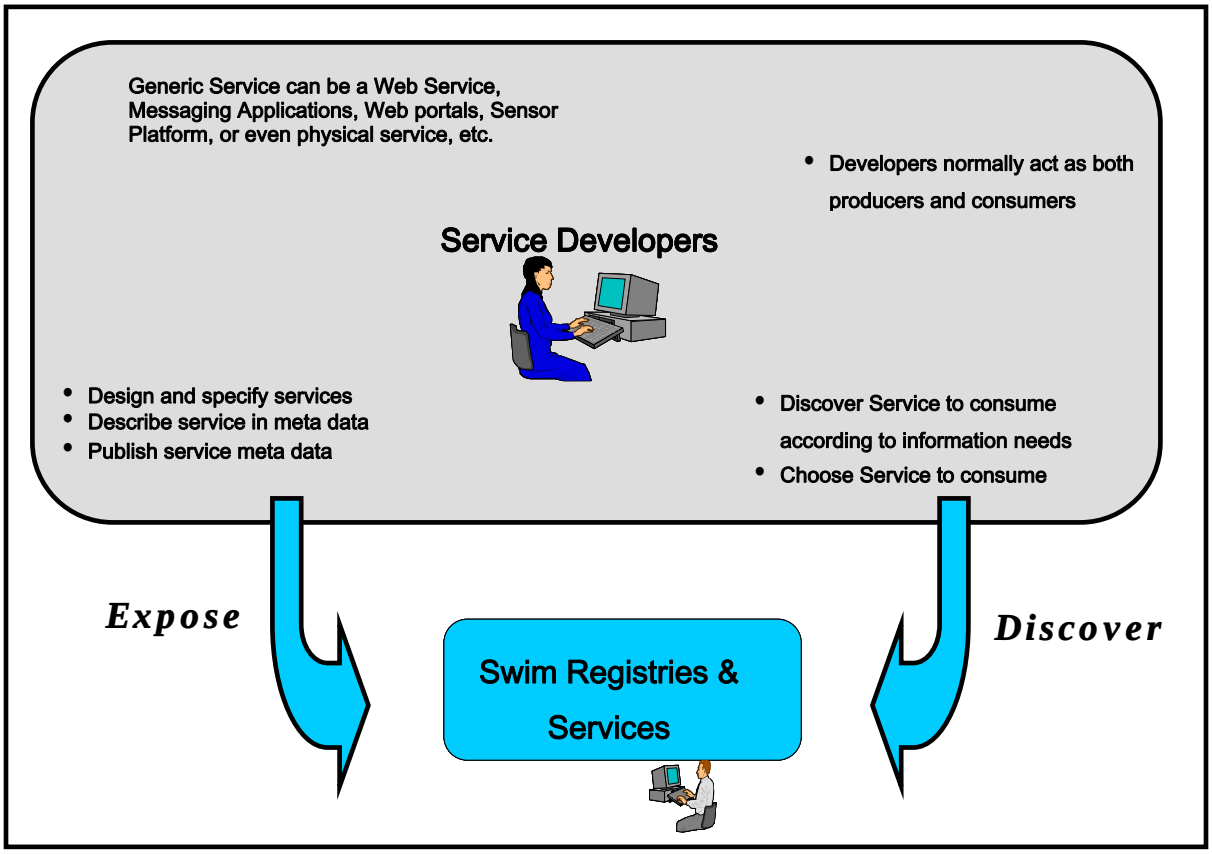
The following provides a description of each service lifecycle phase, highlighting SWIM capabilities to help users create, expose, discover, manage, invoke and consume services. Distinctions between design-time and run-time capabilities are highlighted as needed.

2.1.2.1 Design-Time (Development of Services)

The development of services begins when an operational need is identified and requirements are defined. Requirements are elaborated and design decisions are made that shape the service delivery approach. In particular, services can be developed independently but often will leverage existing services to provide a composite capability. That is, the service being developed can itself be a consumer of other services.
A service developer begins by using SWIM to discover available services. For example, a developer who wants to create a service that can forecast the arrival time of a flight at its destination airport may want to know what services are available that model flight trajectories. The developer will use SWIM discovery to learn about the relevant services (e.g., through the service registry). Service descriptions are available that detail the input,

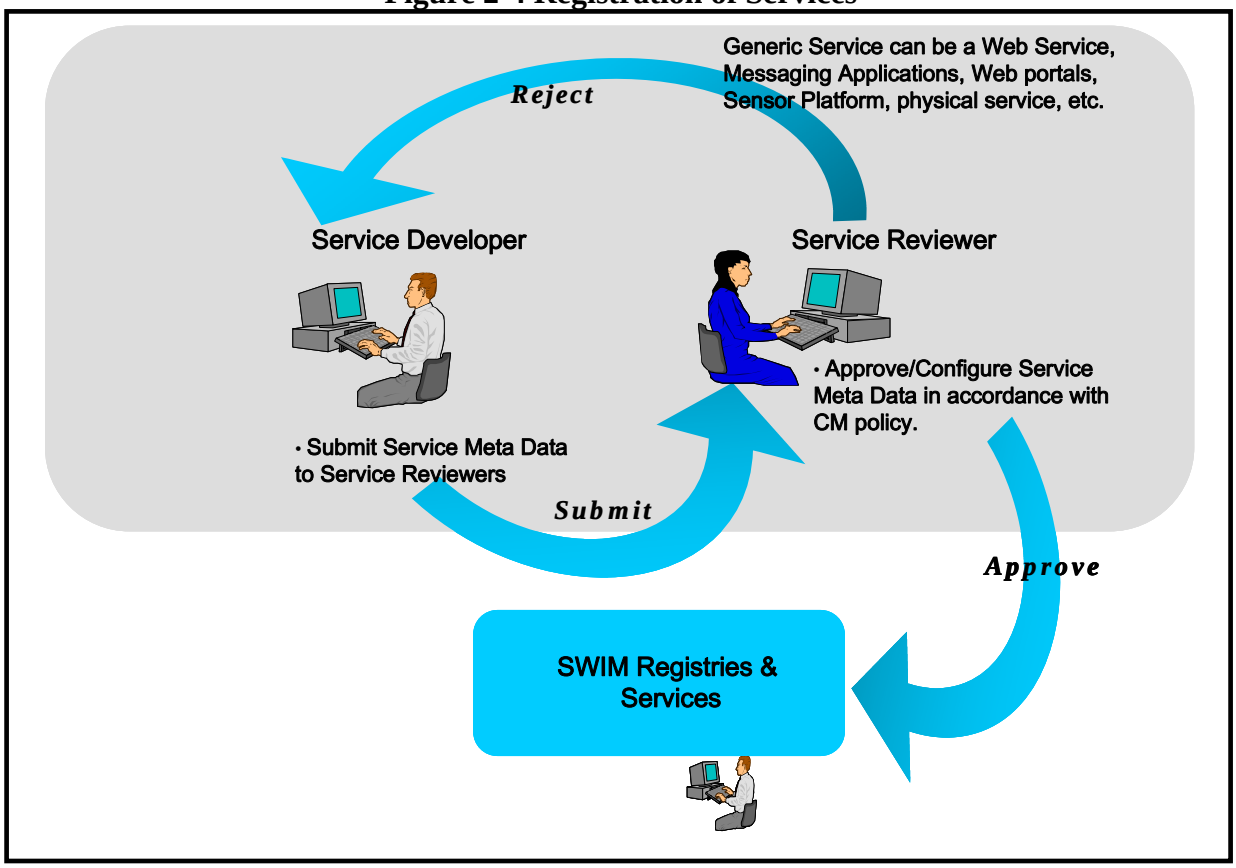
output and performance characteristics. When an appropriate reusable service is discovered, the developer can download a description of the service interface to enable it to be invoked by the new service. Security policies applicable to the service are used to ensure security-compliant service requirements are met. Similarly, service development is required to be performed consistent with applicable Governance policies and rules. Figure 2-3 provides an illustration of service development.

Figure 2-3 Development of Services



In the design-time phase, the service description and service interface specification are reviewed. Figure 2-4 provides an illustration of service development, review and registration. Review and registration are elements of design-time phase. Non-compliant services are rejected and returned to the developers for correction. The Service reviewer is a notional role within the COI or NAS domain that evaluates services for compliance with applicable SWIM guidelines and policies. This activity could be performed as part of the CCB process for the NCP containing the service or as part of the implementing program software QA process.

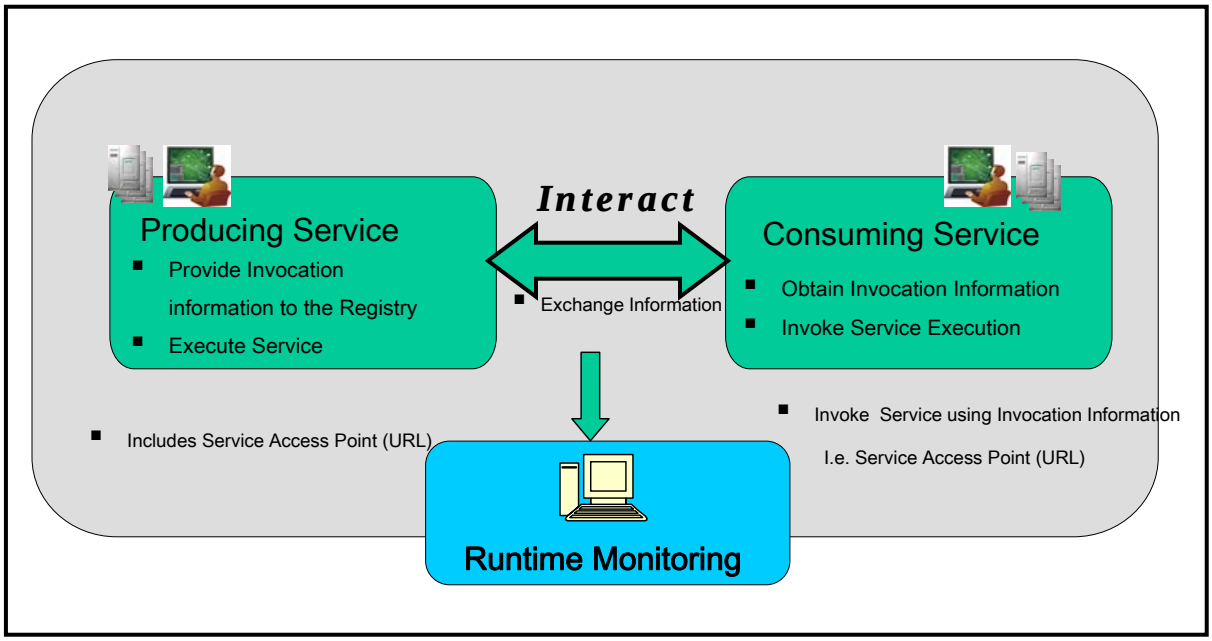
Figure 2-4 Registration of Services



2.1.2.2 Run-Time (Deployment of Services)

Once a service is developed, approved, and registered it is placed at the appropriate resource (e.g., computers, portals or server platforms) for operational use. This defines the beginning of the run-time phase of SWIM-enabled Service. The SWIM Enterprise Service Management and the Security Core Capabilities in each NAS platform using SWIM GFE software will monitor the latency, availability, and performance characteristics. Figure 2-5 provides an illustration of runtime deployment of services.

Figure 2-5 Runtime Deployment of Services



Service exposure in the run-time phase occurs after the service has satisfied all testing and review requirements in its native domain and it is placed into operations. The location of run-time service access point for the operational service is exposed for run-time service execution.

2.1.3 Governance

Successful SOA development and operations depend on well-defined policies and rules tailored to maintain order and consistency in the target environment. The SWIM program will enlist the support of the implementing programs in the development and execution of Governance plans that establish the required processes and capabilities. Governance includes management processes for all service lifecycle phases. To manage risk and maximize SWIM business benefits, a tailored governance process is defined and applied across each of the three major service lifecycle phases: development, exposure and deployment. SWIM Segment 1 Governance primary focus is on design-time or the development phase. Governance establishes policies to assist in decision-making and accountability in developing and growing a SOA-based IT infrastructure. Governance is mandated by the distributed nature of services developed and implemented for SWIM-enabled systems in various NAS domains. Another compelling reason for SWIM Governance is the need to adhere to standards; consensus on, and adherence to, standards is achieved through a Governance mechanism.

Governance helps the disparate teams of architects across NAS domains coordinate activities and work effectively together to create and maintain the elements of the SOA. It provides processes and policies specifying how and by whom services are released and maintained. SOA Governance defines activities to architect, design, develop, test and

implement services. It also defines the methods employed to perform those activities, roles and responsibilities, and metrics to characterize success and adherence to policies.

One of the most significant elements of Governance is QoS management. SOA's dynamic, flexible, and compositional nature requires that QoS management be integrated into service-oriented enterprise architectures. It must support a set of common QoS characteristics and provide comprehensive QoS services end to end, from application, to middleware, and to network and from source hosts to destination hosts across a network. SWIM Segment 1 does not have the dynamic and flexible characteristics of the end-state NAS service-oriented enterprise architecture; therefore, QoS will begin with a basic set of elements determined by the implementing programs as they consider use of core services QoS capabilities consistent with the requirements for critical, essential and routine services as applicable to each NAS Application, in accordance with NAS SR-1000, NAS System Requirements Specification.

A critical element of Governance is Configuration Management (CM). CM covers all aspects of maintaining order across the system lifecycle, including establishing and modifying baselines (e.g., updating services and business processes) comprising services distributed across organizational boundaries. To communicate and manage the performance, functional, and physical attributes of a service, governance defines the content for Interface Control Documentation (ICD) that depicts physical, functional, and test interface characteristics between the service consumer and service provider. SWIM will provide an ICD for the SWIM provided core services software package which each implementing program may modify to document the specific business service implementation. The SWIM program will work with the implementing programs to propose changes to FAA Standard 025, Preparation of Interface Control Documents appropriate for the implementation of SWIM Segment 1.

2.2 Maintenance

2.2.1 Hardware Maintenance

The operational SWIM infrastructure planned in Segment 1 will be developed and deployed by the implementing programs. The SWIM Program Office will purchase, and support for use by the implementing programs, hardware at the WJHTC for the SWIM Test Facility and the SWIM Support Lab. The SWIM WJHTC lab and test facility will be staffed and maintained by a combination of WJHTC and contractor staff, who will coordinate maintenance directly with the vendors from whom the hardware is purchased.

The COI implementing programs will be responsible for any hardware needed to host the SWIM software developed in Segment 1. Each program will provide hardware support in accordance with their existing plans.

2.2.2 Software Maintenance

The SWIM implementing program contractors, as directed by the implementing Program Offices, will develop the SWIM Segment 1 capabilities using SWIM-supplied software. SWIM implementing programs will integrate the SWIM Core Capabilities software and

associated data into their services in accordance with their Software Development and Software Management Plans.

The maintenance concept for the SWIM-acquired commercial products will be Contractor Maintenance and Logistics Support (CMLS). SWIM implementing programs will use their current maintenance strategies to perform operational, maintenance, and support actions on deployed SWIM capabilities. SWIM will not require the development or introduction of new FAA job categories or skill classifications over and above what is currently in the NAS, for the purposes of operation and maintenance of SWIM**.**

2.2.3 Quantities and Locations

Table 2-1 provides a summary of SWIM Segment 1 systems and locations, organized by the implementing program. The number of sites includes the FAA William J. Hughes Technical Center (WJHTC) and the FAA Air Traffic Control System Command Center (ATCSCC), as appropriate. It does not include the development contractor sites to which development systems may be deployed.

Table 2-1. SWIM Segment 1 Sites and Locations

COI	Implementing Program	# Sites	Location	Comments
AIM	AIM	2	FAA Headquarters and ATCSCC	Hardware and software
AIM	ERAM AIM	22	ARTCCs, WJHTC, FAAAC	Software, only
F&FM	TFM	2	WJHTC, VNTSC	Hardware and software
	ERAM	22	ARTCCs, WJHTC, FAAAC	Hardware and software
	Terminal	38	Major TRACONs and ATCTs	Hardware and software
WX	ITWS	1	VNTSC	Hardware and software
	CIWS	1	WJHTC	Software, only
	WMSCR	3	Atlanta & Salt Lake City NNCCs, WJHTC	Hardware and software
	ERAM WMSCR	22	ARTCCs, WJHTC, FAAAC	Software, only
Core Capabilities	N/A	2	WJHTC, ATCSCC	Hardware and software

2.2.4 Schedule Constraints

The overall program strategy is to conduct a phased development approach. Each of the implementing programs has developed their own schedule for their SWIM-enabled capability, and the SWIM program is working to ensure that the Core Capabilities will be available in time to support the implementing programs' schedules.

Starting in late FY08, the SWIM program will provide each implementing program with "GFE from SWIM" software and data packages that provide the SWIM-required protocols, messaging, and interface management capabilities. Identifying the software packages by late FY08 is a schedule constraint so that implementing programs can incorporate the SWIM capability in their planned release schedules.

The Initial Flight Data Services, part of the ERAM Flight Data Services capability, will be the first to use the SWIM Core Capabilities. During ERAM Release 2, Initial Flight Data Services will incorporate the "GFE from SWIM" software and data packages into their release design, and will complete code and test to support ERAM's Release 2 deployment.

Shortly thereafter, a standalone AIM capability and CIWS will become SWIM-enabled. At a later date, TFMS, terminal services, ITWS, WMSCR, and AIM with ERAM will become SWIM-enabled. These capabilities are not interdependent, but do rely on the availability of Core Capabilities. The final capability planned for Segment 1 will be developed by TFMS – SWIM publication of RVR data. This capability depends on the deployment of the new Terminal Data Distribution System (TDDS), which is completed in FY14.

3.0 TECHNICAL PERFORMANCE

3.1 Operational and Functional Requirements

SWIM shall enable sharing of information among registered users.

3.1.1 Design Time Interface Management

3.1.1.1 SWIM Publication Services

3.1.1.1.1 SWIM shall build a Service Registry for deploying information about SWIM services.
3.1.1.1.2 SWIM shall add information to the Service Registry.
3.1.1.1.3 SWIM shall modify information in the Service Registry.
3.1.1.1.4 SWIM shall delete information from the Service Registry.
3.1.1.1.5 SWIM shall provide configuration management for information in the Service Registry.
3.1.1.1.6 SWIM shall maintain the changes of operational status for services in the Service Registry.

3.1.1.2 SWIM Discovery Services

3.1.1.2.1 SWIM shall search the SWIM Service Registry for service definitions and service interface information for registered users.
3.1.1.2.2 SWIM shall retrieve from the SWIM Service Registry for service definitions and service interface information for registered users.

3.1.1.3 SWIM Registry Subscription Services

3.1.1.3.1 SWIM shall monitor the Service Registry with changes including new services commissioned, replaced services, and decommissioned services.
3.1.1.3.2 SWIM shall allow registered users to subscribe to notifications when registry information changes in accordance with new services commissioned, replaced services, and decommissioned services
3.1.1.3.3 SWIM registered users shall define the terms of their registry subscription.
3.1.1.3.4 SWIM registered users shall modify the terms of their registry subscription.

3.1.2 Messaging Management

3.1.2.1 SWIM Message Routing

3.1.2.1.1 SWIM shall record the locations of Service Providers and Service Consumers at design-time.
3.1.2.1.2 SWIM shall provide run-time message routing between Service Consumers and Service Providers using their current recorded location.

3.1.2.2 SWIM Run-Time Business Service Subscriber Status

3.1.2.2.1 SWIM shall monitor Business Service Subscriber Status.
3.1.2.2.2 SWIM shall alter message routing consistent with Business Service Subscriber Status.

3.1.2.3 SWIM Design-Time Business Service Message Management

3.1.2.3.1 SWIM shall publish and route messages and alerts to subscribing Service Consumers.

3.1.2.3.2 SWIM shall ensure messages and alerts are delivered as specified in accordance with service level agreements.

3.1.3 SWIM Security Management

3.1.3.1 SWIM Run-Time Access Management

3.1.3.1.1 SWIM shall implement service security policies which require a SWIM member to register member identification and access privileges.

3.1.3.1.2 SWIM shall grant access to all SWIM services, transactions, and information in accordance with member identification and access privileges.

3.1.3.2 SWIM Security Administration

3.1.3.2.1 SWIM shall publish SWIM service security policies for design-time implementation and run-time monitoring.

3.1.3.2.2 SWIM shall enable design-time modification of SWIM service security policies.

3.1.3.2.3 SWIM shall propagate SWIM service security policies at design-time.

3.1.3.2.4 SWIM shall detect service security events at design-time.

3.1.3.2.5 SWIM shall record service security events and associated data at design-time.

3.1.3.2.6 SWIM shall analyze and report service security events and associated data at design-time.

3.1.3.3 SWIM Run-Time Security Support

3.1.3.3.1 SWIM shall monitor and record run-time transactions in accordance with SWIM service security policy.

3.1.3.3.2 SWIM shall formulate and issue run-time service security alerts.

3.1.4 SWIM Enterprise Management

3.1.4.1 SWIM Run-Time QoS Management

3.1.4.1.1 SWIM shall define SWIM QoS criteria and metrics for run-time monitoring

3.1.4.1.2 SWIM shall modify SWIM QoS criteria and metrics for run-time monitoring.

3.1.4.1.3 SWIM shall propagate SWIM QoS criteria and metrics.

3.1.4.1.4 SWIM shall detect QoS events.

3.1.4.1.5 SWIM shall record QoS events and associated data.

3.1.4.1.6 SWIM shall analyze and report QoS events and associated data.

3.1.4.2 SWIM Run-Time Support Infrastructure Maintenance

3.1.4.2.1 SWIM shall detect SWIM Support Infrastructure failure events including overloads and faults

3.1.4.2.2 SWIM shall record SWIM Support Infrastructure failure events and associated data.

3.1.4.2.3 SWIM shall analyze and report SWIM Support Infrastructure failure events and associated data.

3.1.4.2.4 SWIM shall automatically recover from SWIM Support Infrastructure failure events.
3.1.4.2.5 SWIM shall automatically isolate failed SWIM Support Infrastructure assets.
3.1.4.2.6 SWIM shall maintain an inventory of all active and previously active SWIM Support Infrastructure assets.

3.1.4.3 SWIM Design-Time Governance

3.1.4.3.1 SWIM shall provide a design-time repository for governance policy, standards and process guidelines to assist in defining rules and policies.
3.1.4.3.2 SWIM shall maintain a design-time repository for governance policy, standards and process guidelines to assist in defining rules and policies.
3.1.4.3.3 The SWIM governance design-time repository shall contain policies which address SWIM Service registration.
3.1.4.3.4 The SWIM governance design-time repository shall contain policies which address SWIM Service versioning.
3.1.4.3.5 The SWIM governance design-time repository shall contain policies which address SWIM Service ownership.
3.1.4.3.6 The SWIM governance design-time repository shall contain policies which address SWIM Service discovery and access.
3.1.4.3.7 The SWIM governance design-time repository shall contain policies which address SWIM Deployment of services.
3.1.4.3.8 The SWIM governance design-time repository shall contain policies which address SWIM Security for service.
3.1.4.3.9 The SWIM governance design-time repository shall contain policies which address SWIM QoS for service.

3.2 Product Characteristics and Performance Requirements

3.2.1 Reliability, Maintainability and Availability

3.2.1.1 SWIM shall provide reliability, maintainability and availability in accordance with section 3.12 in NAS SR-1000, NAS System Requirements Specification.

3.2.1.2 SWIM shall not degrade safety-critical functions, critical functions, essential functions, and routine functions, as applicable to each NAS Application.

3.2.2 Capacity

SWIM capacities shall not impact on the capacity and performance of NAS Applications.

3.2.3 Service Levels

SWIM shall support users at peak usage levels, where peak usage is defined in users Service Level Agreement.

3.2.4 Recovery

SWIM shall recover after loss of power within the timeframe specified in accordance with section 3.9.1.6.1 in NAS SR-1000 or service level agreement between users.

4.0 PHYSICAL INTEGRATION

Physical integration shall be in accordance with the physical integration requirements of the implementing programs. Requirements herein apply to the SWIM Support Infrastructure.

4.1 Real Property

4.1.1 Land

Land procurement/lease is not applicable for the SWIM program.

4.1.2 Space

Space shall be accommodated by implementing programs.

4.2 Reserved

4.3 Environmental

The following environmental requirements shall be met:

a) SWIM shall comply with Executive Order (EO) 12873, Federal Acquisition, Recycling, and Waste Prevention.
b) SWIM and its installations shall comply with FAA Order 1050.1, Policies and Procedures for Considering Environmental Impacts; The National Environments Policy Act (NEPA) of 1969; FAA Order 1050.10, Prevention, Control, and Abatement of Environmental Pollution at FAA Facilities; and 40 CFR, Protection of the Environment.

4.4 Energy Conservation

SWIM shall support NAS facility compliance with:

a) The National Energy Conservation Policy Act.
b) FAA Order 1053.1A, Energy and Water Management Program for FAA Buildings and Facilities,
c) 10 CFR Part 435, Energy Efficiency in Buildings,
d) FAA-HDBK-001, Design Handbook Energy Efficiency and Water Conservation in NAS Facilities, and
e) Executive Order 13123, Greening of Government through Efficient Energy Management.

4.5 Heating, Ventilation, Air Conditioning

SWIM shall support NAS facility compliance with:

a) FAA Order 6970.3-chg37, Plant Equipment Modification–Temperature Control, Ventilation;

b) ASHRAE 55-1992, Thermal Environmental Conditions for Human Occupancy; and
c) ASHRAE 62-2001, Ventilation for Acceptable Indoor Air Quality.

4.6 Grounding, Bonding, Shielding, and Lightning Protection

a) SWIM installations shall be in accordance with FAA-STD-019, Lightning Protection, Grounding, Bonding, and Shielding for Facilities;
b) SWIM installations shall comply with applicable sections of the American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE) 1100-1992,
c) SWIM installations shall be in accordance with Powering and Grounding Sensitive Electronic Equipment; NFPA Standard 70, National Electric Code and local codes.

4.7 Cables

SWIM cable installation plans and installation in NAS facilities shall be in accordance with:

a) FAA-G-2100, Section 3.3.1.3.10.2, Electronic Equipment, General Requirements.
b) NFPA 70, National Electrical Code.
c) IEEE STD 1100-1999, Recommended Practice for Powering and Grounding for Sensitive Electric Equipment.

4.8 Hazardous Materials

4.8.1 Handling of hazardous materials shall be in accordance with the 29 Code of Federal Regulations (CFR Title 29, Part 1910), Occupational Safety and Health Standards; FAA Order 8040.4, Safety Risk Management; 29 CFR 1910.1000, Air Contaminants; and 40 CFR 260 to 40 CFR 270 and 40 CFR 700 to 40 CFR 766.

4.8.2 Hazardous materials inherent in SWIM's technology shall comply with FAA Order 1050.1, Policies and Procedures for Considering Environmental Impacts, and FAA Order 1050.10, Prevention, Control and Abatement of Environmental Pollution at FAA Facilities".

4.8.3 SWIM system components shall comply with FAA Order 1050.20, Airway Facilities Asbestos Control; FAA Order 1050.14, Polychlorinated Biphenyls (PCBs) in the National Airspace System (NAS);and 40 CFR Part 82.

4.9 Power Systems and Commercial Power

4.9.1 SWIM power systems and commercial power usage shall comply with applicable sections of FAA-G-2100, Electronic Equipment, General Requirement, and NFPA 70, National Electrical Code.

4.9.2 SWIM power profile characteristics shall comply with applicable sections of FAA-G-2100, Electronic Equipment, General Requirements.

4.10 Telecommunications

SWIM telecommunications requirements shall be in accordance with:

a) FAA-STD-029, Selection and Implementation of Telecommunications Standards;
b) FAA Order 4441.16, Acquisition of Telecommunications Systems, Equipment and Services;
c) FAA Order 6000.22A-chg3, Maintenance of Analog Lines;
d) FAA Order 6000.47, Maintenance of Digital Transmission Channels; and
e) FAA Order 6000.36A, Communications Diversity.

4.11 Special Considerations

None.

5.0 FUNCTIONAL INTEGRATION

5.1 Integration with Other FAA Enterprise Architecture Elements

5.1.1 SWIM shall integrate with existing (legacy) NAS systems.

5.1.2 SWIM shall integrate with NAS systems under development.

5.1.3 SWIM Interface Control Documents (ICDs) shall be developed in accordance with FAA Standard 025, Preparation of Interface Control Documents.

5.1.4 SWIM shall not degrade the capacities of NAS services.

5.1.5 SWIM shall not degrade the functional capabilities of NAS services.

5.1.6 SWIM shall not degrade the performance of NAS services.

5.1.7 The SWIM interfaces shall accommodate implementation of new NAS systems.

5.1.8 The SWIM interfaces shall accommodate in-service transition of NAS systems.

5.1.9 SWIM shall exchange status information with interfacing NAS systems.

5.1.10 SWIM installation shall not adversely affect the operation of NAS elements.

5.1.11 SWIM testing shall not adversely affect the operation of NAS elements.

5.1.12 SWIM operation shall not adversely affect the operation of NAS elements.

5.2 Information Requirements

SWIM information requirements are specified in Section 3 of this document.

5.3 Software Integration

5.3.1 SWIM software integration shall not adversely affect the performance of other systems.

5.3.2 SWIM software shall interoperate and communicate in a heterogeneous platform environment.

5.3.3 SWIM software shall be modular, with subsystem and component independence.

5.4 Spectrum Management

Not applicable.

5.5 Standardization

5.5.1 SWIM shall use industry standard operating systems, communication protocols, data management, security, and software languages to ensure interoperability, portability, and maintainability.

5.5.2 SWIM data shall be in accordance with FAA-STD-060, Data Standard for the National Airspace System (NAS).

5.5.3 SWIM hardware and software shall enable the exchange of standardized data elements with automation systems.

5.5.4 SWIM data management shall be in accordance with FAA Order 1375.1, Data Management.

5.5.5 SWIM-specific software shall be developed in accordance with FAA-STD-026, Software Development for The National Airspace System (NAS).

5.5.6 Software developed by the implementing programs shall in accordance with those programs' established software development process.

6.0 HUMAN INTEGRATION

6.1 Human Product Interface and Tasks

SWIM shall comply with:

a) FAA (2003). Human Factors Acquisition Job Aid.
b) FAA (2005). Human Factors Design Standard (HFDS). Atlantic City International Airport, FAA William J. Hughes Technical Center.
c) Hewitt, G. and R. Gray (2005). Preliminary Human Factors Assessment (HFA) for SWIM JRC.
d) Mejdal, S., M. E. McCauley, et al. (2001). Human Factors Design Guidelines for Multifunction Displays, FAA Office of Aerospace Medicine, Civil Aerospace Medical Institute.
e) Wagner, D., J. A. Birt, et al. (1996). Human Factors Design Guide for Acquisition of Commercial-Off-The-Shelf Subsystems, Non-Developmental Items, and Developmental Systems. Atlantic City International Airport, NJ.
f) 29USC 794D, The Rehabilitation Act Amendments (Section 508)

6.2 Employee Safety and Health

SWIM shall comply with:

a) FAA Order 3900.19, Occupational Safety and Health, CFR Title 29 Part 1910,
b) CFR Title 29 CFR 1910.95 (Code of Federal Regulations), Occupational Safety and Health Standards
c) FED-STD-795, Uniform Federal Accessibility Standard (UFAS), April 1988
d) Executive Order (EO) 12902, Efficiency and Conservation at Federal Facilities, 8 March 1994
e) Occupational Safety and Health Hazards, and with Special Fire Life Safety Requirements, IAW 29 CFR 1960.20, and
f) National Fire Protection Association (NFPA) Standard 70, 1) Clearance Requirements and 2) National Electrical Code.

7.0 SECURITY

General requirements:

a) The SWIM Architecture shall adhere to FAA Information System Security Architecture Version 5.

b) SWIM security policies shall comply with the 44 U.S.C Federal Information System Security Act.

c) SWIM security policies shall comply with FAA Order 1370.82A, dated September 2006, Information System Security Policy.

7.1 Physical Security

7.1.1 Physical Integrity Monitoring

SWIM shall monitor the physical integrity of SWIM assets, to the maximum extent possible.

7.2 Information Systems Security

7.2.1 System Integrity

7.2.1.1 SWIM shall perform a self-check of security functions at start-up.

7.2.1.2 SWIM shall implement system integrity and protect applicable assets in accordance with NAS-SR-1000, section 3.10.3.5.

7.2.2 Availability

7.2.2.1 SWIM shall protect assets from denial of service.

7.2.2.2 SWIM shall implement availability and protect applicable assets in accordance with NAS-SR-1000, section 3.10.3.5.

7.2.3 Access Control

7.2.3.1 SWIM shall enforce system security rules on an entity's access attempts, in accordance with NAS-SR-1000, section 3.10.3.6.

7.2.3.2 SWIM shall enforce separation of security domains.

7.2.3.3 SWIM shall enforce secure import and export of authorized information outside its security domain.

7.2.4 Identification and Authentication

7.2.4.1 SWIM shall uniquely identify all authorized entities.

7.2.4.2 SWIM shall authenticate an authorized entity's identity, in accordance with NAS-SR-1000, section 3.10.3.

7.2.5 Confidentiality

SWIM shall restrict the release of NAS data to authorized users and implement confidentiality/assess clearance in accordance with NAS-SR-1000, section 3.10.3.4.

7.2.6 Non-Repudiation

SWIM shall implement non-repudiation, in accordance with NAS-SR-1000, section 3.10.3.7.

7.2.7 Malicious Activity

SWIM shall detect malicious activity, in accordance with NAS-SR-1000, section 3.10.3.7.

7.2.8 Security Operation

SWIM shall protect access to assets during all operational states, in accordance with NAS-SR-1000, section 3.10.3.8.

7.2.8.1 Recovery

7.2.8.1.1 SWIM shall ensure recovery of access control information after a system failure.

7.2.8.1.2 SWIM shall ensure that all security functions either complete successfully or recover to a consistent and secure state.

7.2.9 Security Management

SWIM shall implement technical security management.

7.2.10 Security Audit

SWIM shall maintain and record all system access attempts in a security audit log, in accordance with NAS-SR-1000, section 3.10.3.9.

7.3 Personnel Security

SWIM shall comply with FAA Order 1600.1, Personnel Security Program.

8.0 IN-SERVICE SUPPORT

SWIM capabilities are deployed to NAS operational facilities.

a) SWIM shall use FAA approved operations and maintenance strategies,
b) There shall be no SWIM Core Capabilities hardware deployed to operational NAS facilities in Segment 1,
c) SWIM lab facilities currently at the WJHTC shall be modified to include a SWIM Test Facility as well as a SWIM Support Lab.

8.1 Staffing

8.1.1 Support staffing for SWIM shall be in accordance with staffing plans put into place by the SWIM implementing programs.

8.1.2 The operation and maintenance of the SWIM system shall not increase staffing requirements over and above the present NAS staffing at sites, second level engineering activities and the depot.

8.2 Supply Support

8.2.1 SWIM logistics support shall be in accordance with the Integrated Logistics Support Plans established by the implementing programs.

8.2.2 The system shall be delivered with adequate levels of initial site spares required to facilitate repair and restoration as determined by the implementing programs.

8.3 Support Equipment

8.3.1 Tools and equipment required for SWIM operation and maintenance shall be provided in accordance with the implementing programs current support equipment strategies.

8.3.2 The maintenance of the system at the site and depot levels shall not require the use of specialized support and test equipment and tools.

8.4 Technical Data

8.4.1 Technical Instruction Books (TIBs), if required, shall be approved and baselined through the SWIM CM process prior to SWIM delivery to the field, for any SWIM Core Capabilities products provided to the implementing programs.

8.4.2 TIBs shall be approved and baselined through the implementing programs' CM process as needed, for any SWIM Segment 1 capability.

8.4.3 Second level hardware and software maintenance documentation shall be delivered to the FAA operational support organization prior to SWIM deployment for any SWIM implementing program that uses FAA staff to maintain the hardware or software.

8.5 Training and Training Support

8.5.1 System Training

Formal training shall be provided for the system through an operational training capability prior to deployment, provided by each implementing program.

8.5.2 Maintenance Training

SWIM training shall provide FAA personnel with the required knowledge and skills required to operate and maintain hardware that is deployed by the implementing programs during SWIM Segment 1, in accordance with the implementing programs' training plans.

8.5.3 Recurrent Training

Airway Facilities personnel shall receive recurrent skill training as required for the SWIM Segment 1 capabilities, in accordance with the implementing programs' training plans.

8.5.4 Second Level Engineering Training

Second-level engineering training shall be provided for the SWIM system in accordance with the implementing programs' training plans.

8.6 First and Second Level Repair

8.6.1 SWIM system equipment shall be maintained in accordance with the maintenance plans established by the implementing programs.

8.6.2 SWIM Second-Level Engineering Support for hardware and software shall be provided in accordance with the second-level engineering support plans established by the implementing programs.

8.6.3 SWIM system on-site maintenance shall be conducted in accordance with FAA Order 6000.15C-chg1, General Maintenance Handbook for Airway Facilities.

9.0 TEST AND EVALUATION

9.1 Critical Operational Issues

The following Critical Operational Issues (COIs) have been identified for SWIM:

a) COI-1: Interoperability: Does SWIM interface and operate effectively with existing systems without degrading performance, and do they accommodate defined (and planned) system interfaces and enhancements?
b) COI-2: Transition and adaptation: Does the SWIM system design, training and documentation allow the NAS to be transitioned, adapted and optimized safely and expeditiously for all sites to which it will be deployed?
c) COI-3: Maintenance: Do SWIM's tools, facilities, processes, training and documentation for first-level maintenance, second-level maintenance, and logistics support, enable maintenance tasks to be performed without interruption to Air Traffic Control (ATC) operations?
d) COI-4: Availability: Does SWIM meet the Reliability, Maintainability, and Availability requirements of Section 3.2.1?
e) COI-5: Safety and Security: Does SWIM have security controls to protect information, components, applications, and systems that are consistent with, and an integral part of, ISS Architecture Version 5?

9.2 Test and Evaluation Requirements

9.2.1 Test and Evaluation shall be conducted to ensure that the functional performance requirements can be met in an operational environment and to address the COIs defined in Section 9.1.

9.2.2 SWIM requirements shall be tested for compliance during Developmental Testing. Developmental Testing shall be conducted to demonstrate that all technical and performance requirements for system hardware and software specified in the development requirements specification have been met.

9.2.3 Integration Testing of all SWIM Segment 1 system components shall be conducted at the FAA William J. Hughes Technical Center to verify correct implementation of interfaces with other NAS systems. Integration Testing shall be performed prior to any SWIM capability being delivered operationally.

9.2.4 Operational Testing shall be conducted to verify that SWIM is operationally effective and operationally suitable for use in the NAS and that the NAS infrastructure is ready to accept the system.

10.0 IMPLEMENTATION AND TRANSITION

SWIM shall provide each implementing program (ERAM, TFMS, AIM, WMSCR, CIWS, ITWS, terminal) with GFE software packages that provide SWIM-required protocols, messaging, and interface management capabilities.

10.1 The implementing programs shall integrate these SWIM-provided software packages into their respective systems.

10.2 Implementing programs shall use existing NAS platforms to the maximum extent feasible for hosting SWIM software.

10.3 The SWIM software shall be included as part of these implementing systems' planned release upgrades, or for new systems, as part of their acquisition process.

11.0 QUALITY ASSURANCE

11.1 Core Capabilities

SWIM quality assurance program for Core Capabilities (as defined in Section 3) shall be in accordance with ISO 9001-200 and *FAA-Integrated Capability Maturity Model (*iCMM) guidelines and the SWIM Quality Assurance Plan (QAP). This plan ensures that the SWIM program processes conform to policies and processes of parent organizations (e.g. Department of Transportation (DOT), the FAA and Office of ATC Communications Services (ATO-W)).

11.2 Implementing Program Capabilities

SWIM configuration management program for capabilities deployed by the implementing programs (as defined in Appendix C) shall be in accordance with their respective QAP.

12.0 CONFIGURATION MANAGEMENT

12.1 Core Capabilities

SWIM CM program for Core Capabilities (as defined in Section 3) shall be in accordance with FAA Order 1800.66, Configuration Management Policy and the SWIM Configuration Management Plan.

12.2 Implementing Program Capabilities

SWIM configuration management program for capabilities deployed by the implementing programs (as defined in Appendix C) shall be in accordance with their respective Configuration Management Program.

13.0 IN-SERVICE MANAGEMENT

SWIM implementing programs shall provide supply support in accordance with their current Integrated Logistics Support Plan (ILSP) and maintenance plans.

13.1 Support facilities

The implementing programs shall be responsible for any support equipment required for maintenance of the SWIM components. Each program shall provide support in accordance with their existing plans.

13.2 Training

The SWIM implementing programs shall perform training in accordance with their existing Program Training Plans.

13.3 First and Second Level Repair

The SWIM capabilities developed by the implementing programs shall be maintained per the current maintenance strategy of the implementing programs.

13.4 Packaging, Handling, Storage, and Transportation (PHS&T)

13.4.1 Production Identification and Marking

SWIM COI implementing program contractors shall use commercial marking practices for the purposes of product identification, configuration management, and inventory management to control and identify lowest replaceable units (LRUs), in accordance with existing contracts.

13.4.2 Packaging & Transportation

13.4.2.1 All spares shall be packaged using standard commercial packing as specified in ASTM International D3951-95.
13.4.2.2 SWIM COI implementing program contractors shall transport all spares by the most economical means possible, considering dependability, safety, urgency of need, and traceability.

13.4.3 Asset Identification - Bar Coding

Items provided to SWIM field sites shall be bar coded in accordance with the guidance provided by NAS Logistics Property Management Division of the Technical Operations Service Unit, and as incorporated into the SWIM COIs' existing programs.

13.5 Post Implementation Review

A Post Implementation Review (PIR) shall be conducted six months after each SWIM program component is deployed per the guidelines in the SWIM Implementation Strategy and Planning Document.

14.0 SYSTEM SAFETY MANAGEMENT

14.1 Core Capabilities

The SWIM Safety Program for Core Capabilities (as defined in Section 3) shall be in accordance with the latest FAA Safety Management System (SMS) Manual; the FAA Safety Risk Management Guidance for System Acquisitions (SRMGSA), dated November 29, 2006; and FAA Order 8040.4, Safety Risk Management.

14.2 Implementing Program Capabilities

The Safety Program for capabilities deployed by the implementing programs (as defined in Appendix C) shall be in accordance with their respective Safety Program.

Appendix A - Mission Need Correlation Matrix

The following traceability matrix maps requirements addressed in this document, by requirement number and statement, to the SWIM Program Mission Shortfall Statement.

Mission Shortfall Statement	Costs to develop, test, deploy and support new interfaces and applications are too high	The NAS is not an agile air traffic system	Data sharing in the NAS is labor-intensive.	Timely access to common data is lacking in the NAS.	The underlying tools to support becoming a performance–based organization are currently lacking.
Core Capabilities					
3.1.1 Interface Management					
3.1.1.1 SWIM Publication Services	X	X	X	X	
3.1.1.2 SWIM Discovery Services	X	X	X	X	
3.1.1.3 SWIM Registry Subscription Services	X	X	X	X	
3.1.2 Messaging Management					
3.1.2.1 SWIM Message Routing		X	X	X	
3.1.2.2 SWIM Business Service Subscriber Status		X	X	X	
3.1.2.3 SWIM Business Service Message Management		X	X	X	
3.1.3 SWIM Security Management					
3.1.3.1 SWIM Access Management	X		X		
3.1.3.2 SWIM Security Administration	X		X		
3.1.3.3 SWIM Security Support	X		X		
3.1.4 SWIM Enterprise Management					
3.1.4.1 SWIM QoS Management		X	X	X	X
3.1.4.2 SWIM Infrastructure Maintenance		X	X	X	

Appendix B – Acronyms

AAR	Adapted Arrival Route
AAR	Airport Acceptance Rate
ADAR	Adapted Departure and Arrival Route
ADR	Adapted Departure Route
AFP	Airspace Flow Program
AIM	Aeronautical Information Management
AIRMET	Airmen's Meteorological Information
AIXM	Aeronautical Information Exchange Model
ANSI	American National Standards Institute
AOC	Airline Operating Center
ARTCC	Air Route Traffic Control Center
ARTS	Automated Radar Terminal System
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
ATCSCC	Air Traffic Control System Command Center
ATCT	Airport Traffic Control Tower
ATO	Air Traffic Operations
ATO-W	Office of ATC Communications Services
ATM	Air Traffic Management
AWC	Aviation Weather Center
CFR	Code of Federal Regulations
CIWS	Corridor Integrated Weather System
CM	Configuration Management
CMLS	Contractor Maintenance and Logistics Support
CMS	Common Message Set
CNS	Communications, Navigation and Surveillance
COI	Community of Interest
COI	Critical Operational Issues
DOT	Department of Transportation

DOTS	Dynamic Ocean Track System
DSP	Departure Sequencing Program
DUATS	Direct User Access Terminal System
EDCT	Estimated Departure Clearance Times
EO	Executive Order
ERAM	En Route Automation Modernization
ETA	Estimated Time of Arrival
FAA	Federal Aviation Administration
FCA	Flow Constrained Area
FDIO	Flight Data Input Output
F&FM	Flow and Flight Management
FSS	Flight Service Station
GDP	Ground Delay Program
GFE	Government Furnished Equipment
GS	Ground Stop
HADDS	Host Automation Data Distribution System
HFA	Human Factors Assessment
HFDS	Human Factors Design Standard
ICD	Interface Control Document
iCMM	FAA-Integrated Capability Maturity Model
IEEE	Institute of Electrical and Electronics Engineers
ILSP	Integrated Logistics Support Plan
IT	Information Technology
ITWS	Integrated Terminal Weather System
JPDO	Joint Planning and Development Organization

LOA	Letter of Agreement
LRU	Lowest Replaceable Unit
MIT/LL	Massachusetts Institute of Technology/Lincoln Laboratory
MSS	Mission Shortfall Statement
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NASR	National Airspace System Resources
NEPA	National Environments Policy Act
NextGen	Next Generation Air Transportation System
NORAD	North American Aerospace Defense Command
NTML	National Traffic Management Log
OAG	Official Airline Guide
OI	Operational Improvement
PCB	Polychlorinated Biphenyl
PDC	Pre-Departure Clearance
PHS&T	Packaging, Handling, Storage, and Transportation
PIR	Post Implementation Review
PIREP	Pilot Report
QAP	Quality Assurance Plan
QoS	Quality of Service
RMA	Reliability, Maintainability, and Availability
RVR	Runway Visual Range
SAMS	Special Use Airspace Management System
SID	Standard Instrument Departure
SIGMET	Significant Meteorological Information

SMS	Safety Management System
SOA	Service-Oriented Architecture
SRMGSA	Safety Risk Management Guidance for System Acquisitions
SMS	Safety Management System
SRMGA	Safety Risk Management Guidance for Acquisitions
STA	Standard Time of Arrival
STAR	Standard Terminal Arrival Route
STARS	Standard Terminal Automated Radar System
STD	Standard Time of Departure
SUA	Special Use Airspace
SWIM	System Wide Information Management
TBD	To Be Determined
TDLS	Terminal Data Link System
TFM	Traffic Flow Management
TFMS	Traffic Flow Management System
TIB	Technical Instruction Book
TM	Traffic Management
TMA	Traffic Management Automation
TRACON	Terminal Radar Approach Control
TS	Thunderstorm
UFAS	Uniform Federal Accessibility Standard
URET	User Request Evaluation Tool
WJHTC	William J. Hughes Technical Center
WMSCR	Weather Message Switching Center Replacement
WSDL	Web Services Description Language

Appendix C - Overview of SWIM Segment 1 COI Capabilities

The following provides a high level overview of capabilities planned to be included in System Wide Information Management (SWIM) Segment 1 by three Communities of Interest (COIs): Flight and Flow Management, Aeronautical Information Management (AIM), and Weather.

C.1.0 Flight and Flow Management COI

The Flight and Flow Management COI is addressing interfaces between the following domains in SWIM Segment 1:

- En Route and TFM
- Terminal and TFM
- En Route and Terminal
- En Route and External Users
- TFM and External Users

C.1.1 En Route and TFM Interface

C.1.1.1 Flight Data Exchange

TFM currently get flight data from En Route via the Host/ATM Data Distribution System (HADDS) Common Message Set (CMS). SWIM ERAM will enable the HADDS/CMS replacement by providing infrastructure and interfaces that support exchange of existing data between HADDS clients, including support for legacy CMS capabilities.

In SWIM Segment 1, ERAM will provide Flight Data Exchange through the following services:

- Flight Information Service
- Surveillance Information Service
- Sector Information Service
- Route Status Information Service
- General Information Service

The Flight Information Service will provide flight data and updates to clients for filed and active flight plans managed within ERAM and amendments for file flight plans by clients.

The Surveillance Information Service will provide a means to subscribe to track updates and deletions from ERAM. The primary operation of the Surveillance Information Service will be to publish tracks and track updates to clients. The service will support a flexible, open subscription format that allows the subscriber to specify content-based

criteria for which track objects the subscriber should be sent and which of the two formats should be sent.

The Sector Information Service will provide a means to query or subscribe to facility sectorization assignments and updates within ERAM.

The Route Status Information Service will provide a means to query or subscribe to adapted arrival and departure route status. The adapted routes are Standard Instrument Departures (SID), Standard Terminal Arrival Routes (STAR), Adapted Arrival Routes (AAR), Adapted Departure Routes (ADR) and Adapted Departure and Arrival Routes (ADAR). The primary operation of the Route Status Information Service will be to publish route status updates to clients.

The General Information Service will provide a means to exchange general information/free text remarks with interfacing systems. The General Information Service will be a peer-to-peer service exposed by ERAM at the ARTCC-Level to exchange messages with peer General Information Services exposed by interfacing systems.

C.1.1.2 Execution of Flow Strategies

TFM, through its Collaborative Decision Making (CDM) programs, facilitates development of aircraft reroutes when necessary due to the effects of weather, facility outages, special events, or emergencies in the NAS. Reroute data exchange between TFMS and ERAM will provide TFM/CDM negotiated reroutes for pre-departure flights via flight object amendments. The SWIM reroute interface will automate what is currently a manual process, whereas the EDCT is already provided as part of the CMS interface. These reroutes and EDCTs will utilize the ERAM Flight Data Exchange capabilities described above.

C.1.1.3 Flow Information Publication

As part of SWIM Segment 1, the Traffic Flow Management System (TFMS) will provide a Flow Information Publication service. The TFMS is a repository of flow information that describes current and planned traffic flow constraints in the NAS. TFMS will provide a Flow Information Publication service that provides a means for ERAM and other clients to subscribe to flow information describing several types of traffic flow constraints. These may include the following:

- Flow Constrained Area (FCA)
- Airspace Flow Program (AFP)
- Ground Delay Program (GDP)
- Ground Stops (GSs)

C.1.2 Terminal and TFM Interfaces

C.1.2.1 Terminal Data Distribution

In the SWIM Segment 1, a new SWIM-based Terminal infrastructure is planned to support publication of terminal data to other domains and subscription to other domain data from the terminal environment. A common platform, referred to as the Terminal Data Distribution System (TDDS), will provide an IP-based front end to existing Terminal legacy systems for which no direct interface currently exists. A number of these Terminal systems, such as Tower Data Link System (TDLS) /Pre-departure Clearance (PDC), are implemented as a passive tap from an existing En Route to Terminal interface to the flight strip printer. They are therefore limited to only those data elements supported by the current flight strip printer interface. The direct interface will allow for the bi-directional flow of information and make available status event information previously unavailable from the Terminal domain.

In the Terminal domain, multiple systems duplicate data communications and data management functions. Consolidating these functions in a common infrastructure reduces redundancy, facilitates system evolution and allows partitioning of the applications from data management infrastructure, enhancing system extensibility and flexibility. As part of the SWIM Segment 1, TDDS will be deployed to all large TRACONs and major ATCTs, to consolidate data feeds from the following systems:

- Electronic Flight Strip Transfer System (EFSTS)
- Airport Surface Detection Equipment (ASDE-X)
- Runway Visual Range(RVR).

Airport and surface data exchange supports better departure prediction and airport capacity determination by providing the following elements:

C.1.2.2 Electronic Flight Strip Transfer System (EFSTS) Publication

EFSTS will provide clearance delivery and flight progress taxi status information from the terminal domain via TDDS.

C.1.2.3 Airport Surface Detection Equipment (ASDE-X) Publication

ASDE-X will provide surface surveillance from the terminal domain via TDDS.

C.1.2.4 RVR Publication

Initially, RVR data published will be based on data currently being acquired by TFMS systems at Towers, TRACONs, and Centers. However, once the TDDS is established, TDDS will publish RVR data to interested NAS users.

C.1.3 En Route and Terminal Interfaces

C.1.3.1 Flight Data Input/Output

Terminal currently get flight data in flight strip format from En Route via Flight Data Input/Output (FDIO). This legacy En Route flight data interface exchanges data with 600+ Tower/TRACON locations and supports Flight Strip printing and flight data inputs.

SWIM will enable the FDIO replacement using the TDDS to exchange data with the following FDIO clients:

- FDIO replacement in the terminal domain
- TDLS/PDC
- EFSTS.

The ERAM flight data exchange with the TDDS will expand the current limited flight strip information to include access to the full flight object data set.

C.1.4 En Route and External User Interfaces

HADDS/CMS currently provides flight data to a number of external parties including NORAD, customs, Department of Homeland Security, Department of Defense, government labs and FAA analysis programs. SWIM segment 1 will support the transition of these interfaces to a SWIM service based interface.

C.1.5 TFM and External User Interfaces

C.1.5.1 Flow Information Publication

As part of SWIM Segment 1, the TFMS will provide a Flow Information Publication service. The TFMS is a repository of flow information that describes current and planned traffic flow constraints in the NAS. TFMS will provide a Flow Information Publication service that provides a means for ERAM and other clients to subscribe to flow information describing several types of traffic flow constraints. These may include the following:

- Flow Constrained Area (FCA)
- Airspace Flow Program (AFP)
- Ground Delay Program (GDP)
- Ground Stops (GSs).

TFMS currently provides flow data to a number of external parties including airlines via TMI-NET. SWIM segment 1 will support the transition of these TMI-NET interfaces to a SWIM service based interface.

C.2.0 Aeronautical Information Management COI

Implementation of the AIM capabilities will improve the current Special Use Airspace (SUA) process by providing better knowledge of when a SUA is active or inactive, i.e., unsafe or safe for non-military aircraft to enter. This information will decrease the number of unnecessary aircraft reroutes around SUAs, which in turn will decrease flight time, which in turn will decrease aircraft fuel costs and airline passenger delay time. In ERAM Release 1, ERAM is sharing Special Use Airspace schedule data with TFM. In the SWIM segment 1 timeframe, this data will be shared with a larger number of users.

C.2.1 SUA Automated Data Exchange

Currently, manual data entry processes are used for entering shape definitions and initial SUA schedule data into NASR (National Airspace System Resources) database. There is a lengthy lead-time for establishing and validating SUA geometry data. In Segment 1, a standard data entry user interface to accommodate creation of SUA and ATCAA (Air Traffic Control Assigned Areas) shapes will be provided. Also, these will be automatically stored in the NASR and the National ATCAA database, respectively.

NASR will be enabled to export SUA data to SAMS (SUA Airspace Management System) dynamically via the AIXM (Aeronautical Information Exchange Model) standard. This will improve the current process, where SAMS receives SUA data from NASR as files on a CD every 56 days which is manually loaded onto SAMS

Currently, the only electronic distribution of SUA information is a posting to the sua.faa.gov website, and the information on the website is not updated dynamically. There is manual notification of information changes in SAMS to the downstream systems, and there is duplicate manual data entry of SAMS information into URET and other downstream systems. The new SUA capability will enable SAMS to publish and distribute SUA information dynamically via the AIXM standard. Furthermore, ERAM will exchange SUA data with SAMS using the AIXM standard.

C.3.0 Weather COI

Thunderstorms (or convective weather systems) are the most significant phenomena impacting NAS operational decisions. ATC decisions are affected by convective weather attributes (e.g., hail, wind shear/microbursts, tornadoes, lightning, turbulence, icing, and reduced ceiling/visibility). Convective weather activity limits the usable capacity of the airspace and directly affects TFM flow-control decisions while ATC decisions are affected more indirectly (i.e., pilot requests for alternate routing or altitude). In the latter case, ATC advises the pilot on avoidance of aviation-impact weather when requested.

Pilot decisions affected by weather range from the highly tactical (escape/impact weather deviations) to the strategic (Route/Altitude selection or Go/No Go that are a part of flight planning). The effects of convective weather are highly dependent on a number of factors including aircraft type, pilot experience, and the airspace where it is encountered. As a result, use and importance of the same weather information can differ from pilot to pilot. Convective weather activity affects all pilot decisions, particularly as it can be unanticipated or develop or move faster/slower than forecast, thereby affecting escape decisions, in-flight route changes, approach commencement, and landing decisions. Forecast activity along an intended flight path, or at the destination airport affects flight planning as well.

Airline dispatchers are located in the Airline Operating Centers (AOCs) (either carrier or third-party vendor) and provide planning and flight monitoring services for assigned aircraft. Their decisions, which range from Go/No Go, in-flight route changes, and route/altitude selection, or diversions, can all be affected by convective weather systems and their attributes. A thunderstorm right over an airport will affect Go/No Go decisions for both arrivals and departures until the activity has passed well out of the area. In-flight route changes are affected as well when convective activity is present in major routing corridors or jetways and routes en route to or at destination terminals.

C.3.1 PIREP Data Publication

One of the SWIM Segment 1 capabilities being developed by the Weather COI is the ability to automatically distribute Pilot Reports (PIREPs) to en route controllers. ERAM will provide controllers with an interface to convert voice PIREPs into auto-PIREPs, and will send the auto-PIREPs to the Weather Message Switching Center Replacement (WMSCR) System. WMSCR will redistribute these via SWIM services to the wider NAS community and to weather forecasts at all levels. Since approximately 90% of PIREPs ‘fall on the floor,’ distribution of these crucial observations via WMSCR will enhance safety and capacity.

C.3.2 Integrated Terminal Weather System (ITWS) Publication

The SWIM ITWS Publication will provide ITWS products to the Airline Operational Centers (AOCs), to the National Weather Service (NWS) and to pilots. Sharing of

ITWS products with all NAS users promotes common situational awareness, which is absolutely crucial to the collaborative decision making (CDM) process that is necessary to reduce weather-related delays.

Greater distribution of ITWS data products will enhance NAS capacity by improving efficiency, as it displays convective weather and associated attributes at selected NAS pacing airports to traffic managers and dispatchers. ITWS also provides a real-time picture of aviation-impacting weather to traffic managers at ARTCCs, the ATCSCC, and large TRACONs via the ITWS Situation Display (SD). This enables Traffic Managers and controllers to track storm activity at major NAS airports, to comprehend airport acceptance rates (AAR), and to facilitate the traffic flow movement to mitigate the effect of weather on NAS operations.

With its microburst prediction capability, ITWS also increases aircraft safety on runways and in approach/departure corridors at NAS pacing airports by providing controllers [and pilots via Terminal Weather Information for Pilots (TWIP)] with advance notice of the likelihood of a wind shear/microburst event. ITWS capacity enhancements include gust-front prediction that enables controllers to optimize runway usage prior to wind-shift passage to help mitigate decreased Airport Acceptance Rate (AAR). The 1-hour Terminal convective weather forecast enables TRACON controllers to anticipate storm passage near gates so that they can maintain a safe and orderly flow of air traffic.

C.3.3 Corridor Integrated Weather System (CIWS) Publication

The SWIM CIWS Publication will provide CIWS products to the Airline Operational Centers (AOCs), to the National Weather Service (NWS) and to pilots. Greater distribution of CIWS functionality will not only provide the ability for traffic managers to collaborate on weather-avoidance routing/re-routing with dispatchers, but will also help to avoid en route delays, in turn helping to save airline fuel costs.

In the en route domain, CIWS produces an automated two-hour regional convective weather forecast (national forecast by the beginning of SWIM Segment 1), which will be available to traffic managers so they can determine the gaps in the convective weather activity and optimize routing. CIWS also provides current and forecast convective weather echo tops which enables traffic managers to exploit potential over-the-top routing.

Appendix D - Applicable Documents

The following specifications, handbooks, orders, standards, and drawings form a part of the requirements and are applicable to the extent specified herein. The latest version of these documents on the date of this approved document shall apply.

D.1.0 FAA/DOT Specifications, Standards, and Orders

NAS SR-1000	NAS System Requirements Specification.
FAA-HDBK-001	Design Handbook Energy Efficiency and Water Conservation in NAS Facilities
FAA-STD-019	Lightning Protection, Grounding, Bonding, and Shielding for Facilities
FAA-STD-029	Selection and Implementation of Telecommunications Standards
FAA Order 1050.1	Policies and Procedures for Considering Environmental Impacts
FAA Order 1050.10	Prevention, Control, and Abatement of Environmental Pollution at FAA Facilities
FAA Order 1053.1A	Energy and Water Management Program for FAA Buildings and Facilities
FAA Order 1050.14	Polychlorinated Biphenyls (PCBs) in the National Airspace System (NAS)
FAA Order 1050.20	Airway Facilities Asbestos Control
FAA Order 1370.82A	Information System Security Policy
FAA Order 1375.1	Data Management
FAA Order 1600.1	Personnel Security Program
FAA Order 1800.66	Configuration Management Policy
FAA Order 3900.19	Occupational Safety and Health
FAA Order 4441.16	Acquisition of Telecommunications Systems, Equipment and Services
FAA Order 6000.15C	General Maintenance Handbook for Airway Facilities. -chg1,
FAA Order 6000.22A	Maintenance of Analog Lines -chg3
FAA Order 6000.36A	Communications Diversity.
FAA Order 6000.47	Maintenance of Digital Transmission Channels
FAA Order 6970.3-chg37	Plant Equipment Modification–Temperature Control, Ventilation
FAA Order 8040.4	Safety Risk Management
	FAA Safety Risk Management Guidance for System Acquisitions (SRMGSA), dated November 29, 2006
FAA-G-2100	Section 3.3.1.3.10.2, Electronic Equipment, General Requirements

FAA-STD-026	Software Development for The National Airspace System (NAS)
FAA-STD-029	Selection and Implementation of Telecommunications Standards
FAA-STD-060	Data Standard for the National Airspace System (NAS)
	Human Factors Acquisition Job Aid (2003).
	Human Factors Design Standard (HFDS) (2005)
	Preliminary Human Factors Assessment (HFA) for SWIM JRC, Hewitt, G. and R. Gray (2005)
	Human Factors Design Guidelines for Multifunction Displays, FAA Office of Aerospace Medicine, Civil Aerospace Medical Institute, Mejdal, S., M. E. McCauley, et al. (2001.
	Human Factors Design Guide for Acquisition of Commercial-Off-The-Shelf Subsystems, Non-Developmental Items, and Developmental Systems,
	Executive Order (EO) 12902, Efficiency and Conservation at Federal Facilities, 8 March 1994
	FAA Information System Security Architecture Version 5
	SWIM Quality Assurance Plan
	SWIM Configuration Management Plan
	SWIM Implementation Strategy and Planning Document.

D.2.0 Other Publications and Specifications

	The National Energy Conservation Policy Act
	The National Environments Policy Act (NEPA) of 1969
10 CFR Part 435	Energy Efficiency in Buildings
Executive Order 13123	Greening of Government through Efficient Energy Management
Executive Order 12873	Federal Acquisition, Recycling, and Waste Prevention
Executive Order 12902	Efficiency and Conservation at Federal Facilities, 8 March 1994
29 CFR	Code of Federal Regulations (CFR Title 29, Part 1910), Occupational Safety and Health Standards
29 CFR1910.1000	Air Contaminants
29 CFR 1960.20	Occupational Safety and Health Hazards, and with Special Fire Life Safety Requirements
40 CFR 260 to 40 CFR 270	
40 CFR 700 to 40 CFR 766	
40 CFR	Protection of the Environment
40 CFR Part 82	
FAA Order 8040.4	Safety Risk Management;
FED-STD-795	Uniform Federal Accessibility Standard (UFAS), April 1988

Standard 70	National Fire Protection Association (NFPA), 1) Clearance Requirements and 2) National Electrical Code
10 CFR Part 435	Energy Efficiency in Buildings
ASHRAE 55-1992	Thermal Environmental Conditions for Human O Occupancy
ASHRAE 62-2001	Ventilation for Acceptable Indoor Air Quality.
	American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE) 1100-1992
	ANSI/IEEE STD 1100-1999, Recommended Practice for Powering and Grounding for Sensitive Electric Equipment
	44 U.S.C Federal Information System Security Act
	ISO 9001-200 and *FAA-Integrated Capability Maturity Model (*iCMM)
D3951-95	ASTM International
29USC 794D	The Rehabilitation Act Amendments (Section 508)