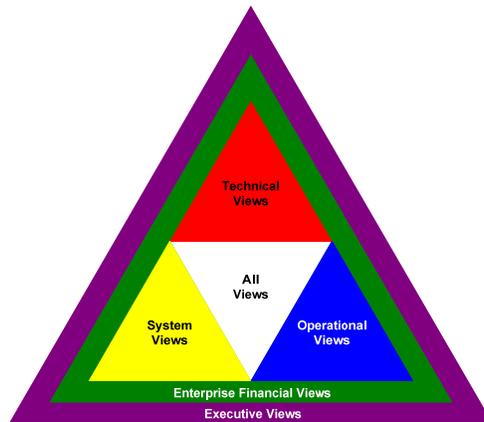




National Airspace System Enterprise Architecture (NAS EA)

Air Traffic Organization



**NextGen Far-Term (2025)
To-Be Enterprise-Level Architecture
Services Functionality Description (SV-4b)
Version 1.0
January 29, 2010**

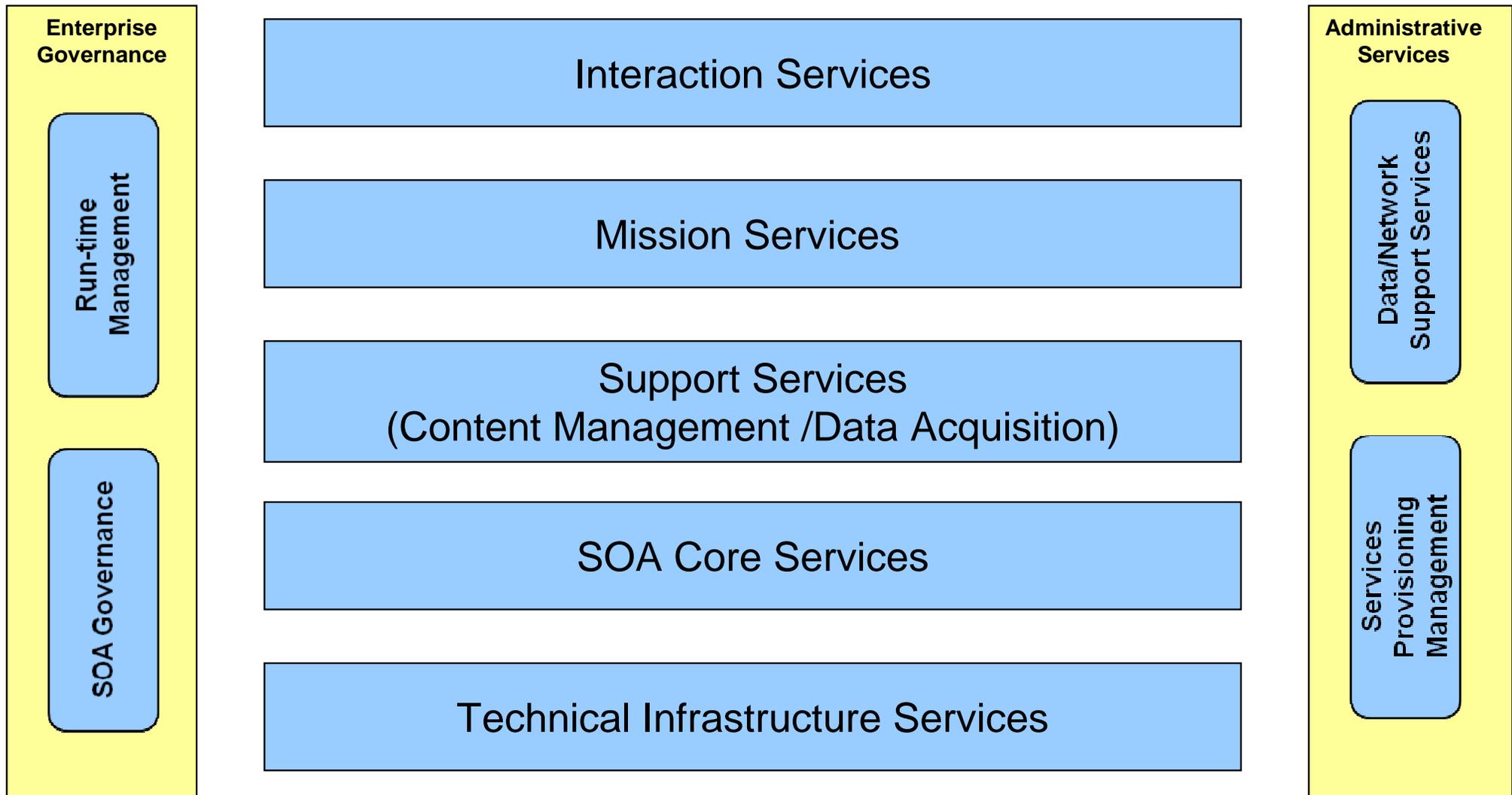


Figure 1
Simplified SV-4b Services Functionality Description TO-BE (NexGen 2025)

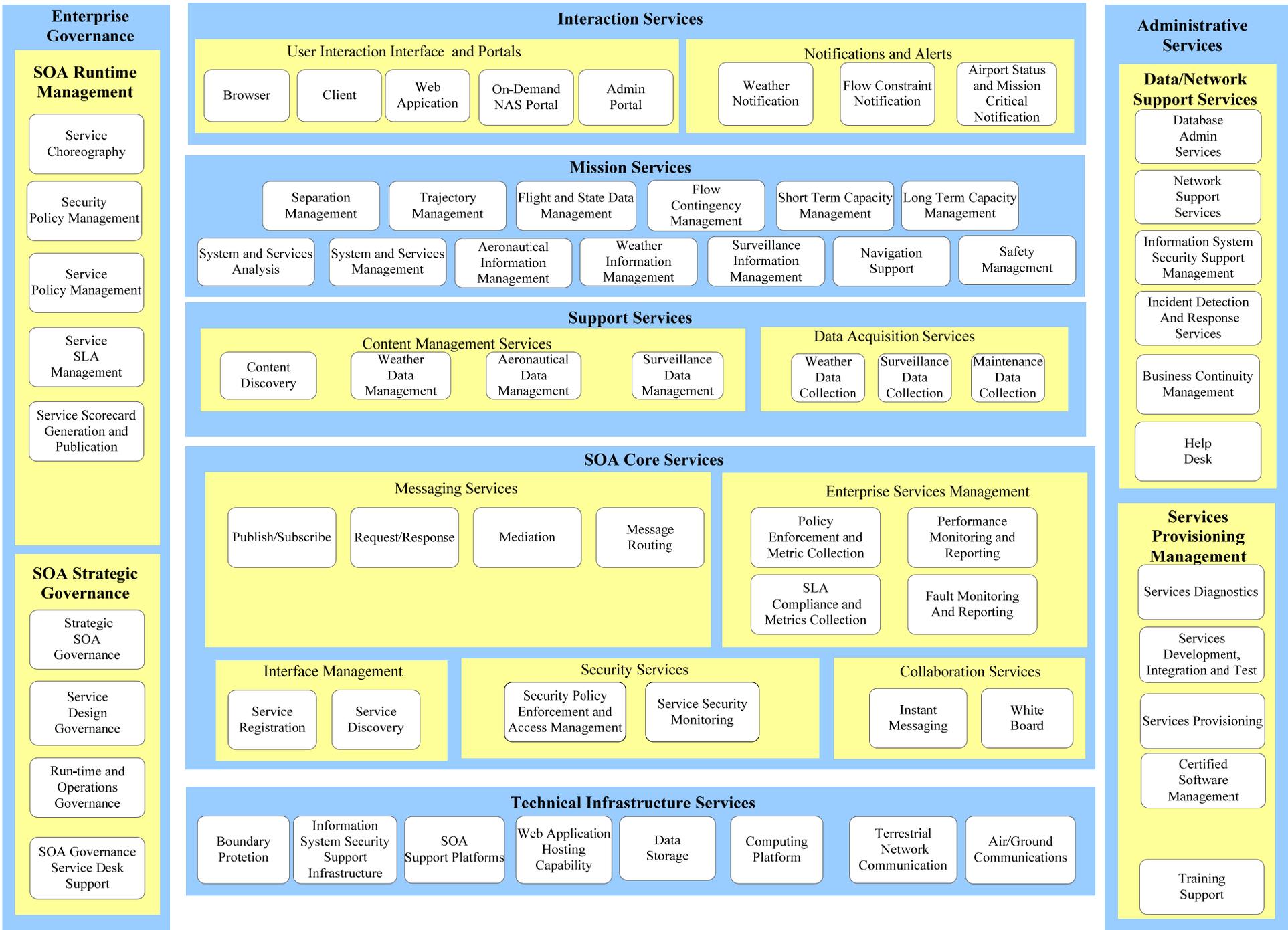


Figure 2
Detailed SV-4b Services Functionality Description TO-BE (NexGen 2025)

Background

The To-Be state for NextGen is identified as the 2025 timeframe. A key element of NextGen is migration to a Service Oriented Architecture and Net Centric Operations for the NAS. These two states drive the thrust of the NextGen NAS SV-4 into a slightly different direction. The 2025 NextGen NAS systems are not known and we want to group the functions into services rather than systems, with the goal of partitioning services into logical abstractions.

There are two basic ways to depict a functional description (SV-4): as a Data Flow Diagram, showing functions connected by data flow arrows; or as a Taxonomic Functional Hierarchy. The taxonomical approach is recommended by DoDAF for use in capability-based procurement where tasks are considered concurrent but dependent. The NAS EA “To-Be” SV-4 Services Functionality Description is represented using this approach, decomposing Enterprise-Level NAS functions in a “tree” structure conducive to modeling functions that are associated with a particular capability.

Purpose of the SV-4b Construct

DoDAF guidance indicates that for net-centric environments, the SV-4b should capture and depict how services are orchestrated together to deliver functionality associated with an operational need. In industry, this is often referred to as composable applications.

For the purpose of defining a Functionality Description for a Service Oriented NAS Architecture our key priorities are to identify NAS functions, describe functions as services, arrange the functions to show decoupling of services, and layer the functions to show abstraction of service types. The Abstraction of the layers is roughly analogous to OSI Layered Communication Model where the lowest layers correspond to physical or “on the wire” services and the upper layers correspond to human interaction type services. The clean lines between the layers indicate the decoupling between service types. Cross cutting Administrative and Governance services are shown vertically to indicate support to all the layers.

Specifics about the layers and the service functions follow in the tables below.

Layer	Description
Interaction Services	Interaction Services provide human observation and interaction using state of the art display and keyboard. Purpose of Interaction service is to provide situation awareness and decision support. It often relies on information provided by the business logic of the Mission services and Support Services. Interaction service utilizes Browser and Client to access services which may be hosted remotely on Application servers and Portals on the NAS network
Mission Services	The application services which provide mission business logic. They are residing in the NAS systems that support air traffic operations. Mission Service subscribes information provided by Support Services such as single authoritative source weather information or Flight and State Data.
Support Services	Information technology infrastructure services that provide information management for the Mission Services including content discovery, content management and data acquisition services for the NAS. Weather Data Management is an example of a Support Service. It provides single authoritative source of Weather information to the Flight Planning Service to assist flight planner to plan for the most efficient flight route.
SOA Core Services	SOA Core Services layer primarily provides interfaces and interoperability to support the upper layers. The prime components are messaging services, collaboration services, security services and Enterprise Service Management.
Technical Infrastructure Services	This layer provides the hardware and software infrastructure to support day to day operations for all NAS services which are on the upper layers Some components are the run-time computing platforms, data storage systems, network infrastructure, and enclave boundary and transport-level protection elements
Enterprise Governance	This layer divides into Strategic and runtime SOA governance. The Strategic governance including setting policy for strategy, services development lifecycle, runtime, and operations, The SOA runtime management is to administer run-time governance, auditing, and monitoring
Administrative Services	Includes network and database administration services, Information Security Support services, and Incident Detection and Response services. Provides process and support services for Service provisioning management

Table 1
SV-4b Layer Descriptions

Interaction Service	Function	Description
User Interaction Interface/Portals	Browser	For accessing information in the form of web pages provided by web servers in the NAS/SWIM network or content from NAS Information Domain systems. In term, the browser displays the provided web page to the user. A web page may contain hyperlinks to other information.
	Client	An application on an end-system that accesses a remote service on another computer system, known as a server, by way of a network. A client application also provides user interfaces with display and keyboard services
	Web Application	An application that is accessed via browser or client over a network such as the NAS network. It is also a computer software application that is coded in a browser-supported language (such as HTML, Java Script, Java, etc.) and reliant on a common web browser to render the application executable.
	On- Demand NAS Portal	Provides a secure unified access point, often in the form of a web-based user interface, and is designed to aggregate and personalize information through application-specific portlets
	Administration Portal	A special kind of portal for administration purpose, i.e. Runtime Management, or Data/Network Support Services.
Notifications and Alerts	Weather Notification	Provides web based user interface to subscribe real-time notification of significant weather condition changes.
	Flow Constraint Notification	Provides web based user interface to subscribe real-time notification of significant Flow Constraint changes.
	Airport Status and Mission Critical Notification	Provides web based user interface to subscribe real-time notification of airport status and mission critical information.

Table 2
Interaction Services Layer Services Descriptions

Mission Service	Description
Separation Management	Separation Management is the tactical response to violations or projected violations of separation standards. It generates tactical variations of flight trajectories to resolve projected conflicts between aircraft, and between an aircraft and an aviation hazard, such as obstacles to flight, restricted airspace, or severe weather.
Trajectory Management	Trajectory Management is the means through which 4-D trajectories are generated, assessed, and modified for use in trajectory-based operations. It supports the implementation of flow management strategies by managing changes to trajectories required by localized changes in capacity and demand.
Flight & State Data Management	Flight & State Data Management is the means through which the NAS establishes agreement with airspace users on expected route, altitude and time of flight using anticipated flight conditions such as weather, navigation capability, available routes, special use airspace and flow control conditions. It also maintains and distributes all flight information, including, aircraft characteristics and capabilities, flight plans and trajectories, flight status, and clearance delivery status.
Flow Contingency Management	Flow Contingency Management is the means through which existing assets are applied to adjust system capacity to meet the demand. It involves the identification of changes in demand, changes in system status and capacity, and the re-allocation of resources to provide sufficient capacity to meet that demand.
Short Term Capacity Management	Short Term Capacity Management is the means through which strategic planning is performed for applying existing assets to adjust system capacity to meet the demand. It involves the assessment of demand within an operational timeframe, and the allocation of resources to provide sufficient capacity to meet that demand.
Long Term Capacity Management	Long Term Capacity Management is the means through which new system capacity is generated or developed. It provides the tools that support the management of capacity during operations, including airspace configurations, pre-defined routes and fixes, procedures, airport infrastructure improvements, and staffing structures.
System & Services Management	System & Services Management represents the enterprise-wide maintenance and system management function. It monitors the health of all system elements in conjunction with Remote System & Services Management, and responds to failures and degradations of service, and provides logistics and preventative maintenance services to minimize system outages and degradation of services. It also monitors the health of external entities critical to the success of collaborative operations.
Systems & Services Analysis	System & Services Analysis includes both real-time and off-line analysis of information gathered throughout the system and from external entities. It is used to assess system performance and to support investigations of accidents, incidents, and criminal activity.

Table 3
Mission Services Layer Services Descriptions

Mission Service	Description
Navigation Support	Navigation Support includes functions performed by both ground-based and space-based navigation and landing systems that provide electronic reference signals to assist an aircraft in determining its position relative to a navigation fix or runway.
Safety Management	Safety Management Service is the means through which safety information is collected, derived from other system data, and analyzed to determine relative risk and appropriate means for mitigation.
Weather Information Management	Weather Information Management is the means for processing raw weather information and transforming it into an integrated, comprehensive, and authoritative source for all consumers and service providers. The processing includes interpolation between sources to provide complete lateral and vertical coverage, and probabilistic extrapolation from current conditions into the future so as to provide a 4-D representation of the weather situation that can be used for decision making related to the current traffic situation and for planning to accommodate projected demand. It also includes the derivation of products and data that can be applied to decision support tools, support trajectory-based operations, and provide advisories of hazardous weather to consumers.
Aeronautical Information Management	Aeronautical Information Management is the means to ensure that all stakeholders have access to critical information about system resources, procedures, constraints, and other factors impacting the use of the airspace system. It is the authoritative source for information produced by other functions and external entities.
Surveillance Information Management	Surveillance Information Management is the means for processing raw surveillance information and transforming it into an integrated, comprehensive, and authoritative source for all consumers and service providers. The processing includes correlating surveillance information with flight data to provide continuous identification and tracking of each flight. It also involves the derivation of information from the surveillance data, such as velocity and intent.

Table 3 (cont)
Mission Services Layer Services Descriptions

Support Service		Description
Content Management	Content Discovery	Content Discovery is the generic capability, re-used within various information domains, to identify and access specific data/information provided by the Support and Mission Services.
	Weather Data Management	Weather Data Management is the means by which weather data/information is managed by the system. This includes the use of 4D cube reference system to store and retrieve weather data/information
	Aeronautical Data Management	Aeronautical Data Management is the means by which aeronautical data/information is managed by the system
	Surveillance Data Management	Surveillance Data Management is the means by which Surveillance data/information is managed by the system
Data Acquisition	Weather Data Collection	Weather Data Collection encompasses all sources of weather data, including ground-based surface observation sensors, weather radar systems, airborne observation sensors, and weather gathered from other sources, such as NWS, weather satellites, and vendors.
	Surveillance Data Collection	Surveillance Data Collection encompasses all sources of surveillance data, including traditional independent (skin-paint) radar systems, cooperative beacon radar systems, and automated dependent surveillance.
	Maintenance Data Collection	Maintenance Data Collection encompasses all sources of NAS status and logistics management data.

Table 4
Support Services Layer Services Descriptions

Core Service	Function	Description
Messaging	Publish/Subscribe	Provides support for publish/subscribe message exchange pattern
	Request/Response	Provides support for request/response message exchange pattern
	Message Routing	Provides support for message routing between service providers and service consumers
	Mediation	Provides the capability for various types of mediation, such as data format transformation, between message senders and receivers
Enterprise Service Management	SLA Compliance and Metrics Collection	Monitors services to determine if factors specified in Service Level Agreements (SLAs) are out of the permitted range, including but not limited to resource utilization, fault behaviors ,and performance metrics
	Performance Monitoring and Reporting	Monitors services to determine level of performance including but not limited to throughput and response time. It also generates threshold based alerts and reports performance based metrics.
	Policy Enforcement and Metrics Collection	Enforces policies set by the governance process including SLA compliance and message QoS compliance
	Fault Monitoring and Reporting	Monitor services to determine if a service has a fault and report the fault
Interface Management	Service Discovery	Provides the capability for service consumers to be able to easily find information about services including the service access point
	Service Registration	Provide Service Registry for the providers to register service description including service SLA and QoS characteristics, and meta-data for Service Interfaces.
Security	Security Policy Enforcement and Access Management	Provides management of access to data resources that are based on the requesting entity’s identity, organizational role, or other considerations such as transaction state or application. Provides mechanisms to enforce security policies based on rules set by the NAS SOA Governance body.
	Service Security Monitoring	Provides monitoring of NAS services for any systems events that may indicate security breach or fraudulent use of NAS system resources
Collaboration	Instant Messaging	Allows any number of authorized users operating on different computers to collaborate with each other through textual messages delivered in real-time
	Whiteboard	Allows session users to view common files and provide the ability for users to collectively draw, annotate and mark “on top” of the common files view

Table 5
SOA Core Services Layer Services Descriptions

Technical Infrastructure Service	Description
Boundary Protection	Provides appropriate mechanisms that: (i) facilitates the adjudication of different interconnected system security policies (e.g., controlling the flow of information into or out of an interconnected system); and/or (ii) monitors and controls communications at the external boundary of an information system to prevent and detect malicious and other unauthorized communications.
INFOSEC Support Infrastructure	Provides capabilities for managing keys and supporting access control in the NAS
SOA Support Platforms	Provides an execution environment for operating systems including a Virtual Machine, common language runtime API, and runtime class library for application and Web Services (Java, Microsoft .Net,..etc.)
Web Application Hosting Capability	Provides hosting functions and platforms that can be used to deploy Interaction Services
Data Storage	Primarily considered as the secondary storage for computer files and relational database.
Computing Platform	Include a computer's architecture, operating system, programming languages and related runtime libraries or graphic user interface.
Terrestrial Network Communications	The NAS IP network primarily used for data communication between NAS applications, web servers, computer platforms and Data Storage.
Air/Ground Communications	Includes data and voice communications services between ground and aircraft systems.

Table 6
Technical Infrastructure Service Layer Services Descriptions

Enterprise Governance Service	Function	Description
Run Time Management	Service Choreography	Establishes community interchange patterns for collaborative purposes by services from different provider entities.
	Security Policy Management	Provides management and storing of the rules that allow and limit access privileges to SWIM data resources.
	Service Policy Management	Storing, categorizing, updating, and distributing policies to control monitoring of faults and quality of services
	Service SLA Management	Storing, updating, and distributing SLA to control monitoring of faults and quality of services
	Services Scorecard Generation and Publication	Collect information from Service Enforcement Point to review performance, capacity, reliability and availability of NAS systems and services and validate Service Policy and SLA are fulfilled.
SOA Governance	Strategic SOA Governance	Includes strategic planning, funding, budgeting, portfolio management, enterprise architecture, and business and technology alignment
	Service Design Governance	Creates and executes governance process including procedures for the design, implementation, test ,and run-time management of the NAS SOA Services
	Runtime and Operationsl Governance	Creates and executes governance process including procedures for runtime management and operations
	SOA Governance Service Desk Support	Provides a single point of contact to meet the needs and satisfy objectives of both SOA implementers and SOA governance management

Table 7
Enterprise Governance Service Layer (Vertical) Services Descriptions

Administrative Service	Function	Description
Data/Network Support Services	Database Administration Services	Providing the environmental aspects for databases including recoverability, integrity, security, availability, performance, development, and testing support
	Network Support Services	Providing maintenance of computer hardware and software that comprises a computer network, including deployment, configuration, maintenance, and monitoring
	Information System Security Support Management	Managing the Information System Security Support Infrastructure within the Technical Infrastructure Services area.
	Incident Detection and Response Services	Monitoring, analyzing and correlating incident detection sensor data from throughout the NAS, as well as reporting and coordinating response activities when an incident does occur.
	Business Continuity Management	Providing mechanisms to do an orderly restoration of NAS services when there is a disastrous disruption of NAS facility.
	Help Desk	Providing a single point of contact to support NAS personnel in the use of NAS services and to resolve reported problems
Services Provisioning Management	Service Diagnostics	Collects fault and performance data to perform diagnostics of services in NAS operation
	Services Development, Integration and Testing	Prototyping and operational testing for service qualities including reliability, availability ,and SLA policies before deployment
	Services Provisioning	Perform deployment, configuration and maintenance in the lifecycle of certified NAS services
	Certified Software Management	Providing a central source of approved software for use in the NAS, including the ability to ensure the integrity of the software
	Training Support	Supports training of NAS personnel to understand the characteristics and functionality of NAS application services

**Table 8
Administrative Services Layer (Vertical) Services Descriptions**