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U.S. Department
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**Federal Aviation
Administration**

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Standard

PREPARATION OF INTERFACE DOCUMENTATION

FOREWORD

This standard contains the requirements for preparing **Interface Requirements Document**s, and **Interface Control Document**s. It specifies the format and minimum acceptable content for documenting interfaces within the Federal Aviation Administration (FAA) Enterprise **Subsystem**s (FESS), including National Airspace System subsystems, and with other external entities.

This standard is intended for use by the FAA and associated contractors preparing interface documentation.

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1 SCOPE

This standard establishes the format and minimum content of **Interface Requirements Document**s (**IRD**) and **Interface Control Document**s (**ICD**) used by the Federal Aviation Administration (**FAA**).

1.1 Purpose

The purpose of this standard is to provide a set of instructions for preparing IRDs and **ICD**s for **key interface**s. This standard is applicable to all programs responsible for acquiring, upgrading, or developing FAA Enterprise Subsystems (FESS). This standard is based on FAA-STD-005, Preparation of Specification Documents.

1.2 Order of Precedence

If a conflict exists between the text of this document and the references cited herein, the document text takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

1.3 Document Organization

This standard is organized into six major sections and an appendix covering the scope; general document; common content; detailed IRD and ICD requirements; and development requirements.

a) Section 1 provides the scope and purpose of the document and lists applicable reference documents and defines terms and abbreviations.

b) Section 2 provides general document requirements on reference standards and publications, format, cover pages, and revision records.

c) Section 3 provides content requirements that are common to IRDs and ICDs, including the scope, applicable documents, quality assurance, and preparation for delivery.

d) Section 4 provides detailed content requirements for IRDs, including common IRD requirements as well as **analog interface**, **discrete interface**, **general service interface**, **Web service interface**, and facility IRD requirements.

e) Section 5 provides detailed content requirements for ICDs, including common ICD requirements as well as analog interface, discrete interface, general service interface, and Web service interface requirements.

f) Section 6 provides guidance on revising IRDs and ICDs.

g) Appendix I provides a development process guide for IRDs and ICDs.

1.4 Applicable Documents

The following documents form a part of this standard to the extent specified herein. IRDs and ICDs shall reflect the latest version of the documents or the date of the documents that are under contract by a project.

1.4.1 Government Documents

FAA Standards:

FAA-STD-002e	Facilities Engineering Drawing Preparation
FAA-STD-005e	Preparation of Specification Documents
FAA-STD-019e	Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
FAA-STD-039c	National Airspace System (NAS) Open Systems Architecture and Protocols
FAA-STD-042	National Airspace System (NAS) Naming and Addressing Structure for Ground-to-Ground Communication
FAA-STD-060b	Data Standard for the National Airspace System

FAA Orders:

FAA Order 1200.22C	NAS Data and Interface Equipment Used by Outside Interests
FAA Order 1370.82A	Information Systems Security Program
FAA Order 1370.83	Internet Access Point
FAA Order 1370.84	Internet Services
FAA Order 1370.92	Password and Pin Management
FAA Order 1370.93	Web Management
FAA Order 1370.94	Wireless Technologies Security
FAA Order 1370.95	Wide Area Network Connectivity Security
FAA Order 1375.1D	Information/Data Management
FAA Order 1600.1E	Personnel Security Program
FAA Order 1600.38D	Employee and Other Internal Security Investigations
FAA Order 1600.6E	Facility Security
FAA Order 1600.69A	Facility Security Management Program
FAA Order 1600.72	Contractor and Industrial Security Program
FAA Order 1600.73	Contractor and Industrial Security Program Operating Procedures
FAA Order 1600.75	Protecting Sensitive Unclassified Information (SUI)
FAA Order 1800.66	Configuration Management Policy
FAA Order 7350.7	Location Identifiers

FAA Specifications:

FAA-G-2100g, h	Electronic Equipment, General Requirements (Note: Both revision g and revision h are in effect.)
FAA-C-1217F	Electrical Work, Interior
NAS-SR-1000	NAS System Requirements Specification.

FAA Handbooks and Manuals:

FAA-HDBK-004	NAS **Internet Protocol Suite**
DOT/FAA/ES-85/01	NAS Interface Management Plan and Appendices, ATC-94-1075 Revision.
FAA WA FORM 4510-1	Materiel Specification Typing Guide Sheet.
SEM	FAA System Engineering Manual Version 3.1
NASEA	National Airspace System Enterprise Architecture
ATN	Aeronautical Telecommunication Network Manual

Copies of FAA specifications, standards, and publications may be obtained from The National Airspace System (NAS) Documentation Control Center at this address:

Federal Aviation Administration
NAS Documentation Control Center
800 Independence Avenue, SW
Washington, DC 20591

Requests shall clearly identify the desired material by number and date and state the intended use of the material.

1.4.2 Non-Government Documents

American National Standards Institute (ANSI):

ANSI/AIIM MS38	Recommended Practice for the Microrecording of Engineering Graphics-Computer-Output Microfilm
ANSI/AIIM MS52	Recommended Practice for the Requirements and Characteristics of Original Documents Intended for Optical Scanning

World Wide Web Committee (W3C):

Web Services Architecture, **W3C** Working Group Note 11 February 2004 may be obtained from W3C.

1.5 Definitions

The following definitions apply to the terms used in this standard. These definitions shall apply when the terms are used in interface documentation.

Analog Interface: A customized or specialized interface between two systems or **subsystem**s that uses **analog signal**s to transmit information.

Analog Signal: A nominally continuous electrical signal that varies in amplitude and / or phase frequency in response to changes in some quantity. Example: Microwave Communication, Primary Radar.

Application Process (AP): An identifiable set of cooperating capabilities within an open system that takes part in the execution of one or more information processing tasks. A particular **FESS** may include one or more application processes.

Aeronautical Telecommunication Network (ATN): The high frequency Aeronautical Telecommunication Network Data Link provides two-way digital data communications over high frequency radios using International Civil Aviation Organization- compliant ATN digital data link applications in the transoceanic domain. A Commercial Communications Service Provider provides this service.

Data Element: A basic unit of identifiable and definable information that occupies the space provided by fields in a record or blocks on a form. A data element has an identifying name and value or values for expressing specific facts. (See FAA Order 1375.1, Information/Data Management.)

Data Integrity: The condition that exists when data, sent from an approved source, has not been accidentally or maliciously modified, altered, or destroyed.

Data Type: A classification of the binary data in a data field used for data interchange. Some examples of data types are bitmap, Boolean, date, date time, decimal, integer, string, and time. For information about data types, see the FAA Data Registry (FDR) at http://fdr.gov/fdr/Home.jsp

Demarcation Point: A point at which operational control or ownership of communications changes from one organizational entity to another.

Device: A combination of hardware and software. A typical device has memory and a set of states that define the relationship between the systems' inputs and outputs. Many devices can interconnect; that is, join to form a bigger system. In industry, the integration of variable-speed drives and programmable logic controllers to automate production lines is a common example of devices connected together to form a (motion control) system.

Digital Signal: A signal that takes on only a discrete set of values. It typically derives from a signal that has been quantized. Common practical digital signals are represented as 8-bit (256 levels), 16-bit (65,536 levels), 32-bit (4.3 billion levels), and so on.

Discrete Interface: A customized or specialized digital interface between two systems or **subsystem**s. The discrete interface may not conform to any open system or network standards.

Discrete Signal: A **digital signal** free of **protocol** information. Example: Radar Azimuth Range and Azimuth Change Pulse.

Design Time: The time during which the static interface **message** structure is defined.

Drawing: A figure, block diagram, schematic, wiring diagram, or any other form of government- or industry-accepted graphic representation approved by the FAA for use in interface documentation.

Efficiency Critical: A condition in which **service thread** loss could be accommodated by reducing capacity without compromising safety; the resulting impact, however, might have a localized or system wide economic impact on **NAS** efficiency. (See NAS-SR-1000, NAS System Requirements Specification)

End System: One or more equipment items (or part of an equipment item) whose operation provides the functions of an open system associated with the interconnection of systems and the associated exchange of information. The end system contains the **application processes** that are the eventual sources and destinations of **user**-oriented **message** flows.

Essential: A condition in which **service thread** loss could be accommodated by reducing capacity without compromising safety; only a localized impact on **NAS** efficiency would result. (See NAS-SR-1000)

Expected Bit Error Rate: The expected number of erroneous bits divided by the total number of bits transmitted, received, or processed over some stipulated period.

Extensible Markup Language (XML): A specification of the World Wide Web Consortium (**W3C**). **XML** is a subset of Standard Generalized Markup Language that constitutes a particular text markup language for the interchange of **structured data**. (See FAA Order 1375.1)

FAA Enterprise Subsystems (FESS): One or more **subsystem**s inside the FAA infrastructure, including Operational, System Support, and Administrative **Subsystem**s.

FAA-Approved Registry: A registry that has been designated by the FAA Data Governance Board as fulfilling the requirements of Order 1375.1, Information/Data Management.

Facility: The total plant (e.g., building, structure, enclosure, assembly, Open-Air Plan "site") required for a **subsystem**/equipment item to function. The facilit**y** houses, supports, and protects the subsystem/equipment item. Facility characteristics are determined by the total complement of dependent subsystems/equipment items.

Facility Interface: A customized or specialized interface between the given **facility** and the given **subsystem**.

Field Name: A descriptive name that reflects the business meaning of the data field (e.g., "Aircraft Inspection Date"). This is not to be confused with an abbreviated or cryptic name (also referred to as internal, access, or symbolic name) that is often used in the software or database environment.

Field Definition: A statement that expresses the essential nature or meaning of the data field (e.g., "the date on which the aircraft was most recently inspected by the FAA").

Frequency of Message: An estimation of the maximum and average rate of message transfer.

Functional Interface: A logical or physical association between functions that allows transmission of a quantity across a boundary. Quantities may include electrical, hydraulic, and

pneumatic power; mechanical forces and torques; gases; heat; vibration, shock, and loads; data; and other quantities. (See **NAS** System Engineering Manual.)

General Service Interface: An interface type that defines or describes functions, such as code conversion, **protocol** conversion, and buffering, required for communications to and from a network. A General Service Interface allows a number of independent **device**s, with varying protocols, to communicate with each other. Examples of such interface include:Automated Radar Terminal System (ARTS) to Remote Displays, Standard Terminal Automation Replacement System (STARS) to External Users, En Route Automation Modernization (ERAM) to Enhanced Traffic Management System (ETMS), Host Interface Device (HID) NAS Local Area Network (LAN) to External Users, and NAS Infrastructure Management System (NIMS) to External Users.

Importance: Value of the **message** used during overload conditions to decide which message should be dropped.

Interface: A functional and physical connection at a boundary. (See the **NAS** System Engineering Manual.)

Interface Control Document (ICD): A design document that describes the detailed, as-built implementation of the functional requirements contained in the IRD. (**NAS** System Engineering Manual)

Interface Requirements Document (IRD): A formal document that provides FAA interface requirements between two elements, including type of **interface** (electrical, pneumatic, hydraulic, etc.) and the interface characteristics (functional or physical). (**NAS** System Engineering Manual)

Intermediate System: A system of one or more equipment items (or part of an equipment item) and/or communications media that performs the function of relaying, routing, and encapsulating information to **end system**s or other intermediate systems. An intermediate system is further detailed to provide network-layer relay functions and is allocated only to the lowest three layers of the open system interconnection (OSI) reference model in order to support the associated network-relay function. Included in the network-layer functions are routing, forwarding, and all associated header processing functions necessary to provide the required communications services requested by the upper layer **protocol**s.

Internet Protocol: A standard **protocol** designed for use in interconnected systems of packet-switched computer communication networks. It provides for transmitting blocks of data from sources to destinations, where sources and destinations are hosts identified by fixed-length addresses. The protocol also provides for fragmentation and assembly of long data blocks, if necessary, for transmission through small-packet networks.

Internet Protocol Suite (IPS): A set of **protocol**s based on Request for Comments de facto standards used within the data link, network, transport and application layers of the **OSI** model for establishing communications between systems.

Is: A verb used to express what the requirement should do, as suppose to must do. See “shall.”

Key Interface: An **interface** is designated as key when it spans organizational boundaries; is mission critical; there are capability, interoperability, or efficiency issues at that interface; or the

interface is vulnerable or important from a security perspective. (See FAA Order 1375.1) Terms used in this definition are further defined below:

Mission Critical Interface: An **interface** that is critical to the functioning of an organization in the accomplishment of its mission. The interface is critical if the loss of its function would result in one or more of the following:

1. Placing the health or safety of the FAA or Flying Public in jeopardy,
2. The loss of efficacy to the **NAS**,
3. Increased financial cost to the FAA capability**.**

Capability: Ability to provide a specified function, including all relevant **quality of services** aspects, such as accuracy, precision, timeliness, availability, reliability.

Interoperability: The ability of different types of computers, networks, operating systems, and applications to work together effectively, without prior communication, in order to exchange information in a useful and meaningful manner. There are three aspects of interoperability: semantic, structural, and syntactical efficiency issues at that **interface**;

Efficiency: A quality of accomplishing a task that recognizes, in an inverse fashion, the resources consumed in the process of accomplishing a task. A means of using resources in a less wasteful way.

Vulnerable: An **interface** is vulnerable to the degree that when subject to interference, the interface is negatively impacted in some aspect of its capability.

Security: The protection of data, system operations, and **device**s from accidental or intentional ruin, damage, or exposure.

Latency: The round-trip time between sending a request and receiving the response; propagation delay.

Local Area Network (LAN): A data communication system that lies within a limited spatial area, has a specific **user** group and topology, and is not a public switched telecommunications network, but may be connected to one. LANs are usually restricted to relatively small areas, such as rooms, buildings, and aircraft.

Maximum Field Length: The upper limit of the size of a data field, expressed in characters or bits.

Message: A defined set of data transferred across an interface.

Metadata: Information that describes the characteristics of data; data or information about data; and descriptive information about an organization's data activities, systems, and holdings. (See FAA Order 1375.1.)

Open System: A system with characteristics that comply with specified, publicly maintained, readily available standards and that therefore can be connected to other systems that comply with these same standards.

Open Systems Interconnection (OSI): A logical structure for communications networks standardized by the International Organization for Standardization (ISO). *Note:* Adherence to the standard enables any OSI-compliant system to communicate with any other OSI-compliant system.

Open Systems Interconnection Reference Model: A layered, abstract description for communications and computer **network protocol** design, developed as part of the **OSI** initiative. It is also called the **OSI** seven-layer model.

OSI Protocol Suite: A protocol suite that is composed of numerous standard **ISO** protocols that are based on the **OSI** reference model.

Permissible Values: The specification of the set of allowable instances of a field (e.g., "Postal U.S. State Codes"; "integers greater than 20 and less than 50."). The set can be specified by name, reference to a source, listing the values, or rules for generating the values.

Physical Interfaces: Interfaces associated with material contact. Physical interfaces are described in terms of their characteristics such as mechanical, electrical, and environmental.

Predefined Data: A unit of **structured data** for which sufficient **metadata** has been registered in an FAA-approved registry such as the FAA Data Registry. These units may range from a simple individual element or field to a complex combination of units such as a flight object or **XML schema**.

Priority: Communicates to the message dispatcher the order of task initiation.

Protocol: In the computer usage, a convention or standard that controls or enables the connection, communication, and data transfer among computing endpoints. In its simplest form, a **protocol** can be defined as the rules governing the syntax, semantics, and synchronization of communication. Protocols may be implemented by hardware, software, or a combination of the two. At the lowest level, a protocol defines the behavior of a hardware connection.

Quality of Service (QoS): A set of quantitative characteristics that measures the value of the provided service.

Routine: A condition in which **service** thread loss would have a minor impact on the risk associated with providing safe and efficient local **NAS** operations. (See NAS-SR-1000.)

Run Time: The duration of a computer program operation's execution, from beginning to termination.

Safety Critical: A condition in which **service thread** loss would present an unacceptable safety hazard during transition to reduced capacity operations. (See NAS-SR-1000.)

Service Oriented Architecture: An approach to integrate applications running on heterogeneous platforms using industry-wide acceptable standards. Each application is exposed as one or more services where each service provides a particular functionality. Services (applications) communicate with each other in a coordinated sequence that is defined by a business process.

Service Thread: A system input, system output, description of the transformations to be performed, and the conditions under which these transformations are to occur. (See **NAS** System Engineering Manual.)

Shall: A directive verb used to designate compulsory/mandatory design compliance. See "**is**."

Size of Message: The number of bytes per **message**.

Structured Data: Data that is organized in well-defined semantic "chunks" or units that are variously called fields, elements, objects, or entities. Individual units are often combined to form

larger, more complex units. Structured data can be described by various techniques, including record layout (for describing formatted **message**s), entity relationship model (for describing relational database content), class model (for describing object-oriented data collections), and **XML schema** (for describing XML instances[1]).

Structured Message: A **message** whose meaning can be extracted by a receiving system, because the receiving system is provided with sufficient **metadata** to construe the meaning of the **message.**

Subsystem: A set of one or more computers, associated software, peripherals, terminals, human operators, physical processes, information transfer means, and so on that forms an autonomous whole capable of performing information processing and/or information transfer.

Subsystem/Subsystem IRD: An **IRD** that specifies the **interface** between two **subsystem**s.

Subsystem/User ICD: An **ICD** designed for a given **subsystem** that interfaces to two or more subsystems (i.e., users) in a very similar way. This ICD specifies the common interface properties shared by the interfaces of the given subsystem with these users.

Subsystem/User IRD: An **IRD** designed for a given subsystem that interfaces to two or more subsystems (i.e., users) in a very similar way. This IRD describes the common interface properties shared by the interfaces of the given subsystem with these users.

Tolerance: The amount by which a measure of a particular characteristic (e.g., size, speed, and so on) is allowed to vary from its preferred or target value.

Throughput: For each **message**, the information packets processed by a system divided by time.

Unit of Measure: A single or multiple word designation assigned to a measurement framework for data elements with representational forms of quantity (e.g., watt, mile, miles per hour, ton, ampere). (See FAA-STD-060, Data Standard for the **NAS**.)

Unstructured Data: Data that does not follow any format or hierarchal sequence nor any relational rules. Unstructured data refers to masses of computerized information that do not have a data structure that is easily readable by a machine. Examples of unstructured data may include audio, video, and unstructured text such as the body of an e-mail or word processor document.

Unstructured Message: A **message** whose meaning cannot be extracted by a receiving system and must rely on a human for interpretation.

Urgency: A measure of the length of the time from a starting point to when a task shall be completed.

User: A computer, **subsystem**, or other entity that employs the services of a telecommunication system or information processing system to transfer information. A user functions as a source or final destination of information or as both.

Verification Requirement Traceability Matrix (VRTM): A matrix correlating requirements and the associated verification method(s). (See the FAA System Engineering Manual, section 4.3.)

[1] XML schemas are also XML instances.

Web Service: A self-describing, self-contained, modular unit of software application logic that provides defined business functionality. Web services are consumable software services that typically include some combination of business logic and data. Web services can be aggregated to establish a larger workflow or business transaction. Inherently, the architectural components of Web services support messaging, service descriptions, registries, and loosely coupled interoperability. (See FAA Order 1375.1.)

Web Service Interface: An **interface** type that employs Web services in order to exchange information.

XML Schema: A data structure and related information encoded as **XML** and used to pass information between systems. (See FAA Order 1375.1.)

1.6 Abbreviations

Following are the abbreviations and acronyms used in this standard. These definitions apply to the terms where they appear in interface documentation.

AC	Alternating Current
AE	Application Entity
ANSI	American National Standards Institute
AP	Application Process
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATN	Aeronautical Telecommunication Network
CATS	Capability Architecture Tool Suite
CCB	Configuration Control Board
CM	Configuration Management
DC	Direct Current
FAA	Federal Aviation Administration
FDR	FAA Data Registry
FESS	FAA Enterprise Subsystems
HTTP	HyperText Transfer Protocol
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
IPS	Internet Protocol Suite
IRD	Interface Requirements Document
ISO	International Organization for Standardization
JMS/QM	Java Messaging Service/Queue Manager
KVA	kilovolt ampere

IWG	Interface Working Group
LAN	Local Area Network
NAS	National Airspace System
NCP	NAS Change Proposal
OSI	Open Systems Interconnection
PM	Project Management
QoS	Quality of Service
SEC	System Engineering Council
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SR	System Requirement
STD	Standard
TBS	To Be Supplied
VoIP	Voice over Internet Protocol
VRTM	Verification Requirements Traceability Matrix
W3C	World Wide Web Consortium
WSDL	Web Services Description Language
XML	Extensible Markup Language

2 GENERAL DOCUMENT REQUIREMENTS

2.1 Interface Documentation

The **IRD** and **ICD** are closely related and each has a specific purpose. The program office within each line of business is typically responsible for developing IRDs and ICDs

IRDs identify the interface requirements between two **subsystem**s, between a subsystem and a "**user**" (where the "user" can be viewed as a variable that can be filled with multiple subsystems), or between a **facility** and a subsystem. The requirements in an IRD are often traced to or derived from requirements in a system-level specification or system requirements document.

ICDs describe the formal agreement that documents how the interface requirements outlined in the IRD are implemented; the ICD is the as-built configuration. The design characteristics in an ICD trace to and are derived from the interface requirements in an IRD.

When IRDs and ICDs are approved, they become baseline documents and are placed under configuration management. Appendix I of this document describes the development and approval process for IRDs and ICDs.

The requirements in this standard shall be used to document **key interface**s for **FESS**. If specific requirements or data are not known at the time for approval (and baseline) of the IRD, they shall be identified as 'To Be Supplied (TBS)'. The term TBS shall not be used in an ICD unless reference is made to a future capability in a future revision. After TBS items are determined, the IRD and ICD shall be revised in a timely manner.

2.2 Basic Approach

For IRDs, government and industry standards, specifications, and documents that act as de facto standards or specifications shall be used to specify interface requirements whenever possible. **Drawings**, figures, tables, and written text shall be used to supplement requirements in a standard or specification, or in the absence of an applicable standard or specification. Standards or specifications may also be used in an IRD to provide information or clarification without imposing requirements.

For ICDs, interface design characteristics shall be documented through drawings, tables, and written text. Drawings include figures, block diagrams, schematics, wiring diagrams, or any other form of government or industry-accepted graphic representation approved by the **FAA** for use in interface documentation. The ICD documents the interface design characteristics to the extent necessary to show compliance with the corresponding requirements from the governing IRD and referenced documents.

An IRD shall use the verb "shall" to document interface requirements, and an ICD shall use the verb "is/are" for documenting interface design characteristics. If an ICD has no parent IRD, the ICD includes both requirements and design characteristics, and uses "shall" to document the requirements and "is/are" to document the characteristics.

2.3 Reference Standards

IRDs and ICDs shall be prepared in accordance with this document and the most recent version of **FAA-STD-005**. Drawings prepared for use in imposing requirements shall comply with the most recent version of **FAA-STD-002**. Clarity and legibility shall meet the reproducibility requirements of **ANSI/AIIM MS52** and **ANSI/AIIM MS38**.

2.4 IRD and ICD Format

Each IRD and ICD shall, at a minimum, conform to the generic format in Figure 2.5.4-2 or Figure 2.5.4-3, depending on the type of contents. Figure 2.5.4-1 can be used to determine the type of contents being covered, and hence the generic type of Table of Contents that applies. Appendices may be used to specify requirements or to provide information in an IRD or ICD when the interface design details are lengthy or otherwise do not fit their respective format. When appendices are used in a manner that specifies requirements, they shall be referred to in sections 3 and 4.

If an item required by the format in Figure 2.5.4-2 or Figure 2.5.4-3 is not applicable to the interface being specified, these words shall be used "This IRD imposes no explicit [title of subsection or paragraph] requirements." Likewise, if an item required by the format in Figure 2.5.4-2 or Figure 2.5.4-3 is not applicable to the interface design, these words shall be used "This ICD imposes no explicit [title of subsection or paragraph] design characteristics." In instances where the requirements of a subsection are imposed by reference to an existing approved IRD/ICD, only the number and title of the subsection, followed by the reference to the that IRD/ICD and its applicable section(s), shall be listed.

If an item required by the format in Figure 2.5.4-2 or Figure 2.5.4-3 is not yet sufficiently defined to permit specification of requirements, it shall be identified by use of the term "To Be Supplied" (TBS). If "TBS" is used in an IRD, the missing information shall be supplied at the completion of the interface design and a revised IRD shall be submitted for approval.

For all documents, figures shall be numbered using the number of the section in which the figures appear, followed by a hyphen, followed by Arabic numerals (i.e., 3.1-1, 3.1-2); and tables shall be numbered using the number of the section in which the figures appear, followed by a hyphen, followed by capital Roman numerals (i.e., 3.1-I, 3.1-II).

2.4.1 Header/Footer

IRD and ICD covers shall be in accordance with the format in Figure 2.5.4-4. Each page, including the front cover, shall contain a header in the upper right-hand corner. Each header shall contain the IRD or ICD number and the date of the document. If the document is a draft, the word "DRAFT" in capital letters shall follow the date. Respective document numbers shall be obtained from the FAA. If the document is a revision to a baselined IRD, the word "REVISION" in capital letters, followed by the revision letter, shall be included immediately under the document's number. See Figure 2.5.4-4 for an example of the placement of this information.

2.4.2 Page Numbering

The cover of the document shall be the first page and shall have no page number. Page numbering shall begin on the Approval Signature page. The Approval Signature, Revision Record, and Table of Contents pages shall be numbered sequentially using lowercase Roman

numerals. The Approval Signature page shall be numbered "ii." All subsequent pages, beginning with page "1" of section 1, SCOPE, shall be numbered sequentially using Arabic numerals.

2.4.3 Paragraph Numbering

This standard uses the terms "section," "subsection," and "paragraph" in discussing the structural requirements for an IRD and the interface design characteristics for an ICD. "Section" and "subsection" are used in the conventional sense. "Paragraph" can mean a single paragraph or multiple paragraphs that are subparagraphs of a main paragraph. The author of an IRD shall subparagraph as necessary to present interface requirements in a logical, concise, and understandable manner.

For IRDs, each subparagraph shall be numbered. All requirements shall be structured such that only one "shall" statement appears in a uniquely identifiable portion of the subparagraph. Use of "shall not" statements is prohibited. Requirements shall be stated in section 3 or the appendices of the IRD.

2.4.4 Drawings and Tables

Drawings and tables may be used to document interface requirements or design characteristics. IRD drawings and tables shall document interface requirements where the interface requirements are of sufficient complexity. ICD drawings and tables shall document interface design characteristics where the design characteristics are of sufficient complexity.

Once a single drawing or table is used in an IRD or ICD, it may be referenced from any paragraph that contains interface design characteristics documented by that drawing or table. It is not necessary to reproduce the drawing or table for multiple references.

2.5 Required IRD/ICD Front Matter

The publication requirements in this section shall apply to all IRDs and ICDs.

2.5.1 Covers

IRD and ICD covers shall be produced using FAA WA Form 4510 or a template reproducing the form. An example of an IRD cover is shown in Figure 2.5.4-4. Covers for subsystem-to-user documents differ from subsystem-to-subsystem document covers in that the second occurrence of the word "subsystem" shall be replaced with the word "**user**." Covers for Facility IRD documents differ from subsystem-to-subsystem document covers in that the first occurrence of the word "subsystem" shall be replaced with the word "facility."

2.5.2 Approval Signature Page

The Approval Signature page shall be the first interior page of an IRD or ICD. Signatures on this page ensure that the interested parties have approved the data. IRD approving parties shall include:

- FAA program managers responsible for interfacing subsystems
- NAS Requirements and Interface Management Group (IRD for NAS related subsystems)
- FAA Enterprise Architect (for subsystems not under NAS CCB purview).

ICD approving parties shall include:

- FAA program managers responsible for interfacing subsystems
- Contractors responsible for developing the interface. (If the interface has not been developed by a separate entity under contract to the program, these signature are not needed)

If an ICD has no parent IRD, the approval signature page shall include all the parties mention above. Examples of an IRD and an ICD signature page are shown in Figure 2.5.4-5 and Figure 2.5.4-6 respectively.

2.5.3 Revision Record

The Revision Record page for an IRD and ICD shall conform to the format in Figure 2.5.4-. The "REVISION LETTER" column shall show the revision letter assigned at the time each revision is incorporated. The "DESCRIPTION" column shall briefly describe the change that was incorporated.

2.5.4 Table of Contents

The Table of Contents shall outline the contents of the document by sections and paragraphs. There are five (5) possible outlines to choose from. They are the following:

- Facilities (note: no ICD is required)
- Analog
- Discrete
- General Services
- Web Services.

Their respective titles and page numbers shall be listed in parallel columns in the order in which they appear in the document. To determine the type of interface and its table of content outline, see Figure 2.5.4-1.

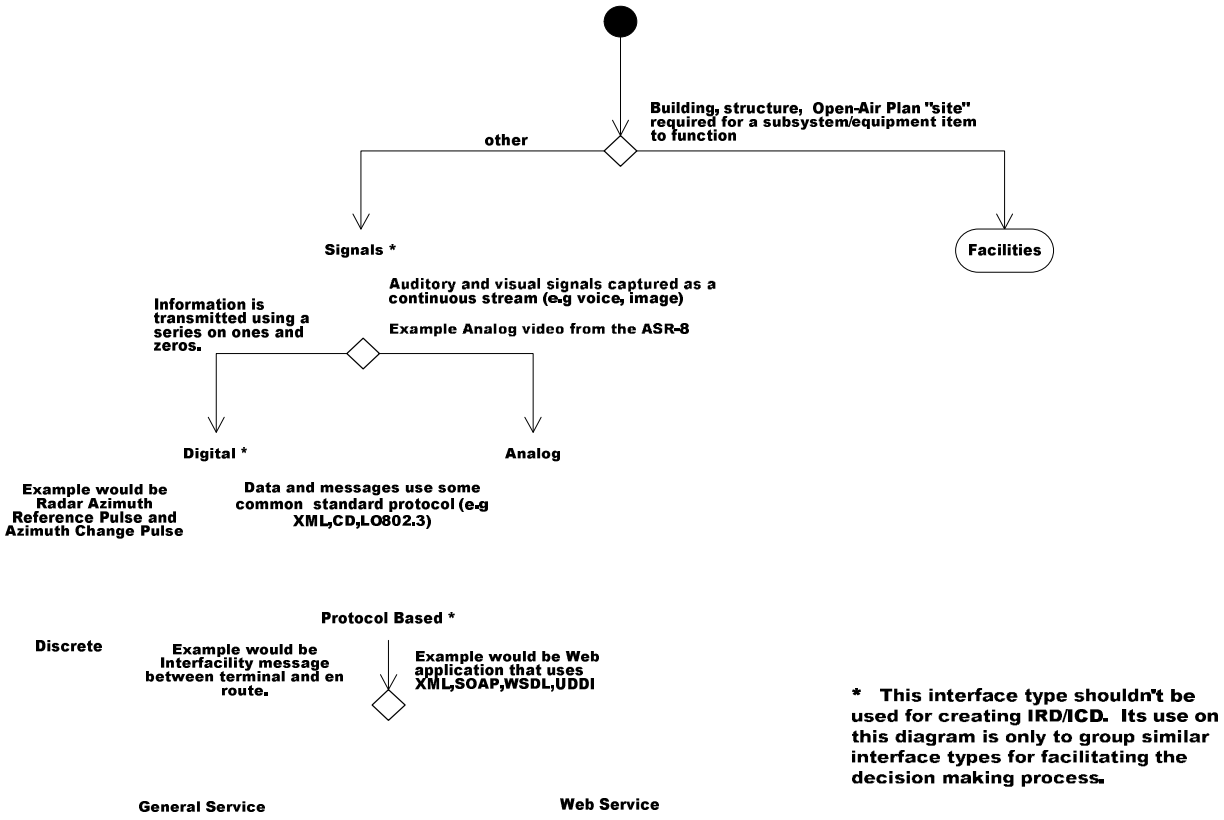

Figure 2.5.4-1 Decision Tree for Determining Interface Type

FACILITY IRD
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Revision Record
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3.2 Physical Requirements
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3.2.2 Electrical
3.2.2.1 Load Power
3.2.2.2 Load Balance
3.2.2.3 Harmonics
3.2.2.4 Overload Protection
3.2.2.5 Input Power Conditions
3.2.2.6 Grounding and Bonding
3.2.2.7 Electrical Power Availability
3.2.2.8 Critical/Essential Power Bus
3.2.2.9 Electrical Wiring
3.2.3 Environmental
3.2.3.1 Thermal/Cooling
3.2.3.2 Noise Levels
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3.2.4.4 Raised Flooring
4 Quality Assurance Provisions
4.1 Responsibility for Verification
4.2 Special Verification Requirements
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3.2 Functional Requirements/ Design Characteristics
3.2.1 Discrete Signal Requirements/ Characteristics
3.2.2 Test Points and Error Indications
3.3 Physical Requirements/ Characteristics
3.3.1 Electrical Power and Electronic Requirements/Characteristics
3.3.1.1 Connectors
3.3.1.2 Wire/Cable
3.3.1.3 Grounding
3.3.1.4 Fasteners
3.3.1.5 Electromagnetic Compatibility
4 Quality Assurance Provisions
4.1 Responsibility for Verification
4.2 Special Verification Requirements
4.3 Verification Requirements Traceability Matrix
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Figure 2.5.4-2 IRD/ICD Format Outline (Facility, Analog, and Discrete Type Interfaces)

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3.2.1 Functional Requirements
3.2.2 Application Processes and Message Requirements
3.2.2.1 Identification of Each Application Process
3.2.2.2 Application Process Capability Requirements
3.2.2.3 Message Content Requirements
3.2.2.4 Relationship among Messages
3.2.2.5 Quality of Service Requirements
3.2.2.6 Error Handling Requirements
3.2.2.7 Interface Summary Table
3.2.3 Protocol Implementation
3.2.3.1 Application Layer Services
3.2.3.2 Transport Layer Services
3.2.3.3 Naming and Addressing
3.3 Physical Requirements/ Characteristics
3.3.1 Electrical Power and Electronic Requirements/Characteristics
3.3.1.1 Connectors
3.3.1.2 Wire/Cable
3.3.1.3 Grounding
3.3.1.4 Fasteners
3.3.1.5 Electromagnetic Compatibility
4 Quality Assurance Provisions
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WEB SERVICE IRD/ICD
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3.2.2.1 Web Service Discovery
3.2.2.2 Web Service Information Transfer Requirements
3.2.2.3 Message Content Requirements
3.2.2.4 Relationship among Messages
3.2.2.5 Quality of Service Requirements
3.2.2.6 Error Handling Requirements
3.2.2.7 Interface Summary Table
3.2.3 Protocol Implementation
3.2.3.1 Application Layer Services
3.2.3.2 Transport Layer Services
3.2.3.3 Naming and Addressing
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4.1 Responsibility for Verification
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4.3 Verification Requirements Traceability Matrix
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6.1 Definitions
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Figure 2.5.4-3 IRD/ICD Format Outline (General Service and Web Service Interfaces)

NAS-IR-XXXXXXXX
Revision A
MM/DD/YYYY

U.S. Department of Transportation

Federal Aviation Administration

Interface Requirements Document

Subsystem 1 / Subsystem 2

Figure 2.5.4-4 Example of an IRD Cover Page (FAA WA Form 4510-1)

NAS-IR-XXXXXXXXX
Revision A
MM/DD/YYYY

Interface Requirements Document
Approval Signature Page
Subsystem 1 / Subsystem 2

Approval Signatures

Name	Organization	Signature	Date Signed
	Subsystem 1 Project Organization		
	Subsystem 2 Project Organization		
	NAS Requirements and Interface Management Group		

Figure 2.5.4-5 Example of an IRD Approval Signature Page

NAS-IC-XXXXXXXXX
Revision A
MM/DD/YYYY

Interface Control Document
Approval Signature Page
Subsystem 1 / Subsystem 2

Approval Signatures

Name	Organization	Signature	Date Signed
	Subsystem 1 Project Organization		
	Subsystem 2 Project Organization		
	Subsystem 1 Developing Contractor		
	Subsystem 2 Developing Contractor		

Figure 2.5.4-6 Example of an ICD Approval Signature Page

			IRD/ICD Number Rev Letter Date
Revision Record			
REVISION LETTER	DESCRIPTION	DATE	ENTERED BY
Revision Letter	Brief summary of change	CCD Approval date	Name of person editing the document

Figure 2.5.4-7 IRD/ICD Revision Record

3 COMMON CONTENT REQUIREMENTS

3.1 Scope

Section 1 shall describe the scope of the **IRD** or **ICD**. At a minimum, the scope of an IRD shall contain the following sentence: “This IRD provides the requirements for an interface between the [**subsystem** 1] and the [subsystem 2] or [Service].” For a subsystem/user IRD, replace “subsystem 2” with “**user**.” For an ICD, the scope shall contain the following sentence: “This ICD satisfies the **interface** design requirements contained in [requirements document number and title].”

For a **facility** IRD, the scope shall contain the following sentence at a minimum: "This IRD provides the requirements for an interface between the [facility] and the [subsystem] or [Service].” (Note: Facility interfaces do not require ICDs.)

Section 1.1 shall consist of a brief summary of the contents of the IRD or ICD and its intended purpose. Section 1.2 shall identify the responsible parties. Depending on the type of interface, the responsible parties shall be identified as indicated in the following subsections.

3.1.1 Subsystem Responsibility List

For IRDs, the Subsystem Responsibility List shall consist of the interfacing **subsystem**s with their respective common names and the responsible **FAA** organizations. For ICDs, the Subsystem Responsibility List shall consist of a list of the interfacing subsystems with their respective common names, the FAA program office responsible for the detailed design specification, and the contractor who is developing the interface. For Web service IRDs and ICDs, it is not necessary to list all the subsystems that could be replaced by the word "**user**,” but reasonable attempts should be made to identify and coordinate with as many users as possible. The Subsystem Responsibility List shall appear in subsection 1.2.

3.1.2 Facility/Subsystem Responsibility List

The Facility/Subsystem Responsibility List shall consist of a list of the interfacing facility/subsystems with their respective common names and the responsible FAA project offices. The Facility/Subsystem Responsibility List shall appear immediately after the scope in subsection 1.2.

3.2 Referenced Documents

If an IRD or ICD makes reference to another document, the document’s version or date of publication shall be specified in Section 2. When requirements are contained in a referenced document, the author shall specify the extent of any tailoring of those requirements and shall specify their verification methods. It is the responsibility of the IRD/ICD author to make sure that all referenced document are accessible throughout the lifecycle of the IRD/ICD. Therefore it is recommended that all referenced documents, whether printable or maintained in electronic databases or registries, be under FAA Configuration Control, as specified by **FAA Order 1800.66.**

3.3 Quality Assurance

Contents of this section apply to all IRDs and ICDs unless otherwise specified.

For IRDs, section 4 shall specify the process of verification for interface requirements presented. The Test and Evaluation process guidelines within the **Verification and Validation section of the System Engineering Manual section 4** shall be used, and tailored as necessary for the levels and methods of verification identified in the Verification Requirements Traceability Matrix (**VRTM**).

For ICDs, section 4 of the ICD shall specify the process of verification for interface design characteristics presented.

3.3.1 Responsibility for Verification

For IRDs, the Responsibility for Verification shall contain a statement to the effect that the government is responsible for developing and implementing the verification of requirements for each project. The government may delegate verification activities to other organizations, independent contractors, and/or the major prime contractor. The Responsibility for Verification shall be in subsection 4.1 of the IRD.

For ICDs, subsection 4.1 shall contain a statement documenting the contractor's testing responsibilities.

3.3.2 Special Verification Requirements

For IRDs, the Special Verification Requirements shall list and describe any special verification requirements necessary to verify the technical requirements imposed within the IRD. Conformance and interoperability verification requirements shall be performed for **ATN** and **IPS** subsystems. The government shall approve all conformance and interoperability verification activities conducted by the contractor. FAA program offices are responsible for obtaining the results of conformance and interoperability testing from the contractor. The Special Verification Requirements shall be in section 4.2 of the IRD.

3.3.3 Verification Requirements Traceability Matrix

There is a one-to-one correspondence between each "shall" statement and each entry in the Verification Requirements Traceability Matrix (VRTM).

Subsection 4.3 of the IRD shall contain the following statement: "Verification shall be in accordance with Table [4-x], Verification Requirements Traceability Matrix (VRTM)." The format of the VRTM shall comply (and be tailored if necessary) with the System Engineering Manual (SEM). The contents of the VRTM shall provide verification of each technical requirement contained in the IRD with the appropriate verification method(s). Only those verification methods used in the VRTM shall be identified at the top of the VRTM. The appropriate verification levels and methods for use in the VRTM are defined in the following paragraphs.

3.3.4 Verification Levels

The three levels of verification are Subsystem or Service, Integration, and Site. All requirements imposed by section 3 of the IRD shall be verified at one or more of these three levels.

a. **Subsystem level (Development).** This level is usually conducted at the contractor's facility and culminates in the formal acceptance of a contractual end-item.

b. **Integration level (Quality Assurance).** This level is conducted at the FAA William J. Hughes Technical Center or at a key site. The verification conducted shall determine if the hardware, software, or subsystem to be deployed for site installation will perform in an FAA environment and in accordance with FAA system-level operational and functional requirements.

c. **Site level (Production).** This level is usually performed at the designated site. The verification portion of the subsystem installation and checkout shall emphasize demonstration of the overall system performance requirements. It includes the demonstration of an end-item, subsystem and/or system, the final acceptance demonstrations, and commissioning activities.

3.3.5 Verification Methods

The four verification methods that can be used at any of the three verification levels are as follows. All requirements imposed by section 3 of the IRD shall be verified using one or more of these four methods.

a. **Inspection.** This method is used to determine compliance without using special laboratory equipment, procedures, or services and consists of a nondestructive static-state examination of hardware, software, and/or technical data and documentation.

b. **Demonstration.** This is a method in which qualitative determination of properties is made for a configuration item, including software and/or the use of technical data and documentation. The items being verified are observed, but not quantitatively measured, in a dynamic state.

c. **Analysis.** This is a method in which hardware or software designs are compared with known scientific and technical principles, procedures, and practices to estimate the capability of the proposed design to meet the mission and system requirements.

d. **Test.** This is a method in which performance is measured during or after the controlled application of functional and/or environmental stimuli. Quantitative measurements are analyzed to determine the degree of compliance. The process uses standardized laboratory equipment, procedures, and/or services.

3.4 Preparation for Delivery

For IRDs, section 5 shall specify any special requirements to ensure safe delivery of the **subsystem**.

For ICDs, section 5 shall document any special preparations for delivery.

Section 5 is not applicable to facility IRDs.

3.5 Notes

Section 6 shall contain information of a general or explanatory nature only.

3.5.1 Definitions

Subsection 6.1 shall define all nonstandard terms used in the document. Terms that are defined in FAA-STD-025, section 1.2, shall have the same definition in the document.

3.5.2 Abbreviations and Acronyms

Subsection 6.2 shall define all abbreviations and acronyms used in the document.

4 DETAILED IRD REQUIREMENTS

4.1 Common IRD Requirements

4.1.1 Interface Requirements

Section 3 of the **IRD** shall specify the general functions, services, options, and physical requirements among the interfacing **subsystem**s and/or services. The detailed **protocol** layer features shall be consistent with a specific functional specification. Performance requirements with **tolerance** measures shall be included.

4.1.2 General Requirements

Subsection 3.1 shall distinctly identify the interfacing subsystem(s), the point(s) of **interface** including associated cable terminations, and functions and services provided by the interface necessary to achieve connectivity. Figure 4.1.2-1 is an example of a subsystem and/or service interconnectivity.

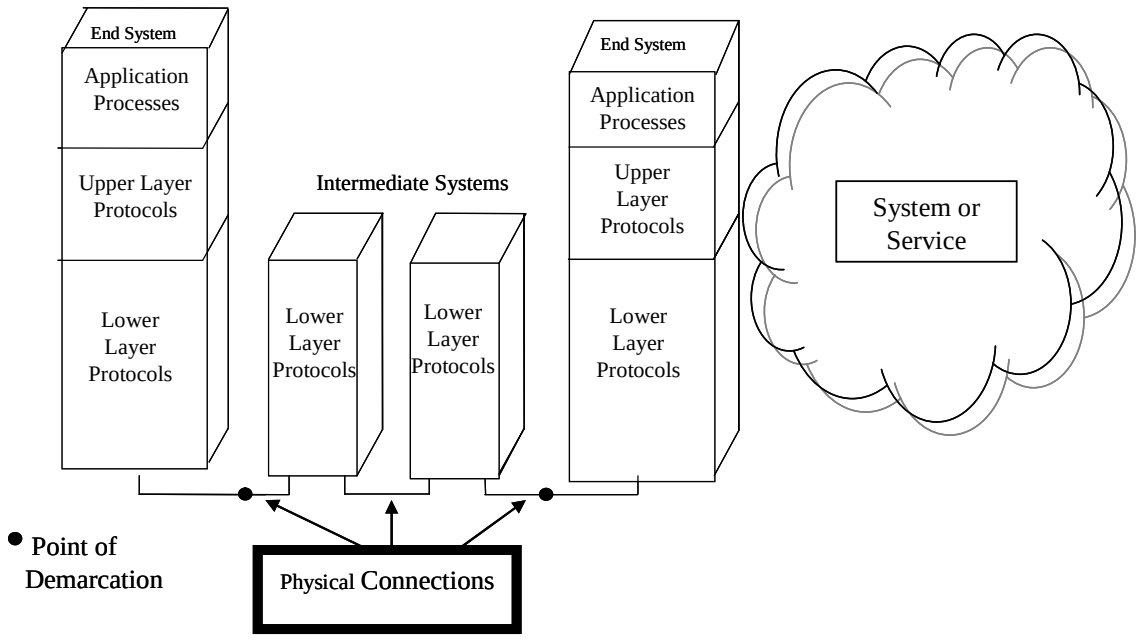


Figure 4.1.2-1 Subsystem and/or Service Interconnectivity

4.1.3 Functional Requirements

Subsection 3.2 is required in each IRD written to this standard and will vary based on the intended purpose of the interface. This subsection of the IRD shall specify the functional requirements for **analog**, **discrete**, **general service**, and **Web service interface**s. The subsection shall specify the physical requirements for **facility interfaces**.

4.1.4 Security Requirements

Subsection 3.1.1 shall specify security requirements for the interface in accordance with FAA policy and applicable functional specifications. Security requirements shall be based on a risk assessment performed jointly by end-users of the interface and service providers whose assets support and may affect the interface's security posture. Security assessment addresses the sensitivity and criticality levels of the data, examines risk exposure at both ends of the interface, and includes all security disciplines in the risk assessment. All layers that are used for security shall be documented. The following orders shall be used where applicable to address the security of the interface:

Information Security
FAA Order 1370.82, Information Systems Security Program Policy
FAA Order 1600.75, Protecting Sensitive Unclassified Information Policy

FAA Personnel
FAA Order 1600.1, Personnel Security Program
FAA Order 1600.38, Employee & Other Internal Security Investigations

FAA Contractors
FAA Order 1600.72, Contractor and Industrial Security Program
FAA Order 1600.73, Contractor and Industrial Security Program Operating Procedures

Facility/Physical Security
FAA Order 1600.6, Facility Security
FAA Order 1600.69, Facility Security Management Program

FAA NAS Data and Systems
FAA Order 1200.22, NAS Data and Interface Equipment Used by Outside Interests
FAA Order 1375.1, Data Management Policy

FAA Access Control
FAA Order 1370.92, Password & Pin Management

FAA Network
FAA Order 1370.94, Wireless Technologies Security
FAA Order 1370.95, Wide Area Network Connectivity Security

FAA Internet
FAA Order, 1370.83, Internet Access Point
FAA Order, 1370.84, Internet Services

FAA Web
FAA Order 1370.93, Web Management Web Service Interface Requirements

4.1.5 Physical Requirements

In certain cases where one or more of the subsystems supply electrical, mechanical, or environmental support to another subsystem, the physical requirements shall be documented in section 3.3 of an IRD for analog, discrete, and general service. Performance and **tolerance**

requirements shall be specified to the extent that they are appropriate to the functional requirement being specified.

4.1.6 Electrical Power and Electronic Requirements

This paragraph is required only when **one** subsystem will provide power to the interfacing subsystem.

Paragraph 3.3.1 shall provide the electrical power/electronic requirements associated with the interface as specified in section 3.1.1, Electrical Power, of **FAA-G-2100**, Electronic Equipment, General Requirements. Currently both revisions AA-G-2100g and FAA-G-2100h are in effect; however, only one of the revisions can be selected and used within a single interface document. The electrical power requirements relate to the transfer of primary-type power between subsystems. Electronic requirements relate to the process of signaling or controlling or transferring information. The specific electrical power/electronic factors to be considered in specifying the power transfer requirements are:

a) Voltage (Alternating Current (AC)/Direct Current (DC))

b) Frequency

c) Current (AC/DC)

d) Transients (voltage and current)

e) Harmonic Distortion

f) Polarity (+/-), number of phases

g) Overload Protection (voltage and current)

h) Power and power factor (displacement and distortion)

i) Maximum noise level

j) Load balancing and protection

k) Impedance

l) Grounding and Shielding

4.1.6.1 Connectors

Paragraph 3.3.1.1 shall specify the requirements for electrical power/electronic connectors. When it is necessary to specify requirements for connectors, such requirements may include the mechanical and electrical characteristics of size, shape, type, design, materials, finishes, number of pins, gender, polarity, fastening requirements, and voltage or current limitations.

4.1.6.2 Wire and Cable

Paragraph 3.3.1.2 is required only when there are specific limitations to cable characteristics or environmental. Reference **FAA-C-1217** and **FAA-STD-019** when using this paragraph.

4.1.6.3 Grounding

Paragraph 3.3.1.3 shall specify the requirements for connecting each circuit to the common electrical reference(s) for power and signals. Reference **FAA-STD-019** when using this paragraph.

4.1.6.4 Fasteners

Paragraph 3.3.1.4 shall specify the requirements for fasteners to be used to assemble interfacing components accordance with **FAA-G-2100**.

4.1.6.5 Electromagnetic Compatibility

Paragraph 3.3.1.5 is required only when the operating environment imposes specific limits on (1) the electromagnetic radiation produced by the interfacing subsystem or (2) the electromagnetic susceptibility of the interfacing subsystem. Such requirements include limits on the production of and susceptibility to radar and communications interference and maintaining specific signal transmission levels.

4.2 Analog Interface Requirements

The functional requirements for an **analog interface** in subsection 3.2.1 shall specify the number of **analog signal** paths required in each direction; the nature of the signals (e.g., voice band audio, video); the requirements for switching, control, and supervisory signaling; and the common electronic characteristics of the analog signals to be accommodated by the communications link or network that serves the interface (e.g., frequency bandwidth, impedance, signal-level, noise, and distortion limits). Any other requirements (for signal processing, signaling, call setup, toll quality, voice quality, jitter, wander, signal template, and so on) that pertain to the analog portion of the interface shall also be specified. Any requirements for test points and error indications shall be stated in paragraph 3.2.2.

4.3 Discrete Interface Requirements

The functional requirements for a **discrete interface** in subsection 3.2.1 shall specify the number of control signal paths to be used in each direction; functional requirements for switching, signaling, etc.; functions controlled on each signal path (e.g., "receiver mute" or "automatic gain control"); the common electrical characteristics (e.g., voltage, polarity, rise time, frequency, pulse rate, etc.) to be accommodated by the communications link or network that serves the interface; and any other requirements that pertain to the discrete control signal portion of the interface. Any requirements for test points and error indications shall be stated in paragraph 3.2.2.

4.4 General Service Interface Requirements

The functional requirements for a **general service interface** shall be specified in subsection 3.2.1. This subsection shall identify each **application process** and the services required, **message** content, **quality of service**, error handling, and security. Messages and their sizes, options, parameter settings, and class of services shall be defined at each protocol layer that is described.

4.4.1 Application Process

Subsection 3.2.2 and the following subsections apply to **general service interface**s.

4.4.1.1 Identification of Each Application Process

Subsection 3.2.2.1 identifies and describes each **application process** (AP) that utilizes the **interface**.

4.4.1.2 Application Process Capabilities

Subsection 3.2.2.2 shall describe the kind of capability(s) required by the **AP** (e.g., **message** transfer, file transfer, database inquiry, graphics, surveillance, sensor, and so on) and shall also specify the category of the system that supports the service (**safety critical**, **efficiency critical**, **essential**, or **routine**) as specified in **NAS-SR-1000**.

4.4.1.3 Message Content

Subsection 3.2.2.3 shall specify the requirements for the data transferred across the interface.

Subsection 3.2.2.3 shall identify the data transferred across the interface in conformance with FAA Order1375.1 Information/Data Management and FAA-STD-060 Data Standard for the **NAS**.

Data messages shall be specified in terms of size and type (e.g., audio, video, images, or text).

Structured data messages shall be further specified by describing the semantic (meaningful) units of data that comprise the messages.

The specifications may be placed in the IRD appendix. Subparagraphs a) through k) below describe how to specify data requirements.

a) Structured data shall be described in this paragraph by decomposing it into its semantic units.

b) All semantic units, complex as well as simple, shall be described. Common techniques for decomposing data include the record layout, entity relationship model, class model, and **XML schema**.

c) Any unit at any level of decomposition that is predefined (i.e., its description can be located in an FAA-approved registry) does not need to be decomposed further, but shall be described by providing an unambiguous reference to its description. The reference may be to the unit's FDR registration identifier, the URL of a registered XML schema containing the unit's description, etc.

d) Any unit that is not predefined shall be described by providing its conceptual definition.

e) A unit at the lowest level of decomposition (i.e., having no subunits) shall be further described by providing its unit of measure where applicable (e.g., feet, kilograms) and its permissible values.

f) Permissible values shall be specified by the name of a list (e.g., USPS State Codes), reference to a source (e.g., **FAA Order 7350.7.** Location Identifiers), a range of numbers, a textual description, or listing the values.

g) If the values are coded, the meanings of the codes shall be provided.

h) Other **metadata** shall be provided where relevant for units at any level of decomposition, including format or layout, **data type** (e.g., date, integer, decimal, bitmap, string), character set (e.g., 7-bit ASCII, Unicode), maximum length, explanatory comments, etc.

i) When XML schema is used, then either the entire schema shall be appended to this document or an accessible source of the schema shall be unambiguously referenced.

j) Messages exchanged via Web services can consist of one or more parts, where a part represents a single item that can be sent or received. The part can take many forms, including structured data objects, text, images, graphics, audio, and video. Currently the preferred and recommended way to describe units of data exchanged via Web services is XML schema.

k) If Web Services Description Language (**WSDL**) is used, then each message shall be consistent with its corresponding WSDL <message> element, and units shall be consistent with corresponding WSDL <types> elements. If an <xsd:schema> element is used, it shall refer to the same schema being described in this interface document.

4.4.1.4 Relationship among Messages

Subsection 3.2.2.4 shall specify the requirements for the relationships among messages transmitted across the interface. This information is only required for application level messages. Protocol message relationships such as TCP/IP acknowledgements (ACKs and NAKs) should not be included because they are specified as part of the protocol.

a) **Message Exchange Pattern**

Message traffic shall have predictability with respect to time.

The predictability shall be specified for scheduled messages—for example, the schedule, the periodicity.

The predictability shall be specified for unscheduled messages—for example, the peak rate.

The expectation for the transmission frequency shall be provided in this paragraph.

It is possible that bandwidth allocations will be made according to this estimate.

b) **Interfaces direction**

For interfaces, direction shall be identified for each message.

c) **Sequence of messages**

If receipt of a response message is expected, either in normal execution or in the case of errors, then the response requirement shall be stated in this paragraph.

Response messages shall be specified as described in paragraph 4.4.1.3 above.

Identify the response message and specify the maximum time interval allowed by which the response message shall traverse the interface.

4.4.1.5 Quality of Service

The Quality of Service (**QoS)** parameters in subsection 3.2.2.5 shall be in accordance with the approved standards listed in section 1.4 of this standard.

The QoS parameters required shall be documented. Parameters include:

a) Priority

b) Urgency

c) Importance

d) Data integrity

e) Expected bit error rate

f) Latency

g) Throughput

h) **Message** size

If the authors of the IRD/ICD believe that a given QoS parameter is not relevant it can be removed, if the reason for the removal is documented in the IRD/ICD. Note that the removal of the parameter is not valid until the IRD/ICD document has been approved by the CCB.

4.4.1.6 Application Process (AP) Error Handling

AP error conditions shall be specified in subsection 3.2.2.6. AP error-handling procedures shall be specified in subsection 3.2.2.5.

The error-handling capabilities of the lower layers are assumed to be unrelated to the AP error-handling process.

4.4.1.7 Interface Summary Table

The interface summary table below (Table 4.4.1.-I) illustrates the decomposition of an AP and its data messages, and shows where the various information requirements are potentially applicable ("X"). It also illustrates one way of arranging the information requirements called for in section 3.2.2 and its subsections. The intent is to capture the information requirements; this table or any convenient format may be used to do so.

Application Processes		Message Content										
4.4.1.1	4.4.1.2	4.4.1.3.a, b	4.4.1.3.c, i	4.4.1.3.c	4.4.1.3.d	4.4.1.3.h	4.4.1.3.h	4.4.1.3.h	4.4.1.3.h	4.4.1.3.e	4.4.1.3.f	4.4.1.3.g
Application Process Name	**Capa-bilities**	**Descriptive Name of Schema, Message, Unit or Subunit (An example decomposition is shown here)**	**Registry used, Registration Number or URL, or reference to appendix.**	**Name on registry, if different from Descriptive Name**	**Definition**	**Maximum Length**	**Character Set**	**Format or Layout**	**Data Type**	**Units of Measure (for quan-titative elements)**	**Permissible Values**	**Value Meanings (for coded values)**
AP 1	X											
		Schema A (predefined)	X	X								
		Message B (predefined)	X	X								
		Message C			X	X	X	X				
		Element C.1			X	X	X	X	X			
		Element C.1.1			X	X	X	X	X	X	X	X
		Element C.1.2			X	X	X	X	X	X	X	X
		Element C.1.3 (predefined)	X	X								
		Element C.1.4			X	X	X	X	X			
		Element C.1.4.1			X	X	X	X	X	X	X	X
		Element C.1.4.2			X	X	X	X	X	X	X	X

Application Processes	Message Content			Relationship among Messages				Quality of Service							Error Handling
4.4.1.1	4.4.1.3	4.4.1.3	4.4.1.3	4.4.1.4.a	4.4.1.4.b	4.4.1.4.b	4.4.1.4.c	4.4.1.5	4.4.1.5	4.4.1.5	4.4.1.5	4.4.1.5	4.4.1.5	4.4.1.5	4.4.1.6
Application Process Name (from previous table)	**Descriptive Name of Schema or Message (from previous table)**	**Type (e.g. audio, video, images, text)**	**Product Size**	**Peak Trans-mission Frequency**	**Source**	**Sink**	**Response Required? Give message name and response time**	**Priority**	**Urgency**	**Impor-tance**	**Integrity**	**Expected bit error rate**	**Latency**	**Through-put**	**Error conditions and error handling procedures**
AP 1								X	X	X	X	X	X	X	X
	Schema A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Message B	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Message C	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4.4.1-I Interface Summary Table

4.4.2 Protocol Implementation

Subsection 3.2.3 shall identify the required protocols for each layer of each subsystem. For the layers not used, this text shall be used: "This layer is not implemented." To ensure interoperability, subsection 3.2.3 shall address the specific features of the protocols supported at each layer as required. The protocols shall be described in accordance with **FAA-STD-039** and **FAA-HDBK-04** . An example of a stack is shown in Figure 4.4.2-1.

Layers used but not shown in the diagram shall be identified and defined.

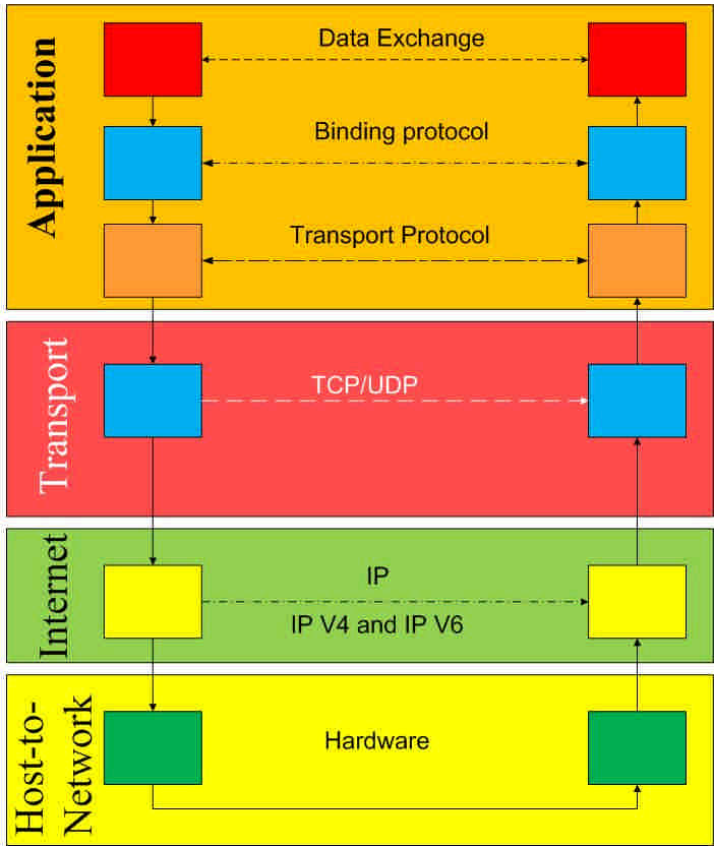


Figure 4.4.2-1 Internet Stack

4.4.2.1 Application Layer Services

Subsection 3.2.3.1 shall identify the functions and services (e.g., remote login, file transfer, and electronic mail) required for each subsystem).

All protocols to be used in the Application Layer shall be defined in this section (e.g., **HTTP** [Hypertext Transfer Protocol], **XML**, **SOAP** [Simple Object Access Protocol], and **VoIP** [Voice over Internet Protocol]. All protocols and relationships shall be specified in this section.

4.4.2.2 Transport Layer and Lower Layers

Subsection 3.2.3.2 shall identify the transport layer (end-to-end communications, packet routing, addressing, packet fragmentation, and reassembly, security, physical interface) required for each subsystem. The transport layer (known as network layer) shall be in accordance with **FAA-STD-39** and **FAA-STD-042** with guidance of **FAA-HDBK-04**.

4.4.2.3 Naming and Addressing

Subsection 3.2.3.3 shall identify the system naming and addressing requirements. Naming and addressing requirements for **NAS** open systems (i.e., intermediate and **end system**s) shall be in accordance with FAA-STD-042. Naming and addressing characteristics for Aeronautical Telecommunication Network (**ATN**) open systems shall be in accordance with the ATN Manual.

4.5 Web Service Interface Requirements

The functional requirements for a **Web service interface** shall be documented in subsection 3.2.1. This subsection shall identify each application process and its requirements, capabilities, message content, relationship among messages, quality of service, error handling, and security. Service Oriented Architecture (SOA) is one framework under which to implement Web service interfaces as shown in Figure 4.4.2-1.

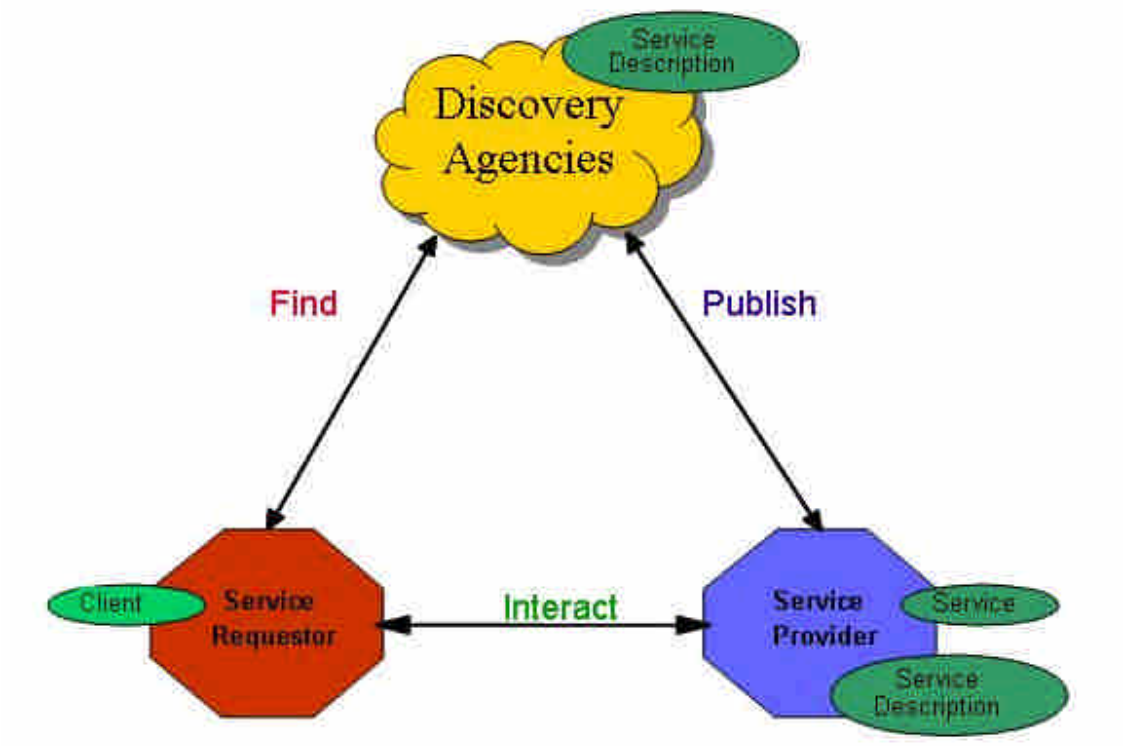


Figure 4.4.2-1 Service Oriented Architecture

In the figure, the service provider publishes the service (details) to discovery agencies. The client /service requestor finds the needed service from the discovery agencies, and then interacts with the service provided by the service provider.

4.5.1 Web Services Required by the Application Process

Subsection 3.2.2 shall describe the **AP** as shown below, with additional specifications shown in the following paragraphs. In accordance with SOA, this interface has two parts: Web service discovery and Web service information transfer.

4.5.1.1 Web Service Discovery

Subsection 3.2.2.1 shall describe Web service discovery information. The requestor agent shall obtain, at a minimum, the following information from the Web service discovery at **design time** and/or **run time**:

a. The kind of **AP** capability(ies) to be supported by the service (e.g., message transfer, file transfer, database inquiry, graphics, surveillance, sensor, and so on)

b. The category of the system that supports the service (**safety critical**, **efficiency critical**, **essential**, or **routine**) as specified in **NAS-SR-1000**

c. The discovery Uniform Resource Locator (URL)

d. The data description (**metadata** information)

e. The message binding to the application protocol.

Note: the provider needs to provide this information to the Web service discovery agent.

4.5.1.2 Web Service Information Transfer

Subsection 3.2.2.2 shall describe Web service information transfer requirements. Refer to 4.4.1.2, 4.4.1.3, and 4.4.1.4 of this Standard.

4.5.1.3 Quality of Service

Refer to 4.4.1.5 of this Standard.

4.5.1.4 AP Error Handling

Refer to 4.4.1.6 of this Standard.

4.5.1.5 Interface Summary Table

Refer to 4.4.1.7 of this Standard.

4.5.2 Protocol Implementation

Refer to 4.4.2 of this Standard.

4.5.2.1 Application Layer Services

Subsection 3.2.3.1 shall identify all the functions and services (e.g., remote login, file transfer, and electronic mail) required for each subsystem. All protocols that are required from the transport layer to the Web service shall be defined (e.g., **SOAP**, **JMS/QM**).

4.5.2.2 Transport Layer and Lower Layers

Refer to 4.4.2.2 of this Standard.

4.5.2.3 Naming and Addressing

Refer to 4.4.2.3 of this Standard.

4.6 Facility IRD Requirements

This section describes the detailed requirements unique to a facility IRD.

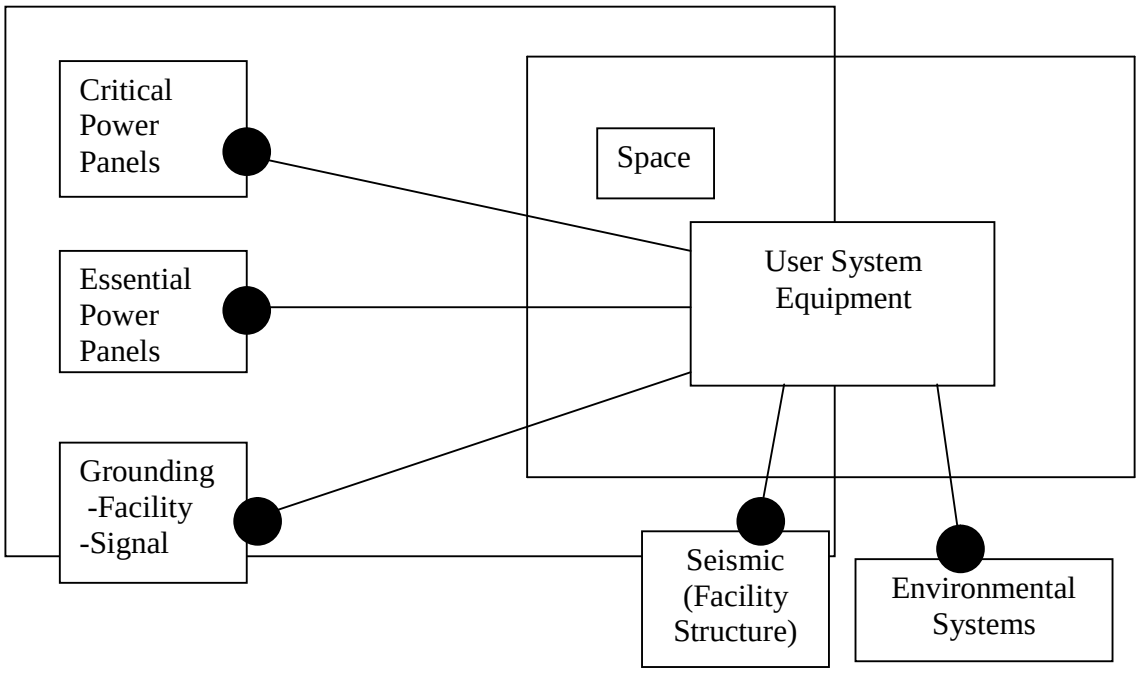
4.6.1 Interface Requirements

Section 3 of the facility IRD shall specify the general and physical interface requirements between a facility and a subsystem. Requirements shall be specified only to the extent necessary to ensure adequate interface design.

4.6.2 General Requirements

Subsection 3.1 shall contain the following statement: "The [subsystem] equipment shall be installed in the [facility] and conform to the requirements specified within this IRD."

The user subsystem's interface to other NAS subsystems is specified in other documents, and does not form a part of the facility IRD. Only facility-to-subsystem interfaces required for equipment installations are identified in subsection 3.1. Figure 4.6.2-1 is an example of a typical facility-to-user subsystem interface.



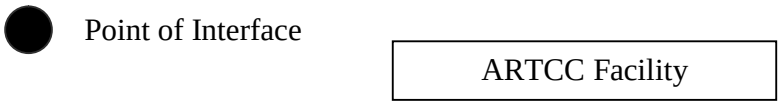


Figure 4.6.2-1 ARTCC Facility-to-User Subsystem Interface Diagram

4.6.3 Physical Requirements

Subsection 3.2 shall specify the space, electrical, and environmental requirements. In some instances, it may be advantageous to use text, as identified in the following paragraphs, to specify requirements in addition to the data tables. Performance and **tolerance** requirements shall be specified to the extent that they are appropriate to the functional requirement being detailed.

4.6.4 Space

Subsection 3.2.1 shall specify the space, footprint, location, and orientation requirements necessitated by the interface. Minimum and maximum space requirements of subsystem/equipment items shall be specified to ensure compatibility with associated facilities and to mitigate possible detrimental interaction. The impact of weight limits and dimensional limits (accessibility and access clearance for maintenance and repair activities) and durability on the interface shall be taken into account in specifying interface location and orientation. The subsystem space requirements shall be recorded in accordance with Table 4.6.4-I. The subsystem space allocation shall be recorded in accordance with Figure 4.6.4-II. If multiple areas are used, multiple figures may be used.

QTY	WIDTH (In.)	DEPTH (In.)	HEIGHT (In.)	FRONT CLEAR (In.)	REAR CLEAR (In.)	UNIT SPACE (Sq. Ft.)	TOTAL* SPACE (Sq. Ft.)	WEIGHT
* Includes all access space and "no-build" buffer space.								

Table 4.6.4-I User Subsystems Space Requirements

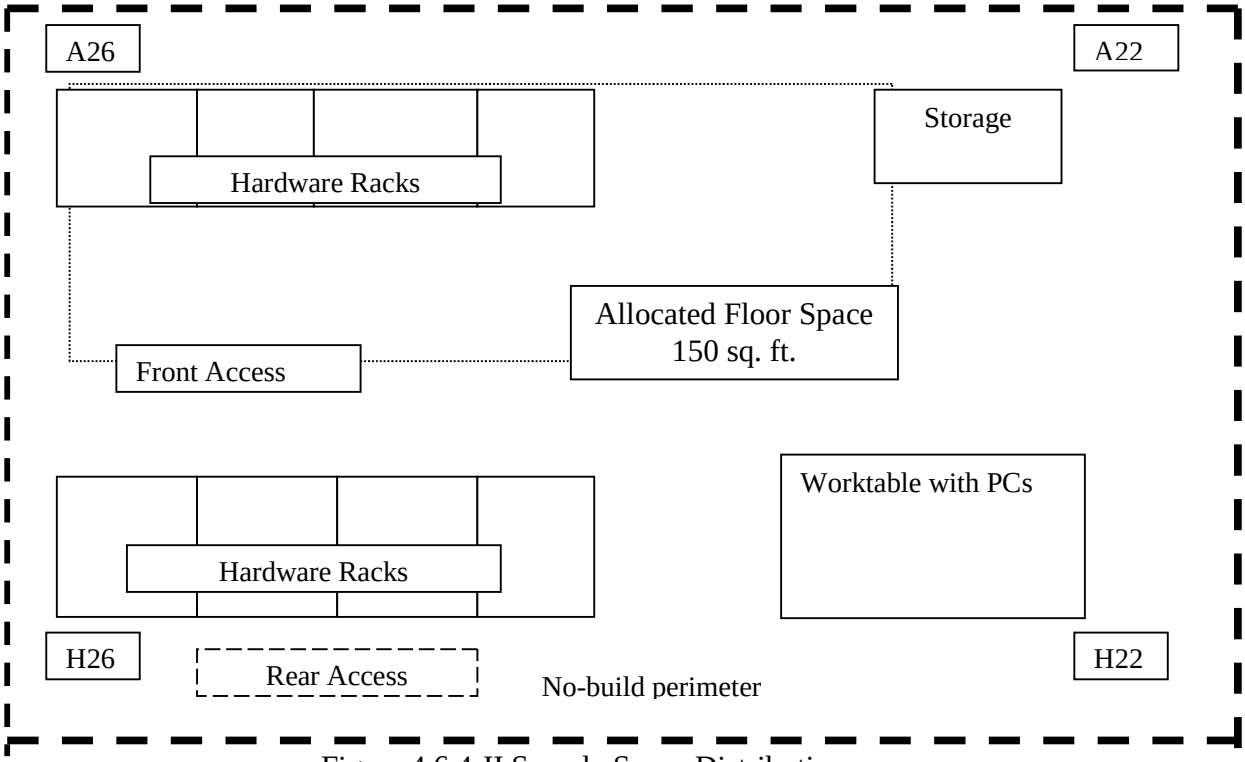


Figure 4.6.4-II Sample Space Distribution

Note: When space considerations are more complex than can be shown on the simplified diagram above, standard facility drawing markups shall be used and attached as necessary.

4.6.5 Electrical

Subsection 3.2.2 shall specify the electrical power requirements the facility must provide to the subsystem in order for the subsystem to operate as designed.

4.6.5.1 Load Power

Subsection 3.2.2.1 shall specify the inrush current and power factor requirements of the user subsystems within the facility in accordance with section 3.1.1.3, Load Power Characteristics, of FAA-G-2100.

4.6.5.2 Load Balance

Subsection 3.2.2.2 shall specify the load balance requirements of the user subsystems within the facility in accordance with section 3.1.1.4, Electrical Load Balance, of FAA-G-2100.

4.6.5.3 Harmonics

Subsection 3.2.2.3 shall specify the harmonics requirements of the **user subsystem**s within the facility in accordance with section 3.1.1.5, Harmonics, of FAA-G-2100.

4.6.5.4 Overload Protection

Subsection 3.2.2.4 shall specify the overload protection requirements of the user subsystems within the facility in accordance with section 3.1.1.6, Circuit Overload Protection, of FAA-G-2100.

4.6.5.5 Input Power Conditions

Subsection 3.2.2.5 shall specify the input power conditions, such as voltage source, current draw and power load, and voltage/time event requirements (ride-through), required by the user subsystems within the facility in accordance with section 3.1.1.7, Input Power Conditions, of FAA-G-2100.

4.6.5.6 Grounding and Bonding

Subsection 3.2.2.6 shall specify the grounding and bonding requirements of the user subsystems within the facility in accordance with section 3.1.1.9, Grounding and Bonding, of FAA-G-2100 and FAA-STD-019.

4.6.5.7 Electrical Power Availability/Maintainability/Reliability

Subsection 3.2.2.7 shall specify the electrical power availability requirements, electrical power maintainability requirements (e.g. system must remain powered at all times, system may be shut down for Quarterly Maintenance) and electrical power reliability requirements of the user subsystem within the facility.

4.6.5.8 Critical/**Essential** Power Bus

Subsection 3.2.2.8 shall specify the critical and essential power requirements for the user subsystem within the facility.

4.6.5.9 Electrical Wiring

Subsection 3.2.2.9 shall identify wiring by a single line diagram depicting equipment groups, branch circuits, and independent power connections.

4.6.6 Environmental

Subsection 3.2.3 shall specify the environmental requirements for operating the subsystem at a facility.

4.6.6.1 Thermal/Cooling

Subsection 3.2.3.1 shall specify the thermal/cooling requirements, including any specialized water or forced air-cooling requirements.

4.6.6.2 Noise Level

Subsection 3.2.3.2 shall specify noise level and noise abatement requirements in the operations and general work areas in accordance with FAA-G-2100.

4.6.6.3 Lightning

Subsection 3.2.3.3 shall specify any special lightning requirements per FAA-STD-019.

4.6.7 Project-Unique Requirements

Subsection 3.2.4 shall specify unique requirements that the facility must provide to the subsystem in order for the subsystem to operate as designed. “Unique” implies a service/requirement not typically provided by a facility. Included among the project-unique requirements would be the following sections.

4.6.7.1 Structural

Subsection 3.2.4.1 shall specify any specialized structural requirements for the user subsystem within the facility.

4.6.7.2 Grounding, Shielding, and Lightning Protection

Subsection 3.2.4.2 shall specify any special grounding, shielding, and lightning requirements for the user subsystem within the facility in accordance with FAA-STD-019.

4.6.7.3 Power-Conditioning Requirements

Subsection 3.2.4.3 shall specify any power-conditioning requirements for the user subsystem within the facility.

4.6.7.4 Raised Flooring

Subsection 3.2.4.4 shall specify any raised flooring requirements for the user subsystem within the facility.

5 DETAILED ICD REQUIREMENTS

5.1 Common ICD Requirements

The ICD is the document that describes the design characteristics that satisfy the requirements of the IRD, acts as the interface specification during the implementation, and documents the as built interface. An ICD shall be prepared for interfaces using the outlines in Figures 2.5.4-2 and 2.5.4-3 to document how the requirements have been implemented and to provide any other information necessary to implement and maintain the interface. Because an IRD is an FAA controlled document and an ICD is a deliverable from the developer, the IRD shall be revised as necessary to reflect any new or modified requirements that surface during development and implementation.
Occasionally, situations arise in which an ICD has no parent IRD; such an ICD shall document both the IRD requirements and the ICD design characteristics. The practice of submitting ICD with no parent IRD is not encouraged.

5.1.1 Interface Design Characteristics

Section 3 documents the general functions, services, options, and physical design characteristics among the interfacing **subsystem**s/services. The detailed **protocol** layer features shall be consistent with a specific functional specification. The **interface** design characteristics shall be documented to the extent necessary to show compliance with interface requirements layers that are described in section 3 of the parent IRD. Design characteristics and **tolerance**s shall also be included.

5.1.2 General Characteristics

Subsection 3.1 shall distinctly identify the interfacing subsystem(s), the point(s) of interface including associated cable terminations, and functions and services provided by the interface necessary to achieve connectivity. Figure 4.1.2-1 is an example of a subsystem-subsystem interface.

5.1.3 Security Characteristics

Subsection 3.1.1 shall document the security characteristics of the interface corresponding to the requirement of the parent IRD.

5.1.4 Functional Design Characteristics

Subsection 3.2 is required in each ICD written to this standard. The contents of this subsection will vary based on the purpose of the interface. For **analog**, **discrete**, general service, or Web service interfaces, this subsection of the ICD shall specify the functional design characteristics.

5.1.5 Physical Design Characteristics

Physical design characteristics shall be documented in subsection 3.3 of Analog, Discrete, and General Service interface ICDs. In certain cases where one or more of the subsystems supplies electrical, mechanical, or environmental support to another subsystem, the physical design characteristics shall be documented in the parent IRD. Tolerances shall be documented to the extent that they are appropriate to the functional characteristic being documented. Interfacing

subsystems shall be specified in their installed (or "mated") condition. In addition, the "halves" of the interface shall be separated and specified in detailed views. Only that portion of the hardware that is applicable to the interface needs to be identified. Each component or part shall be identified with the participant responsible for supplying it.

5.1.6 Electrical Power and Electronic Characteristics

When one subsystem will provide power to the interfacing subsystem, paragraph 3.3.1 shall document the electrical power and electronic characteristics associated with the interface as specified in section 3.1.1, Electrical Power, of FAA-G-2100. Currently both revision FAA-G-2100g and FAA-G-2100h are in effect; however, only one of the revisions can be selected and used within a single interface document. The electrical power characteristics relate to the transfer of primary-type power between subsystems. Electronic characteristics relate to the process of signaling or controlling or transferring information. The specific electrical power and electronic factors to be considered in describing the power transfer characteristics are:

a) Voltage (Alternating Current (**AC**)/ Direct Current (**DC**))

b) Frequency

c) Current (AC/DC)

d) Transients (voltage and current)

e) Harmonic Distortion

f) Polarity (+/-), number of phases

g) Protection (voltage and current)

h) Power and power factor (displacement and distortion)

i) Maximum noise level

j) Load balancing and protection

k) Impedance

l) Grounding and Shielding

5.1.6.1 Connectors

Paragraph 3.3.1.1 shall document the connectors used in the interface addressing any relevant requirements in the parent IRD. The mechanical characteristics to be documented shall include the following: the size, pin/socket configuration, keyway indexing, tolerance, materials, finish, and torque. Electrical characteristics to be documented shall include pin-to-pin isolation, breakdown voltage, contact resistance, dielectric properties, conductivity, and bonding. Connectors shall be specified in their "mated" condition with the wiring configuration of each half defined. Signal/function-to-pin assignments shall be defined for each connector half to ensure proper connection of the circuits involved. All wires, including jumpers, splices, spares, etc., shall be identified. All unconnected pins, including uninstalled pins, shall also be identified. These documented characteristics may be satisfied using a combination of **drawings**, tables, and written text.

5.1.6.2 Wire and Cable

Paragraph 3.3.1.2 shall document characteristics addressing any requirements in the parent IRD regarding wire type, conductor size, conductor material, jacket material, insulation voltage rating, color code, and so on. Wire characteristics to be documented shall include wire lengths, maximum resistances, cable capacitance, and characteristic impedance. If cable routing is critical to maintain electromagnetic compatibility or pulse isolation, or twist characteristics is required, a special note shall be included. Reference **FAA-C-1217** and **FAA-STD-019** when using this paragraph.

5.1.6.3 Grounding

Paragraph 3.3.1.3 shall document characteristics addressing any requirements in the parent IRD concerning how each circuit is connected to the common electrical reference(s) for power and signals. Reference FAA-STD-019 when using this paragraph.

5.1.6.4 Fasteners

Paragraph 3.3.1.4 shall document characteristics addressing any requirements in the parent IRD regarding the fasteners to be used to assemble interfacing components. Characteristics to be documented shall include head type, size, diameter, tolerance, thread definition, length, material, finish, and torque/installation values in accordance with FAA-G-2100.

5.1.6.5 Electromagnetic Compatibility

If there are electromagnetic compatibility requirements applicable to this interface, then paragraph 3.3.1.5 shall document signal transmission levels and electromagnetic compatibility characteristics of any equipment used to satisfy the requirements. If there is a required limit on the electromagnetic susceptibility of the subsystem, then the performance characteristics of the subsystem at the interface must be documented when the subsystem is operating in an environment where radiation limits are met or exceeded.

5.2 Analog Interface Characteristics

The functional characteristics corresponding to the requirements in the parent IRD of an **analog interface** shall be documented in subsection 3.2.1 and shall include the number of **analog signal** paths used in each direction; the nature of the signals (e.g., voice band audio, video); the functional characteristics for switching, control, and supervisory signaling; and the common electronic characteristics of the analog signals accommodated by the communications link or network that serves the interface (e.g., frequency bandwidth, impedance, signal level, noise and distortion limits). Any other characteristics (for signal processing, call setup, toll quality, voice quality, jitter, wander, signal template, signaling, and so on) that pertain to the analog portion of the interface shall also be documented.

5.3 Discrete Interface Characteristics

The functional characteristics corresponding to the requirements in the parent IRD of a **discrete interface** shall be documented in subsection 3.2.1 and shall include the number of control signal paths used in each direction; functional characteristics for switching, signaling, and so on; functions controlled on each signal path (e.g., “receiver mute” or “automatic gain control”); the

common electrical characteristics (e.g., voltage, polarity, rise time, frequency, pulse rate, and so on) accommodated by the communications link or network that serves the interface; and any other characteristics that pertain to the discrete control signal portion of the interface.

5.4 General Service Interface Characteristics

The functional design characteristics of a **general service interface** corresponding to the requirements in the parent IRD shall be documented in subsection 3.2.1. This subsection shall identify each **application process** and the services provided, message content, **quality of service**, error handling, and security.

5.4.1 Application Process

Subsection 3.2.2 and the subsequent subsections apply to **general service interface**s.

5.4.1.1 Identification of Each Application Process

Subsection 3.2.2.1 shall identify and describe, for those **application process**es required by the parent IRD, each application process (AP) that utilizes the interface.

5.4.1.2 Application Process Capabilities

Subsection 3.2.2.2 shall describe, for those capabilities required by the parent IRD, the capabilities of the **AP** (e.g., message transfer, file transfer, database inquiry, graphics, surveillance, sensor, etc.) and shall also specify the category of the system that supports the service (**safety critical**, **efficiency critical**, **essential**, or **routine**) as specified in **NAS-SR-1000**.

5.4.1.3 Message Content

Refer to 4.4.1.3 of this Standard.

5.4.1.4 Relationship among Messages

Refer to 4.4.1.4 of this Standard.

5.4.1.5 Quality of Service

Refer to 4.4.1.5 of this Standard.

5.4.1.6 AP Error Handling

Refer to 4.4.1.6 of this Standard.

5.4.1.7 Interface Summary Table

Refer to 4.4.1.7 of this Standard.

5.4.2 Protocol Implementation

Refer to 4.4.2 of this Standard.

5.4.2.1 Application Layer Services

Subsection 3.2.3.1 shall document, for those capabilities required by the parent IRD, the functions and services (e.g., remote login, file transfer, and electronic mail) implemented for

each subsystem. All **protocol**s that are used in the Application layer shall be documented in this section (e.g., **HTTP**, **XML**, **SOAP**, and **VoIP**).

5.4.2.2 Transport Layer and Lower Layers

Subsection 3.2.3.2 shall identify, for those capabilities required by the parent IRD, the transport (end-to-end communications, packet routing, addressing, packet fragmentation and reassembly, security, physical interface) implemented for each subsystem.

5.4.2.3 Naming and Addressing

Subsection 3.2.3.3 shall identify, for those capabilities required by the parent IRD, the system naming and addressing characteristics implemented for each subsystem.

5.5 Web Service Interface Characteristics

The functional design characteristics corresponding to the requirement of the parent IRD of a **Web service interface** shall be documented in subsection 3.2.1. This subsection shall identify each required **application process** and those of its design characteristics, capabilities, message content, relationship among messages, **quality of service**, error handling, and security corresponding to requirements in the parent IRD. Refer to subsection 4.5.

5.5.1 Web Services Used by the Application Process

Refer to 4.5.1 of this Standard.

5.5.1.1 Web Service Discovery

Refer to 4.5.1.1 of this Standard.

5.5.1.2 Web Service Information Transfer

Refer to 4.5.1.2 of this Standard.

5.5.1.3 Quality of Service

Refer to 4.5.1.3 of this Standard.

5.5.1.4 AP Error Handling

Refer to 4.4.1.6 of this Standard.

5.5.1.5 Interface Summary Table

Refer to 4.5.1.5 of this Standard.

5.5.2 Protocol Implementation

Refer to 4.5.2 of this Standard.

5.5.2.1 Application Layer Services

Refer to 4.5.2.1 of this Standard.

5.5.2.2 Transport Layer and Lower Layers

Refer to 4.5.2.2 of this Standard.

5.5.2.3 Naming and Addressing

Refer to 4.5.2.3 of this Standard.

6 IRD/ICD REVISIONS

Historically, revisions to IRD/ICD required submission of a special Interface Revision document. This practice is no longer followed by FAA; instead, the document is revised and given a new revision number to show that it supersedes the original IRD/ICD. Reasons for originating a revision may include:

a) Improving or expanding interface requirements

b) Adding information to complete an incomplete document

c) Bringing a document into compliance with actual design or operation

d) Incorporating requirement or design changes to resolve interface incompatibility

e) Documenting changes in **interface**s

f) Correcting typing errors.

The revised IRD/ICD is submitted for approval in accordance with FAA Order 1800.66.

Appendix I DEVELOPMENT AND APPROVAL GUIDE FOR INTERFACE DOCUMENTS

I.1 Introduction

I.1.1 Purpose

This appendix is an overview of the interface management process and a guide for developing **IRD**s and ICDs. It is intended for authors responsible for developing and maintaining IRDs and ICDs.

I.1.2 Scope

This guide is not meant to be all encompassing, but it does include sources for obtaining the information for developing IRDs and ICDs and identifies the organizations involved in coordinating the effort.

I.1.3 Overview

An IRD specifies the interface requirements between two or more **subsystem**s or facilities. It is used to ensure that affected offices agree to the interface requirements between an existing subsystem/**facility** and a new subsystem/facility. The IRD, except facility IRDs, becomes part of the procurement package to the contractors to ensure that the contractors are designing toward a mutually understood interface.

For the **facility** IRD, it is recommended that the document be developed in four iterations.

a) **Initial.** At the conception of the program, the document most likely contains minimal information. It is used as a reservation document for transition planning and defining the initial scope of site space and preparation requirements.

b) **Primary.** The document is targeted after development of the system specification and contains assumptions as well as firm data. It is a first refinement of the initial effort.

c) **Intermediate.** The document is developed after the program has matured to the point that a prototype has been developed or first-article testing has been completed.

d) **Final.** The document is refined and completed based on acceptance testing or key-site testing.

An ICD is a formal agreement prepared by the interface developer(s) that documents how the interface requirements defined in an IRD are implemented. The ICD identifies, quantifies, and controls the design characteristics of the interface. The ICD ensures interface compatibility by documenting form, fit, and function.

An IRD should be started in the early phase of an acquisition and must be in place before a statement of work is finalized. If both an IRD and ICD are required, as a rule, IRDs must be approved prior to an ICD. The ICD implements the IRD requirements in the design. Development of a revision, or a change to a previously developed IRD or ICD, can occur anytime after an IRD or ICD is baselined.

Any author of IRDs/ICDs (i.e., **FAA** personnel or appropriate contractors) may use the procedures and processes in this guide.

Specific procedures may vary depending on where the document is initiated. The IRD/Revision development process is described below and complies with FAA Order 1800.66, National Airspace System Configuration Management Procedures. The ICD approval process is a subset of the IRD/Revision approval process.

I.2 IRD Development and Approval Process

Note: The following process applies to IRDs associated with NAS Subsystems. A similar process for approving IRDs associated with subsystems that are not under NAS Configuration Control Board purview is being developed.

When a program has been approved by the Joint Resource Council (JRC) and an a decision has been made to identify user requirements and implement an interface, the responsible and/or designated Project Management organization(s) will appoint a IRD author.

The IRD author is responsible for defining the requirements for the interface between two **subsystem**s, a subsystem and a generic **user**, or between a subsystem and the **facility**. The author shall draft the IRD, request a document number from the Enterprise Configuration Management Branch and lead an Interface Working Group (**IWG**). The IWG should include representatives from Project Management, Systems Engineering, and stakeholders impacted by the IRD. Technical interchange meetings should be conducted to ensure complete and correct definition of requirements.

The IRD must be coordinated with the NAS Systems Engineering Requirements and Interface Management Group (NAS SE) or, in the case of an IRD that affects non-NAS systems, with the FAA Enterprise Architect as part of the approval process.

Once the draft IRD is completed, a draft case file shall be prepared. The case file package shall include FAA form 1800-2, the draft IRD, a comment resolution matrix, a list of reviewers, and approval of the stakeholders impacted by the IRD.

The case file originator will submit the draft case file to the Enterprise Configuration Management Branch's control desk. The control desk forwards the case file for prescreening review to the NAS SE and/or FAA Enterprise Architect. Upon completing the prescreening activity, the NAS SE will sign the final draft case file and forward the case file to the control desk. The Enterprise Configuration Management Branch will process the case file in accordance with FAA Order 1800.66 and the NAS **CCB** Charter and Operating Procedures and assigns an NAS Change Proposal (NCP) number. The originator is responsible for the IRD throughout the entire process until the IRD is approved by the NAS CCB, including comment resolution during prescreening and must evaluation.

Figure I.2-1 is a flowchart of this process.

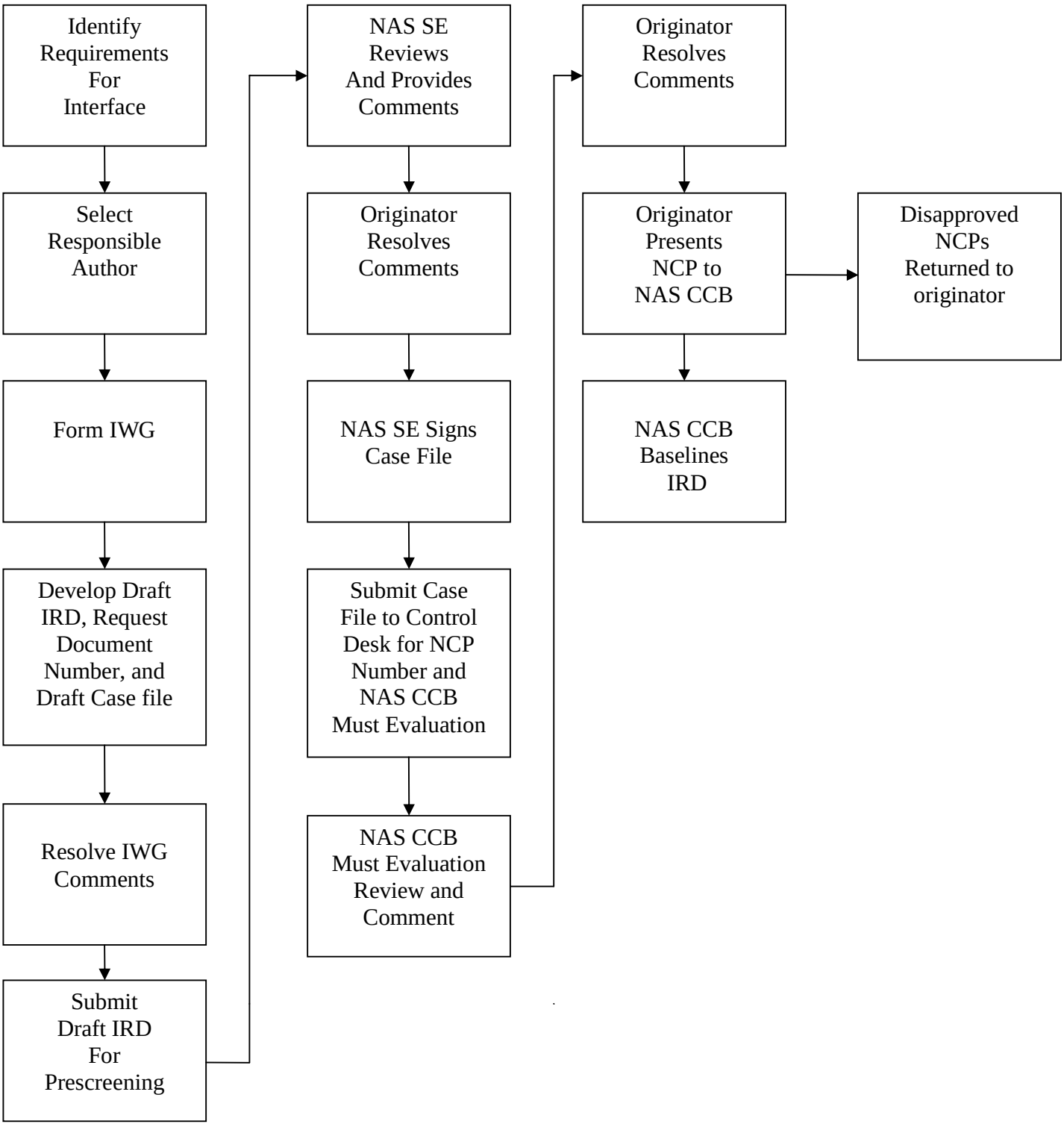


Figure I.2-1 IRD Development and Approval Process

I.3 Roles and Responsibilities

I.3.1 Project Management (PM)

PM is responsible for ensuring that all project requirements and funding for the interface are properly defined and that the IRD is used as the agreement for communicating these requirements. PM has one formal and several informal opportunities to comment on the IRD. PM is required to attend meetings associated with the IRD. PM is also responsible for developing required Memoranda of Agreement to detail the specifics of cost and schedule agreements. PM may consist of more than one organization. PM selects the IRD author. The IRD author is normally a member of the PM organization

I.3.2 IRD Author

The IRD author is the document originator representing the IWG. This individual is responsible for the IRD throughout the review process, originating the case file, ensuring that all comments are properly resolved, and presenting the document is its final form to the NAS CCB. The IRD author is responsible for submitting the final draft to the NAS SE for review and comments and will be required to resolve and incorporate any comments received as a result of the NAS SE prescreening review.

I.3.3 Interface Working Group

The IWG provides a forum to facilitate coordination of interface activities between project managers for the IRDs. The IWG is responsible for resolving interface incompatibilities, determining the required interface controls, resolving disputes, and determining document compliance with FAA-STD-025 requirements. The IWG ensures that the interface requirements stated in the document are valid.

I.3.4 NAS Systems Engineering Requirements and Interface Management Group

The NAS SE reviews the subject IRD for technical content, impacts to NAS Architecture and NAS Requirements, and format. The NAS SE is responsible for ensuring that the requirements in the IRD are consistent with system documentation and sufficiently detailed at the NAS system level.

I.3.5 System Engineer

System Engineer is responsible for preparing a safety risk management assessment and decision document for the IRD, which will be coordinated with PM. Team members for the assessment may include PM, stakeholder organization, IWG, and others as needed.

I.3.6 Configuration Management (CM)

CM's role is to process the case file in accordance with FAA Order1800.66 and the NAS CCB Charter and Operating Procedures. CM ensures that all documentation necessary for the CCB to make a decision on the IRD is included in the NCP package. CM develops a Configuration Control Decision to indicate formal baselining of the IRD and assigns actions to responsible organizations. The case file originator provides copies of the approved IRD to the Document Control Center and CM. CM will enter the IRD into the CM database.

I.4 ICD Development and Approval Process

During development, part of the design effort is to arrive at and document the interfaces that exist between systems. The ICD shall implement the IRD requirements in the design. All new or revised ICDs shall be processed for approval and baselining. The new or revised ICD shall be coordinated with all stakeholders and product teams of the interfacing systems. Reviews and agreement shall be documented and the final ICD signed by the product teams of the interfacing systems. A case file shall be developed to accompany the signed ICD and presented to the more mature system's CCB for baselining. The case file package shall include the signed ICD and evidence of the coordination and approval of affected organizations responsible for the subsystems. If a chartered CCB does not exist for the more mature subsystem, the case file shall be submitted to the NAS CCB for processing. If no parent IRD exists for the ICD, the ICD shall follow the IRD process and be submitted to NAS CCB for processing.

I.5.1 Interface Document references, Contents, Development, and Review

The following are sources of technical data that may be available, depending on where the projects are in their life cycle.

I.5.1.1 Sources of Requirements

The following are the prime sources of requirements:

a) **NAS Architecture Tool Set.** NAS-SR-1000 is being incorporated into the NAS Architecture, which can be accessed via the Internet. The NAS Architecture has been developed as a systems engineering tool to help sustain the high level of NAS safety and air traffic services; define new NAS capabilities in partnership with the aviation system users to improve safety, security, and efficiency; and increase understanding of the complexity of the airspace system and its services and capabilities.

b) **Capital Investment Plan**. This document contains general descriptions of the NAS projects.

c) **Mission Need Statement.** This document defines a mission capability shortfall or technological opportunity the agency should address.

d) **Final Requirements Document (FRD).** This document establishes the operational framework and performance baseline for satisfying the mission need of an acquisition program.

e) **Standards and Orders.** These are various Federal and industry standards and orders that specify procedures, practices, and **protocol**s for interfacing subsystems.

It is recommended that the following sources be used as they become available:

a) **Integrated Program Plan.** The plan encompasses all elements of program implementation. This may include the acquisition of subsystems and equipment, construction or modification of facilities and the physical infrastructure; functional integration of planned capabilities within the existing infrastructure; and procurement of services.

b) **Acquisition Strategy Paper.** This paper documents the strategy for executing the program during the Solution Implementation and for managing fielded products and services during in-service management. The document also integrates planning for all functional disciplines associated with program implementation, such as systems engineering, system safety management, in-service support, test and evaluation, security, quality assurance, human integration, and configuration management.

c) **Acquisition Program Baseline.** This baseline defines the cost, schedule, benefits, and performance baselines for the acquisition program.

d) **Investment Analysis Report.** This report contains the information used by the Joint Resources Council to make a sound and informed selection of the best overall solution to the capability shortfall or technological opportunity identified in the Mission Need Statement.

e) **Related IRDs.** Related IRDs that reference the same subsystem or facility may prove to be useful in providing requirements. A listing of available IRDs/ICDs appears in appendices I, II, and III of the Interface Management Plan

f) **Project Specifications.** These specifications provide additional information for each subsystem.

I.5.1.2 Other Sources

In addition to the technical sources mentioned above, other information sources should be used. These include, but are not limited to, the following people and organizations:

a) **Project Manager.** This individual is an excellent source for obtaining up-to-date project information, supplemental documentation, and specific interfacing criteria. The project manager can provide schedules and specific information on the **subsystem** development phase, and subsystem specifications.

b) **Systems Engineering.** Systems Engineering provides **NAS** system requirements information and interpretation of the requirements. Systems Engineering also provides information relating to requirements verification at the NAS system level (i.e., the Verification Requirements Traceability Matrix (**VRTM**)).

c) **Documentation Control Center.** The center provides copies of interface documentation, FAA standards and orders, and other documents.

I.5.2 Planning, Coordination, and Review of an IRD

Proper planning and early coordination with Program Office, Systems Engineering, Office of NAS Facilities, and Testing, Evaluation, and Laboratory will expedite the IRD process.

I.5.2.1 Planning

The author should coordinate early to ensure that word processing, graphics, and editing support are available.

I.5.2.2 IRD Coordination

The author developing IRDs can use the checklist in Table 10-1 to ensure that coordination is formally documented. Coordination with the following organizations is necessary:

a) **Program Office.** Early discussions with the applicable stakeholders and project managers will ensure that they are part of the IRD development process. These early discussions must emphasize the need to assess the cost impact of the IRD. When IRDs are formally processed and presented to the NAS CCB, they shall include the necessary funds.

b) **Systems Engineering Organization.** Coordination with the appropriate divisions of the Systems Engineering organization is required.

c) **Office of NAS Facilities.** This office will review the environmental, electrical, and mechanical characteristics, and maintenance-related messages.

d) **William J. Hughes Office** and the **Mike Monroney Aeronautical Center**, and / or the appropriate testing entity will provide coordination with engineering, test, evaluation and laboratory organizations as appropriate.

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Before the IRD is submitted for formal review, final coordination, and approval, the engineer/author should answer the following questions:

a) Are the requirements in the IRD traceable to the NAS Requirements Document?

b) Is the IRD written in accordance with the latest version of FAA-STD-025?

c) Have the **VRTM**s been developed specifically for this document? Do not copy VRTMs. Verify with the appropriate requirements testing organizations.

d) Are any cost impacts being defined?

Note: Coordination with the project's financial analysis group will identify the cost of implementing these requirements so that the program manager can determine if the costs are within scope. This will assist in the preparation of the case file needed to baseline the IRD and subsequent revisions.

I.5.2.3 Interface Document Review

Following are the required reviewers.

FAA Organization	Area	Interface Document Content
William J. Hughes Office and /or Mike Monroney Aeronautical Center and / or the appropriate testing organization.	William J. Hughes Technical Center and/or Mike Monroney Aeronautical Center.	Depends on document content
Information System Security	FAA HQ	Depends on document content
Affected Business Unit or Program Offices	FAA HQ	Depends on document content
NAS Systems Engineering and Safety Office	FAA HQ	All IRDs
Investment Analysis	FAA HQ	Depends on IRD content
NAS Implementation	FAA HQ	All Interface documents
NAS Planning and Support	FAA HQ	All Interface documents
NAS Operations	FAA HQ	All Interface documents

Table 5.2-I Recommended Reviewers

The **Interface Requirements Document** checklist is to be used as an aid in developing interface requirements documentation.

Quality Assurance Checklist	Confirmed by	Date
1. Ensure that the IRD is developed in accordance with the latest version of FAA-STD-025, unless there are contractual obligations to use a previous version.		
2. Ensure that "DRAFT" IRD versions are noted as such in the document header.		
3. Ensure that the Table of Contents is generated during IRD development by marking paragraph titles, rather than manually composed.		
4. Ensure that document titles cited in section 2, Applicable Documents, are correctly defined with the current revision level or date, unless there are contractual obligations to use previous revisions.		
5. Ensure that all documents referenced in the IRD have been cited in section 2.		
6. Ensure that the document revision letters are referenced only in section 2, except when a specific citation (e.g., paragraph, section, table, figure, or appendix) within the document is made, then the revision identification should be included.		
7. Ensure that paragraphs are structured so only one requirement or "shall statement" is defined per each unique identifiable text entity.		
8. Ensure that references to "who does what" are clear and accurate (e.g., Controller-Pilot Data Link Communications shall….)		
9. Ensure that each requirement in section 3 is addressed with a one-to-one correspondence in the Verification Requirements Traceability Matrix (VRTM).		
10. Ensure that verification phase/method entries in the VRTM have been coordinated with IWG and the project.		
11. Ensure that tables and figures are legible and properly aligned on the page.		
12. Ensure that tables and figures are placed on the page directly following their text reference. In the case of multiple references per page, position figures and tables in the order in which they are referenced.		
13. Ensure grammar is correct and content is clear.		
14. Ensure that the entire document has been spell-checked.		
*15. Ensure that square footage for panel-mounted components is calculated using width x height.		
*16. Ensure that square footage includes required clearance space for the component.		
*17. Ensure that the heat-generated value is calculated from the kilovolt ampere [kVA] value, unless citing known values.		
18. Ensure that the "Development and Approval Guide for IRDs" has been followed.		
19. Ensure that IRD development has been coordinated with the Program Offices and Systems Engineering.		

* For Facility IRDs.

Table 5.2-II IRD Development and Review Checklist