Foreword

The Web Service Requirements Document (WSRD) contained herein is an instructional example of a set of requirements developed as prescribed by FAA-STD-070 [4] for a fictitious “Flight Plan Service (FPS)”.

The FAA Pilot/Controller Glossary (P/CG) defines a flight plan as “specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility.” This example WSRD simulates a scenario in which a new Web service is needed for filing and modifying a flight plan online.

This document does not attempt to model or suggest a new Web service. Therefore, while an effort was made to present realistic requirements for a Web service that could be developed for flight planning, a number of logical and technical components that a “real” Web service usually requires were purposely omitted to make it easier for a reader to perceive or understand the major notions presented in FAA-STD-070. For the same reason, all technological standards or protocols employed in this example should not be taken as endorsing, recommending, or favoring any technology used in implementing Web services.

To make this example complete, the WSRD also includes a fictitious “Flight Plan Exchange Model” (FPXM) designed to enable the management and distribution of flight plan data in digital format (see more in section 5.2.4 of this document). This model and associated artifacts, including a fictitious flight plan schema and diagram, do not represent any actual model or artifacts developed or being developed by FAA and should not be used for any purpose except as an instructional aide.

It should be mentioned that there is also an associated instructional example of how to write a Web Service Description Document (WSDD) that describes a fictitious implemented FPS in accordance with FAA-STD-065A, Preparation of Web Service Description Documents [3].

Questions about the example WSRD may be directed to:

Federal Aviation Administration
Communication, Information and Network Programs, Enterprise Engineering, AJM-31
800 Independence Avenue, SW
Washington, DC 20591
Typographical Conventions used in the Instructional Example

Page headers, page numbers, figure and table captions, etc. are in accordance with FAA-STD-070 Section 4, General Requirements [4].

FAA-STD-070 does not dictate other stylistic aspects of a WSRD (e.g., font face, font size, page borders, etc.).

Instances of shaded and bordered paragraphs (like this) inserted at several points in this document represent explanatory notes that would not appear in an actual WSRD.
Web Service Requirements Document

Flight Plan Service (FPS)
# Web Service Requirements Document

**Flight Plan Service (FPS)**

## Approval Signatures

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Signature</th>
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</tr>
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<tbody>
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<td>July 18, 2012</td>
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<tr>
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</tr>
</tbody>
</table>
## Revision Record

<table>
<thead>
<tr>
<th>Revision Letter</th>
<th>Description</th>
<th>Revision Date</th>
<th>Entered By</th>
</tr>
</thead>
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1 Scope
This Web Service Requirements Document (WSRD) provides the requirements for the Flight Plan Service (FPS). This service will give a service consumer the capability to file, modify, and cancel a flight plan operating under Instrument Flight Rules (IFR).

This WSRD has been prepared in accordance with FAA-STD-070, Department of Transportation Federal Aviation Administration, Preparation of Web Service Requirements Documents [4].

1.1 Background
In today’s NAS environment, a flight plan specifies information that describes a desired route of flight between a well-defined departure and destination point within which separation services are required. Additional information provided in the flight plan shows that the flight meets the legal requirements of Instrument Flight Rules (IFR).

The intended outcome of filing an IFR flight plan is to receive air traffic control (ATC) separation services between the departure and destination airports through a subsequent flight plan clearance.

As a part of transitioning toward the Next Generation Air Transportation System (NextGen), the En Route Services Modernization Group (ESMG) intends to implement this flight plan filing capability as a Web-enabled service.
2 Applicable Documents


2.1 Government Documents


2.2 Non-Government Standards and Other Publications


3 Definitions

3.1 Terms and Definitions
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [11]. These key words are capitalized when used to unambiguously specify requirements. When these words are not capitalized, they are meant in their natural-language sense.

Terms and definitions shown below are taken from FAA-STD-070 [4] unless otherwise indicated.

**Access Control** Protection of system resources against unauthorized access; a process by which use of system resources is regulated according to a security policy and is permitted by only authorized entities.

**Audit** A process that records information needed to establish accountability for system events and for the actions of system entities that cause them.

**Audit Trail** A chronological record of system activities that is sufficient to enable the reconstruction and examination of the sequence of environments and activities.

**Authentication** The process of verifying an identity claimed by or for a system entity.

**Authorization** The granting of rights or permission to a system entity (mainly but not always a user or a group of users) to access a Web service.

**Binding** An association between an interface, a concrete protocol, and a data format. A binding specifies the protocol and data format to be used in transmitting messages defined by the associated interface.

**Business Function** A characteristic action or activity that needs to be performed to achieve a desired objective, or in the context of this WSRD, to achieve a real world effect.

**Confidentiality** Protective measures that assure that information is not made available or disclosed to unauthorized individuals, entities, or processes (i.e., to any unauthorized system entity).
**Credentials**  
Data that is transferred to establish the claimed identity of an entity.

**Data Element**  
A unit of data for which the definition, identification, representation, and permissible values are specified by means of a set of attributes.

**Datatype**  
A computer representation of a well-known abstract concept such as integer or date.

**Effect**  
A state or condition that results from interaction with a service. Multiple states may result depending on the extent to which the interaction completes successfully or generates a fault.

**FAA Data Registry (FDR)**  

**FAA Telecommunications Infrastructure (FTI)**  
A network that supports National Airspace System (NAS) operations by providing the connectivity required by systems including the Enhanced Traffic Management Systems (ETMS), the Standard Terminal Automated Replacement System (STARS), and the Wide Area Augmentation System (WAAS), and applications like e-mail, Internet, payroll, and other administrative services. (Adapted from [http://www.faa.gov/air_traffic/technology/fti/](http://www.faa.gov/air_traffic/technology/fti/))

**Fault**  
A message that is returned as a result of an error that prevents a service from implementing a required function. A fault usually contains information about the cause of the error.

**Format**  
The arrangement of bits or characters within a group, such as a data element, message, or language.

**Idempotent**  
A term used to describe an operation in which a given message will have the same effect whether it is received once or multiple times; i.e., receiving duplicates of a given message will not cause any undesirable effect.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier (ID)</td>
<td>A sequence of characters, capable of uniquely identifying that with which it is associated, within a specified context.</td>
</tr>
<tr>
<td>Input</td>
<td>Data entered into, or the process of entering data into, an information processing system or any of its parts for storage or processing.</td>
</tr>
<tr>
<td>Integrity</td>
<td>Protective measures that assure that data has not been changed, destroyed, or lost in an unauthorized or accidental manner.</td>
</tr>
<tr>
<td>Interface</td>
<td>See Service Interface.</td>
</tr>
<tr>
<td>Internet</td>
<td>A large, heterogeneous collection of interconnected systems that can be used for communications of many different types between any interested parties connected to it. The term includes both the &quot;core Internet&quot; (Internet service provider networks) and &quot;edge Internet&quot; (corporate and private networks, often connected via firewalls, network address translation boxes, application layer gateways, and similar devices).</td>
</tr>
<tr>
<td>Message</td>
<td>An identifiable collection of units of information (data elements), presented in a manner suitable for communication, interpretation, or processing within a context of interacting SOA components.</td>
</tr>
<tr>
<td>Message Exchange Pattern (MEP)</td>
<td>A template, devoid of application semantics, that describes a generic pattern for the exchange of messages between agents. It describes the relationships (e.g., temporal, causal, sequential, etc.) of multiple messages exchanged in conformance with the pattern, as well as the normal and abnormal termination of any message exchange conforming to the pattern.</td>
</tr>
<tr>
<td>Metadata</td>
<td>Data that defines or describes other data.</td>
</tr>
<tr>
<td>Name</td>
<td>The designation of an object by a linguistic expression.</td>
</tr>
<tr>
<td>Namespace</td>
<td>A collection of names, identified by a URI reference, that are used in XML documents as element types and attribute names. The use of XML namespaces to uniquely identify metadata terms allows those terms to be unambiguously used across applications, promoting the possibility of shared semantics.</td>
</tr>
</tbody>
</table>
Non-Repudiation  Protective measures against false denial of involvement in a communication.

Operation  A set of messages related to a single Web service action.

Output  Data transferred out of, or the process by which an information processing system or any of its parts transfers data out of, that system or part.

Permissible Values  The set of allowable instances of a data element.

Precondition  A state or condition that is required to be true before an action can be successfully invoked.

Processing  A set of algorithms, calculations, or business rules that operate on input data in order to produce the required output or to produce a change of internal state.

Protocol  A formal set of conventions governing the format and control of interaction among communicating functional units.

Quality of Service (QoS) Characteristic  A parameter that specifies and measures the value of a provided service.

Real World Effect  An ultimate purpose associated with the interaction with a particular service. It may be the response to a request for information or the change in the state of some entities shared between the participants in the interaction.

Role  A collection of permissions to use resources made available by a Web service.

Role-Based Access Control (RBAC)  A form of identity-based access control where the system entities that are identified and controlled are functional positions in an organization or process.

Security  The protection of information and data so that unauthorized persons or systems cannot read or modify them and authorized persons or systems are not denied access to them.

Service  See Web service.

Service Category  One or more values selected from a hierarchical convention that is used to categorize all FAA services.
**Service Consumer**  An organization that seeks to satisfy a particular need through the use of capabilities offered by means of a service.

**Service Criticality**  A single value selected from a list of values that is used to categorize a service in terms of the significance given to a functional failure of that service.

**Service Description**  The information needed in order to use, or consider using, a service.

**Service Interface**  An abstract boundary that a Web service exposes. It defines the types of messages and the message exchange patterns that are involved in interacting with the Web service, together with any conditions implied by those messages.

**Service Provider**  An organization that offers the use of capabilities by means of a service.

**Software Agent**  A running program that drives Web services, both to implement them and to access them.

**Synchronous Operation**  A type of operation whose message exchange pattern describes temporally coupled or "lock-step" interactions, e.g., remote procedure call (RPC)-style request-response interactions.

**Token**  A data object or a portable, user-controlled, physical device used to verify an identity in an authentication process.

**User**  A human, his/her agent, a surrogate, or an entity that interacts with information processing systems. A person, organization entity, or automated process that accesses a system, whether authorized to do so or not.

**Web Service**  A platform-independent, loosely-coupled software component designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format. Other systems interact with the Web service in a manner prescribed by its description by means of XML-based messages conveyed using Internet transport protocols in conjunction with other Web-related standards.
3.2 Acronyms and Abbreviations

**ANSI**  American National Standards Institute
**ATC**  Air Traffic Control
**ATS**  Air Traffic Services
**ESMG**  FAA En Route Services Modernization Group
**FAA**  Federal Aviation Administration
**FDR**  FAA Data Registry
**FIPS**  Federal Information Processing Standards
**FPS**  Flight Plan Service
**FPXM**  Flight Plan Exchange Model
**FSS**  Flight Service Station
**FTI**  FAA Telecommunications Infrastructure
**hPa**  hectopascal
**HTTP**  Hypertext Transport Protocol
**ICAO**  International Civil Aviation Organization
**ID**  Identifier
**IEC**  International Electrotechnical Commission
**IFR**  Instrument Flight Rules
**INCITS**  InterNational Committee for Information Technology Standards
**ISO**  International Organization for Standardization
**MDR**  Metadata Registry
**MEP**  Message Exchange Pattern
**MSL**  Mean Sea Level
**NAS**  National Airspace System
**NextGen**  Next Generation Air Transportation System
**NIST**  National Institute of Standards and Technology
**OASIS**  Organization for the Advancement of Structured Information Standards
<table>
<thead>
<tr>
<th><strong>P/CG</strong></th>
<th>Pilot/Controller Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PIN</strong></td>
<td>Personal Identification Number</td>
</tr>
<tr>
<td><strong>QoS</strong></td>
<td>Quality of Service</td>
</tr>
<tr>
<td><strong>RBAC</strong></td>
<td>Role-Based Access Control</td>
</tr>
<tr>
<td><strong>RFC</strong></td>
<td>Request For Comments</td>
</tr>
<tr>
<td><strong>RPC</strong></td>
<td>Remote Procedure Call</td>
</tr>
<tr>
<td><strong>SOA</strong></td>
<td>Service-Oriented Architecture</td>
</tr>
<tr>
<td><strong>SOAP</strong></td>
<td>Simple Object Access Protocol</td>
</tr>
<tr>
<td><strong>TLS</strong></td>
<td>Transport Layer Security</td>
</tr>
<tr>
<td><strong>TMP</strong></td>
<td>Traffic Modernization Program</td>
</tr>
<tr>
<td><strong>URI</strong></td>
<td>Uniform Resource Identifier</td>
</tr>
<tr>
<td><strong>URL</strong></td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td><strong>UTC</strong></td>
<td>Coordinated Universal Time</td>
</tr>
<tr>
<td><strong>VFR</strong></td>
<td>Visual Flight Rules</td>
</tr>
<tr>
<td><strong>W3C</strong></td>
<td>World Wide Web Consortium</td>
</tr>
<tr>
<td><strong>WSDD</strong></td>
<td>Web Service Description Document</td>
</tr>
<tr>
<td><strong>WSDL</strong></td>
<td>Web Services Description Language</td>
</tr>
<tr>
<td><strong>WSRD</strong></td>
<td>Web Service Requirements Document</td>
</tr>
<tr>
<td><strong>WSS</strong></td>
<td>Web Service Security</td>
</tr>
<tr>
<td><strong>XML</strong></td>
<td>eXtensible Mark-up Language</td>
</tr>
</tbody>
</table>
4 Required Service Information

NOTE: This section must not contain any requirements.

4.1 Service Characteristics

Name: Flight Plan Service (FPS)
Description: Service for filing, deleting, and modifying an IFR flight plan for subsequent automatic submission to FAA flight data processing
Revision: A

Service Category:
- Air Traffic Control Information Service [urn:us:gov:dot:faa:taxonomies:service-category#1.3.1.3]
- Flight Information Service [urn:us:gov:dot:faa:taxonomies:service-category#1.3.1.3.2]


4.2 Service Provider

Name: FAA En Route Services Modernization Group (ESMG)
Description: A program within the FAA Air Traffic Organization responsible for developing Web services
Namespace: urn:us:gov:dot:faa:example:atm
Web Page: http://www.faa.gov/air_traffic/flight_info/

4.3 Service Consumers

4.3.1 Traffic Modernization Program (TMP)

Name: FAA Traffic Modernization Program (TMP)
Description: The FAA-maintained program responsible for regulating traffic during arrival, departure, or approach stages of flights with the goal to avoid exceeding airport or air traffic control capacity.
Web Page: http://www.faa.gov/air_traffic/TMP/*
4.3.2 Alpha Airline

Name: Alpha Airline

Description: A United States commercial air carrier headquartered in Atlanta, Georgia. Alpha Airline provides air transport services for passengers and freight.

Web Page: http://www.example.alpha.com *

* The URLs in section 4.3 are provided as examples only and do not resolve to any resource.
5 Functional Requirements

5.1 Service Business Function Requirements

1. The FPS SHALL allow consumers to file a flight plan as described in section 3.1.1 of the FPS Final Requirements Document [6].

2. The FPS SHALL allow consumers to change the destination aerodrome of a filed flight plan as described in section 3.1.2 of the FPS Final Requirements Document [6].

3. The FPS SHALL allow consumers to retract (i.e., cancel) a filed flight plan as described in section 3.1.3 of the FPS Final Requirements Document [6].

Table 5-1 addresses the above business function requirements in terms of real world effects as prescribed by FAA-STD-070 [4].

<table>
<thead>
<tr>
<th>Business Function</th>
<th>Real World Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>File a flight plan.</td>
<td>A flight plan has been filed and persists in the FAA Web server for distribution to the FAA flight data processing application within some parameter time of the estimated departure time.</td>
</tr>
<tr>
<td>Change destination aerodrome of a flight plan.</td>
<td>The destination aerodrome of a filed flight plan has been changed.</td>
</tr>
<tr>
<td>Cancel a flight plan.</td>
<td>A previously filed flight plan has been retracted before being submitted to FAA ATS, thereby reducing the flight plan processing load and systemic workload of the FAA air traffic planning system.</td>
</tr>
</tbody>
</table>
5.2 Service Interface Requirements

1. The FPS SHALL implement a single interface called “FlightPlanInterface” which includes three (3) operations described in Table 5-2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>FlightPlanInterface</td>
<td>FlightPlanInterface allows a service consumer to file and subsequently modify or cancel a flight plan.</td>
<td>FileFlightPlan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>UpdateDestinationAerodrome</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CancelFlightPlan</td>
</tr>
</tbody>
</table>

5.2.1 Operations

1. The FPS SHALL perform operation FileFlightPlan as specified in section 5.2.1.1 below.

2. The FPS SHALL perform operation UpdateDestinationAerodrome as specified in section 5.2.1.2 below.

3. The FPS SHALL perform operation CancelFlightPlan as specified in section 5.2.1.3 below.

Messages to be exchanged during execution of the operations are specified in section 5.2.2 of the WSRD. Faults to be generated as a result of operation failure are specified in section 5.2.3 of the WSRD.

5.2.1.1 Operation FileFlightPlan

![Figure 5-1 Operation FileFlightPlan Sequence Diagram](image-url)
Table 5-3 Operation FileFlightPlan Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Message Exchange Pattern</th>
<th>Operation Type</th>
<th>Idempotency</th>
<th>Precondition</th>
<th>Input</th>
<th>Output</th>
<th>Effect</th>
<th>Faults</th>
</tr>
</thead>
<tbody>
<tr>
<td>FileFlightPlan</td>
<td>The FileFlightPlan operation allows the creation of persistent information defining an intended flight (flight plan).</td>
<td>In-Out</td>
<td>Synchronous</td>
<td>Idempotent</td>
<td>Service consumer has been authenticated and authorized to perform the FileFlightPlan operation.</td>
<td>Message FileFlightPlanRequest containing required flight plan information encapsulated in FlightPlan element.</td>
<td>Message FileFlightPlanResponse containing FlightPlanId for filed flight plan.</td>
<td>Flight plan has been submitted (filed).</td>
<td>Fault InvalidDataFault is returned when submitted flight plan data is not valid and service is unable to process the flight plan.</td>
</tr>
</tbody>
</table>

5.2.1.2 Operation UpdateDestinationAerodrome

![Figure 5-2 Operation UpdateDestinationAerodrome Sequence Diagram]
### Table 5-4 Operation UpdateDestinationAerodrome Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>UpdateDestinationAerodrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>The UpdateDestinationAerodrome operation allows updating the destination aerodrome information within a filed flight plan.</td>
</tr>
<tr>
<td><strong>Message Exchange Pattern</strong></td>
<td>In-Out</td>
</tr>
<tr>
<td>Operation Type</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Idempotency</td>
<td>Idempotent</td>
</tr>
<tr>
<td>Precondition</td>
<td>Service consumer has been authenticated and authorized to update flight plan information. The referenced flight plan has been filed.</td>
</tr>
<tr>
<td>Input</td>
<td>Message UpdateDestinationAerodromeRequest containing FlightPlanId and the new destination aerodrome.</td>
</tr>
<tr>
<td>Output</td>
<td>Message UpdateDestinationAerodromeResponse containing Flight Plan ID of the updated flight plan (FlightPlanId) and Aerodrome data for the destination aerodrome as it is recognized by the service.</td>
</tr>
<tr>
<td>Effect</td>
<td>Originally indicated flight destination aerodrome has been changed.</td>
</tr>
<tr>
<td>Faults</td>
<td>Fault InvalidDataFault is returned when submitted flight plan ID or aerodrome ID is not valid.</td>
</tr>
</tbody>
</table>
5.2.1.3 Operation CancelFlightPlan

Table 5-5 Operation CancelFlightPlan Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>CancelFlightPlan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>The CancelFlightPlan operation allows canceling a previously filed flight plan.</td>
</tr>
<tr>
<td>Operation Type</td>
<td>Synchronous</td>
</tr>
<tr>
<td>Idempotency</td>
<td>Idempotent</td>
</tr>
<tr>
<td>Precondition</td>
<td>Service consumer has been authenticated and authorized to perform the CancelFlightPlan operation. The referenced flight plan has been filed.</td>
</tr>
<tr>
<td>Input</td>
<td>Message CancelFlightPlanRequest containing FlightPlanId of a FlightPlan to be canceled.</td>
</tr>
<tr>
<td>Output</td>
<td>Message CancelFlightPlanResponse containing confirmation of canceling the flight plan.</td>
</tr>
<tr>
<td>Effect</td>
<td>Flight plan has been canceled.</td>
</tr>
<tr>
<td>Faults</td>
<td>Fault InvalidDataFault is returned when submitted flight plan ID is not valid</td>
</tr>
</tbody>
</table>
5.2.2 Messages

1. The FPS SHALL exchange with service consumers the messages listed and specified in Table 5-6.

Table 5-6 FPS Message Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Direction</th>
<th>Data Objects/Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>FileFlightPlanRequest</td>
<td>Used by a service consumer to submit (file) a flight plan.</td>
<td>In</td>
<td>FlightPlan</td>
</tr>
<tr>
<td>FileFlightPlanResponse</td>
<td>Used to inform a service consumer that flight plan information has been accepted and returns the ID that has been assigned to the flight plan.</td>
<td>Out</td>
<td>FlightPlanId</td>
</tr>
<tr>
<td>UpdateDestinationAerodromeRequest</td>
<td>Used by a service consumer to change a destination aerodrome.</td>
<td>In</td>
<td>DestinationAerodrome, FlightPlanId</td>
</tr>
<tr>
<td>UpdateDestinationAerodromeResponse</td>
<td>Used to inform a service consumer that the original destination aerodrome has been changed.</td>
<td>Out</td>
<td>DestinationAerodrome, FlightPlanId</td>
</tr>
<tr>
<td>CancelFlightPlanRequest</td>
<td>Used by a service consumer to cancel a previously filed flight plan.</td>
<td>In</td>
<td>FlightPlanId</td>
</tr>
<tr>
<td>CancelFlightPlanResponse</td>
<td>Used to inform a service consumer that the flight plan has been canceled.</td>
<td>Out</td>
<td>FlightPlanId</td>
</tr>
</tbody>
</table>

5.2.3 Faults

1. If the value of a flight plan element is invalid or missing from the consumer request and no default value was established, then the FPS SHALL respond with an InvalidDataFault fault message as described in Table 5-7.

NOTE: A service will ordinarily have more than one fault message.

Table 5-7 FPS Fault Message Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Data Objects/Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>InvalidDataFault</td>
<td>Used to inform a service consumer that submitted flight plan data is not valid and FPS is unable to process the flight plan.</td>
<td>InvalidDataError</td>
</tr>
</tbody>
</table>
5.2.4 Data Elements

NOTE: Section 5.9.2.4 requirement(s) of FAA-STD-070 [4] states that a data model of all data used by the service shall be included in this section of the WSRD. A data model is usually the result of an architectural effort, and a reference to the model’s location in the architecture can be made instead of reproducing the model in the WSRD.

In this WSRD example, we have simulated a scenario in which a “Flight Plan Exchange Model” has been developed as a separate effort and the FPS is being required by the WSRD to conform to this model. Because the example is unable to supply a real URL for the model, a conceptual model of the data elements that appear in the FlightPlan XML schema is provided in Figure 5-4, and the XML schema itself is provided in Appendix A (a diagram of the schema is in Appendix B.) An example of an instantiation of this schema is shown in Appendix C.

1. All data exchanged by the FPS SHALL conform to the FPXM 1.0, Flight Plan Exchange Model, 10 January 2006, available at http://faa.gov/fpxm/2006/ * [5]. A conceptual data model (Figure 5-4) is available at http://faa.gov/fpxm/2006/FPXM_Conceptual_Model.pdf *.

2. All data elements provided by the FPS SHALL be valid, that is, conform to definitions, syntax, and constraints as defined in the XML schema found at http://faa.gov/fpxm/2006/fpxm10.xsd *. (See Appendix A for a copy of the schema.) Data elements are also specified in Table 5-8 in accordance with FAA-STD-070 section 5.9.2.4 [4].

* The URLs in section 5.2.4 are provided as examples only and do not resolve to any resource.
Figure 5-4 Flight Plan Exchange Conceptual Model
NOTE: Section 5.9.2.4 requirement (a) of FAA-STD-070 [4] states that section 5.2.4 of the WSRD shall list and specify all data elements, of complex or primitive datatype, that appear in messages (or faults) to be sent or received via the Web service. The following table does not contain an exhaustive list of all of the data elements but rather provides a subset of elements selected to exemplify how data elements should be presented in a WSRD.

Note also that all metadata is required (Unit of Measure and Permissible Values are required if applicable) except for Maximum Length and Format which are optional. In addition, two of the elements have been registered in the FAA Data Registry (FDR) and given registration identifiers.

All data elements in Table 5-8 are defined in the namespace urn:us:gov:dot:faa:example:atm:enroute:fps:entities.

<table>
<thead>
<tr>
<th>FDR ID</th>
<th>Name</th>
<th>Definition</th>
<th>Permissible Values</th>
<th>Unit of Measure</th>
<th>Datatype</th>
<th>Format</th>
<th>Obligation</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FlightPlan</td>
<td>The outmost container (root) element for all data provided by the pilot or his/her designated representative to air traffic services units, relative to the intended flight or portion of the flight of the aircraft.</td>
<td>N/A</td>
<td>N/A</td>
<td>Complex</td>
<td>Required</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FlightPlanId</td>
<td>An element that uniquely identifies the flight plan.</td>
<td>N/A</td>
<td>N/A</td>
<td>String</td>
<td>[A-Za-z0-9]*</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>FlightPlan.flightRule</td>
<td>A code representing regulations (i.e., instrument or visual flight rules) under which the pilot is flying or intends to fly the aircraft.</td>
<td>“I” - IFR only “V” - VFR only “Y” - IFR first “Z” - VFR first</td>
<td>N/A</td>
<td>String</td>
<td>Required</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FDR ID</td>
<td>Name</td>
<td>Definition</td>
<td>Permissible Values</td>
<td>Unit of Measure</td>
<td>Datatype</td>
<td>Format</td>
<td>Obligation</td>
<td>Occurrence</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>-----------------</td>
<td>----------</td>
<td>-------------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>FlightPlan.filingTime</td>
<td>The point in time (UTC) at which the flight plan is filed.</td>
<td>N/A</td>
<td>N/A</td>
<td>dateTime</td>
<td>CCYY-MM-DDThh:mm:ssZ</td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>An element that indicates the pressure altitude above mean sea level (MSL) at which the aircraft is flying or is intended to be flown.</td>
<td>N/A</td>
<td>N/A</td>
<td>Complex</td>
<td></td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Altitude.uom</td>
<td>A code representing the units of measure of the aircraft's altitude.</td>
<td>“m”, “meter” – altitude in meters “foot” – altitude in feet</td>
<td>N/A</td>
<td>String</td>
<td></td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Altitude.referenceDatum</td>
<td>A code representing the atmospheric pressure reference used to adjust a pressure altimeter.</td>
<td>“Local” – local pressure extrapolated to zero MSL. “Standard” – pressure with respect to the pressure datum 1013.2 hectopascals (hPa).</td>
<td>N/A</td>
<td>String</td>
<td></td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>2730</td>
<td>Aircraft.aircraftType</td>
<td>An aircraft type designator that informs an air traffic controller of the performance characteristics of the aircraft.</td>
<td>Values are listed in ICAO 8643, Aircraft Type Designators, <a href="http://legacy.icao.int/anb/ais/8643/">http://legacy.icao.int/anb/ais/8643/</a>.</td>
<td>N/A</td>
<td>String</td>
<td></td>
<td>Required</td>
<td>1</td>
</tr>
<tr>
<td>FDR ID</td>
<td>Name</td>
<td>Definition</td>
<td>Permissible Values</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2732</td>
<td>WakeTurbulenceCategory</td>
<td>A code that classifies the aircraft for the purpose of wake turbulence separation minima, based on the maximum certified takeoff mass of the aircraft.</td>
<td>“H”, “HEAVY” - aircraft having a maximum certificated takeoff mass of 136,000 kg (300,000 lb) or more. “M”, “MEDIUM” - aircraft having a maximum certificated takeoff mass of less than 136,000 kg (300,000 lb) and more than 7,000 kg (15,500 lb). “L”, “LIGHT” - aircraft having a maximum certificated takeoff mass of 7,000 kg (15,500 lb) or less.</td>
<td>N/A</td>
<td>String</td>
<td>Required</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DestinationAerodrome</td>
<td>A container element for all data related to the primary aerodrome to which the flight is destined.</td>
<td>N/A</td>
<td>N/A</td>
<td>Complex</td>
<td>Required</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FDR ID</td>
<td>Name</td>
<td>Definition</td>
<td>Permissible Values</td>
<td>Unit of Measure</td>
<td>Datatype</td>
<td>Format</td>
<td>Obligation</td>
<td>Occurrence</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>DestinationAerodrome. Name</td>
<td>An element that contains the name or location (nearest city) of the destination aerodrome.</td>
<td>N/A</td>
<td>N/A</td>
<td>String</td>
<td>N/A</td>
<td>Optional</td>
<td>1</td>
</tr>
</tbody>
</table>
All **data elements** in Table 5-9 are defined in the **namespace** `urn:us:gov:dot:faa:example:atm:enroute:fps:entities`

### Table 5-9 Selected Flight Plan Service Elements

<table>
<thead>
<tr>
<th><strong>FD ID</strong></th>
<th><strong>Name</strong></th>
<th><strong>Definition</strong></th>
<th><strong>Unit of Measure</strong></th>
<th><strong>Permissible Values</strong></th>
<th><strong>Datatype</strong></th>
<th><strong>Obligation</strong></th>
<th><strong>Occurrence</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>InvalidDataError</td>
<td>A field that contains the faulty value.</td>
<td>N/A</td>
<td>One or more (separated by a comma and a space) of the following values:</td>
<td>String</td>
<td>Required</td>
<td>1</td>
</tr>
</tbody>
</table>
5.3 Machine-Processable Service Description Document

1. The FPS SHALL present an externalized machine-processable service description document, hereinafter called “WSDL file”, which defines and describes its interface and invocation bindings.


3. The WSDL file SHALL be prepared by the developer during the FPS design stage in compliance with requirements specified in sections 5.2, 5.2.1, 5.2.2, 5.2.3, and all subsections of section 7.1 of this WSRD.

NOTE: An example of a machine-processable service description document that might be produced based on the requirements provided in this section of the WSRD can be seen in an associated instructional document called How to Write a Web Service Description Document (WSDD) that describes an implemented FPS in accordance with FAA-STD-065A [3].
6 Non-Functional Requirements

6.1 Quality of Service Requirements

1. The FPS SHALL meet the required values shown for the quality of service (QoS) characteristics listed in Table 6-1.

<table>
<thead>
<tr>
<th>QoS Characteristic Name</th>
<th>Definition</th>
<th>Calculation Method</th>
<th>Unit of Measure</th>
<th>Required Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Probability that the service is present or ready for immediate use.</td>
<td>100 * ((24 - Total Outage Time) / 24). Measurements are taken daily and apply to the preceding 24-hour period.</td>
<td>Percentage, accurate to 3 decimal places</td>
<td>99.900</td>
</tr>
<tr>
<td>Capacity</td>
<td>Number of service requests that the service can accommodate within a given time period.</td>
<td>Simple count.</td>
<td>Whole positive number, per period of time.</td>
<td>20 per minute</td>
</tr>
<tr>
<td>Response Time</td>
<td>Maximum time required to complete a service request.</td>
<td>Measured from the time the service provider receives the request to the time the service provider transmits the response.</td>
<td>Seconds.</td>
<td>3</td>
</tr>
</tbody>
</table>

6.2 Security Requirements


6.2.1 Authentication
1. The FPS SHALL require each service consumer to authenticate itself to the FPS at the transport level by deploying a Username/Token credential in accordance with the Web Services Security UsernameToken Profile 1.0, OASIS Standard 200401, March 2004, available at http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0.pdf [16].


6.2.2 Authorization
1. The FPS SHALL use the credentials received as part of the authentication process (specified in section 6.2.1 of this WSRD) for future determinations of whether or not a service consumer is authorized to invoke an operation it may request.

2. The FPS SHALL deploy role-based access control (RBAC) for implementing authorization.


4. The FPS SHALL define two (2) roles, “Reader” and “Originator” as described in Table 6.2 and further depicted in Figure 6-1.
Table 6-2 FPS Roles

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reader</td>
<td>A user who only has permission to read or examine ('view only') a filed flight plan.</td>
</tr>
<tr>
<td>Originator</td>
<td>A user, generally a pilot or operator, who submits a flight plan and has permission to file and subsequently modify or cancel the filed flight plan. Since the Reader role is derived from the Originator role, an Originator role inherently includes the “view” privileges.</td>
</tr>
</tbody>
</table>

Figure 6-1 FPS Roles Use Case Diagram

6.2.3 Integrity
Because the FPS uses TLS protocol (see section 6.2 requirement 3 of this WSRD), the integrity requirements are being addressed (the data is checked for possible corruption).

6.2.4 Confidentiality
This WSRD does not impose any confidentiality requirements.
6.2.5 Non-Repudiation
1. The FPS SHALL require that each user's message be digitally signed in accordance with XML Signature Syntax and Processing (Second Edition), W3C Recommendation, 10 June 2008, available at http://www.w3.org/TR/xmldsig-core [18].

6.2.6 Audit Capability
1. The FPS SHALL require that each service request include a timestamp that indicates the date and time the request was made.
2. The FPS SHALL provide an audit trail of all service requests.
3. Each audit trail record SHALL include user ID (using credentials received as part of the authentication process), date, time, operation requested, and an error description if the operation failed.
4. Access to the audit trail SHALL be internal, i.e., inaccessible via a Web service interface.
5. Access to the audit trail SHALL be limited to users with system administrator privileges.

6.2.7 Other Security Requirements
This WSRD does not impose any other security requirements.
7 Implementation Requirements

7.1 Binding Requirements

7.1.1 Binding “SOAPoverHTTPBinding”
1. The FPS SHALL deploy the protocols described in sections 7.1.1.1 through 7.1.1.4 for the binding to the interface “FlightPlanInterface”.

7.1.1.1 Data Protocol
1. For data serialization, the FPS SHALL use Extensible Markup Language (XML) 1.0 (Fifth Edition), W3C, November 2008, http://www.w3.org/TR/2008/REC-xml-20081126/ [10].

7.1.1.2 Message Protocol

7.1.1.3 Transport Protocol

7.1.1.4 Other Protocols
This WSRD does not impose any other protocol requirements.

7.2 Processing Requirements
1. Any system errors (excluding those associated with fault messages) generated by the FPS SHALL be logged to aid in resolving the problem.

7.3 Operational Environment Requirements
1. The FPS SHALL be able to be used over the FAA Telecommunications Infrastructure (FTI).
2. The FPS SHALL be able to be used over the public Internet.
3. The FPS SHALL be able to use Oracle 10G as the relational database.
4. The FPS SHALL support 24-hours-a-day, 7-days-a-week operations.
5. The FPS SHALL allow continuous monitoring during operational use without disruption or any detectable degradation of normal service operations.

This WSRD does not impose any hardware compliance requirements.
8 Quality Assurance Provisions

8.1 Responsibility for Verification
The FAA is responsible for developing and implementing the verification of requirements for each project. The FAA may delegate verification activities to other organizations, independent contractors, and/or the prime contractor.

8.2 Special Verification Requirements
2. The FPS SHALL be tested in its normal operating mode at the William J. Hughes Technical Center (WJHTC) System Support Computer Complex, or other appropriate demonstration site.
3. The FPS test environment SHALL include a separate testing database.
4. The FPS test environment SHALL provide a separate network address (URL) for consumer testing.
5. Problems encountered with the FPS software agent during consumer software agent testing SHOULD be reported to John D. Doe, 609-555-4444, john.d.doe@faa.gov.

8.3 Verification Requirements Traceability Matrix

Table 8-1 Verification Requirements Traceability Matrix
A = Analysis; D = Demonstration; I = Inspection; T = Test; X = Not Applicable

<table>
<thead>
<tr>
<th>Section Number</th>
<th>Requirement Title</th>
<th>Req’t. ID</th>
<th>Verification Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Functional Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.1</td>
<td>Service Business Functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>File flight plan</em></td>
<td>1</td>
<td>D D</td>
</tr>
<tr>
<td></td>
<td><em>Change destination aerodrome</em></td>
<td>2</td>
<td>D D</td>
</tr>
<tr>
<td></td>
<td><em>Cancel flight plan</em></td>
<td>3</td>
<td>D D</td>
</tr>
<tr>
<td>5.2</td>
<td>Service Interfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Implement FlightPlanInterface</em></td>
<td>1</td>
<td>D D</td>
</tr>
<tr>
<td>5.2.1</td>
<td>Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Perform operation FileFlightPlan</em></td>
<td>1</td>
<td>D D</td>
</tr>
<tr>
<td>Section Number</td>
<td>Requirement Title</td>
<td>Req’t ID</td>
<td>Verification Level</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------------</td>
<td>----------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Service Level</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>I, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>A, D</td>
</tr>
</tbody>
</table>

5.2.2 Messages

|              |                   |          | D               | D                |

5.2.3 Faults

|              |                   |          | D               | D                |

5.2.4 Data Elements

|              |                   |          | D               | D                |

5.3 Machine-Processable Service Description Document

|              |                   |          | I               | X                |

6.1 Quality of Service Requirements

|              |                   | A, D     | A, D            |

6.2 Security Requirements

|              |                   | A, D     | A, D            |

6.2.1 Authentication

|              |                   | A, D     | A, D            |

Comply with NIST 800-95

Deploy **TLS** Protocol v1.2 *(RFC 5246)*

Deploy **WSS SOAP** Message Security 1.1

Deploy Username/Token credential per **OASIS** Standard 200401

Comply with Identification and Authentication requirements in NIST **FIPS** publication 200
<table>
<thead>
<tr>
<th>Section Number</th>
<th>Requirement Title</th>
<th>Req’t. ID</th>
<th>Verification Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Service Level</td>
<td>Integration Level</td>
</tr>
<tr>
<td></td>
<td>Comply with FAA Order 1370.92A</td>
<td>3</td>
<td>A, D</td>
</tr>
<tr>
<td>6.2.2</td>
<td>Authorization</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utilize authentication credential to authorize service operations</td>
<td>1</td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td>Deploy role-based access control (RBAC)</td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Comply with ANSI/INCITS 359-2004</td>
<td>3</td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td>Define 2 roles, “Reader” and “Originator”</td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td>6.2.3</td>
<td>Integrity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2.4</td>
<td>Confidentiality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.2.5</td>
<td>Non-Repudiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Require digital signatures per W3C Recommendation 10 June 2008</td>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td>6.2.6</td>
<td>Audit Capability</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Include timestamp on each request</td>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Provide an audit trail</td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Provide specified audit trail data elements</td>
<td>3</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Audit trail access is internal</td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Limit access to system administrator</td>
<td>5</td>
<td>D</td>
</tr>
<tr>
<td>6.2.7</td>
<td>Other Security Requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Implementation Requirements</td>
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<td>7.1</td>
<td>Binding Requirements</td>
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<tr>
<td>7.1.1</td>
<td>Binding “SOAPOverHTTPBinding”</td>
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<td>Implement SOAPOverHTTPBinding</td>
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<td>7.1.1.1</td>
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<td>Utilize XML 1.0 for data serialization</td>
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<tr>
<td>Section Number</td>
<td>Requirement Title</td>
<td>Req’t. ID</td>
<td>Verification Level</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------------------------------</td>
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<td>Service Level</td>
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<td>Integration Level</td>
</tr>
<tr>
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<td>Construct messages per W3C <strong>SOAP V1.2 Part 1</strong></td>
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<td>Utilize <strong>HTTP 1.1 (RFC 2616)</strong></td>
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<td>A, D</td>
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<td>7.1.1.4</td>
<td>Other Protocols</td>
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<td>Processing Requirements</td>
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<tr>
<td></td>
<td><strong>Log all system errors generated by FPS</strong></td>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td>7.3</td>
<td>Operational Environment Requirements</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Utilize <strong>FTI</strong></td>
<td>1</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Utilize public <strong>Internet</strong></td>
<td>2</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Utilize Oracle 10G as relational database</td>
<td>3</td>
<td>I, D</td>
</tr>
<tr>
<td></td>
<td>Support operations 24/7</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Allow continuous monitoring</td>
<td>5</td>
<td>A, D</td>
</tr>
<tr>
<td>8</td>
<td>Quality Assurance Provisions</td>
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<tr>
<td>8.1</td>
<td>Responsibility for Verification</td>
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<tr>
<td>8.2</td>
<td>Special Verification Requirements</td>
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<tr>
<td></td>
<td><strong>Conduct testing in accordance with FAA Acquisition Management System Test and Evaluation Process Guidelines</strong></td>
<td>1</td>
<td>A, D</td>
</tr>
<tr>
<td></td>
<td><strong>Conduct testing at WJHTC</strong></td>
<td>2</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td><strong>Include separate testing database</strong></td>
<td>3</td>
<td>I, D</td>
</tr>
<tr>
<td></td>
<td><strong>Provide separate URL for consumer testing</strong></td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td><strong>Provide FPS problem reporting point of contact</strong></td>
<td>5</td>
<td>X</td>
</tr>
</tbody>
</table>
9 Appendixes

Appendix A. FlightPlan.xsd

```xml
<?xml version="1.0" encoding="UTF-8"?>
<x:schema xmlns:x="http://www.w3.org/2001/XMLSchema"
   xmlns="urn:us:gov:dot:faa:example:atm:enroute:fps:entities"
   targetNamespace="urn:us:gov:dot:faa:example:atm:enroute:fps:entities"
   elementFormDefault="qualified" attributeFormDefault="unqualified">
  <xs:annotation>
    <xs:documentation xml:lang="en">
      Title: FlightPlan schema for WSRD Example.
      Description: This schema declares XML elements for defining a Flight Plan transmitted by FlightPlanService
      Creator: Mark Kaplun (mark.kaplun@faa.gov)
      Date: 2010-01-21
      See also: WSRD Flight Plan Service.doc
    </xs:documentation>
  </xs:annotation>

 <!-- //////////////////////////////////////////////////////////////////
  Global types ////////////////////////////////////////////////////////////////// -->
  <xs:element name="FlightPlan">
    <xs:complexType>
      <xs:sequence>
        <!-- "FlightPlanId" is always required.
             When flight plan is filed and the "FlightPlanId" element has no content
             - the content is nil. -->
        <xs:element name="FlightPlanId" type="FlightPlanIdType" nillable="true"/>
        <xs:element name="Originator" type="OriginatorType"/>
        <xs:element ref="Aircraft"/>
        <xs:element ref="Route"/>
      </xs:sequence>
      <xs:attribute name="filingTime" type="xs:dateTime" use="required"/>
      <xs:attribute name="flightRule" type="FlightRuleType" use="required"/>
      <xs:attribute name="numberOfAircraft" type="xs:positiveInteger" default="1"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="Aircraft" type="AircraftType"/>
  <xs:element name="Route" type="RouteType"/>

 <!-- //////////////////////////////////////////////////////////////////
  Types definitions ////////////////////////////////////////////////////////////////// -->
  <xs:simpleType name="FlightPlanIdType">
    <xs:restriction base="xs:string">
    </xs:restriction>
  </xs:simpleType>
</xs:schema>
```
<xs:complexType name="AircraftType">
  <xs:sequence>
    <xs:element name="Equipage" type="xs:complexType">
      <xs:sequence>
        <xs:element name="Communication" type="xs:string"/>
        <xs:element name="Navigation" type="xs:string"/>
        <xs:element name="Surveillance" type="xs:string"/>
      </xs:sequence>
    </xs:complexType>
    <xs:element name="WakeTurbulenceCategory" type="WakeTurbulenceCategoryType"/>
  </xs:sequence>
  <xs:attribute name="aircraftId" type="xs:string"/>
  <xs:attribute name="aircraftType" type="xs:string"/>
</xs:complexType>

<xs:complexType name="OriginatorType">
  <xs:sequence>
    <xs:element name="Name" type="xs:string"/>
  </xs:sequence>
  <xs:attribute name="airmanId" type="xs:string" use="required"/>  
</xs:complexType>

<xs:complexType name="RouteType">
  <xs:sequence>
    <xs:element name="Altitude" type="AltitudeType"/>
    <xs:element name="EstimatedTime" type="xs:duration">
      <xs:sequence>
        <xs:element name="EstimatedDepartureTime" type="xs:time"/>
        <xs:element name="EstimatedEnRouteTime" type="xs:duration"/>
      </xs:sequence>
    </xs:element>
    <xs:element name="AirSpeed" type="AirSpeedType"/>
    <xs:element name="DepartureAerodrome" type="AerodromeType"/>
    <xs:element name="DestinationAerodrome" type="AerodromeType"/>
    <xs:element name="AlternateAerodrome" type="AerodromeType"/>
    <xs:any minOccurs="0" maxOccurs="unbounded">
      <!--This element is declared as "any" to indicate that Route element can be extended with elements such as: fixes (significant points), route names, route segments and etc. -->
    </xs:any>
  </xs:sequence>
</xs:complexType>

<xs:complexType name="AerodromeType">
</xs:complexType>
Values for aerodrome Ids are listed in ICAO Document 7910, Location Indicators, http://www.icao.int/eshop/index.html.
<xs:simpleType name="FlightRuleType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="I"/>
    <xs:enumeration value="V"/>
    <xs:enumeration value="Y"/>
    <xs:enumeration value="Z"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="WakeTurbulenceCategoryType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="H"/>
    <xs:enumeration value="HEAVY"/>
    <xs:enumeration value="M"/>
    <xs:enumeration value="MEDIUM"/>
    <xs:enumeration value="L"/>
    <xs:enumeration value="LIGHT"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="ReferenceDatumType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="local"/>
    <xs:enumeration value="standard"/>
  </xs:restriction>
</xs:simpleType>

<xs:simpleType name="UnitOfSpeedType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="km/h"/>
    <xs:enumeration value="knots"/>
  </xs:restriction>
</xs:simpleType>
<xs:simpleType name="UnitOfAltitudeType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="m"/>
    <xs:enumeration value="meter"/>
    <xs:enumeration value="foot"/>
  </xs:restriction>
</xs:simpleType>
Appendix B. FlightPlan.xsd - diagram
Fragment - Route element

RouteType

AltitudeType

EstimatedTime

AirSpeedType

TrueSpeedType

Route

DepartureAerodrome

DestinationAerodrome

AlternateAerodrome

AerodromeType

Any 0 or
Appendix C. FlightPlan.xml

<?xml version="1.0" encoding="UTF-8"?>
<FlightPlan
xmlns="urn:us:gov:dot:faa:example:atm:enroute:fps:entities"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="/FlightPlan.xsd"
flightRule="I"
numberOfAircraft="1"
filingTime="2001-12-17T09:30:47Z">
  <FlightPlanId xsi:nil="true" />
  <Originator airmanId="215336745">
    <Name>John Doe</Name>
  </Originator>
  <Aircraft aircraftType="PA-32R" aircraftId="JHB426E">
    <Equipage>
      <Communication>V</Communication>
      <Navigation>C</Navigation>
      <Surveillance>OL</Surveillance>
    </Equipage>
    <WakeTurbulenceCategory>LIGHT</WakeTurbulenceCategory>
  </Aircraft>
  <Route>
    <Altitude referenceDatum="local" uom="foot">7000</Altitude>
    <EstimatedTime>
      <EstimatedDepartureTime>14:20:00.0Z</EstimatedDepartureTime>
      <EstimatedEnRouteTime>PT3H30M</EstimatedEnRouteTime>
    </EstimatedTime>
    <AirSpeed>
      <TrueSpeed uom="knots">170</TrueSpeed>
      <MachNumber>0.12</MachNumber>
    </AirSpeed>
    <DepartureAerodrome aerodromeId="KBWI">
      <Name>Baltimore-Washington International, MD</Name>
    </DepartureAerodrome>
    <DestinationAerodrome aerodromeId="KBOS">
      <Name>Logan International Airport, Boston, MA</Name>
    </DestinationAerodrome>
    <AlternateAerodrome aerodromeId="KJFK">
      <Name>John F. Kennedy International Airport, NY, NY</Name>
    </AlternateAerodrome>
  </Route>
</FlightPlan>