INTERNATIONAL AVIATION DATA REGISTRY

OPERATIONAL CONCEPT DOCUMENT

Draft Version 1.0

Prepared for:
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1 System

1.1 Concept Definition

The title of the proposed system is the International Aviation Data Registry.

The purpose of this document is to identify and describe the capabilities of the Registry to guide further work in system requirements, system design, development, and testing processes. The intended audience for this document is:

- System stakeholders can use the document to verify the concept for the Registry and to verify that their required functionality is represented.
- System designers and developers can use the document to better understand the proposed Registry as they design and develop the Registry.

This section defines a registry, describes the purpose of the International Aviation Data Registry, describes its benefits, and describes phases for developing the Registry, and describes other aspects.

Definition of a Registry

A data registry is an online and accessible system which includes a data dictionary and related metadata[1]. The definition for a data element registry that will be used throughout this document can be found in the draft standard, "Information Technology – Specification and Standardization of Data Elements", also known as " International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Standard 11179." A data registry is defined as "an information resource kept by a registration authority that describes the meaning and representational form of data elements, including registration identifiers, definitions, names, value domains, metadata and administrative attributes, etc."[2].

Data Registry initiatives are being pursued by a number of organizations. The ISO/IEC Standard 11179 is being defined to provide a standard structure for data registries.

A data registry is intended to facilitate the use of common data across a variety of information systems in order to enable data sharing across information systems and to assist system users in understanding the data. It does this by allowing users to learn about the existence of data standards, understand their metadata (that is, their definitions, formats, etc.), and download the metadata for use in their local aviation system. Download operations can include downloading a list of valid values for a given data element.

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[1] Metadata is data about data. It includes the name of a piece of data (such as Street Address), its business definition, format (character, number, etc.), length (for instance, length of 250 characters), owner, system(s) where it is used, etc.)

[2] P.7, Part I of Information Technology – Specification and Standardization of Data Elements", International Standards Organization (ISO)/International Electrotechnical Commission (IEC) Standard 11179 (Draft);

System managers who obtain data from the Registry can then incorporate some or all of that data into their local (aviation) system. This will synchronize the local system with international aviation data standards (allowing more uniform reporting about aviation and a broader base of data for aviation analysis). If lists of valid values are also incorporated into the local system, then the local system is made more current and reduces their effort to maintain their own lists of valid values. (Any list of valid values needs to be updated periodically to drop off values that are no longer valid and to add any new values that have arisen).

Purpose

The International Aviation Data Registry is intended to be a comprehensive, authoritative clearinghouse of reference information about aviation metadata especially for agreed upon and emerging international aviation data standards. This includes information on the purpose of the standard, definition of the standard, a list of valid values for the standard, date on which the standard was developed, context of the standard, and format of the standard. It will serve two key functions:

1) It will be a major tool in supporting the standard-setting process for international aviation data - by recording and disseminating data standards, and ultimately facilitating data sharing between organizations and users.

2) When used in conjunction with an aviation system, the Registry will enable users to better understand the information they are accessing.

The Registry is intended to be widely accessible to members of the international aviation community. It will most likely do this through a web-based architecture. By providing wide access to the Registry, users will be able to register their data elements in this Registry so that other system managers can make use of those data element names and formats in their information systems.

The Registry will support the efforts of various aviation stakeholders in the development of information standards by providing a location for recording data elements and tracking their progress through the standardization process. These standard data elements will be reusable. They can be utilized by developers of information systems, aviation stakeholders, and others developing reporting requirements for involved agencies [civil aviation agencies throughout the world, the Joint Aviation Agency (JAA), international aviation related associations, ICAO, air carriers, U. S. National Aeronautics and Space Administration (NASA), etc.].

Benefits

Ideally, an International Aviation Data Registry would contain standards supported by civil aviation authorities, air carriers, associations and manufacturers. An initial objective is to simply curtail the proliferation of taxonomies by offering participating members a ready-to-use standard that can be applied to new systems. More ambitious objectives would be the support of metadata management and data transformation functions (which could be addressed in a later phase of the system).

The registry will benefit those conducting any type of analysis of aviation data because the registry will enable the use of standardized data and the synthesis of internationally derived aviation data. For industry and CAAs, this will especially assist with aviation safety analysis as well as other functions. By utilizing common information, the ability to understand and report aviation information will be improved. The registry will also preserve the meaning of aviation data elements over time by recording information about data elements that are used in legacy systems. This will facilitate the sharing of data within and between organizations. The Registry will also preserve the meaning of aviation data elements over time by recording information about data elements that are used in legacy systems.

The Registry is intended to be an important time and money saving tool that will continue to improve the effectiveness of aviation data usage. The Registry will advance and accelerate the aviation community's efforts to provide meaningful reporting on aviation activities, serve as a key part of a data standards process, and strengthen an aviation organization's capacity to use information effectively to attain higher levels of safety.

The system shall be compliant with Information Technology –Specification and Standardization of Data Elements" (ISO/IEC Standard 11179) and "Information Technology - Procedures for Achieving Data Registry Content Consistency in ISO/IEC 11179 Metadata Registries" (ISO/IEC Working Paper, Draft 3.0) in order to support standardized data transfer.

The planned operating site(s) remain to be determined.

Relation to Current Projects

This proposed system is related to the following systems or initiatives within the international aviation community:

- The ICAO Accident/Incident Data Reporting (ADREP) system contains information on a number of existing data standards.
- The CAST/ICAO Common Taxonomy Team's initiatives to propose data standards for international aviation safety data is a source of potential data standards for publication in the Registry
- There is an initiative by the International Institute for the Unification of Private Law (UNIDROIT) and ICAO to facilitate asset-based financing of aircraft by developing an international aircraft registry. There is potential to coordinate the standards for on identification of aircraft being developed by the CAST/ICAO Common Taxonomy Team with those used in the international aircraft registry.

Existing aviation information systems are all potential users of the international aviation data registry. System developers and managers would be able to download key data elements from the registry and to use existing data element formats from the registry.

1.2 Document Overview

- Section 2 describes the current situation that leads to the proposal for a Registry.

- Section 3 describes the need for the Registry.
- Section 4 describes the Registry concept in further detail.
- Section 5 provides an analysis of the proposed system including advantages and disadvantages.
- Section 6 presents recommendations and decision points.

1.3 Reference Documents

"Establishment of an ICAO Aviation Data Registry", Accident Investigation and Prevention (AIG) Divisional Meeting (1999), Montreal, 14 to 24 September 1999.

"Information Technology – Specification and Standardization of Data Elements", International Standards Organization (ISO)/International Electrotechnical Commission (IEC) Standard 11179 (Draft); Work in progress by the Metadata Working Group (Subcommittee ISO/IEC JCT1/SC32); 1999; See especially 11179-3, Basic Attributes for Data Elements

Information Technology - Procedures for Achieving Data Registry Content Consistency in ISO/IEC 11179 Metadata Registries" ISO/IEC Working Paper Draft 3.0, September 1999

MIL-STD-498, "Software Development – And Documentation", U.S. Department of Defense; 5 December 1994.

Data Item Description (DID) for Operational Concept Document, DI-IPSC-81430; U.S. Department of Defense, 5 December 1994.

1.4 Concept Evolution

The development of the Registry can be undertaken in phases. One potential phased approach to developing the Registry is described as follows. Other alternatives may be pursued depending on stakeholder needs.

Phase I

The first phase of an International Aviation Data Registry could be developed to prove the concept of the registry and serve as a starting point for collecting standard taxonomies. The initial system could be very simple in design, easy to maintain, and low in cost. Its functionality would be very basic.

Operating on a personal computer, and accessible via a thin client web application, the initial registry could allow a user to display a simple list of standard taxonomies, select a taxonomy, and then display or download information related to the taxonomy's standard form. Examples of basic information related to a standard follow:

- Purpose of the standard,
- Standard valid values associated with the taxonomy,
- The definition of the taxonomy and its valid values,
- The date on which the standard was adopted,
- A point of contact for questions,

- The context of the taxonomy. (To promote appropriate use of a standard taxonomy, it will be important to provide users with an explanation of how and when the taxonomy was intended to be used),
- Format (For example, a date might be eight numeric characters in the format YYYYMMDD), and
- References.

The management of the data registry will be under the sponsorship of an international organization. New or proposed taxonomies can be added to the registry by the system administrator at any time the sponsoring organization approves such action. Valid values for specific data elements can be updated by the system administrator on a frequent basis or whenever new information is made available by authorized providers. These providers are approved at the time the taxonomy is accepted into the registry. All changes to the system would be administered in accordance with ISO/IEC Standard 11179.

Phase II

Once the first phase of the International Aviation Data Registry proved the overall concept as being sound, a second phase could be introduced. This phase would see the contents of the registry expand to include metadata related to source system taxonomies and the transformations required to convert source data to meet CAST/ICAO standards. In short, Phase II could serve as an international metadata repository that displays cross-references between source system taxonomies and standard taxonomies.

Key functions of the Phase II International Aviation Data Registry would be to store, organize, cross-reference and distribute source system taxonomies and data transformation routines.

Accessible via an web browser, the International Aviation Data Registry could also acquire, store and distribute a broad range of metadata types. Examples follow:

- Source system instances within a taxonomy (valid values)
- Transformation scripts and descriptions,
- Expanded business rules,
- Data quality information,
- Data element characteristics and descriptions,
- Historical anomalies in the data,
- Source system structures,
- Data models showing relationships between data entities or objects, and
- Contextual narratives that describe the data sources in terms of how, when, where and why the source data was collected.

Phase III and Beyond

In its most advanced form, a third phase International Aviation Data Registry could become a metadata repository that actively transforms data to a standard. Conceptually, a user could access the repository, specify a transformation requirement, and cause a target data set to be transformed to CAST/ICAO standard. In short, the International Aviation Data Registry, in its most advanced form, could serve as an automated data translation tool.

To help users understand how data transformations operate, it would be important to describe transformations through a formalized syntax (structured language). Types of transformations that could be stored and executed by a third phase system include the following:

- Transformations used to restructure or move records,
- Field level decoding and standardization transformations,
- Transformations that work in conjunction with data quality routines, and
- Transformations that derive data values. For example, aggregating routines, summarization routines and calculations.

2 Current Situation

This section describes the current situation as it relates to international aviation data standards.

2.1 Background, Objectives & Scope

This paragraph has been tailored out. It is not applicable because no current system exists.

2.2 Operational Policies and Constraints

Operational policies are those defined by the various types of involved organizations described as follows:

- Private sector corporations, non-profit international aviation organizations, or government organizations set their own format and structures for the data that they provide. This is driven by the business functions they are supporting.
- With participation from its member states, ICAO sets policies and procedures for maintaining the ADREP system. These are defined to support ICAO's mission of promoting aviation safety. ICAO data standards evolve from source input data and from collaborative discussions with participating states.
- Individual system managers set their operational policies with a focus on the business functions and scope they are supporting. This includes private industry or governmental system managers for aviation systems.

2.3 Description of Current Situation

Currently, there is no international aviation data registry. Today, aviation data standards (for metadata and lists of valid values) evolve in an ad hoc manner from a variety of sources including:

- Private sector standards such as for flight number and flight data (provided through OAG Worldwide) have been developed to meet specific business needs of air carriers. Groups such as the Air Transport Association (ATA) have developed standard models and guidance for the aircraft manufacturing industry
- International aviation organizations sometimes promote data usage and de facto data standards particularly in conjunction with a particular initiative or function they perform. For example the ICAO ADREP maintains data in formats some of which may be de facto international standards.

- Data standards are promoted by individual States particularly for use in systems within the State. They sometimes offer their data standards for use internationally.
- Data standards exist within a system. The focus is on the scope of the business functions supported by the system (often excluding an international scope or types of aircraft or other aspects). Each system stores and maintains data according to its own definitions and formats. Lists of valid values are periodically updated with new additions and deletions. These may or may not be consistent with any international standards. Once synchronized with an international standard, they quickly become out of date with the standard.

Internationally, the use of such ad hoc standards evolves gradually as potential users of the data standard gradually become aware of them and consider them for use within their systems. There is no consolidated place to find out about such evolving or existing data standards. International aviation meetings are a key way for stakeholders to learn of evolving data standards.

Until recently, the current situation did not have the benefit of the Internet as a potential tool. With the advent of the Internet, there is now an international telecommunications network for exchanging data amongst aviation stakeholders.

2.4 Users or Involved Personnel

Current participants in promoting and using international aviation data standards include aviation managers, regulated entities, state and local agencies, regulation writers, and computer system developers and managers. Less frequently, it involves those interested in aviation information generally and the public.

2.5 Support Concept for Current Situation

Managers of individual systems, whether in the private or public sector, must make their own arrangements to maintain and support their aviation data and its metadata standards. This becomes particularly burdensome when lists of valid values change (due to new additions, deletions, and revisions). This involves any type of lookup table such as a list of manufacturers, aircraft models, event types, phases of flight, etc.

3 Need for Change

3.1 Justification for Change

Until recently, data sharing among aviation safety organizations has been hampered by three principal obstacles:

(1) The lack of effective, mature and affordable data management tools,
(2) The lack of an infrastructure to promote and enable data sharing, and
(3) The absence of data standards that could make disparate data sources more interoperable and useful.

Recently, the first two obstacles have been largely overcome. Advances in data management tools, in conjunction with the arrival of inexpensive and easy-to-use Internet tools, have addressed many of the technical factors that have traditionally inhibited the

sharing of data. With regard to the lack of a single global infrastructure to promote and support data sharing, many management issues are now being addressed through internationally sponsored initiatives that feature the sharing or improvement of safety data as a central objective[3].

The third obstacle, the lack of data standards, remains as a serious problem. The proliferation of non-standard taxonomies, e.g., aircraft make/model codes, event types, phases of flight, causal factors for accidents and incidents, and many more, has made it difficult and/or expensive to integrate data from multiple sources for use in aviation safety. Although some system managers have sought to promote data standards, they have often only been able to do this for the system(s) within their control. This is resulting in a proliferation of data standards.

While some organizations are working to define and propose additional international aviation data standards, there is also a need for a way to promote the use of such standards so that 1) further proliferation is less likely to occur and 2) stakeholders can converge on standards that meet their cross-functional needs.

3.2 Description of Needed Changes

The International Aviation Data Registry will provide a way to promote the use of international aviation data standards. By publishing such data standards on an Internet based Registry for international aviation stakeholders to view and download, the Registry will enable system managers to align their systems with international aviation data standards and to reduce their maintenance burden for remaining in alignment.

3.3 Priorities among the Changes

This paragraph has been tailored out. It is not applicable because no current system exists.

3.4 Changes Considered But Not Included

The following capabilities were considered but are not planned for the initial phase of the Registry:

- Upload capability to add items to valid value lists and to add cross references between taxonomies. This may require more significant resource access control (system security). For instance, it is likely that only authorized users will be able to write to the Registry with data elements and their formats. In addition, it is anticipated that certain data elements and their format will not be readable except to authorized users.
- More ambitious objectives would be the support of data transformation functions.

3.5 Assumptions and Constraints

The following assumptions have been made:

- There is a common international interest in being able to synthesize aviation data from across the globe in order to have increased quantity and quality of data for conducting aviation analyses whether for public or private sector purposes.

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[3] Two of these initiatives are the Global Aviation Information Network (GAIN) and the CAST/ICAO Common Taxonomy Team, both of which involve joint activities with the International Civil Aviation Organization (ICAO).

- The Internet offers a useful technology for enabling more international collaboration on aviation data standards.

The following constraints are recognized:

- There are no mechanisms to enforce data standardization internationally.
- Standardization efforts need to be pursued collaboratively with as much diverse international involvement as possible.
- Different states have varying levels of resources for participating in international data standards initiatives. This may limit the amount of international participation in developing and promoting such standards.
- Resources are very limited for operating and maintaining a Registry.

4 New System

This section describes the concept for the International Aviation Data Registry.

4.1 Background, Objectives and Scope

The International Aviation Data Registry is intended to be a comprehensive, authoritative clearinghouse of reference information about aviation metadata especially for agreed upon and emerging international aviation data standards. It will serve two key functions:

1. It will be a major tool in supporting the standard-setting process for international aviation data - by recording and disseminating data standards, and ultimately facilitating data sharing between organizations and users.

2. When used in conjunction with an aviation system, the Registry will enable users to better understand the information they are accessing.

The scope of the data for the initial Registry is aircraft identification categories (manufacturer, model, and series of aircraft), phases of flight, causal factors of accidents and incidents, and event categories. The data can include draft standards as well as final international standards. (Draft standards are those standards which international committees have put forward as drafts).

The scope of the system is planned to include the following classification schemes. Please note this list may change as the system is developed:

Aircraft
- Aircraft Identification Categories
- Engine Identification Categories

Organizations

Events
- Accident Categories
- Incident Categories
- Event Types

Factors
- HumanFactors
- Other Groupings

Phases of Flight or Operations
Date and Time
Location
    Countries/States
    Airport Identifiers

4.2 Operational Policies and Constraints

Once a determination has been made of a system sponsor for the Registry, more detailed operational policies can be defined. At this time, the following operational policies and constraints are known:

- Standards contained in the Registry will need to be reviewed and concurred upon by a management board for the Registry.
- Availability - Except for internet communications problems that interfere with the Registry's operations, the Registry would be available for 95% to 99% of its scheduled up-time. Some time may be scheduled for maintenance, backup, uploads, and related system administration functions.
- Access Controls – Current plans are to require a user identifier (user ID) and no password for a first phase of the Registry. The purpose of the User ID is for the system to track who is using the system in order to target future development to better support them. A password is not required to use or pull data from the system because the system will not contain sensitive data. Please note that data within the Registry will be secured so that general users cannot change or delete the data.
- The Registry is intended to operate for extended periods of time without attending operating staff.
- The system will present an introduction to the Registry in the 6 languages used by ICAO: French, English, Spanish, Russian, Chinese, and Arabic. All other functionality will be in English.

The following are developmental constraints to consider in designing and developing this application:

- Drawing in a representative international sample of users for acceptance testing of the system will likely be too expensive. A subset of such users will be selected.
- Resources for system development are limited. See section 6 for more information.
- The system is defined to use the Internet as the way for users to access the Registry and download data from it.

The following are operational constraints in operating the Registry effectively

- The system shall be compliant with ISO/IEC Standard 11179 in order to support standardized data transfer.
- Sponsorship (system ownership) of the Registry remains to be determined by ICAO and other international aviation stakeholders.
- Use of the Registry will be voluntary by participating States.
- Funding of the Registry is dependent on participating State contributions.
- The resources for maintaining the system are expected to be limited.

4.3 New System Description

The Registry shall be a stand alone system with the capability for a) disseminating its data standards and content to users including system owners over the Internet and shall have b) system administrators to receive and load new data standards and applicable valid values. Individuals and organizations receiving downloaded standards from the Registry may use this information to analyze the quality of data in their in-house systems and to assess whether to modify that data with data standards and lists of valid values from the Registry. Given the diverse hardware and software configurations of the related systems and their disparate geographical locations, there is a design constraint that the Registry needs to use a web-based architecture.

The following diagram presents a summary of the Registry:

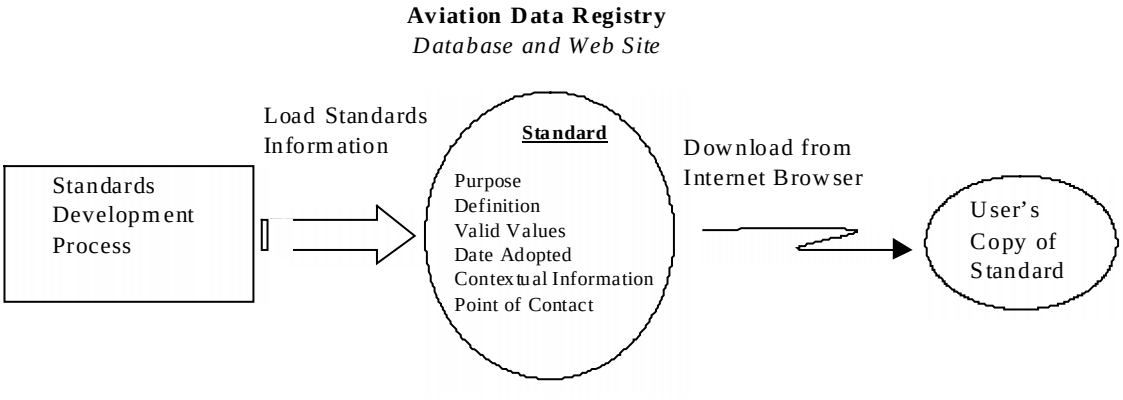

Figure 1

The Registry will provide a single source of information about aviation data standards. It will operate as a dictionary, a directory, and a road map for people who use aviation data. As a dictionary, the Registry shall describe aviation data by providing information on **data names, definitions, formats, valid values, and relationships**. It shall provide a resource for standard data elements for use during system development or re-engineering.

Operational Environment

The Registry will be dependent on users having access to the Internet. User experience with the performance (response time) of the Registry will be dependent on the Internet.

There is potential that some customers of the Registry will be using older hardware and software. System support of the Registry will focus on supporting the current version of software plus one prior version back.

Major System Components

Major system components include:

- Software – Custom software will support the functionality of the Registry. This will include the Registry's user interface as well as its functionality to display and provide downloads of aviation data standards.

- DBMS – A Database Management System will likely be used as part of the Registry to store its information
- Internet – The Internet will be the communications mechanism for the Registry
- Hardware – The Registry will run on at least one server computer.

Interfaces

System interfaces will primarily exist to users requesting access to the Registry. No other interfaces to other information systems are planned for the initial Registry.

Capabilities

The following are key capabilities of the Registry:

- The system shall have a capability for the user to select which data shall be downloaded. Downloading shall be limited to data from within a classification scheme. They shall select the level of the taxonomy that they wish to download. It may be metadata about one or more taxonomy elements or lists of valid values for one or more data elements.
- The system shall identify the business context of each taxonomy. (Initially, the only values for business context will be InternationalStandard; ADREP Standard, and European Co-ordination Centre for Aircraft Incident Reporting Systems (ECCAIRS) Standard.)
- The system shall allow taxonomies and other information to be grouped by major subject areas.
- Source system providers shall submit requests for changes to the Registry by sending messages to the Registry Administrator through a specific web mail address. Data transfers may be done by mail, electronic mail file transfer, or other means agreed upon by the Registry Administrator. Requests for changes includes only changes to taxonomies and valid value lists already established in the Registry. Submissions of new standards must go through a management board before being posted to the Registry. Completed requests for changes will be broadcast to the user community through system messages prepared by the Registry Administrator.

4.4 Source Systems

Source systems, or systems which will provide data to the Registry, are any participating aviation system stakeholder following the procedures and policies of the Registry. Initial data sources will be defined after this document has been considered by involved stakeholders.

4.5 System Integration

The Registry is not planned to integrate with any other system for its initial phase of operation.

4.6 Users/Affected Personnel

The Registry will be available to those interested in aviation information, including the public, aviation managers, regulated entities, state and local agencies, regulation writers, and computer system developers and managers. There are three major classes of users:

1) Registry members; These are system owners and their staff (including their vendors) who are engaged in building and maintaining aviation related information systems. In particular, the Database Administrators and System Administrators from Registry member organizations will be direct users of the Registry.
2) Members of the public – The system is intended to allow the public to view and download selected data elements. (This will contribute to promoting the use of standards)
3) System Administrators of the Registry – This is the staff responsible for running and maintaining the Registry.

4.7 Support Concept

A ***control board*** will be responsible for the contents of the data registry and oversee its operation and maintenance. It will set policy and procedures for the scope, function, security, and other aspects of managing and maintaining the Registry. They will also control approval of standardization processes which may be performed by a variety of groups worldwide, authorize the addition of new metadata items, determine levels of access, and ensure that participating members are kept informed about the condition and contents of the registry. Due to the international scope of the Registry, the board will need to work in an on-line manner, usually without the advantage of face-to-face meetings.

It is anticipated that the ICAO study group for the Registry (identified in the September 1999 ICAO AIG Meeting) will consider and enumerate the duties of the control board.

4.8 Operational Scenarios

Uses of the Registry involve the following types of functions (or use cases):

1) Cleaning a system's reference table data – This involves downloading a "clean" and updated set of standardized reference data (such as a valid, current list of all aircraft manufacturers) and importing that into a system which needs that data. Such systems include aviation systems maintained by industry and government. This function may be done on a recurring basis by users. This involves such steps as:

   - Specify the data set to be copied and map it to the receiving system (Example: download make, model, and engine type and all aliases)
   - Specify major options (structure, rules, values, etc.) Examples may be:
     - Specify the query range based on fields inputted by the user (phase one may be limited to a user selecting "all" or from a set of pre-canned choices)
     - Specify value ranges for each field (phase one may be limited to a user selecting "all" or from a set of pre-canned choices)

- Specify the format of the download (ASCII delimited (using commas, tabs or other delimiters), text, Excel, Access, PDF, other, and JPEG for graphical images)
- Specify the value range for the download (for instance download only Boeing data or only data from 1/1/1990 to the present)

2) A new database table in a system may need to be populated for the first time using standardized and current data from the Registry

3) (Registry Administrators only) Perform manual updates of Registry data using new information (particularly new valid values) and informing users of the availability of such updates

4) Query the Registry
- Specify the query mode
- Specify the query fields
- Specify the query range for each field (including value ranges); may be limited in phase one to the user selecting "all" or from a pre-canned set of choices.
- View or print the data

5) One time download of data.

4.9 System Impact

This section describes various impacts involved in developing and operating the Registry.

Operational Impacts

Stake holder	System & Data Center Interfaces	Procedures	Data Sources	Data quantity, type, & timing	Data Retention
User	No new interfaces beyond use of web to access the Registry and ability to receive downloads for use in local system(s)	Execute downloads of data standards from the Registry and incorporate some or all standardized data in user system(s)	N/A	The size of global data standards may impact database design at the local level.	N/A
Sponsoring Organization	Revision of existing data center operations procedures to include requirements for operating the Registry	Promotion of the use of the Registry; Review and monitor process for operating and maintaining the Registry; Plan and initiate any further expansion of Registry functionality	N/A	Monitoring of System data quantity for capacity impacts	Decide on data retention policies and procedures; Periodic data backup
Developer	N/A	Use of developer's and contracted procedures for system development	Make use of supplied data sources for initializing the Registry	Structure the database based on anticipated data requirements	N/A
Support Agencies - (Common Taxonomy Team, FAA, etc.)	N/A	Review and monitor process for operating and maintaining the Registry; Plan and initiate any further expansion of Registry functionality	Supply initial data standards content to Registry developer	N/A	Decide on data retention policies and procedures
Control Board	Articulation of business needs for added or enhanced interfaces	Promotion of the use of the Registry; Review and comment on the process for operating and maintaining the Registry; Participate in planning and initiating any further expansion of Registry functionality	N/A	N/A	Participate in defining policies involving data retention

Organizational Impacts

Stakeholder	Responsibilities & Positions	Training	Number, skills, location of staff
User	Periodic viewing and download of Registry data	Use of on-line help within the Registry	N/A
Sponsoring Organization	Overall system planning and control functions; Coordination of the Registry with users; Update and maintenance of Registry data; Filtering of user supplied updates; Backup of Registry periodically; Plan for system hardware and networking capacity	Requires computer training in operating and maintaining the Registry	Requires about one full time person at one location to operate and maintain the Registry
Developer	System and database development of the Registry; Development of operational and maintenance procedure manuals	Familiarization with system requirements for the Registry and with similar Registries that have been built	Reqiures skills and staff in system development
Support Agencies - (Common Taxonomy Team, FAA, etc.)	Review and acceptance of system requirements; Testing of the developed Registry against requirements	N/A	N/A
Control Board	Participate in system planning, policy-making, and management functions in conjunction with the role of the Sponsoring Organization	N/A	Several members will be needed from aviation stakeholders representing many governments and industry; Each member needs to be broadly knowledgeable about aviation functions and the aviation industry

Impacts during Development

Developmental Impacts					
Stake holder	**Meetings**	**Database Development**	**Training**	**Parrallel Operation**	**Testing Impacts**
User	Meetings on system requirements, prototype(s), test results and developed system	N/A	N/A	N/A	Users to participate in system testing
Sponsoring Organization	Meetings on system requirements, prototype(s), test results and developed system; on planning for the Registry system as a whole	Plan, direct, review, and testing of database development	May require training in system software (such as DBMS, web, etc.) in order to participate fully in system testing and acceptance processes	N/A	Participate in testing; ensure comprehensive testing; plan and schedule tests
Developer	Meetings on system requirements, prototype(s), test results and developed system;on planning for the Registry system as a whole	Recommend DBMS and implement database	N/A	N/A	Support customer acceptance testing; Perform unit and integration testing
Support Agencies - (Common Taxonomy Team, FAA, etc.)	Meetings on system requirements, prototype(s), test results and developed system; B6	Participate in planning database development; Participate in testing Registry including its database functionality	May require training in system software (such as DBMS, web, etc.) in order to participate fully in system testing and acceptance processes	N/A	Participate in testing;
Control Board	Meetings on System goals, functions, usage, enhancements and operating policies	Indirect involvement when specifying functional requirements of the Registry	N/A	N/A	Some members of the Board may participate in system testing

5 Analysis of the Proposed System

This section summarizes the advantages and disadvantages of the Registry and describes various considerations.

5.1 Summary of Advantages

- Provides a mechanism for international aviation stakeholders to converge on data standards
- Provides an authoritative clearinghouse to publish aviation data standards and to promote their use internationally; The Registry will be a consolidated place to learn about and use existing or evolving aviation data standards.
- Will enable stakeholders to curtail the proliferation of taxonomies
- Will enable system owners to synchronize their local system(s) with international aviation data standards periodically
- Enables analysts performing analyses against aviation data to synthesize and use a larger volume of aviation data from standardized international sources
- Enables users to better understand the information they are accessing and using

5.2 Summary of Disadvantages and Limitations

- Relies upon voluntary use of the Registry and voluntary compliance with data standards
- No mechanism exists to enforce use of defined international aviation data standards
- Different states have varying levels of Internet and computer capabilities for making use of a Registry.
- Cost to build and maintain the Registry
- Limitations of the Internet for overall system performance (or end user response time)

5.3 Trends and Options

Functional trends impacting the Registry include:

- Significant growth in air traffic is driving more interest in improving aviation systems.
- Continued interest and signs of growing interest in aviation data standardization internationally. This is reflected in both private industry and government initiatives. Recent efforts in the aviation safety area have been made to propose standards for data commonly used in aviation analyses.

Technical trends impacting the Registry include

- Growing use of the Internet; Some international aviation stakeholders are not yet using the Internet but prospects are good for growing widespread use.
- The advent of metadata standards initiatives provides useful input for designing the database structure of the Registry.
- The advent of data transformation technology (such as CORBA) offers a prospect of a data transformation role for the Registry in the long-run.

Organizational trends impacting this domain are limited. They include:

- Continued interchange of ideas between industry and governments on aviation information
- Continued evolution of private sector based aviation data standards for such areas as flights and aircraft make, model and series.

Options include:

- Continue the status quo without a Registry
- Develop international mechanisms to promulgate and require compliance with international aviation data standards. This would involve moving from a voluntary compliance environment (with data standards) to a regulated environment.

5.4 Choices and Trade-offs

This document recommends the establishment of an International Aviation Data Registry in order to provide a means for participating stakeholders to converge on aviation data standards. This, in turn, will improve the quantity and quality of data available for aviation analyses conducted by industry and governments. Continuing with the status quo will continue an ad hoc process of slowly evolving data standards. The status quo lacks structured mechanisms for enabling data standardization. The Registry is intended to provide such a structured mechanism while maintaining the voluntary nature of international efforts to attain aviation data standardization. Initiatives to move more toward a regulated international data environment are not being pursued at this time.

5.5 Feasibility Analysis

The Registry is considered feasible because of the existence of similar Registries in operation today. The advent of metadata standards for Registries and related systems also demonstrate the public and private sector interest in pursuing Registries and similar capabilities. Finally, data registries are an extension of data dictionary technology which has long been in existence and feasible.

One feasibility concern is that metadata standards (such as ISO/IEC Standard 11179 and private sector standards) are relatively new and some are still in draft stages. This impacts the ability of the system developer to benefit from and comply with such emerging standards.

5.6 Rough Order of Magnitude Costs

The rough order of magnitude costs for developing the Registry are two hundred thousand U.S. dollars.

6 Recommendations and Decision Points

Contingent upon concurrence by international aviation system stakeholders, this paper recommends the development of an international aviation data registry.

6.1 Proposed System Life Cycle Approach

The proposed system life cycle approach is to complete the following phases: requirements, design, development, acceptance testing, and implementation. These would take place after approval of the Registry concept (as defined in this document) by international aviation data stakeholders. Specific documentation requirements remain to be determined. The following is a brief description of each phase:

- Requirements - If this document is accepted, the next step is to define system requirements for the Registry using materials from this paper as an input. This includes detailed functional and technical requirements. It may also include preliminary design constraints or concepts.
- Design – The system design including its database design will be described, reviewed, and related back to the requirements.
- Development – The system including its database, user interface, and Internet connectivity will be developed. The development will proceed based on the requirements and design. The developer will test and modify the system prior to acceptance testing.
- Acceptance Testing – Using test scripts, the developed system will be tested against requirements. Based on the test findings, the system will be revised to address test findings and attain coverage for system requirements.
- Implementation – The Registry software, hardware, and network connections are installed and tested.

6.2 Coordination of System

The need and development plans for this Registry are being coordinated with ICAO, the CAST/ICAO Common Taxonomy Team, and international aviation data stakeholders in governments and industry. ICAO has assigned consideration of this concept to a study group.

6.3 Implementation Approach

A first phase capability is proposed in this document and is described in section 1.4. Potential subsequent phases are also described in that section.

Further details on the physical implementation of the developed system remain to be determined.

6.4 Management Decision Points

The ICAO study group will decide the process for further consideration of the Registry including any appropriate management decision points.