# INTERNATIONAL AVIATION DATA REGISTRY: PHASE ONE

# SOFTWARE REQUIREMENTS SPECIFICATION

## Draft

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# 1 Introduction

This section provides background on the Registry.

## *1.1 Project Background*

The title of the proposed system is the International Aviation Data Registry. The purpose of this document is to identify and describe the software requirements of the Registry including its functional requirements, system architecture, and process and data model. These materials are intended to be used in subsequent efforts involving system design, development, and testing processes. The intended audience for this document may use it in the following ways:

- System stakeholders can use the document to verify that their required functionality is represented here.
- System designers and developers can use the document to design and develop the Registry.
- System testers can use the document to more completely and comprehensively test the developed Registry against the stated requirements.

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 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.

The Registry is intended to be widely accessible to members of the international aviation community. It will 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.

Further information on the purpose and background of the Registry can be found in the Registry's Operational Concept Document.

## *1.2 Relationship to Prior Projects*

The Registry has a relationship to past aviation data standards that provide a basis for formulating proposed international aviation data standards. This includes past standardized lists of valid values for phases of flight, concatenations of aircraft make, model and series, and human factor taxonomies.

### *1.3 Relation to Current Projects*

This proposed system is related to the following efforts within FAA, NASA, and the international aviation community:

- 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.
- The FAA is considering establishment of an internal data registry for promoting data standardization within the FAA. There is potential synergy between these two efforts. Whereas the FAA Registry has a scope focusing on FAA data systems, the International Aviation Data Registry has an international scope involving aviation data systems throughout the world.
- There is an emerging initiative by insurers of aircraft to maintain an international aircraft registry in order to support functions involving titles to aircraft. There is potential to coordinate how these two efforts uniquely identify aircraft.

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

### *1.4 Relationship to Other Systems*

Published materials on the Registry will have been developed based on inputs involving the content of existing aviation data systems from participating organizations throughout the world. This includes the ICAO ADREP system which makes use of a number of existing data standards. The initial version of the Registry is not planned to have any automated interfaces to other aviation systems.

### *1.5 References*

"International Aviation Data Registry Operational Concept Document", Draft Version 1.0, CAST/ICAO Common Taxonomy Team Members, FAA's Office of System Safety, Volpe Center and Data Union, L.L.C.; Dec. 15, 1999.

"IEEE Std 830-1998, IEEE Recommended Practice for Software Requirements Specification", IEEE Computer Society, June 25, 1998.

"Federal Aviation Administration Office of System Safety Software Development Process Templates" Draft; SRA International Inc.; December 1999.

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

Draft Standard ISO/IEC 11179 Information Technology – Specification and Standardization of Data Elements, International Standards Organization (ISO)/International Electrotechnical Commission (IEC); Work in progress by the

Metadata Working Group (Subcommittee ISO/IEC JCT1/SC32); 1999; See especially 11179-3, Basic Attributes for Data Elements

"ISO/IEC Procedures for Achieving Data Registry Content Consistency", Working Paper Draft 3.0, September 1999

## *1.6 Terminology*

Acronyms and terms are described below.

### 1.6.1 Acronyms

| Acronym | Meaning |
|---|---|
| ADREP | Accident/Incident Data Reporting |
| CAST | Commerical Aviation Safety Team |
| EECAIRS | European Co-ordination Centre for Aircraft Incident Reporting Systems |
| GUI | Graphical User Interface |
| ICAO | International Civil Aviation Organization |
| IEC | International Electrotechnical Commission |
| ISO | International Organization for Standardization |
| NASA | National Aeronautics and Space Administration |
| NASDAC | National Aviation Safety Data Analysis Center |
| RDBMS | Relational Database Management System |
| RVTM | Requirements Verification Traceability Matrix |

### 1.6.2 Terms

The following are selected terms and their meaning used in this document:

Taxonomy – a taxonomy is a hierarchical classification of a domain. For instance, botanists classify plants using a taxonomy

Taxon – is a branch of a taxonomy; for instance, genus and specie of a plant are taxons in a taxonomy of plants.

Data Entity – An object in a business or organization such as customer or product

Data Element – a piece of data used in a business or organization; examples include customer identification number and product description.

Metadata – Data about data; includes the definition of a data element, its maximum length in characters, its format (number, character, date, or other). Metadata is often stored in a data dictionary for an information system.

# 2 System Scope

This section describes the scope of the Registry in terms of its business objectives and stakeholders.

## *2.1 Business Objectives*

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 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.

The following diagram presents a summary of the Registry:

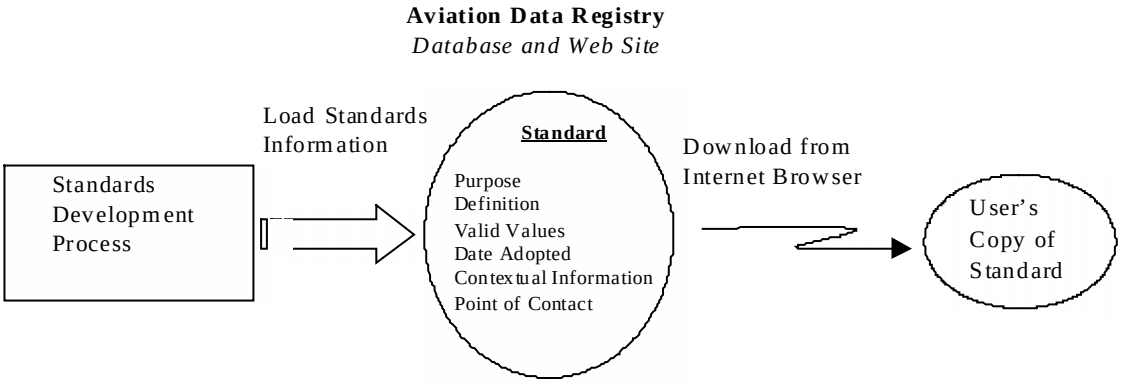



Figure 1

## *2.2 System Context*

The Registry shall be a stand alone system with the capability for:

- Disseminating its data standards and content to users including system owners over the Internet
- Allowing system administrators to load new data standards and applicable valid values

Individuals and organizations that download 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/update that data with data standards and lists of valid values from the Registry.

Operating on a personal computer, and accessible via a thin client web application, the initial registry will 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, data element, or concept found within the registry (this is usually the source system name or the overall name of the standard
- Comments on the use 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),
- References (documents or other objects such as data models that are related to the standard),
- Registration status,
- Registration authority,
- Submitting organization, and
- Responsible organization.

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**
- **Aircraft Lifting Device**
- **Engine Identification Categories**

**Organizations**

**Events**
- **Accident Categories**
- **Incident Categories**
- **Event Types**

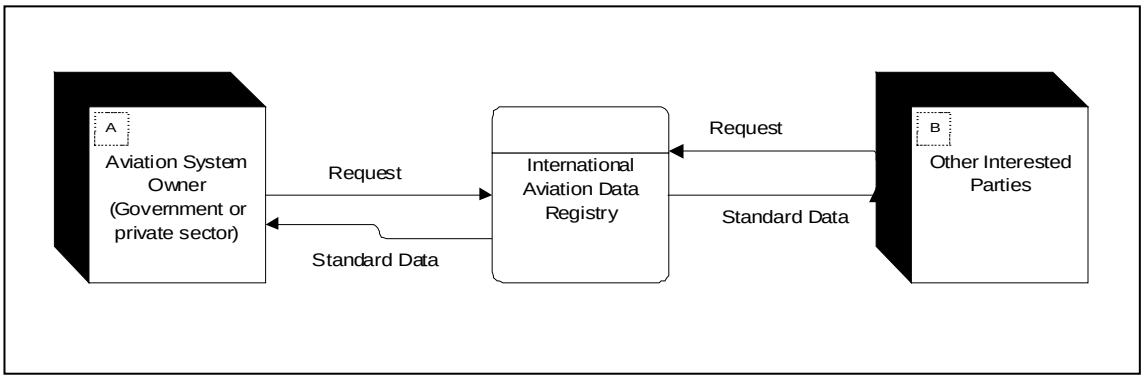
**Factors**
- **Human Factors**
- **Other Groupings**

**Phases of Flight or Operations**

**Date and Time**

**Location**
- **Countries/States**
- **Airport Identifiers**

The following is a context diagram of the International Aviation Data Registry showing the external entities which interact with the Registry.



### *2.3 External Entity Specifications*

| External Entity # | External Entity Name | External Entity Description |
|---|---|---|
| A | Aviation System Owner | System managers and their staff responsible for one or more aviation information systems. System owners are known to include governmental agencies such as CAAs and ICAO, aviation organizations and associations, and private sector corporations. |
| B | Other Interested Parties | Anyone with a web browser may enter the Registry web site and view data. Interested parties are expected to include consultants, educators, safety analysts, and the public. |

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.

### *2.4 Stakeholders*

Names of specific stakeholders include:

| Stakeholder | Organization | Project Role |
|---|---|---|
| Robert Sutton | Commercial Aviation Safety Team (CAST) | Co-Chair of the CAST/ICAO Common Taxonomy Team |
| Reinhard Menzel | International Civil Aviation Organization (ICAO) | Co-Chair of the CAST/ICAO Common Taxonomy Team |
| Cynthia Dickinson | Federal Aviation Administration (FAA) | Operational Concept Document<br>System Requirements Specification for Phase I |
| Yuri Gawdiak | National Aeronautics and Space Administration (NASA) | System Developer for Phase I |

### *2.5 User Roles Specifications*

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 contractors) 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.

The following charts provide more details on these four categories of users for Phase I:

| | |
|---|---|
| **User Role** | System administrator of the Registry |
| **User Role Description** | Manages the Registry as a system by keeping it operational and updating its content when required |
| **Access Type** | Local |
| **Skill Level** | Expert |
| **User Motivation** | A focus of the person's job |
| **Mandatory/Discretionary** | Mandatory |
| **Number of Users for Role** | 1-2 people |
| **Participants and Time Requirements** | To be determined but expected to be about 16 hours per month |

| | |
|---|---|
| **User Role** | System owner/representative |
| **User Role Description** | Downloads material from the Registry in order to keep their systems current |
| **Access Type** | Remote |
| **Skill Level** | More advanced |
| **User Motivation** | After investing in merging Registry data into their system, these users will have improved the currency and quality of some of their key lookup tables |
| **Mandatory/Discretionary** | Mandatory |
| **Number of Users for Role** | Hundreds of users |
| **Participants and Time Requirements** | To be determined but time expected to be about 4-6 hours per month |

| | |
|---|---|
| **User Role** | Standard or data provider |
| **User Role Description** | Supplies taxonomies or data element information to the registry to enable that information to be disseminated through the Registry |
| **Access Type** | Remote by Phase II. In Phase I there will not be a direct connection. Data will be sent to the Registry system administrator through any means agreeable to both parties. |
| **Skill Level** | More advanced |
| **User Motivation** | To promote the standards that they manage and maintain to the international aviation community. |
| **Mandatory/Discretionary** | Mandatory |
| **Number of Users for Role** | One hundred |
| **Participants and Time Requirements** | To be determined but expected to be 4-6 hours per month |

| | |
|---|---|
| **User Role** | General user |
| **User Role Description** | Peruses Registry for information about definitions of key terms and taxonomies used in aviation and to learn more about the functions of the Registry |
| **Access Type** | Remote |
| **Skill Level** | Moderate |
| **User Motivation** | Will vary. Some users will find the definitions very important for more uniform analysis of aviation data; others will simply want to understand the role of standards in aviation. |
| **Mandatory/Discretionary** | Discretionary |
| **Number of Users for Role** | Several thousand users over time |
| **Participants and Time Requirements** | Not applicable |

## *2.6 Business Events*

| Business Event Identifier | External Entity Identifier | Business Event Title and Description |
|---|---|---|
| 1 | Aviation System Owner | Download request – request to download a set of aviation data and/or metadata |
| 2 | General User | Download request – request to download a set of aviation data and/or metadata |
| 3 | Standard or Data Provider | Update submission – an off-line request to update the Registry's standards or data elements with new or revised information; can be posted to the Registry by the Registry's system administrator |
| 4 | Aviation System Owner | Request to display data – this is a user request to view certain data on-line |
| 5 | General User | Request to display data – this is a user request to view certain data on-line |

## *2.7 System Concept of Operations*

The Registry will provide a single source of information about aviation data and will function as a suite of data tools. In Phase I it will operate as a data dictionary and a directory to business uses and sources of standards for people who use aviation data. In Phases II and III it will become a reference book for people who wish to integrate aviation data. As a dictionary, the Registry shall describe aviation data by providing information on **data names, definitions, formats, relationships, other metadata, and valid values.**. It shall provide a resource for standard data elements for use during system development or re-engineering.

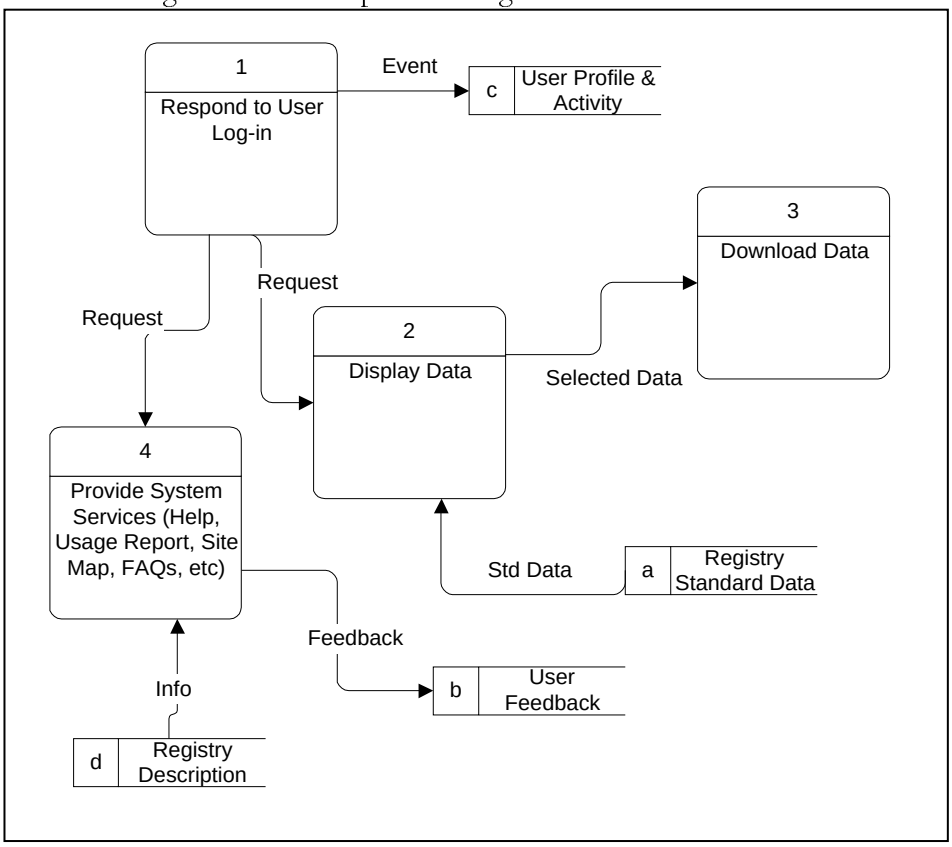
Users would access the Registry as a web site on the Internet. After entering their user ID, they would be able to view various aviation data standards online. After viewing the standards information, they may choose to download a standard. Once they had downloaded a standard, they could incorporate the standardized data in any local lookup tables used by the user's information system(s).

Data published on the Registry would be done by the Registry's system administrator who would add new material to the Registry's database for publication on the web site. There would be no online modification of the Registry's content.

# 3 Business Process Model

## *3.1 System Process Models*

The following is a level zero process diagram:




## *3.2 System Process Descriptions*

Process 1 – Respond to User Log-ins – The system will check if a user's log-in is in its database of previously registered users. If it is, then the system will allow the user to proceed. If not, the system will ask the user to log-in and provide selected identifying information. Once completed, the user is allowed to proceed. There is nothing to prevent a user from creating multiple log-ins.

Process 2 – Display data and metadata – Based on a user's request to view a selected data element or taxonomy (a type of classification scheme), the system will display the metadata about the data element or taxonomy. This will include information about the status of the item within the registry. The user may then select one or more layers of the taxonomies to view the components (also known as taxons) of the taxonomy. The user may also select valid values of data elements associated with a taxonomy if they are included in the registry.

Process 3 – Download data and metadata – After a user has indicated which data to download and made a download request, the system shall download the selected data in one of the formats supported by the Registry. Metadata indicating the status, context, and uses of the data may also be selected for download. The user may download one or more layers of a taxonomy and may or may not elect to download any associated valid values.

Process 4 – Provide system services – This is to provide introductory information about the Registry. This includes a site map, answers to frequently asked questions (FAQs), on-line help, and a report on use of the Registry.

### *3.3 Process Business Rules*

Rules are stated within the functional requirements Section 7. Additional business rules that may affect the process are given in Section 4.

### *3.4 Process Access Matrix*

Access controls are limited to requiring that :

- A user have a user ID
- The system shall prevent any non-system administration user from changing Registry data.

## 4 System Data Model

The system data model consists of both a conceptual and a physical data model. These have been developed in ErWin software and are available separately from this document. Both data models are in compliance with ISO/IEC 11179 "Information Technology – Specification and standardization of data elements" except as specifically noted below. Members of the ISO/IEC 11179 Metadata Registry Coalition, who are among the authors of the 11179 documentation, have reviewed the models for compliance. It is important to note that the authors did not originally focus on issues related to the management of ontologies and taxonomies although the standard is now being used for those purposes. Presentations at the Open Forum conference held in Santa Fe, New Mexico during January 2000 addressed many of the complexities related to managing ontologies and taxonomies. Future documentation of 11179 is likely to incorporate more features related to classification system management.

References in the section below to "11179, Part III" are from the International Standard 11179-3 (Draft Revision) for Basic Attributes of Data Elements dated June 12, 1998. Please note that the data models are based on the Part III metamodel revision of October 15, 1999. Some definitions below have been revised to reflect advances in the metamodel.

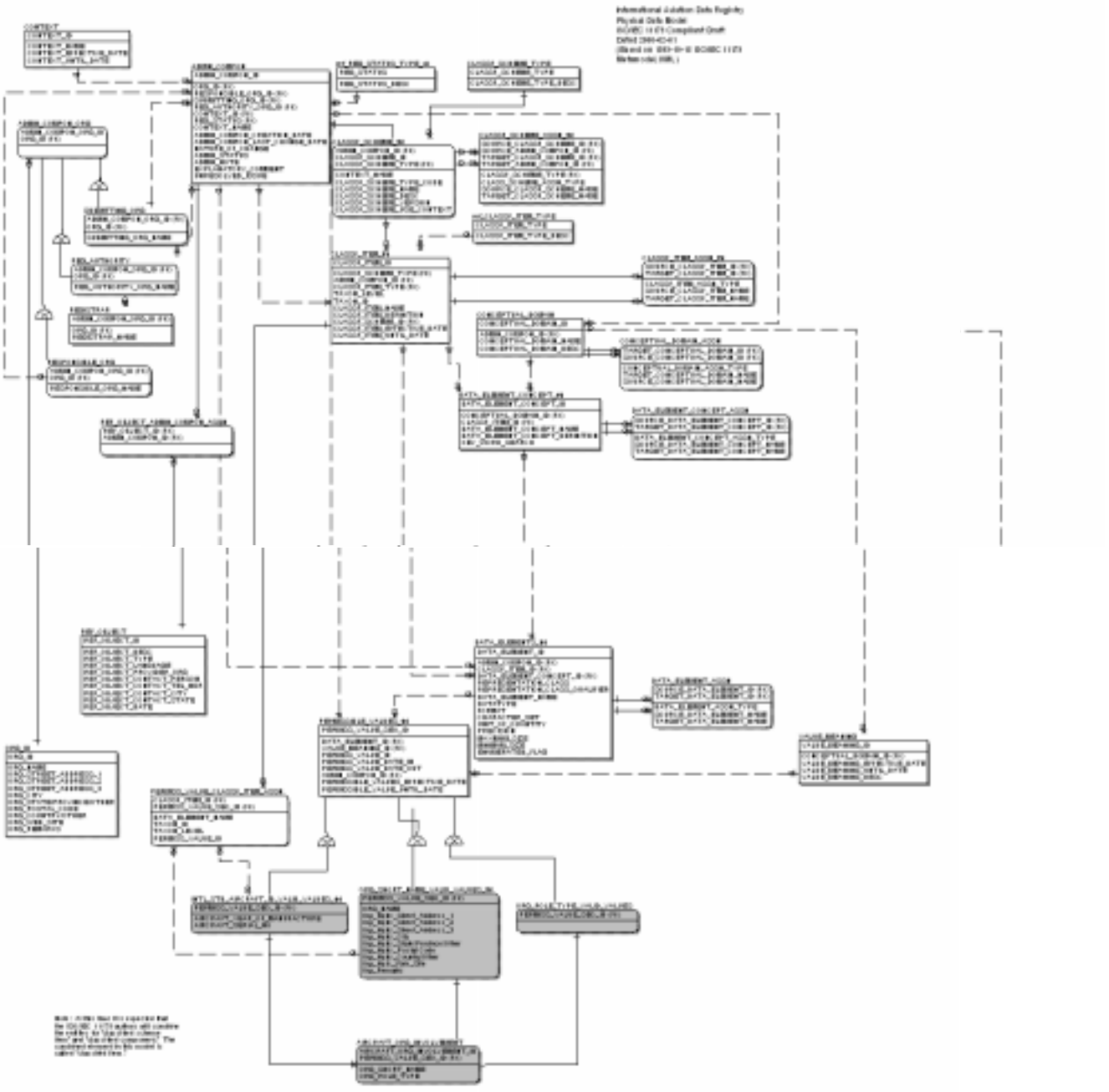
A taxonomy is a hierarchical classification scheme. The aviation safety taxonomies within the International Aviation Data Registry will be managed as classification schemes consisting of classified items of the "taxon" type. In addition, the International Aviation Data Registry

will include some data elements and their valid value lists that will be managed as permissible values of data elements.

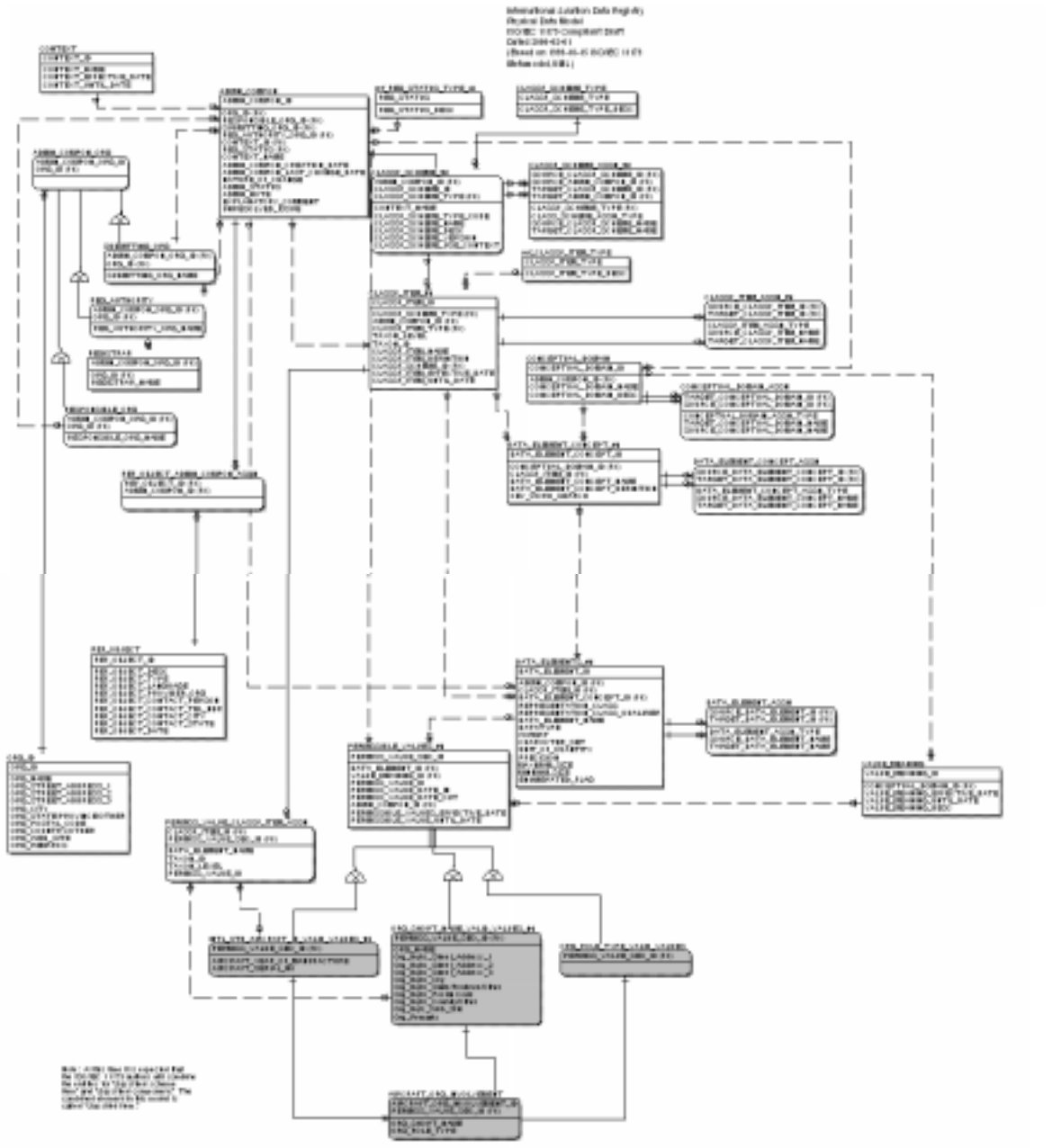
For the definitions and business rules associated with the conceptual and physical data models please see section 4.3 below.

## *4.1 Entity Relationship Models*

### 4.1.1 Conceptual Data Model



### 4.1.2 Physical Data Model



### *4.2 External Data Requirements*

Not applicable to Phase I.

### *4.3 Data Entity Definitions (and Business Rules)*

**Context**

The context is the business system, standard document, or environment in which the taxonomy or data element was created. In the case of international aviation standards this will be identified as "International Standard" (and abbreviated as "Intl Std"). If a taxonomy is provided by a source system such as "ADREP" or ECCAIRS, the context would be the name of the system. In some registry designs the context is referred to as a "name context" or "name space."

**Administered Component**

A data element or its components (classification scheme, classified item, data element concept, conceptual domain, object class, property, etc.) that require definition, specification, and administration for reuse and/or sharing in or among enterprises.

Business rules:

- An administered component must belong to one and only one context.
- An administered component must be submitted by an organization before it can be included in the International Aviation Data Registry.
- An administered component must be given a registration status by the registrar of the International Aviation Data Registry before it can be distributed through the registry.
- An administered component must be maintained by a responsible organization before it can be distributed through the registry.
- An administered component must have one and only one registration status type at any point in time.

**Registration Status Type (reference entity)**

The status of an administered component within the International Aviation Data Registry that indicates its point in the registration life cycle. Valid status types will be determined by the initial international registration authority, but may include categories such as proposed or accepted international standard. Please note that the registration authority may be an international standards organization and not the organization responsible for administering the International Aviation Data Registry. An administration status type may be added if necessary to manage the status of items within the registry itself.

Status types below are suggested by ISO/IEC 11179 authors in Section VI. Please note that these would need to be adapted to cover taxonomies in addition to data elements and mandatory values would differ depending on the procedures adopted for the registry and whether the item is a data element or taxonomy.
Quoting from 11179, Section VI, Page 8:

- Incomplete: The registered data element does not contain all mandatory attribute values.
- Recorded: The registered data element contains all mandatory attribute values, but the contents may not meet the quality requirements specified in other parts of ISO/IEC 11179.
- Certified: The recorded data element has met the quality requirements specified in this and other parts of ISO/IEC 11179.
- Standardized: The certified data element that is established by the registration authority as a data element preferred for use in data interchange and in new or updated applications. The "standardized" data element may be unique within the registry, or it may be the preferred data element among similar data elements.
- Retired: A recorded, certified, or standardized data element that is no longer used after having been marked as "phased out" for a period of time as prescribed by the appropriated registration authority. (end quote from 11179, Section VI, Page 8)

**Administered Component Organization**
An organization related to an administered component in one of the following three ways (shown in the data model as subtypes):

1. As a submitting organization – group suggesting a taxonomy or data element for admission in the registry
2. As a registration authority – the organization accepting the taxonomy or data element on behalf of the registry
3. As a responsible organization – the organization that agrees to maintain the currency of the information relating to the taxonomy, data element, or valid values within the registry

**Organization Identifier**
A label to identify organizations directly involved with administering or managing the components within the registry. The identifier has attributes with the name, address, and other information about the organization. Please note that this is not the same as a data element candidate for the registry which might be called "organization." It is strictly a list of organizations that have submitted, registered or accepted responsibility for the management of registry components.

**Registrar**
The individual who performs the administrative steps to register the administered components within the data registry (See 11179, page 4)

**Reference Object**
A reference object is used to describe or refine the understanding of an administered component. It may be a document, a data model, or multi-media object. This definition represents an expansion of the 11179 standard to include objects as well as documents.

**Reference Object to Administered Component Association**
"An association between an administered component and a reference object." (11179, Part III, page 11)

Business rules:

- An administered component may be described by one or more number of reference objects.
- A reference object may provide reference to one or more administered components.

**Classification Scheme**
"A structured set of classified components established according to the relations among them, each component being determined by its position in the set." (11179, Part III, page 6) The classification schemes included within the International Aviation Data Registry Phase I will be hierarchical.

Business rule:

- All classification schemes and lists within the International Aviation Data Registry will be administered.

**Classification Scheme Type (reference entity)**
A name and description of the type of classification scheme. "It may be a list, a taxonomy, a network, an ontology, or any other schema for systematizing where the categories are mutually exclusive." (11179, Part III, page 6) In Phase I these will be taxonomies or lists. Lists will be used to develop the subject areas for the registry. The subject areas will be used to group the taxonomies or data elements contained within the registry into logical areas for the user. As the user accesses the registry they will view the available taxonomies and data elements organized by subject area.

**Classified Scheme to Classified Scheme Association**
The association between one classified scheme within a context to another classified scheme within another context. In Phase II this will permit a taxonomy to be identified as having a cross reference to another taxonomy.

**Classified Item**
Any component or item that is part of a classification scheme or constitutes its own classification grouping such an object class or representation class.

Business rules:

- In the International Aviation Data Registry, taxons and object classes are always classified items.
- Data elements are not classified items. They are related to classification groupings through their object classes or representation classes.
- In the International Aviation Data Registry, the top level of a taxonomy is a classified item as well as a classification scheme.
- In Phase I it is expected that as a minimum the object classes labeled as classified items will include: aircraft, organization, and country (also known as State).

- In Phase I all classified items that are taxonomies or taxons will be tagged with taxon identifier and a taxon level. This will enable users to download taxonomies down to specified levels and identify the components of taxonomies by a short name or code as well as by a description. These fields are additions to the 11179 standard.
- A classified item may have one and only one classified item type

**Classified Item Type (reference entity)**
A name and description of a type of classified item. In the International Aviation Data Registry classified item types are expected to be: taxonomies, taxons, and object classes.

**Data Element Concept**
"A concept that can be represented in the form of a data element, described independently of any particular representation." (11179, Part III, page 21)

Business rules:
- A data element concept must belong to one and only one object class. For example the data element concept of "unique aircraft identifier" belongs to the object class of "aircraft."
- A data element concept will usually have at least one data element associated with it. For example the data element concept of "unique aircraft identifier" will have a data element called "international standard aircraft identifier" that represents the precise format of a internationally acceptable aircraft identifier.

**Data Element Concept to Data Element Concept Association**
The association between one data concept within a context and another data concept within the same or another context

**Data Element**
A piece of data or an object for which the definition, identification, representation, and permissible values (if any) are specified.

Business rules:
- Data elements may be associated with one and only one data element concept.
- Data elements must have one and only one representation class (A representation class is a type of symbol, character or other designation that defines how data elements look. Valid representation classes for the International Aviation Data Registry are: code, measure, quantity, number, name, text, and amount.)
- Data elements may have many permissible values associated with them.
- Data elements must be administered. As such they will belong to one and only one context.

**Data Element to Data Element Association**
The association between one data element within a context and another data element within the same or another context.

**Permissible Values**
An expression of a value of a data element.

Business rules:

- A permissible value must be associated with one and only one data element.
- Permissible values of a data element may contain attributes associated with the data element provided that these attributes do not need to be administered separately from the data element. In other words, changes to these attributes do not need to tracked independently of the data elements. (Please note that the additional attributes are represented as subtypes in the data model.) For example the subtype of aircraft instance identifier will have an attribute for the initial year of manufacture of the aircraft which will be entered into the system at the time the identifier is known. The addition of non-administered attributes is not in strict compliance to the 11179 standard. Under the standard, attributes would be administered as separate data elements. The purpose of this rule is to lower administrative costs of the registry.
- A permissible value may be associated with multiple classified items through permissible value to classified item associations.

**Permissible Value to Classified Item Association**
The association of specific permissible values to multiple classified items. In the International Aviation Data Registry this association would be used to link a specific permissible value to multiple levels of one or more taxonomies. For example the unique aircraft identifier "Boeing-727-12345678" could be linked to the:

manufacturer taxon known as "Boeing"
master model taxon know as "Boeing-700"
model taxon known as "Boeing-727"
master series taxon known as "Boeing -727-200,"
series taxon known as "Boeing-727-212"
lifting device taxon known as "fixed wing"
sub-lifting device taxon known as "airplane"

The first five taxons belong to the taxonomy for "aircraft identification categories" and the last two belong to the taxonomy for "aircraft lifting device."

**Value Meaning**
"A valid value in a conceptual domain" (11179, Part III, page 49). The meaning of a permissible value. This is a conceptual entity designed to enable a specific permissible value of a data element to be linked to its true meaning. This element can be used to cross reference a permissible value for a data element in one context to a permissible value for a data element in another context. As there are not expected to many data elements in Phase I, use of the value meaning in Phase I is uncertain. As cross references are added in Phase II, it is expected that this entity will be very useful.

Business rules:

- A permissible value may belong to one and only one value meaning
- A value meaning may belong to one more conceptual domain

**Conceptual Domain**
"A set of possible valid value meanings of a data element expressed without representation." (11179, Part III, page 17)

Business rules:

- Conceptual domains are optional within the International Aviation Data Registry. They may prove useful in the future when the registry contains large numbers of data elements (rather than taxonomies as in Phase I).
- A conceptual domain may or may not be administered. If it is administered it may belong to a context identified as the "cross reference context" or "aviation conceptual context" so that it may be used to identify sets of value meanings used for the purpose of cross references between data elements. This is an extension of the use of this entity within the 11179 framework. (Under a strict interpretation of 11179, the conceptual domain, if administered or linked to classified items, would be limited to a single context.)

**Conceptual Domain to Conceptual Domain Association**
The association between one conceptual domain and another conceptual domain. This is usually used to identify hierarchical (parent/child) relationships.

**Aircraft to Organization Involvement**
The association between a specific permissible value of the subtype, "International Standard for Aircraft Identifier" to any specific permissible value of the subtype "Organization Short Name" through a relationship as defined by a specific permissible value of the subtype "Organization Role Type." For example a helicopter with the proposed international aircraft standard identifier of "Bell-UH1H-47516" has "GARLIK" (organization short name) listed as a "CONFORMER" (organization role type). GARLIK is a company that conforms Bell helicopters for the U. S. Military.

### *4.4 Data Business Rules*

See Section 4.3 above.

### *4.5 CRUD Matrix*

Not provided.

### *4.6 Data Access Matrix*

Not provided.

# 5 System Architecture

## *5.1 Current System Architecture*

Because the project is a new development effort, there is no current operational system that needs to be documented.

## *5.2 Target System Architecture*

The target system architecture can be divided into three separate components; hardware, software and communications.

The **hardware component** can be divided into several sub components to support a three tiered approach to receiving, processing/housing and delivering data; the classic client, middle and server tiers. Each tier will require different pieces of hardware to support the requirements of the registry.

The **software component** can be divided into 4 distinct sub components, the operating system, the database software, the Webserver software and the application software. Application software may be in the form of COTS tools/products or developed products. The developed products are outside the scope of this document, as they are based on requirements not yet documented. However, recommendations for tools to create products have been included as part of the target architecture.

The **communications component** needs to be managed as a completely separate piece. Each tier will have a separate set of communications requirements dependent on implementation. It can be assumed that some variation of a TCP/IP communications scheme will be applied; Internet, intranet or extranet on public or private lines. Because the delivery of data may be low speed, high volume ( in the case of the entire registry, (all metadata/data) or high-speed, low volume ( CORBA on-demand component delivery of small sets of data in the form objects), this component needs special attention, and should be viewed as a separate development effort onto its own. It is suggested that this piece be addressed after initial software/hardware requirements have been finalized.

### 5.2.1 The Hardware Component

The following is the opinion of an author, and is no endorse of one vendor or another. The recommendations for hardware are based on working experience, and not on an evaluation process. See Appendix A: Hardware Recommendations .

There should be at least one backend server, one middle tier server and perhaps a web-hosting server (could be part of the middle tier). All pieces should be completely scalable and have a respective hardware backup strategy.

#### 5.2.1.1 Backend Server

The backend server should be considered a database host. It should have the capacity to host at least a terabyte of data and provide for enough speed and ram to support 50/100 threads of on demand low volume requests AND 10/25 threads of high volume, batch or scheduled tasks simultaneously. The server should have a hardware backup strategy that archives daily and allows for 24-7 access. The hardware should be generic enough to be supported world wide on demand.

#### 5.2.1.2 Middle Tier Server

The middle tier server configuration is solely dependent on the CORBA implementation. What tools, applications – the entire environment cannot be determined at this time.

#### 5.2.1.3 Web Hosting Server

The web server is dependent, again, on the CORBA strategy.

### 5.2.2 Software Component

The following is the opinion of the authors, and is no endorse of one vendor or another. The recommendation is based on working experience, and not on an evaluation process.

#### 5.2.2.1 Operating System

It is recommended that Windows NT 4.0/5.0 be used as the Operating System for the Air Registry on all tiers.

There are advantages and disadvantages to using NT, but the following the author leans in favor of NT for the following reasons:

- Multi-language support provides no fuss interoperability within the international community.
- Microsoft's aggressive training initiative has created an army of trained NT administrators worldwide.
- NT is fairly easy to install and maintain
- Most of the commercial-off-the-shelf products operate cleanly in the NT Environment
- Built in Webserver (Internet Information Server) supported at the Operating System level.
- Supports SQL 7.0 natively (suggested database for registry)

#### 5.2.2.2 Database Software

It is the opinion of the authors to consider Microsoft's SQL 7.0 as the Database Platform to drive the Registry. The software is relatively inexpensive and provides a large variety of native tools that apply to development and operation of the Registry. See Appendix B: Database Software Recommendation for details on SQL 7.0

#### 5.2.2.3 Application Software

The group has already established a set of *de-facto* application software. They are:

- Microsoft Office Professional 97 – which includes Microsoft Word, Microsoft Access, Microsoft PowerPoint and Microsoft Excel.
- Platinum ErWin 3.5.2 as the Data Modeling tool.

Application development tools should be left to the discretion of the application developers.

## *5.3 Development Platform*

The development platform should be a scaled down version the of the Target System Architecture.

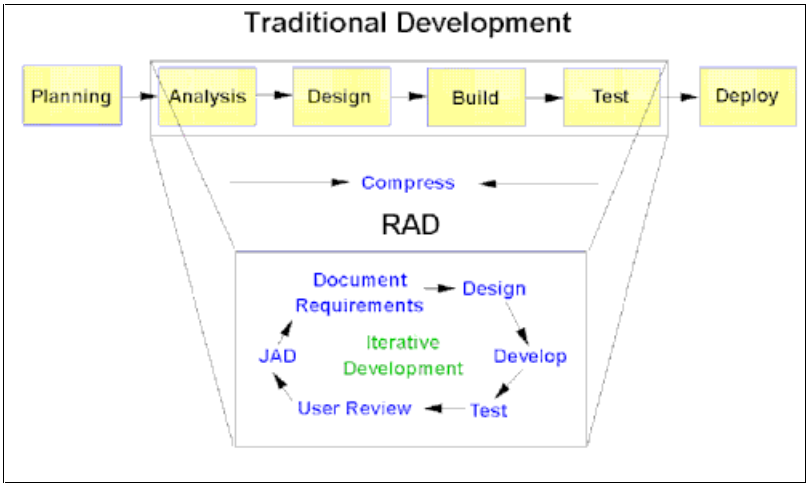
## *5.4 Development Approach*

The development approach for this project has been using the Rapid Application Development/Joint Application Development (RAD/JAD) iterative software development model.

The traditional software development cycle follows a rigid sequence of steps with a formal sign-off at the completion of each. A complete, detailed requirements analysis is done that attempts to capture the system requirements in a Requirements Specification. Users are forced to "sign-off" on the specification before development proceeds to the next step. This is followed by a complete system design and then development and testing.

But, what if the design phase uncovers requirements that are technically unfeasible, or extremely expensive to implement? What if errors in the design are encountered during the build phase? The elapsed time between the initial analysis and testing is usually a period of several months. What if business requirements or priorities change or the users realize they overlooked critical needs during the analysis phase? These are many of the reasons why software development projects either fail or don't meet the user's expectations when delivered.

RAD is a methodology for compressing the analysis, design, build, and test phases into a series of short, iterative development cycles. This has a number of distinct advantages over the traditional sequential development model. (See Figure below)




**Traditional vs. RAD Development**

Iteration allows for effectiveness and self-correction. Studies have shown that human beings almost never perform a complex task correctly the first time. However, people are extremely good at making an adequate beginning and then making many small refinements and improvements. We should encourage and exploit this rather than fight it.

RAD projects are typically staffed with small integrated teams comprised of developers, end users, and IT technical resources. Small teams, combined with short, iterative development cycles optimizes speed, unity of vision and purpose, effective informal communication and simple project management.
An important, fundamental principle of iterative development is that each iteration delivers a functional version of the final system. It is a properly engineered, fully working portion of the final system and is not the same as a prototype. For example, the first iteration might deliver 100% of 10%, the second iteration 100% of 25%, etc.

This type of development lends itself nicely to the working group considering the logistics, personnel and resources available at this time.

# 6 Assumptions, Constraints, and Issues

## *6.1 Assumptions*

Managers of aviation information systems can benefit from a centralized repository of standards. Use of the standards permits greater interoperability of tools and data and lowers operational costs.

These managers also have a recurring need to update their reference tables with new or revised values in order to keep their systems current and to facilitate analysis of their system's information against standardized reference values.

### *6.2 Constraints*

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

As a design topic, there are three potential ways to navigate the Registry. In Phase I the registry shall be navigated through a list. The system shall present a list of subject areas with related taxonomies and data elements. In later phases, the access may be through a through a data model (by clicking on objects on a data model, such as entities or relationships, the system would present the user with information about that object) or through a visual diagram. Some systems present data through diagrams like Venn diagrams. If the user clicks on an object on the visual diagram, the system presents more information about that object.

The system shall be compliant with ISO/IEC Standard 11179 in order to support standardized data transfer.

The design team shall conduct a design review with the customer after they have drafted a design for the Registry. The design review shall include review of a matrix which traces the requirements in this document into the designed components of the Registry (this is termed a Requirements Verification Trace-ability Matrix or RVTM). It shall also include a review of proposed user interface or graphical user interface (GUI) standards proposed by the design team. It shall also include review of the naming conventions for use in developing the physical database and related software.

The design team shall also propose a hardware and software configuration for the server(s) which operate the Registry. The specification shall include the type of server hardware and its operating system.

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.

The following are operational constraints in operating the Registry effectively:

- Sponsorship 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.
- Because resources for maintaining the system are expected to be limited, the system should not be designed in a way that requires system administration staff to have unusually advanced skills including experience with advanced or very recent technology.

### *6.3 Open Issues*

Open Issues include:

- Identification of an organizational home for the Registry
- Development and documentation of procedures for management and administration of the registry including acceptance of contents.
- Funding of Registry maintenance

### *6.4 Future Requirements*

See the Operational Concept Document for future requirements.

## 7 Functional Requirements

The following are key capabilities of the Registry.

### *7.1 Scope*

The scope of the data for phase one is aircraft identification (make, model, serial number), phases of flight, accident categories, and incident categories.

The data shall include draft standards as well as final international standards. Draft standards are those standards which international committees have put forward as drafts.

### *7.2 User Log-on Activity*

The system shall track user log-on identifiers. This shall include user identifiers but no passwords.

The system shall grant a user ID upon any request in phase one. To get an ID, a user must provide the following information: family/surname, first name, a free form text field for their personal title (Mr., Ms., Dr., Herr Dr., etc.) with examples shown on the screen, organization name, role description, phone number, country, email address. They should also indicate whether they wish to be on an email list for update and other system information.

To indicate their country, the user must select from a fixed list of countries (see ICAO or ISO list to be determined). (The latter is important for tracking usage of the Registry by country of origin).

### *7.3 Classification Data Selection & Display*

The system shall present data by classification scheme name as an introductory navigation method. The scheme names are:

Aircraft
- Aircraft Identification Categories
- Aircraft Lifting Device Categories
- Engine Identification Categories

Organization

Events
- Accident Categories
- Incident Categories
- Event Types

Phases of Flight or operations

Factors
- Human Factors
- Other groupings

Date and Time

Location
- Countries/States
- Airport Identifiers

### *7.4 Download data from the Registry*

At a minimum users shall be able to download data from the Registry in accordance with the following.

7.4.1 Contents of registry to be available for download

7.4.1.1 Classification Scheme Information

- Classification scheme name
- Classification scheme description
- Classification scheme type (list or taxonomy)
- Context name for classification scheme (such as "Intl Std" or "ECCAIRS")
- Classification scheme version

- Classification scheme version date (usually the last date of change of the administered component)
- Submitting party organization name (other information may be added here as needed such date of submission)
- Registration authority organization name
- Responsible organization name (data steward and point of contact for questions)
- Registration status (incomplete, recorded, certified, standardized, and retired) (Note well: These are under possible revision by 11179 working group)
- Nature of change (descriptive information)
- Subject area for the classification scheme if applicable
- Associations (to other Classification Schemes)
- Classification scheme use context (description of the types of situations where the taxonomy or list is intended to be used)
- Classification scheme references (other source materials pertinent to the standard or the establishment of the standard such as related data models, meeting minutes, documents, standards, etc.)
- Explanatory comments

7.4.1.2 Classified Item Information

**For Taxonomies**

1. Presented by level down to lowest level selected by user
2. Presented as a current taxonomy or retired taxonomy as selected by user

- Taxonomy name
- Taxon level
- Taxon identifier
- Taxon name (classified item name)
- Taxon definition (classified item definition)

**For Object Classes**

- Object class name (classified item name)
- Object class definition (classified item definition)
- Object class effective date
- Object class until date

7.4.1.3 Data Element Information

If enumerated user may request valid value list.
If a data element concept has been identified, the user may request keyword search criteria if available.

- Data element name
- Data element definition
- Data element data type
- Data element format
- Data element character set
- Maximum size
- Minimum size
- Unit of Quantity
- Precision
- Representation class (in the data registry this is usually a code) A representation class is the type of symbol, character or other designation that that the data element represents, i.e. what it looks like. Representation classes must be one of the following: measure, quantity, number, code, text, or amount.
- Associations (also known as relationships)
- Data element concept name
- Data element concept definition
- Data element object class
- Data element concept key word search
- Data element conceptual domain name
- Data element conceptual domain description
- Data element last change date (from administered component last change date)
- Context name

7.4.1.4 Permissible Values (also known as Valid Values)

User may select current values or retired values.

- Value (varies depending on subtype)
- Other attributes depending on the subtype
- Value meaning description
- Permissible value effective date
- Permissible value until date

7.4.2 Download messages

The user shall be provided a message telling them the size of the file they are about to download. The system shall give the option to cancel the download. The system shall ask the user to specify whether to save the download to their computer's hard disk or to view the data on-line. If the user executes the download, the system shall give a message to the user (after the download is complete) indicating that the download is completed.

#### 7.4.3 Download formats

The Registry shall provide downloads in the following formats: PDF, ASCII delimited text (comma or tab delimited), Microsoft Access, Excel. The download option shall be a full download for the levels requested (not an incremental download of changes). (Users will not know what has changed, so incremental downloads can lead to data quality mishaps).

### *7.5 Business Context*

The system shall identify the business context (or source) of each taxonomy. (Initially, the only value for business context will be ICAO Standard; other values are possible such as Europe and standards, ISO or IEEE standards, and others).

#### 7.5.1 Subject area capability

The system shall allow taxonomies and other information to be grouped by major subject areas.

### *7.6 Query Methods*

The system shall support the following query methods (for users to query the Registry for its contents):

#### 7.6.1 Data Entity or Subject Query

A user may select from a pre-defined list of subjects, taxonomies or taxonomy components to view contents about that subject.

#### 7.6.2 Data Element Query

The system shall allow a user to search by the first letter of the data element name to retrieve a list of data elements beginning with that letter.

### *7.7 System Administration*

The system shall support several system administration functions.

#### 7.7.1 Help features

Phase I shall be supported by a Help Desk.

The system shall offer on-line help. The on-line help shall at least be offered on a page by page basis and shall be indexed by key word.

### 7.7.2 Journal of changes

The system shall support a capability to maintain a journal of changes. (Design issue: It is preferable that entries be made automatically into such a journal.)

### 7.7.3 Usage reporting

The system shall provide a system usage report to system administrator users upon request. The report shall indicate for a specified time period, the name of each user, indication of view only usage, indication of download usage, and country. The report shall sort the data in order of first country, then person family/surname, then download usage, and finally view only usage. The system shall also tabulate the total number of visits to the site for a specified period and provide a breakdown of that count into number of view only visits and number of download visits.

### 7.7.4 Special features of registry accessible from the home page

The system shall provide an introductory page for the Registry which will include information on the appropriate use and functionality of the Registry.

This page shall offer access to a site map.

The system shall offer a way to describe new features of the Registry as new releases are issued.

The system shall offer a way to present answers to frequently asked questions.

The system shall permit linkage to related web sites including sites of standards groups, sites related to specific standardized data elements (such as manufacturers), and organizations working on aviation data standards.

## *7.8 Languages*

The system shall 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.

## *7.9 User Interface*

### 7.9.1 General user interface requirements

Typical users will be system and data administrators from widely disparate computer environments across the globe. The interface must be designed with an expectation of minimal computer skills and disparate originating environments. It is important that the interface help to communicate the Registry's uses to stakeholders who must decide on its utility and viability.

On-line help shall be rapidly available at least from every screen in the Registry.

### 7.9.2 User interface standard

The design/development organization shall propose a user interface standard and obtain validation from Registry stakeholders. There is no specific requirement for screen format, page or window layouts, or need for programmable function keys. It is anticipated that screen designs will be reviewed by users.

## *7.10 System Interfaces*

The only planned interfaces in phase one are through internet-based links to other relevant web sites. No other interfaces to other information systems are planned for phase I.

## *7.11 Data Updates*

As an off-line process, source system providers will submit data for upload to the Classification Schemes already established in the Registry. Submissions must go through a system manager before being posted to the Registry (during phase one). Submissions may be made by electronic mail or regular mail. This includes new, changed, retired, and deleted data. This constitutes a change request.

### 7.11.1 Location of instructions

Instructions on format for new or revised taxonomy or data element submissions shall be available through the online help.

### 7.11.2 The format for submissions shall be as follows:

- Spreadsheet Format (.xls)(MS Excel for Win95), using individual columns labeled for each data field. The file can be zipped or not.
- ASCII text files with character separated values. Format is one line for each record with each data field enclosed in quotes and separated by commas. [For example: "value", "value", "value", etc].

At the beginning of the file, include the following identification information (maximum length shown in parentheses):

- Responsible organization name
- Responsible organization address
- Responsible organization electronic mail address
- Other information as determined by procedures to be developed
- Context name (source system or standard name
- File creation date

Each component provided for inclusion in the registry must contain the information show in the physical data model and determined to be mandatory through the procedures to be developed

7.11.3 Submission address instructions

For electronic mail submissions and regular mail submissions , the system shall provide instructions on how to make each type of submission and the appropriate address (electronic mail or street address) where the submission should be sent.

# 8 Non-Functional Requirements

## *8.1 Usability*

Navigation attributes will be based on user interface design standards selected by the design team.

## *8.2 Performance*

The Registry shall be able to support at least 7 concurrent users at any one time.
Because the Registry will likely be built using the public internet, no further performance requirements (such as end user response time for given types of transactions) are specified. This is due to the variability of traffic on the Internet, availability of internet servers, size of demand on internet capacities, and other factors. We anticipate that some user requests will require significant time to process particularly if large volumes of valid valid/domain values are requested for download.

## *8.3 Operational*

Except for internet communications problems that interfere with the Registry's operations, the Registry shall be available for 99% of its scheduled up-time. Some time may be scheduled for maintenance, backup, uploads, and related system administration functions.

To the extent practical, the Registry shall be developed so that it is portable to other hardware platforms using the same operating system. This is due to the international nature

of the Registry and the potential that it may be re-hosted as operations and maintenance responsibilities evolve over time.

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.

The Registry is intended to operate for extended periods of time without attending operating staff. The Registry is also intended to be operational at all times except for scheduled maintenance of the system. If the system ceases to operate on a given day, the operations staff are required to restart the Registry by the next **business** day (at the location where the Registry is housed).

The Registry's data needs to undergo backup at least weekly or on any day that changes have occurred. Twice a year, recovery of the database from backup files should be tested. A written procedure for backup and recovery operations needs to be developed.

### *8.4 Supportability*

Requirements and design documentation will be captured and stored to facilitate software maintenance of the Registry.

### *8.5 Security*

In phase I, security requirements are limited to a user ID.

8.5.1 The system shall secure the data within the Registry so that general users cannot change or delete the data.

8.5.2 Users shall be required to request a log-on to use the Registry. (A password is not needed.) The purpose is for the system to track who is using the system.

### *8.6 Human Factors*

No specific human factors engineering standards are specified at this time. Designers shall take into account colorblindness before selecting color combinations.

### *8.7 Resources*

See Section 2.5 above.

# 9 Support Requirements

## *9.1 Training Specifications*

None

## *9.2 Documentation*

Requirements and design documentation will be captured and stored to facilitate software maintenance of the Registry.

It would also be useful to develop a Registry Software Maintenance Manual to address maintenance of the Registry's software and its database.

# 10 Acceptance Criteria

## *10.1 Satisfaction of Requirements*

## *10.2 Closure of Problem Reports*

## *10.3 System Requirements Matrix*

# 11 Appendices

## *11.1 Appendix A: Hardware Recommendations*

### 11.1.1 Database server

It is recommended at this time to use the ProLiant ML530, the world's fastest 2-way server, combines maximum performance with ultimate expansion and manageability features. With the next generation Highly Parallel System Architecture, 133MHz SDRAM, 64-bit/66MHz PCI, and the new Pentium III 800MHz Xeon processors, the ML530 provides the fastest overall 2-way system performance.

In addition to its leading performance, the new ML530 is also optimized for maximum internal system expansion. The ML530 features sixteen bays including twelve hot-plug hard drive bays, eight PCI slots, memory expandable to 4GB, and dual processing support ensuring that it provides the highest level of IT investment protection by enabling the server grow with data requirements of the Registry

Combined with its performance and expansion capabilities, the ML530 also features industry leading management tools including Compaq Remote Insight Lights-Out management support, Compaq Insight Manager, and SmartStart guaranteeing maximum network uptime.

With leading 2-way performance, expansion, and manageability features, the ML530 is the ideal solution as a plug in Database server for the Registry

Some of the Key Features include:

- Intel Pentium® III Xeon Processor (dual processor capability)
- Next generation Highly Parallel System Architecture featuring the RCC LE 3.0 Chipset with 133MHz Front Side Bus
- 64-Bit PCI for latest I/O performance
- 133MHz SDRAM
- Memory expansion to 4GB
- 16 media bays: twelve Hot Pluggable hard drive bays, two 5.25-inch removable media bays, CD ROM, and floppy
- Internal hot pluggable storage capacity up to 218.4 GB
- Eight total PCI slots: two 64-Bit, 66Mhz PCI, five 64-Bit, 33Mhz PCI, and one 32-Bit, 33Mhz PCI
- Redundant Hot Plug system fans support
- Hot Pluggable hard drives
- 450-Watt Hot Pluggable Redundant Power Supply support

- Redundant NIC support
- Prefailure Alerting on hard drives, processors and memory allows replacement of a degraded component before it fails
- ECC protected memory
- Lights Out Management support
- Redesigned cable management
- Diagnostic lighting provides status indication of degraded or failed components in the major subsystems for quick and easy hardware diagnostics
- Lights Out Management Support
- Compaq Insight Manager, SmartStart, Integrated Remote Console (IRC) and Automatic Server Recovery-2 (ASR-2 )
- Protected by a global three-year, on-site limited warranty with next business day response, and extended Pre-Failure Warranty which covers processors, memory and disk drives, as well as a wide range of Compaq Services.

Specifications and Benefits include:

*Form Factor*

Tower or rack (7U); Optional ProLiant ML530 tower-to-rack conversion kit available

*Processor*

800MHz Pentium III Xeon processors with 256KB level 2 Advanced Transfer Cache. Support for up to 2 Pentium III Xeon processors

Memory

133 MHz ECC SDRAM expandable to 4GB using 512 MB modules

*System Architecture*

Next generation Highly Parallel System Architecture for improved system throughput and overall system performance

*Internal Expansion Slots*

Eight total slots: two 64-Bit 66MHz PCI, five 64-Bit 33MHz, and one 32-Bit, 33MHz PCI

*Drive Controller*

Integrated Dual-Channel Wide-Ultra2 SCSI Adapter

*Network Controller*

NC3123 Fast Ethernet NIC PCI 10/100 controller featuring Wake On LAN

*Drive Bays*

Four media bays: (1) IDE CD-ROM (2) Available 5.25" removable media bays (1) 1.44 MB floppy drive

*Internal Storage*

218.4 GB Maximum Internal Hot Plug Storage Ultra2 and Ultra3 ready

*Interfaces*

One RJ-45 Ethernet port, two serial, one parallel, keyboard, mouse, and one graphics port, and external SCSI through knock-out

*Power Supply*

450-Watt Hot Pluggable Power Supply (one standard) with optional redundant Hot Plug Power Supply

### 11.1.2 Middle tier server

The above recommendation applies to the Middle Tier Server as well.

### 11.1.3 Web hosting server

It is recommended to use the Compaq ProLiant ML350 Server. The ProLiant ML350 Server provides the latest Pentium III processors, support for 64-bit PCI cards, PC-133MHz ECC Registered SDRAM memory, 133 MHz front side bus, and an integrated dual-channel Wide-Ultra2 SCSI controller to meet demanding performance requirements. With four hard drive bays (hot-plug or non-hot-plug), four removable media bays (1.44MB 3.5" diskette drive, 32X IDE CD-ROM, with two available), two 64-bit PCI slots, four 32-bit PCI slots (3 available), and 1 dedicated ISA slot, the ProLiant ML350 Server offers the expandability to grow. With such features as SmartStart, Compaq Insight Manager, ASR, and a Pre-Failure Warranty, the ProLiant ML350 Server maintains the standard of reliability and manageability unique to Compaq. This formidable combination of features, manageability, serviceability, and expandability make the ProLiant ML350 an ideal platform for a Webserver.

**This ProLiant ML350 Server is also backed with comprehensive service and support partnerships through Compaq Systems Service Providers around the world.**

*Some Key Features Include*:

- Intel Pentium III 600-MHz, 667-MHz (CTO only), or 733-MHz processor with 256KB of on-chip cache
- 128MB of PC133-MHz ECC Registered SDRAM DIMM standard, upgradeable to 2GB
- 7 (6 available) expansion slots (2 64-bit PCI, 4 32-bit PCI [3 available], and 1 dedicated ISA)
- Support for four 1" hot-plug or non-hot-plug hard drives for up to 72.8 GB of internal storage, or 109.2 GB total internal storage if hard drives are also installed in the two available removable media bays
- Four removable media bays - 2 available (with sufficient room to support internal DLT), one 1.44 MB 3.5" diskette drive, and one 32X IDE CD-ROM drive
- Ultra3 ready
- Integrated Dual Channel Wide-Ultra2 SCSI Controller
- Compaq NC3163 Fast Ethernet NIC (embedded) PCI 10/100 WOL, and RJ-45 connector
- Integrated 1024 x 768 x 16.7 million colors video controller on the PCI local bus with 4MB Video SDRAM
- Two serial ports, one parallel port, mouse & keyboard ports External Wide Ultra2 capable (option kit required to implement)
- 300 Watt power-factor corrected power supply, CE Mark compliant Automatic Server Recovery (ASR)

- Compaq SmartStart and Compaq Insight Manager Compaq's industry-leading Pre-Failure Warranty (on hard drives, memory, and processor)
- Hot plug hard drive model Latest Intel Pentium III Processors and 133-MHz FSB
- Up to 2GB memory capacity (uses PC133-MHz ECC Registered SDRAM DIMMs) Two available 64-bit PCI slots, in addition to 3 available 32-bit PCI slots and 1 ISA slot Integrated dual channel Wide Ultra2 SCSI
- ROM-based BIOS setup
- DLT tape drive support Large internal capacity (up to 109GB)

Specifications and Benefits Include:

- Hot-plug hard drive model (in addition to non-hot-plug model) provides leading levels of availability features at a value price
- Redundant NIC capability provides fail-over for network communications
- SMART Array Controller support provides data integrity, reliability and more uptime by offering automatic storage fault tolerance, storage management and open system drive interface
- Error Checking and Correcting Memory (ECC) checks and corrects single-bit memory errors without causing the system to halt operation or corrupt data Internal expansion enables you to easily meet new and growing registry needs -
- 109.2GB capacity if 18.2GB hard drives are used in the two removable media bays (72.8GB of internal storage otherwise)
- Hot-plug hard drive upgrade kit provides flexibility and investment protection to meet changing needs
- Two 64-bit PCI, four 32-bit PCI (3 available), and one dedicated ISA expansion slots keep up with growing demands for instant information access
- 2GB memory capacity (comes standard with 128MB)
- Two available removable media bays provide additional room to grow as users and data increase
- DLT tape drive support provides the latest storage capabilities
- True tower to rack conversion kit provides easy conversion to a standard 5U rack solution. ProLiant tool-free design eases serviceability requirements, especially for remote sites -
- Entirely tool-free entry to chassis and access to system components provides superior ease of service on the ProLiant ML350 Server. Compaq leading manageability helps save time and resources over the life of the server -
- Easy to set-up and maintain; built-in Compaq server management tools help you take care of the network, minimizing the need for IT resources and expertise
- Built-in server management tools enable quick and easy set-up, maintenance, and troubleshooting, whether you are an IT administrator or not. Faster servicing and easier management gives you a solution that you can confidently manage.

- SmartStart simplifies system setup and optimizes platform configuration so that hardware and software are integrated for top-level performance, reliability, and stability
- Compaq Insight Manager prevents problems before they occur with pre-failure alerts and identification of degrading system components. Compaq's comprehensive Pre-Failure Warranty provides free replacement of hard drives, memory, and processors before they cause costly, unexpected down-time.
- Web-Based Compaq Insight Manager allows flexible enterprise management of your Compaq systems, networking devices and third party systems. Based on web technologies, Compaq Insight Manager XE allows you to manage from all points, not just a centralized single console.
- Remote management with the Remote Insight Board (PCI) allows access to servers at remote sites and branch offices, providing convenient management of systems and data
- ASR (Automatic Server Recovery) eases server management by automatically rebooting the server when a critical hardware or software error occurs; this is especially beneficial for remote site and branch office locations where immediate IT staff intervention may not be possible

## *11.2 APPENDIX B: Database Software Recommendation*

Key Features of Microsoft SQL 7.0 that apply to the Registry

| Feature | Description |
|---|---|
| **Dynamic Memory** | Improves performance by optimizing memory allocation and usage. Simplified design minimizes contention with other resource managers. |
| **Dynamic Row-Level Locking** | Full row-level locking is implemented for both data rows and index entries. Dynamic locking automatically chooses the optimal level of lock (row, page, multiple page, and table) for all database operations. This feature provides improved concurrency with no tuning. The database also supports the use of *hints* to force a particular level of locking. |
| **Dynamic Space Management** | A database can automatically grow and shrink within configurable limits, minimizing the need for DBA intervention. It is no longer necessary to pre-allocate space and manage data structures. |
| **Large Memory Support** | SQL Server version 7.0 Enterprise Edition will support memory addressing greater than 4 GB, in conjunction with Windows NT Server 5.0, Alpha processor-based systems and other techniques. |
| **Log Manager** | Simplified design improves performance for truncation, online backup, and recovery operations. |
| **Read Ahead** | Smart read-ahead logic improves performance and eliminates the need for manual tuning. |
| **Reliability** | Concurrency, scalability and reliability are improved with simplified data structures and algorithms. Run-time checks of critical data structures make the database much more robust, minimizing the need for consistency checks. |
| **Scalable Storage** | The new disk format and storage subsystem provide storage that is scaleable from very small to very large databases. Specific changes include:<br>Simplified mapping of database objects to files eases management and enables tuning flexibility. DB objects can be mapped to specific disks for load balancing.<br>More efficient space management including increasing page size from 2K to 8K, 64k I/O, lifting of the column limit, variable length character fields up to 8k, and the ability to add and delete columns from existing tables without a unload/reload of the data.<br>Redesigned utilities support terabyte size databases efficiently. |
| **Unicode** | Native Unicode, with ODBC and OLE DB Unicode APIs, improves multilingual support. |
| **Backup and Restore** | Parallel backup and restore utilities scale at device speeds. Low impact on operational systems—very high server transaction processing is maintained during full on-line backup. |
| **Bulk Data Loading** | Data import/export speed is greatly improved. Now uses OLE DB and works in conjunction with the query processor to plan and optimize queries. |
| **DBCC** | Checks physical and logical consistency of database. Patented single-pass algorithm speeds performance. New features are supported and can fix some problems. New Storage Engine architecture minimizes need for DBCC, but it's still a good practice. |
| **Administration Wizards** | Many new wizards simplify advanced tasks such as creating databases, |

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| | scheduling backups, importing and exporting data, and configuring replication. |
| **DBA Profiling and Tuning Tools** | New tools provide advanced profiling and tuning:<br>• Profiling improves debugging by allowing the capture and replay of server activity.<br>• Index tuning wizard provides guidance through the index tuning process.<br>• Graphical query analyzer allows easy, in-depth query analysis. |
| **Distributed Management Objects** | Independent software vendors and corporate developers can easily develop custom management applications. The COM-based framework exposes all management interfaces for SQL Server. Automation components and custom applications can be written using Visual Basic®, Visual Basic for Applications, and Java scripting. |
| **Dynamic Self-management** | Reduced need for DBA intervention: memory and lock resources are adjusted dynamically; file sizes grow automatically; auto-tuning features guarantee consistent performance under variable load conditions. |
| **Event/Alert Management** | Enhanced ability to monitor performance, availability and security status through policy-based event management. Improved alert management provides automatic notification and recovery in response to thresholds and severity levels. |
| **Job Scheduling and Execution** | The job scheduling and execution environment is extended to allow stand-alone, multiserver, single-step, multi-step jobs and job step with dependencies. Great flexibility is provided though a variety of scripting environments: Visual Basic Scripting Edition, Java scripting, Windows NT commands and custom ODBC and OLE DB programs. |
| **Multi-site Management** | Improved power and flexibility for managing multiple servers. Drag-and-drop and single commands can be used to implement changes across groups of servers. Management is simplified through the use of a repository that maintains schema, profiles and data transformation metadata for all servers in the enterprise. |
| **Security** | Security administration is improved and simplified through better integration with Windows NT security and new server and SQL Server roles. Windows NT integration includes authentication, support for multiple groups, grant/revoke/deny model and dynamic use of groups. |
| **Standards Compliance** | Full compliance with the ANSI/ISO SQL-92 Entry Level standards. Views are included for the ANSI/ISO schema information tables as defined in SQL-92, providing a standard method for metadata examination. |
| **Version Upgrade** | Databases are easily transferred from version 6.x to 7.0, via a fully automated upgrade utility. Customers are able to quickly get up and running on the new version and take advantage of new features with minimal impact on operations. |
| **Visual Data Modeler** | New tools provide a graphical interface for building and managing schema and other database objects. |
| **Ease of Use** | Simplified user interface with wizards, improved monitoring, scripting, and troubleshooting. |
| **Heterogeneous Support** | Standard published APIs support bi-directional replication with other data providers like Oracle, DB2, Sybase and Informix. Replication to non-relational data stores is also supported via third party solutions. |
| **Immediate Update** | Changes to a Subscriber's data can be immediately propagated to the Publisher via two-phase commit, and then to other Subscribers using Transactional or Snapshot replication. |

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| **Internet Support** | Anonymous pull subscriptions allow servers on the Internet to subscribe to publications without having to register with the publisher. This model allows large numbers of servers to participate in SQL Server replication. |
| **Merge Replication** | Merge is a new replication model in which users work freely and independently. At a later time the work is combined into a single uniform result. This model is ideal for offline or disconnected applications. |
| **Merge Replication Conflict Resolution** | Methods are provided to resolve merge conflicts via priority-based resolution. A standard interface is provided to support business rule reconciliation. |
| **Multi-site Update** | Allows updates on multiple copies of the same data at different locations. |
| **Scalability** | Replication to hundreds of servers and thousands of users is supported through a streamlined architecture that reduces contention on replication tables. |
| **Snapshot Replication** | Snapshot replication takes a snapshot of the published data in the database at one moment in time. Snapshot replication requires less constant processor overhead than transactional replication because it doesn't require continuous monitoring of data changes on source servers. |
| **Transactional Replication** | Transactional replication is the original SQL Server Publisher/Subscriber model. It uses the transaction log to monitor changes made to data. Changes are queued and then sent and applied to Subscribers. |
| **OLAP Services** | Integrated OLAP provides fast, efficient analysis of complex information in data warehouses. SQL Server OLAP Services delivers outstanding flexibility and integration with the Windows family, while lowering the total cost of building, deploying and managing OLAP applications. Features include:<br>• Tight integration with Windows NT, Office and the BackOffice family<br>• Supports all forms of OLAP (relational, multi-dimensional, and hybrid)<br>• Easy-to-use wizards and taskpads via Microsoft Management Console |
| **Data Transformation Services (DTS)** | DTS simplifies the process of importing and transforming data from multiple, heterogeneous sources, either interactively or automatically. Custom transformation objects can be created that integrate into third-party applications. DTS supports data lineage, making it easy to track where and when data came from. |
| **English Query** | End users are given the ability to pose questions in English instead of forming queries with SQL statements. English Query is targeted for developers of custom applications. |
| **Microsoft Management Console (MMC)** | The MMC improves integration and ease of use for data warehousing with wizards and taskpads. |
| **PivotTable Service (PTS)** | PivotTable® Service is a companion to OLAP Services that provides desktop multi-dimensional analysis. It provides superior integration with the next version of Microsoft Excel, in-memory data and query caching, and cube persistence. |
| **Repository** | The Microsoft Repository is a common, open infrastructure for data warehousing applications, with a broad set of shared capabilities for schema and metadata. Microsoft is extending the Repository with information models for schema, data transformation, scheduling and OLAP. |
| **Universal Data Access** | Universal Data Access is Microsoft's strategy for enabling high-performance access to a variety of information sources: OLE DB and ADO that build on the wide support for ODBC. |

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| **Dynamic Encryption** | Encrypts data automatically. Passwords, data, stored procedures; views and triggers can easily be encrypted. |
| **Full-Text Search** | SQL Server 7.0 supports a linguistic search of character data stored in the database, which operates on words and phrases, not just character patterns. |
| **Integration—<br>Internet Information Server,<br>Site Server, Proxy Server** | Provides superior integration with Windows NT Server's Internet Information Server (IIS) and Site Server. For secure databases on the Internet, users can take advantage of SQL Server integration with Microsoft Proxy Server. This integration allows SQL Server transactions, including replication, to pass though a secure proxy server. |
| **Internet Communications** | SQL Server transactions are optimized for the bandwidth constraints imposed by Internet communications. Tabular data streams (TDS) minimize traffic on the Internet, improving performance and conserving bandwidth. |
| **Web Assistant** | The enhanced Web Assistant makes it easy to publish data to the web. Provides support for multiple queries per page. |
| **Web-based Management** | Users can easily manage servers and server resources using a browser. Web-based management supports a subset of the graphical management tools. |