Volume IV Digital Products and Services

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Introduction

Annex 15 requires globally interoperable aeronautical information models and data exchange models to be used for the provision of data sets.

Aeronautical information and data exchange models represent a digital means to exchange the aeronautical data and aeronautical information. By the use of these models, an improved interoperability is achieved between providers and data users, thus creating a safe and reliable environment.

An aeronautical information model is an abstract, formal representation of entity types including their properties and relationships. The entity types in the model are real-world objects, such as airports or navaids, or they may themselves be abstract, such as organisations or services.

An aeronautical exchange model is an encoded format specification based on the aeronautical information model.

PANS-AIM, provides specifications for the aeronautical information model in Chapter 5.3.1.4 and for the aeronautical exchange model in Chapter 5.3.1.5.

AIXM

The Aeronautical Information Exchange Model AIXM, is an information and exchange model, which was developed in collaboration between EUROCONTROL and the FAA, is considered best practice for the digital exchange of aeronautical information. Version 5.1 of AIXM was published 2010 and complies with the specifications in PANS-AIM.

Note 1.— AIXM 5.1.1 is now (18. Nov 2018) available as the latest AIXM version. This minor version is fully compatible with AIXM 5.1.

Note2.— The AIXM Change Control Board (CCB) is responsible to maintain and to evolve the AIXM specification as necessary for enabling States to comply with the ICAO global and regional requirements for the provision of aeronautical information, in the context of the evolution towards digital AIM and SWIM.

AIXM 5.1 consists of the components that are required according to PANS-AIM Chapter 5.3.1:

a) The AIXM data model (UML) is the aeronautical information model describing the aeronautical information features and their properties, associations and data types using Unified Modelling Language (UML);

b) The XML Schema (XSD) defines an encoding format, which encloses aeronautical information into digital format, based on the Extensible Markup Language (XML) and Geography Markup Language (GML);

c) The AIXM temporality model, enables capturing the evolution of aeronautical information features over time;

d) The AIXM extension mechanism provides for specific additions meant only for a specific group of users; and

e) Additional guidelines, provide verification rules (such as business rules) value constraints and guidance for metadata.

The current AIXM Specification is available on the website http://www.aixm.aero and contains the following documents:

a) AIXM Data Model (UML)

b) AIXM XML Schema (XSD)

c) AIXM Temporality Concept

d) AIXM Feature Identification and Reference

e) Guidance and Profile of GML for use with Aviation Data

f) AIXM Application Schema and Extensions

g) AIXM 5.1 Business Rules (data verification) – Using Schematron and SBVR

The following sections provide an overview to AIXM 5.1 in connection with the PANS-AIM specification.

Aeronautical information model

The AIXM data model represents a "map" of the encompassed aeronautical data and aeronautical information. It is achieved through the description of features and attributes, and through the associations and assigned data types. The method of representation is achieved with the use of Unified Modelling Language (UML).

UML is a standard modelling language used in modelling a system. The core of any information model, UML contains all the formal data and information, along with its description. This is represented by diagrams, classes, attributes, data types, associations, etc. that interact with one another.

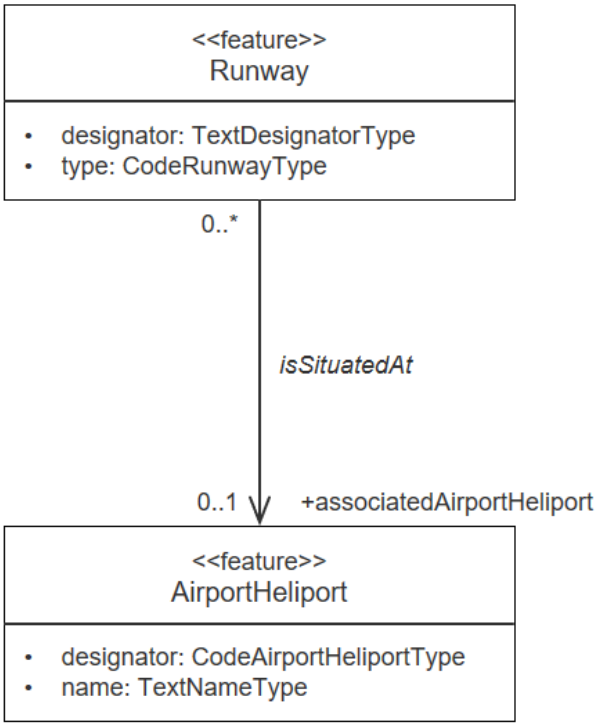

Figure 2-1. UML example

In the example figure, two features (namely "Runway" and "AirportHeliport") are represented in class diagrams. Each of them has various attributes that describe the features (attributes "designator" and

“type” from class “Runway”, attributes “designator” and “name” from class “AirportHeliport”). Subsequently, each of them has a data type that describes the value or characteristic of the attributes (data types such as “TextDesignatorType”, “CodeRunwayType”, “CodeAirportHeliportType”, and “TextNameType”). The relationship and association are represented by the arrows and its elements.

Extensive documentation on the use of UML is available at the following website: http://www.uml.org/.

Encoding format

The encoding format of AIXM 5.1 is an XML schema (XSD) based on GML. It is derived from the AIXM data model by scripts. The mapping rules between the AIXM UML classes/properties and the equivalent AIXM XML Schema types and elements are available at the website www.aixm.aero ,

Note. GML is defined in the standard ISO 19136:2007 Geographic information -- Geography Markup Language (GML)

The GML profile for aviation provides guidance how to encode geographical property of AIXM features (such as airspace, runways, etc).

Temporality model

The AIXM temporality concept introduces a time property to the AIXM features. The time property represents an important characteristic for the aeronautical information products. Therefore, the difference between permanent and temporary changes is needed in the digital format of the aeronautical information products, as well.

Feature identification

Each AIXM Feature is identified through the use of the identifier property which is the only time-invariant property staying with the feature during its entire lifetime.

A feature identifier property should be

a) unique – the same identifier should never be used by anyone for anything else; and

b) universal – the same identifier should be used universally in all systems to identify a given AIXM Feature.

The use of a Universal Unique Identifiers (UUID) is recommended for feature identification because creation algorithms can guarantee that the risk for the same UUID value to be generated by another system for another feature, is extremely low.

Since the UUID is an identifier of the data about a feature and not the identifier of the feature care must be taken that all stakeholders use the same UUID for their date about the same feature.

The AIXM feature identification and reference document provides detailed guidance how to generate UUIDs and how to use them in associations between features.

Business Rules

The data verification rules guideline introduces business rules as additional provisions to the definitions of the features and associations. The standard used in defining business rules is SBVR (Semantics of Business Vocabulary and Business Rules). Additional restrictions and constrictions are defined in order to be incorporated in the structure of the AIXM domain. For example, the AIXM conceptual model does not reference in its structure that a heliport cannot have a runway (which is meant only for an aerodrome). Therefore, a business rule (AIXM-5.1_Rule-E8E90) was defined that constricts the structure, taking the form presented below.

Example 1: AIXM-5.1_Rule-E8E90:

It is prohibited that **Runway** with assigned **type** equal-to 'RWY' *isSituatedAt* **AirportHeliport** with assigned **type** equal-to 'HP

Business rules can also be applied to define constraints in the data such valid range of a data element, accuracy requirements, mandatory attributes etc.

Example 2: The horizontal accuracy for obstacles in AREA2 shall at least be 5.0 m.

Business rule:

It is prohibited that an **ObstacleArea** with **type** equal-to 'AREA2' hasObstacle **VerticalStructure** with **part.VerticalStructurePart.horizontalProjection.VerticalStructurePartGeometry.location.ElevatedPoint.horizontalAccuracy.uom** equal-to 'M' and **part.VerticalStructurePart.horizontalProjection.VerticalStructurePartGeometry.location.ElevatedPoint.horizontalAccuracy** higher-than 5.0

Example 3: The Navaid type shall be consistent with the associated Navaid equipment:

Business rule:

It is prohibited that a **Navaid** with assigned **type** equal-to 'NDB' isComposedOf **NavaidEquipment** specialisation **Localizer**