

AIXM

Presented by: E. Porosnicu (EUROCONTROL) & D. Cowell (FAA)

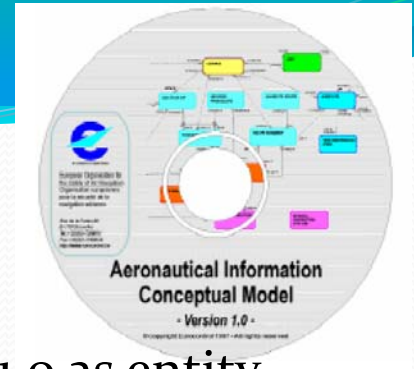




Contents

- AIXM
 - versions in use
 - CCB activity and future versions
- AIXM and Interoperability

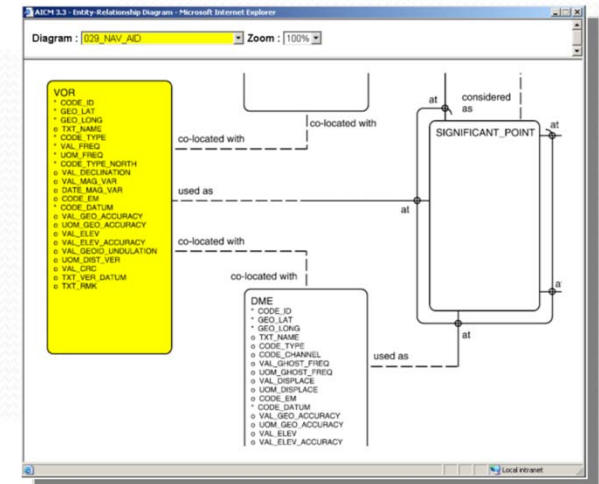
AIXM



- October 1997
 - Aeronautical Information Conceptual Model (AICM) 1.0 as entity-relationship model
- April 1998
 - Aeronautical Information Exchange Model (AIXM) 1.1 based on SQL transactions on a reference relational model
- March 2002
 - AIXM 3.1 – first XML based version
- October 2002
 - AIXM 3.3 – first implementation in the European AIS Database
- November 2005
 - AIXM 4.5 – second version for EAD

AIXM 4.5

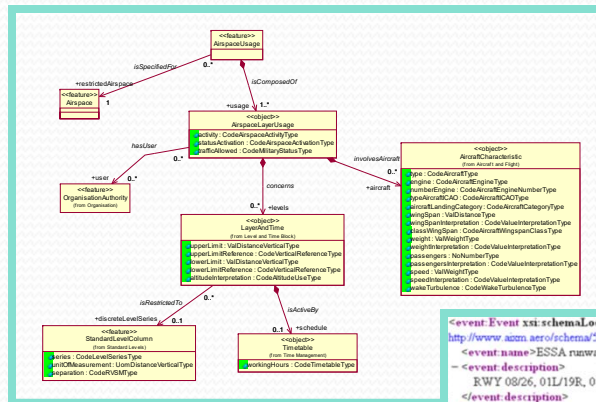
- Published: 2005
 - Entity/Relationship
 - Custom XML schema
 - Core AIP data
- Usage:
 - European AIS Database (EAD) and European national systems
 - Around 20 other AIS national systems world-wide



```
<AIXM-Snapshot>
  <Vor>
    <VorUid>
      <codeID>AML</codeID>
      <geoLat>34.3928N</geoLat>
      <geoLon>123.4333W</geoLon>
    </VorUid>
    ...
  </AIXM-Snapshot>
```

AIXM 5.0

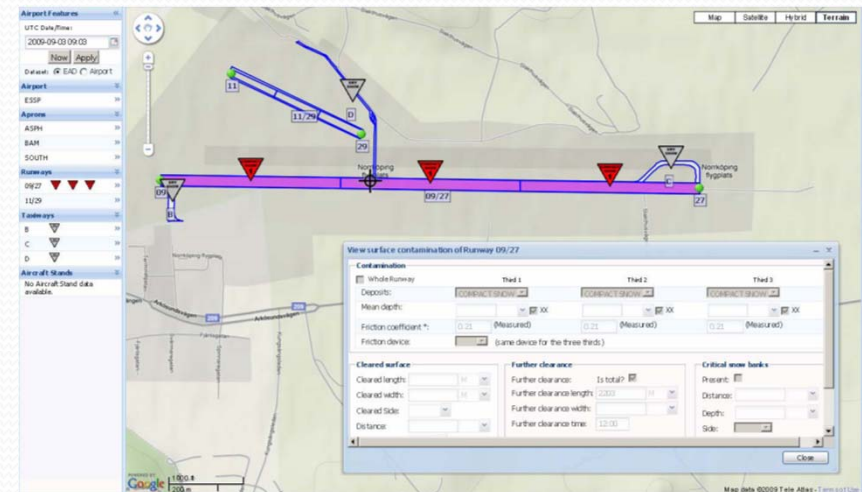
- Published: MAR 2008
- UML Model
- GML Schema
- Full AIP/NOTAM data
 - Including obstacle, airport mapping, etc.
- Metadata
- Extensibility
- Usage:
 - Partially, by FAA and NGA



```
<?xml version='1.0' encoding='UTF-8'>
<event Event xsi:schemaLocation='http://www.icao.int/schemas/5.0/event/5.0 http://www.icao.int/schemas/5.0/extensions/eur/5.0/FUA_Features.xsd' gml:id='Event-0003'>
  <event name>ESSA runways closed</event name>
  <event description>
    RWY 08/26, 01/19R, 01R/19L closed temporarily due to snow contamination and bad we
  </event description>
  <event type>TEMPORARY</event type>
  <event hasMember>
    <axim:AirportHelpUsage gml:id='VID2678448'>
      <gml:identifier codeSpace='http://www.eurocontrol.int/axim'>0cfb-d1ea-bf39-4006</gml:identifier>
      <axim:timeSlice>
        <axim:AirportHelpUsageTimeSlice gml:id='VID2678449'>
          <gml:validTime>
            <gml:TimeInstant gml:id='VID0000002'>
              <gml:timePosition>2009-02-12T07:00:00</gml:timePosition>
            </gml:TimeInstant>
          </gml:validTime>
          <axim:interpretation>PERMANENT</axim:interpretation>
          <axim:sequenceNumber>1</axim:sequenceNumber>
          <axim:correctionNumber>0</axim:correctionNumber>
        </axim:AirportHelpUsageTimeSlice>
      </axim:timeSlice>
    </axim:AirportHelpUsage>
  </event hasMember>
</event>
```


AIXM 5.1



- Published: FEB 2010
- Update of AIXM 5.0
 - Usage/availability model
 - Notes vs. descriptions
 - Other adjustments to facilitate Digital NOTAM encoding
- Usage
 - *see AIXM Wiki*
(www.aixm.aero/wiki)
 - *Data Sources*



AIXM 5.1.1 (minor update)

- Published: April 2016
- First version released by the new CCB!
- Minor Update of AIXM 5.1
 - Migration to Sparx EA
 - Alignment with GML 3.2.1
 - Small corrections UML/XSD
- Usage
 - Recommended for new projects only*
 - Fully forward/backwards compatible with AIXM 5.1 (mapping scripts provided)*

Change Proposal	
ID:	AIXM-168
target version:	AIXM 5.1.1
version:	1.0
last updated:	15 FEB 2016
status:	Implemented



Change Control Board

Migration to Sparx EA

Description

Migrate the maintenance of the AIXM UML model from IBM Rational Rose to Sparx EA. Provide scripts that enable the generation of the AIXM XML Schema from the new Sparx EA environment. Provide guidelines for the migration of existing AIXM extensions to the new UML modelling environment. Provide scripts that enable the generation of AIXM XML extension schemas from an AIXM UML extension developed in Sparx EA.

Rationale for change

See <https://aixmccb.atlassian.net/browse/AIXM-132>

Up to and including AIXM version 5.1, the UML model was developed/maintained using IBM Rational Rose Data Modeler. There is a general interest in the AIXM community for migrating the UML model to a tool that is more flexible in terms of import/export of the model, less expensive, etc. Consensus has developed around the idea to migrate the UML model to Sparx EA.

The purpose of this change proposal is to formalise this migration and to indicate which support documents and scripts have been developed for this purpose. This concerns both the migration of the core AIXM UML model and the migration of eventual AIXM extensions, the latter not being under the authority of the AIXM CCB.

Impact assessment

The migration to the new modelling environment does not have any impact on existing AIXM 5.1 users. No changes need to be made in the content and structure of the AIXM UML model or of the AIXM XML Schema. The migration is done to a large extent through automatic conversions between tools and the risk of discrepancies between the previous model and the new model is very low. However, as with any migration, the risk is not null. Therefore, the model resulting from the migration needs to be formally identified as a new AIXM version.

The migration might have an impact on existing AIXM 5.1 extensions, as much as they need to be further maintained by their respective community. For this purpose, guidelines and scripts are being developed.

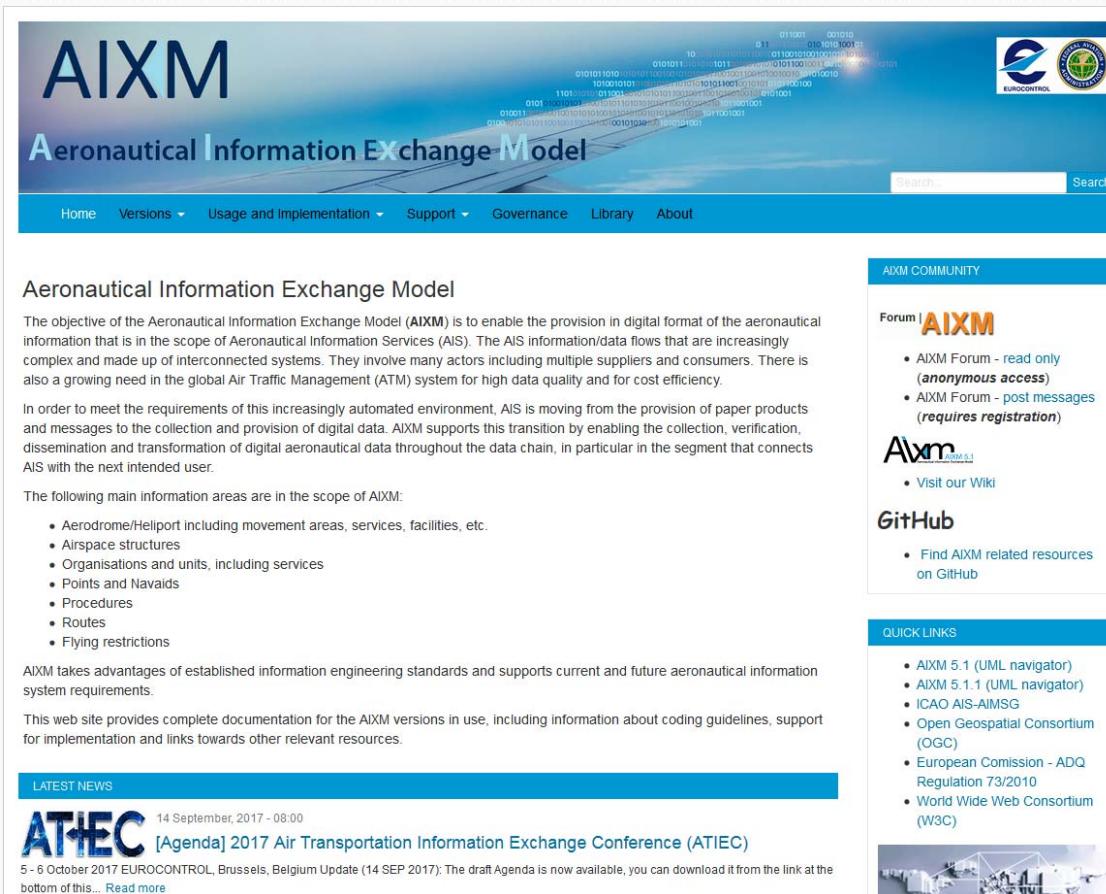
Change Proposal details

The reference AIXM 5.1 UML model, currently available as an .mdl file (IBM Rational Rose Data Modeler specific format) is replaced with an equivalent model provided in the form of a .eap file (Sparx EA specific format).

The current XML schema components AIXM_Features.xsd and AIXM_DataTypes.xsd are replaced with identically named files generated (with a dedicated script) from the Sparx AIXM 5.1.1 EA model.

Change Proposal details

www.aixm.aero



The screenshot shows the homepage of the Aeronautical Information Exchange Model (AIXM) website. The header features the AIXM logo and the text 'Aeronautical Information Exchange Model'. Below the header is a navigation bar with links: Home, Versions, Usage and Implementation, Support, Governance, Library, and About. The main content area is titled 'Aeronautical Information Exchange Model' and contains a paragraph about the objective of AIXM, which is to enable the provision of aeronautical information in digital format. It also mentions the need for high data quality and cost efficiency. A list of main information areas is provided, including Aerodrome/Heliport, Airspace structures, Organisations and units, Points and Navaids, Procedures, Routes, and Flying restrictions. The page also includes a 'LATEST NEWS' section with a link to the 'ATIEC' conference agenda.

AIXM
Aeronautical Information Exchange Model

Home Versions Usage and Implementation Support Governance Library About

Aeronautical Information Exchange Model

The objective of the Aeronautical Information Exchange Model (AIXM) is to enable the provision in digital format of the aeronautical information that is in the scope of Aeronautical Information Services (AIS). The AIS information/data flows that are increasingly complex and made up of interconnected systems. They involve many actors including multiple suppliers and consumers. There is also a growing need in the global Air Traffic Management (ATM) system for high data quality and for cost efficiency.

In order to meet the requirements of this increasingly automated environment, AIS is moving from the provision of paper products and messages to the collection and provision of digital data. AIXM supports this transition by enabling the collection, verification, dissemination and transformation of digital aeronautical data throughout the data chain, in particular in the segment that connects AIS with the next intended user.

The following main information areas are in the scope of AIXM:

- Aerodrome/Heliport including movement areas, services, facilities, etc.
- Airspace structures
- Organisations and units, including services
- Points and Navaids
- Procedures
- Routes
- Flying restrictions

AIXM takes advantages of established information engineering standards and supports current and future aeronautical information system requirements.

This web site provides complete documentation for the AIXM versions in use, including information about coding guidelines, support for implementation and links towards other relevant resources.

LATEST NEWS

ATIEC 14 September, 2017 - 08:00
[Agenda] 2017 Air Transportation Information Exchange Conference (ATIEC)
5 - 6 October 2017 EUROCONTROL, Brussels, Belgium Update (14 SEP 2017): The draft Agenda is now available, you can download it from the link at the bottom of this... [Read more](#)

AIXM COMMUNITY

Forum | **AIXM**

- AIXM Forum - read only (**anonymous access**)
- AIXM Forum - post messages (**requires registration**)

Aixm 5.1

- Visit our Wiki

GitHub

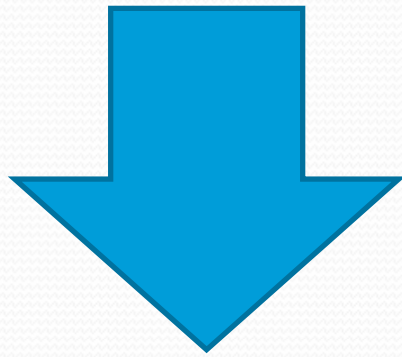
- Find AIXM related resources on GitHub

QUICK LINKS

- AIXM 5.1 (UML navigator)
- AIXM 5.1.1 (UML navigator)
- ICAO AIS-AIMSG
- Open Geospatial Consortium (OGC)
- European Commission - ADQ Regulation 73/2010
- World Wide Web Consortium (W3C)

- AIXM versions
 - 4.5, 5.0, 5.1/5.1.1
- Usage/Implementation
 - Coding Guidelines
 - Business Rules
 - Digital NOTAM
- Support
 - Wiki
 - Training
 - Open source
 - Commercial products
 - AIXM Viewers
- Governance (CCB)
- Library

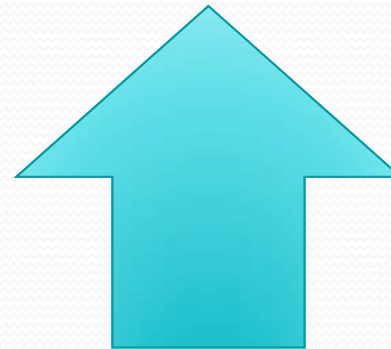
AIXM evolution



Protect
investments

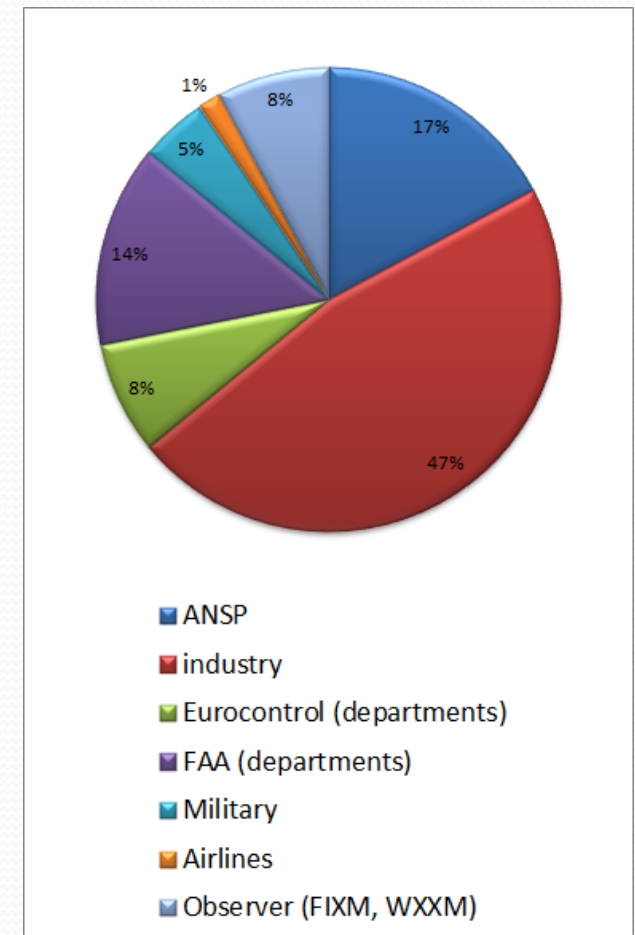


Ensure
progress



AIXM CCB

- AIXM Change Control Board
 - Established based on the ICAO AIS-AIMSG recommendations
 - In close contact with the ICAO IMP
 - CCB process to be aligned with eventual IMP decisions
 - Reports progress on an annual basis
 - Membership implies acceptance of the Charter
 - <http://www.aixm.aero/page/governance>
 - Current distribution of members
 - 71 members
 - including FIXM & WXXM observers
 - FAA & Eurocontrol ensuring the secretariat and support





[2018] AIXM 5.2

- Objectives:
 - to enable the provision of ICAO data sets (except for terrain data), as specified in the new Annex 15 and PANS-AIM. This includes the development of guidance material for the provision of the data sets and of the associated metadata in a globally interoperable manner;
 - to simplify the metadata schema, either through a profile or through a dedicated aviation metadata schema;
 - to enable an initial global implementation of Digital NOTAM;
 - to enable the provision of data that supports the deployment of “performance based” ICAO concepts, such as PBN, etc.
 - to enable data provision for emerging concepts such as free routes, large-scale use of RPAS, etc.
 - to ensure the interoperability of aeronautical data (AIXM) with flight data (FIXM) domain and with the MET data (iWXXM) domain;
 - to introduce a deprecation mechanism for features/properties that are no longer used or are replaced by a new concept. A common approach with AIXM and FIXM is envisaged.
 - to correct issues and limitations detected in the previous versions.
- Currently, the AIXM CCB is working on evaluating issues and improvement proposals that might be considered for AIXM 5.2.

AIXM CCB – Change Proposal (example)

Change Proposal	
ID:	AIXM-245
target version:	AIXM 5.2
version:	0.2
last updated:	13 JUNE 2017
status:	WIP



AIXM XML namespace policy

Description

An XML namespace policy is established for AIXM, to be applied starting with version 5.2.

Rationale for change

See <https://aixmccb.atlassian.net/browse/AIXM-233>

Until now, each AIXM version came with its own namespace. For example, AIXM 5.1.1 declares the namespace <http://www.aixm.aero/schema/5.1.1>, which is different from the AIXM 5.1 namespace (<http://www.aixm.aero/schema/5.1>).

However, every time you change the namespace, you will break all processing applications. So existing implementations, which rely on code generated from the AIXM 5.1 schema, can't easily adapt to exchange AIXM 5.1.1 based data sets, even if the used elements haven't changed between AIXM 5.1 and AIXM 5.1.1.

So the namespace shall stay the same if there are no impacts on the existing implementations. Bug fixing and patching should not break implementations.

Impact assessment

AIXM 5.1.1 Data Providers and Data Users will not be impacted by this proposal since there is no change in the XML schema.

Change Proposal details

The following AIXM XML namespace policy shall be published and adhered to starting with AIXM 5.2:

Version designator

The XML namespace can assist traceability from an XML implementation to its specification document. New components can be defined in major and minor revisions of a specification document. Hence, the XML namespace used in an implementation SHALL incorporate the major and minor version designation of the documents that contains the specification of the components implemented.

A patch revision corrects but does not change the meaning of, or add any new functionality to an AIXM implementation. The patch version designator SHALL NOT appear in the XML namespace.

Note: The XML namespace combined with the value of `xsd:schema/@version` uniquely identify the XML schema.

Pattern for namespace

The pattern for an XML namespace used for XML implementation of AIXM is

`http://www.aixm.aero/schema/{X}.{Y}`

where:

- {X}.{Y} are the first two version levels from the version designator of the corresponding AIXM release (see <http://aixm.aero/page/aixm-versioning-policy>).

Note: The pattern applies to all AIXM namespaces, not just the main namespace. Specifically, for the "message" namespace the pattern is `http://www.aixm.aero/schema/{X}.{Y}/message`

The use of only the first two version elements is consistent with the principle that the third number in a version designator designates patch releases only, with no change of content, so users should only use the latest patch version.

Namespace example

If there were a 2nd bugfix revision of the XML implementation of the schema with the namespace <http://www.aixm.aero/schema/5.2> the <schema> element should contain the following:

```
<xsd:schema targetNamespace="http://www.aixm.aero/schema/5.2" ... version="5.2.2"> ...
```

Schema locations still may be different, as outlined in the following two sample XML instance documents:

```
<message:AIXMBasicMessage xmlns:message="http://www.aixm.aero/schema/5.2/message"
xmlns:aixm="http://www.aixm.aero/schema/5.2"
xsi:schemaLocation="http://www.aixm.aero/schema/5.2/message
http://www.aixm.aero/schema/5.2.1/message/AIXM_BasicMessage.xsd" ...>
```

```
<message:AIXMBasicMessage xmlns:message="http://www.aixm.aero/schema/5.2/message"
xmlns:aixm="http://www.aixm.aero/schema/5.2"
xsi:schemaLocation="http://www.aixm.aero/schema/5.2/message
http://www.aixm.aero/schema/5.2.2/message/AIXM_BasicMessage.xsd" ...>
```

Mapping AIXM 5.1.1 to AIXM 5.2 (forward)

NIL (Not applicable)

Mapping AIXM 5.2 to AIXM 5.1.1 (backward)

NIL (Not applicable)

- END -



[2020 or later] AIXM 5.3

- Objectives:
 - alignment with the ICAO SWIM requirements as developed by the ICAO Information Management Panel;
 - enable the provision of new aeronautical data elements specified by ICAO, in particular in support of FF-ICE;
 - enable the provision of aeronautical data in support to future ATM concepts, such as time based operations (TBO);
 - ensure the interoperability of aeronautical data (AIXM) with the evolving needs of the flight data (FIXM) and MET data (iWXXM);
 - correct issues and limitations detected in the previous versions;
 - provide Guidance material for the implementation of AIS data services compliant with the SWIM concepts.

AIXM and Interoperability

- ***Interoperability***

- *“a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, at present or future, in either implementation or access, without any restrictions”*

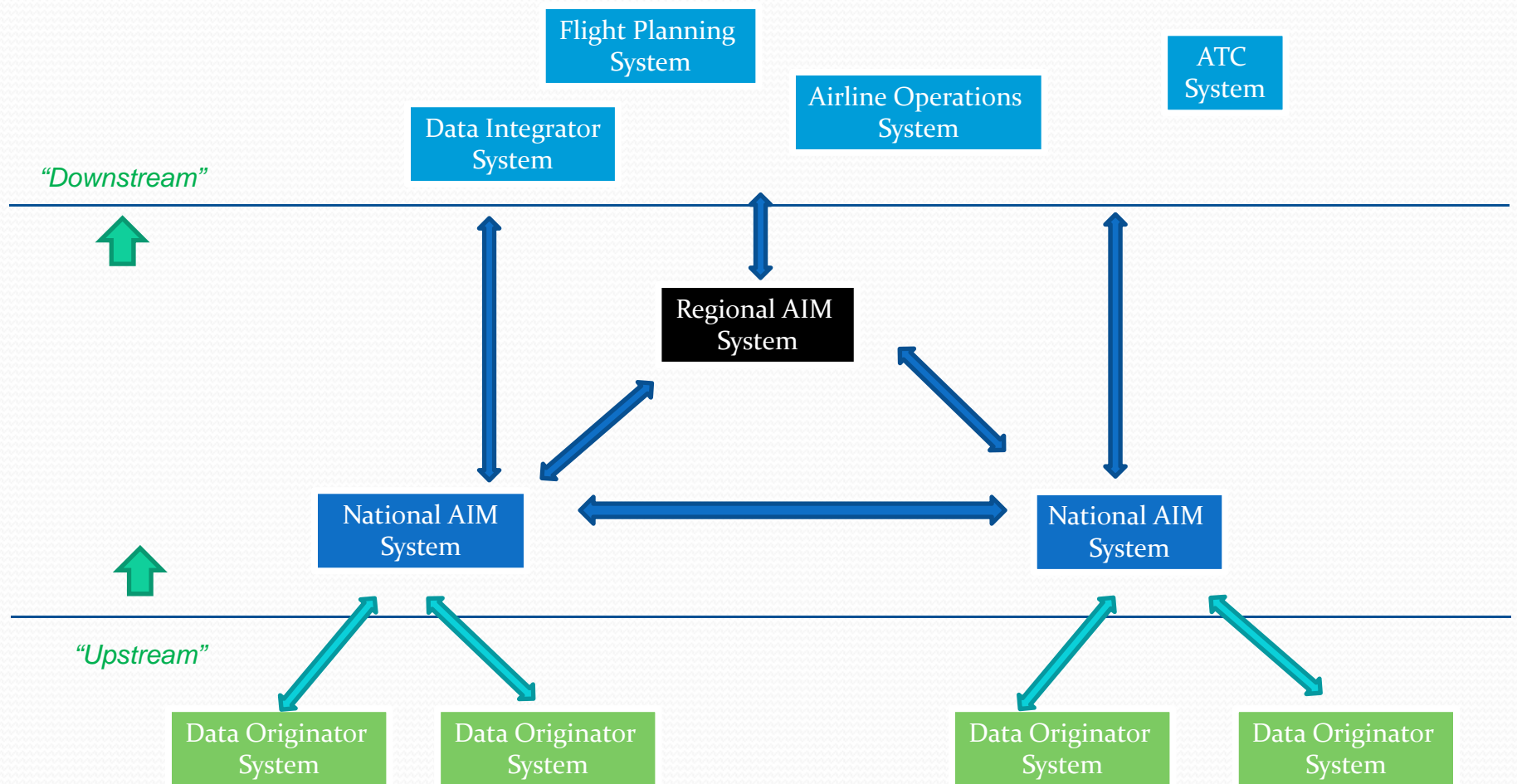
- *Source: Wikipedia*

- *“the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge.*

- *Source: (Draft) ICAO IMP SWIM Controlled Vocabulary*

AIM Systems Interoperability

Alignment of protocols, interfaces, formats, processes, etc.



AIXM and interoperability

- AIXM
 - **Data coding format** (XML Schema)
 - UML model – AIRM mapping (semantic interoperability)
 - **Usage rules** (temporality, feature identification and reference, coding guidelines, use of GML, etc.)
 - Business Rules (SBVR) -> data set verification services
 - By design (explicit requirement for flexibility!), AIXM 5.x allows options on certain points (such as use of UUID)
 - **AIXM alone cannot ensure the interoperability!**
 - Partial implementations and non-coordinated use of the AIXM 5.x options can harm interoperability!
 - Proposed **SOLUTION : Interoperability scenarios**
 - ICAO Data Sets (downstream interoperability)
 - AIM to Data Originator (upstream interoperability)
 - Hub scenario (where applicable)

AIP Data Set – coding rules

Pages 0

Overview

Created by EDUARD POROSNICU, last modified on 28 Jul 2017

www.aixm.aero/confluence

The purpose of this Web site is to enable the AIXM community to collaboratively develop guidance material in support to the AIXM implementations and to provide information about such implementations. Three high-level areas of interest are identified: data sources, coding guidelines and extensions. In order to facilitate contributions from the global AIXM community, anonymous users are allowed to provide comments on certain sections of the Web site. Registered users have the possibility to make both inline and global comments and can also contribute to the development of the site.

AIXM Data Sources



Presented as:

- map of the World
- list of sources

AIXM Coding Guidelines

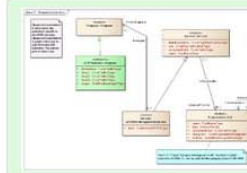
Coding Guidelines



Including:

- AIXM 5.1(1) Model Overview
- (ICAO) AIP Data Set
- Digital NOTAM

AIXM Extensions



Will be added progressively!

How to use

Structure

The AIXM Confluence site is organised in "Spaces", each dedicated to a specific topic or sub-topic. Each space is a collection of pages, organised as a tree. A page may have other child pages.

Commenting

There are two ways of providing comments to the content.

- **Inline commenting:** highlight a text or part of a text on a page and keep the cursor over it for a second - a "comment" icon appears. Click on it, enter your comment and save it.
- **Comment field:** In case you have a general comment relevant for the whole content of a page, please enter it comment in corresponding field displayed at the bottom of each page and save it. This way of commenting allows some additional formatting (e.g. text colouring, italic, bold, etc.) and for named users also some additional functions (e.g. upload of images).

Please note that comment fields remain visible even once the comment was

User categories

There are two main types of users. Based on the type of the user, different access permissions are granted.

Anonymous user (no log-in required)

- The anonymous user has read access to "published" pages, which is most of the site content. However, some pages might be in development and therefore not yet publicly visible.
- the anonymous user can review and comment on all published pages.

Named user (log-in is required)

- A named user may have Read & Write access, depending on the Space/Page
- A named user can create content (i.e. write/update content, upload images and files, etc.) and also review and comment all the content pages (i.e. draft versions and published versions).
- **Registration:** the AIXM Confluence server is hosted by the European Organisation for the Safety of Air Navigation (EUROCONTROL). Log-in is possible for anyone who has an EUROCONTROL extranet account. However, this still require that the corresponding user is added in a specific group. Please use this registration page in order to request

Style and format aspects

Mark-up

The following four types of mark-up are used on some pages in order to draw the attention of the reader on some particular aspects:



Note

This mark-up is used to create awareness for a matter of specific importance. A Note may be editorial or content related.



Issue

Used to highlight issues such as inconsistencies detected in source documents, limitations of the AIXM model, etc. In general, an issue will require an action to be taken, such as bringing the issue to the attention of the AIXM Change Control Board, etc.

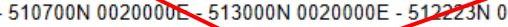


Good to know

This mark-up is used, for example, when providing coding examples or information about other resources that might complement the information provided on the page.

- For example, FIR/UIR boundaries...

Lateral limits	510521N 0023244E - 510700N 0020000E - 513000N 0020000E - 512223N 0032147E - along the <u>Belgian-Dutch border</u> - 504515N 0060116E - along the <u>Belgian-German border</u> - 500748N 0060816E - along the <u>German-Luxembourg border</u> - 492810N 0062202E - along the <u>French-Luxembourg border</u> - 493247N 0054907E - along the <u>Belgian-French border</u> - 510521N 0023244E.
Vertical limits	



Revised ICAO Annex 15

Revised ICAO Annex 15 and PANS-AIM

AIP Data Set

AIP

~~Up to 10 000
points for
some FIR!
...Unusable
for downstream
operations~~

[illegible]

- ... no reference to State boundary
- ... degree/minute resolution

51.07056	35.27611
51.07056	35.27611
51.05417	35.27333
51.05417	35.27333
51.05444	35.25722
51.05444	35.25722
51.06417	35.25278
51.06417	35.25278
51.04583	35.22222
51.04583	35.22222
51.05389	35.21278
51.05389	35.21278
51.05306	35.19056
51.05306	35.19056
51.07889	35.17111
51.07889	35.17111
51.08167	35.15083
51.08167	35.15083
51.08889	35.17222
51.08889	35.17222
51.10167	35.16639
51.10167	35.16639
51.10194	35.16139
51.10194	35.16139
51.11111	35.15861
51.11111	35.15861
51.12278	35.17556



Conclusions

- Revised ICAO Annex 15 and PANS-AIM
 - Digital data sets (AIP, obstacles, IFP, ...)
 - AIXM 5.1 as coding format (proposed)
 - Plus coding rules in support to interoperability objective
 - AIXM 5.2 will improve the coding, in particular for IFP