GroupEAD

AIXM Coding Guidelines

GroupEAD Scope and Approach,
Mexico Sep-19, Rev. 01.00

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BACKGROUND

Key | questions

- What is the difference between aeronautical data and aeronautical information?
- What are the digital data set?
- How can use AIXM in order to meet the digital data set requirements?

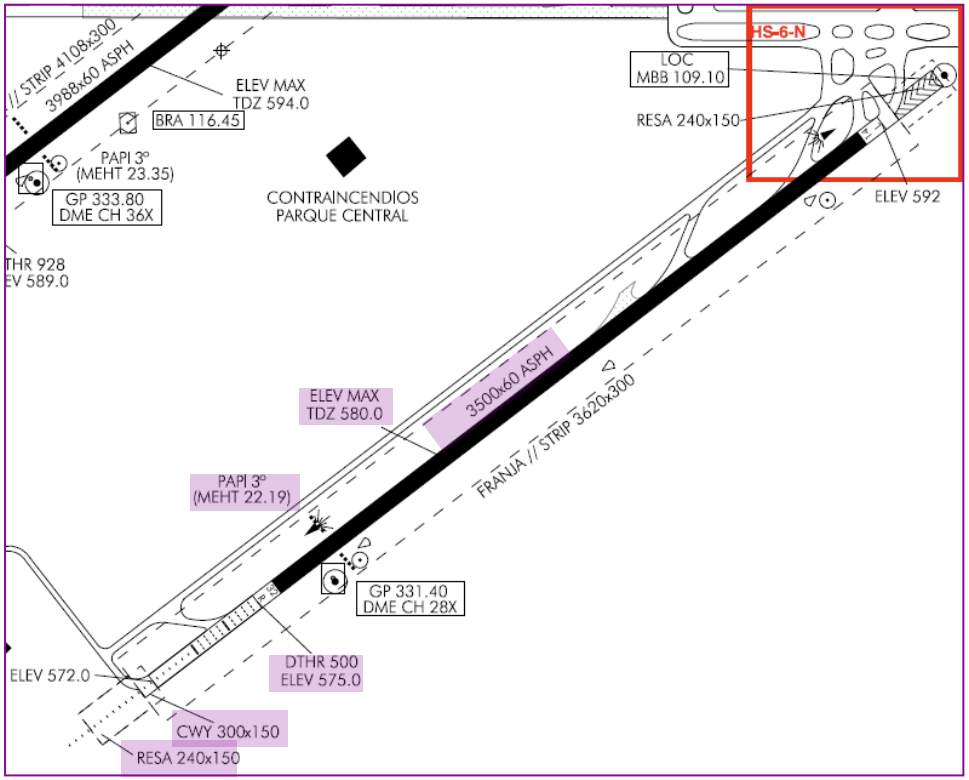
Definition | Aeronautical data

- A representation of aeronautical facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing.

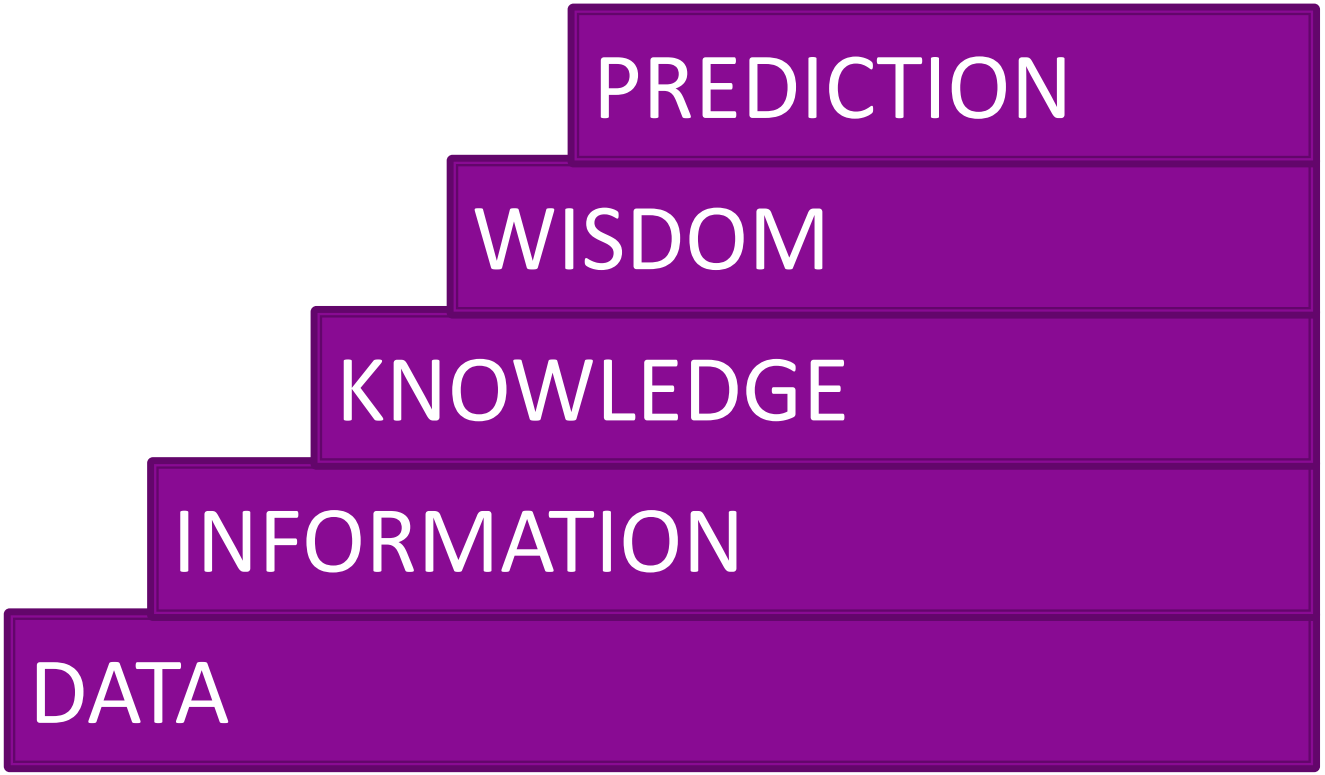
RWY	Orientación Direction	DIM (m)	THR PSN	THR ELEV TDZ ELEV
14L (8) (9)	142.21° GEO 143° MAG	3500 x 60	402941.71N 0033328.33W	THR: 592 m / 1942 ft TDZ: No

Definition | Aeronautical Information

- Information resulting from the assembly, analysis and formatting of aeronautical data.



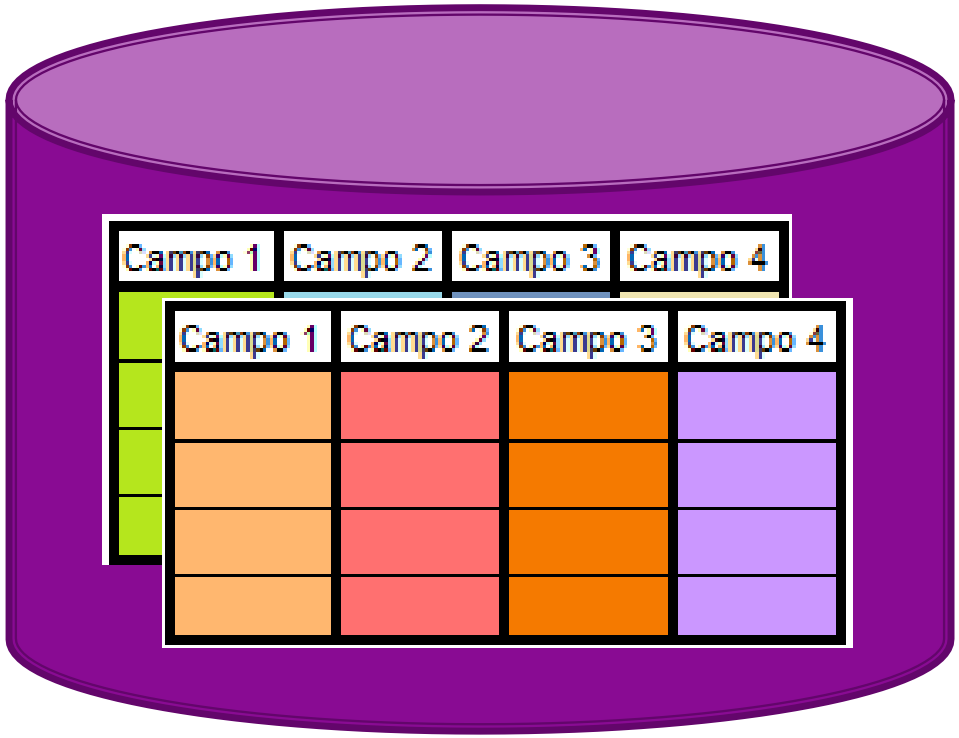
Definition | Data Science



Definition | Data Set

- Identifiable collection of data

RWY	Orientación Direction	DIM (m)	THR PSN	THR ELEV TDZ ELEV
14L (8) (9)	142.21° GEO 143° MAG	3500 x 60	402941.71N 0033328.33W	THR: 592 m / 1942 ft TDZ: No
32R (1) (7)	322.22° GEO 323° MAG	3500 x 60	402824.85N 0033210.30W	THR: 574.8 m / 1886 ft TDZ: 579.9 m / 1903 ft
14R (8) (10)	142.20° GEO 143° MAG	3988 x 60	402905.50N 0033433.64W	THR: 608 m / 1995 ft TDZ: No
32L (2) (7)	322.21° GEO 323° MAG	3988 x 60	402747.10N 0033314.02W	THR: 589.1 m / 1933 ft TDZ: 594.2 m / 1949 ft
18L (3) (7)	179.76° GEO 181°MAG	3500 x 60	403141.22N 0033333.68W	THR: 585.9 m / 1922 ft TDZ: 587.7 m / 1928 ft
36R (8) (11)	359.76° GEO 001°MAG	3500 x 60	403003.97N 0033333.15W	THR: 592 m / 1942 ft TDZ: No
18R (4) (7)	179.76° GEO 181° MAG	4179 x 60	403122.40N 0033429.27W	THR: 606.9 m / 1991 ft TDZ: 606.9 m / 1991 ft
36L (8) (12)	359.76° GEO 001° MAG	4179 x 60	402933.32N 0033428.64W	THR: 605 m / 1985 ft TDZ: No



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Definition | Products vs. Data

DIGITAL DATA SETS AND AIXM

Requirements | Digital Data Set and AIXM

- Annex 15: One of the Aeronautical Information products (former IAIP)
  - AIP
  - Obstacles
  - Terrain
  - Aerodrome Mapping
  - Instrument Flight Procedures

ED 98/DO 276
Manual eTOD
ED 99/DO 272

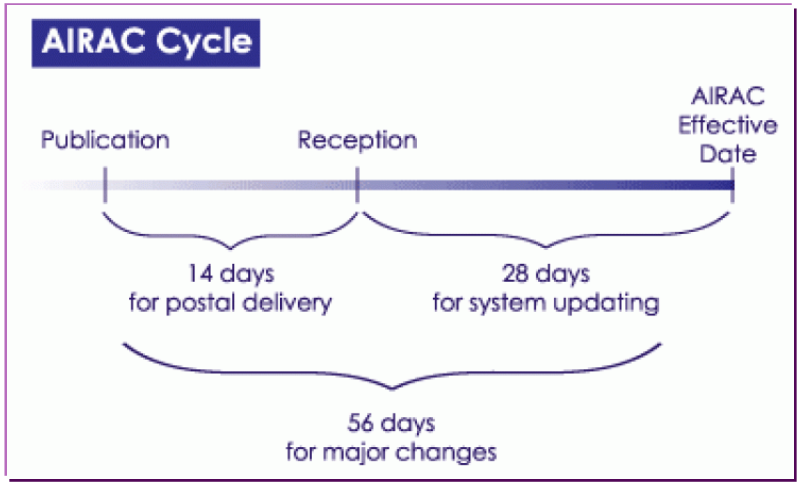
AIXM 5.1(.1)
AIXM 5.1(.1)

AIXM 5.1(.1)
AIXM 5.1(.1)

- PANS AIM
  - More detailed requirements
  - Based in Data Catalogue
    - Features and properties
    - Types and description

Requirements | Digital Data Set and AIXM

- Shall include metadata (e.g. Name of organization, data and time)
- Subject to the same update cycle as AIP



AIXM meets the requirements of Metadata and temporality

Requirements | Data Catalogue and AIXM

- Describes in detail the elements and properties, the quality requirements and data type.

	A	B	C	D	E	F	G	H	I	J	K
1					**Table A 1-1 Aerodrome/Heliport data**						
2	**Subject**	**Property**	**Sub-Property**	**Type**	**Description**	**Note**	**Accuracy**	**Integrity**	**Orig Type**	**Pub. Res.**	**Chart Res.**
3	Runway				A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft. (Annex 14)						
4		Designator		Text	The full textual designator of the runway, used to uniquely identify it at an aerodrome/heliport. E.g. 09/27, 02R/20L, RWY 1.						
5		Nominal length		Distance	The declared longitudinal extent of the runway for operational (performance) calculations.		1 m	critical	surveyed	1 m or 1 ft	1 m
6		Nominal width		Distance	The declared transversal extent of the runway for operational (performance)		1 m	essential	surveyed	1 m or 1 ft	1 m
7		Geometry		Polygon	Geometries of RunwayElement, RunwayDisplacedArea and RunwayIntersection						
8		Centre line points									
9			Position	Point	The geographical location of runway centre line at each end of the runway, at the stopway and at the origin of each take-off flight path area, and at each significant change in slope of runway and stopway	Definition from Annex 4 3.8.4.2	1 m	critical	surveyed		
10			Elevation	Elevation	The elevation of the corresponding centre line point.		0.25 m	critical	surveyed		
11			Geoid undulation	Height	The geoid undulation at the correspoding centre line point						

AIXM meets the requirement of the data catalogue

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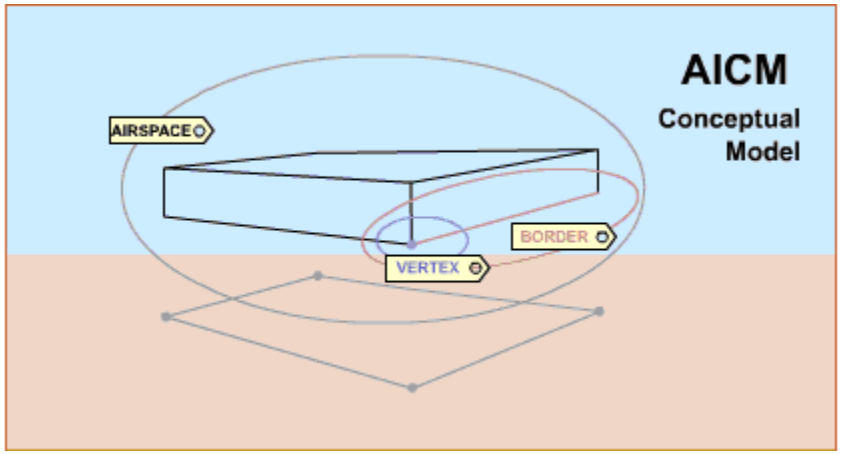
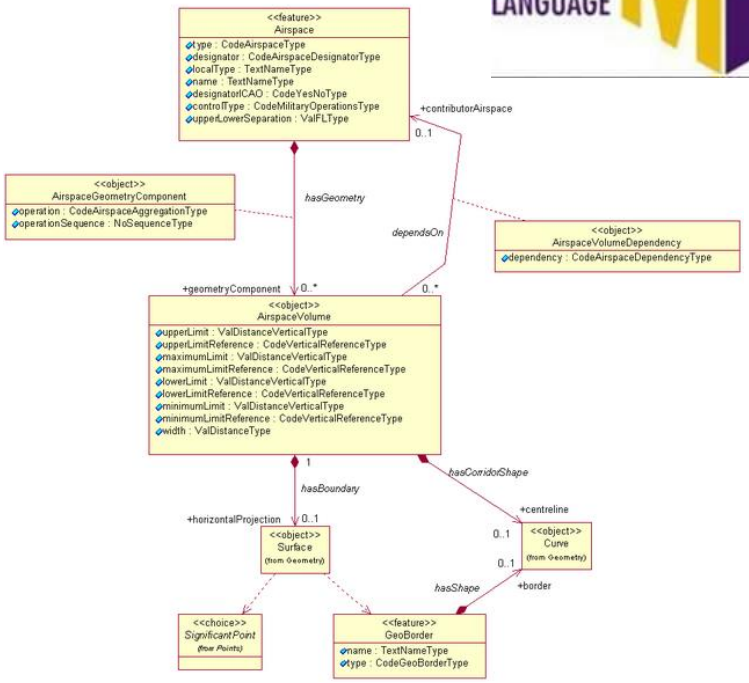
Requirements | Conceptual Model and AIXM

- Based in UML





"Vocabulary of the common language, the concepts and relations"

AIXM is defined in UML

Requirements | Conceptual Model and AIXM

- Include restrictions and verification rules

Name	Data Type	Definition
nilReason	NilReasonEnumeration	
AD	string	Aerodrome only.
AH	string	Aerodrome with heliport landing area.
HP	string	Heliport only
LS		
OTHE		

F	G
Â§	**Rule textual description**
AirportHeliport	It is prohibited that **Runway** with assigned **type** equal-to 'RWY' isSituatedAt **AirportHeliport** with assigned **type** equal-to 'HP'

AIXM includes restrictions and verification rules

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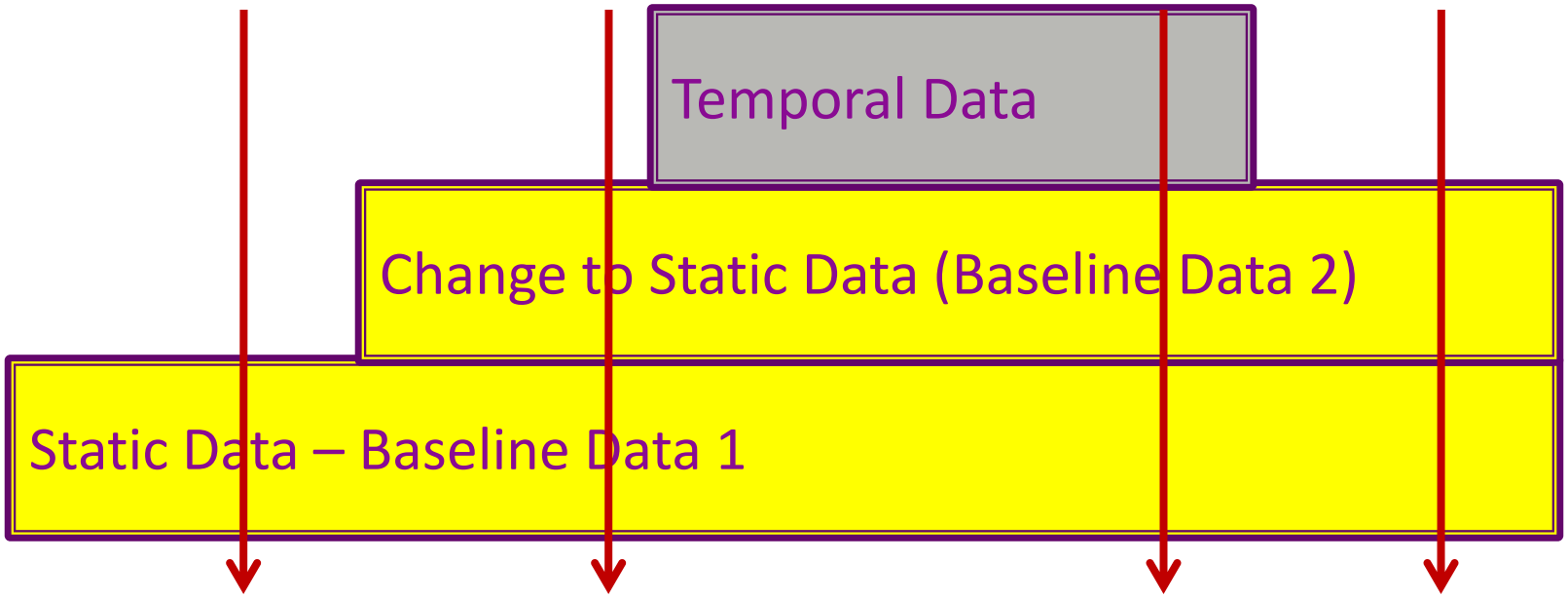
Requirements | Conceptual Model and AIXM

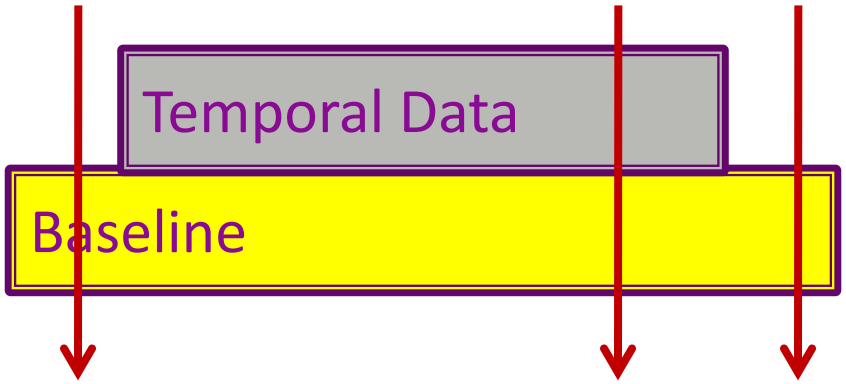
- Include a temporality model



AIXM provides an extensive temporality model

Requirements | Conceptual Model and AIXM

- Include a temporality model



AIXM provides an extensive temporality model

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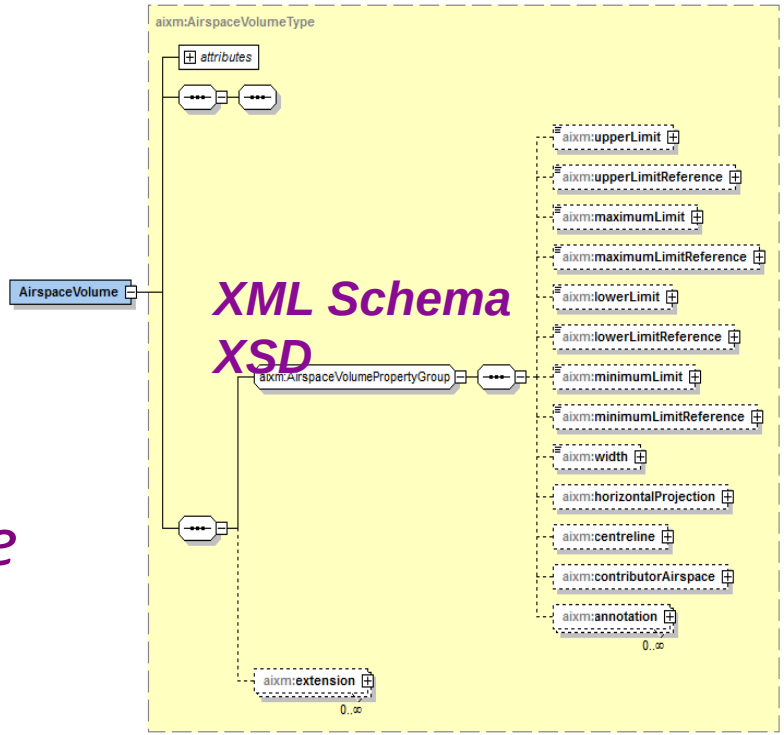
Requirements | Exchange model and AIXM

- Use a common coding format (e.g. XML, GML, JSON)

```
<aixm:type>CTA</aixm:type>
<aixm:designator>EADD</aixm:designator>
<aixm:name>CTA DONLON</aixm:name>
 <aixm:geometryComponent>
  <aixm:AirspaceGeometryComponent gml:id="AV001">
   <aixm:operation>BASE</aixm:operation>
   <aixm:operationSequence>1</aixm:operationSequence>
    <aixm:theAirspaceVolume>
     <aixm:AirspaceVolume gml:id="V001">
      <aixm:upperLimit uom="FL">245</aixm:upperLimit>
      <aixm:upperLimitReference>STD</aixm:upperLimitReference>
      <aixm:lowerLimit uom="FL">30</aixm:lowerLimit>
      <aixm:lowerLimitReference>STD</aixm:lowerLimitReference>
```

"Format and grammar of the common language"



AIXM is coded in GML/XML

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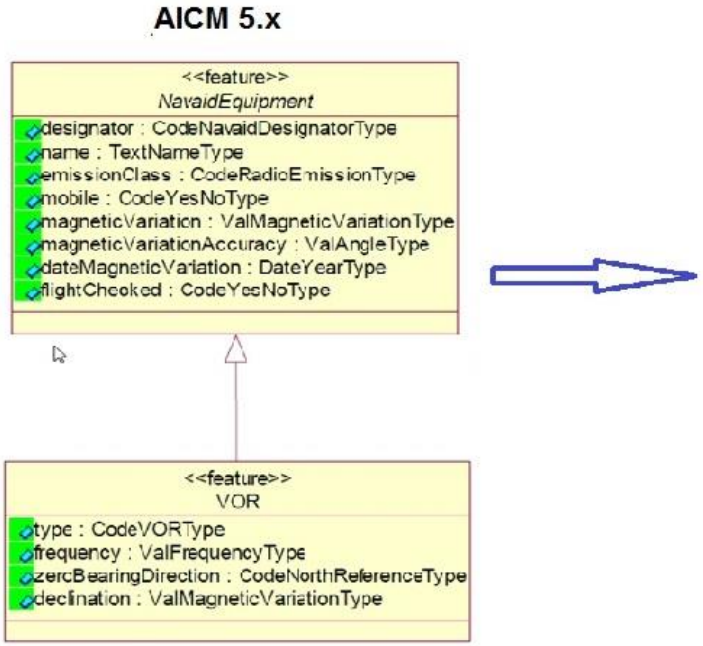
Requirements | Exchange model and AIXM

- Cover all the elements, attributes and relations of the conceptual model



AIXM is the implementation of AICM in XML/GML

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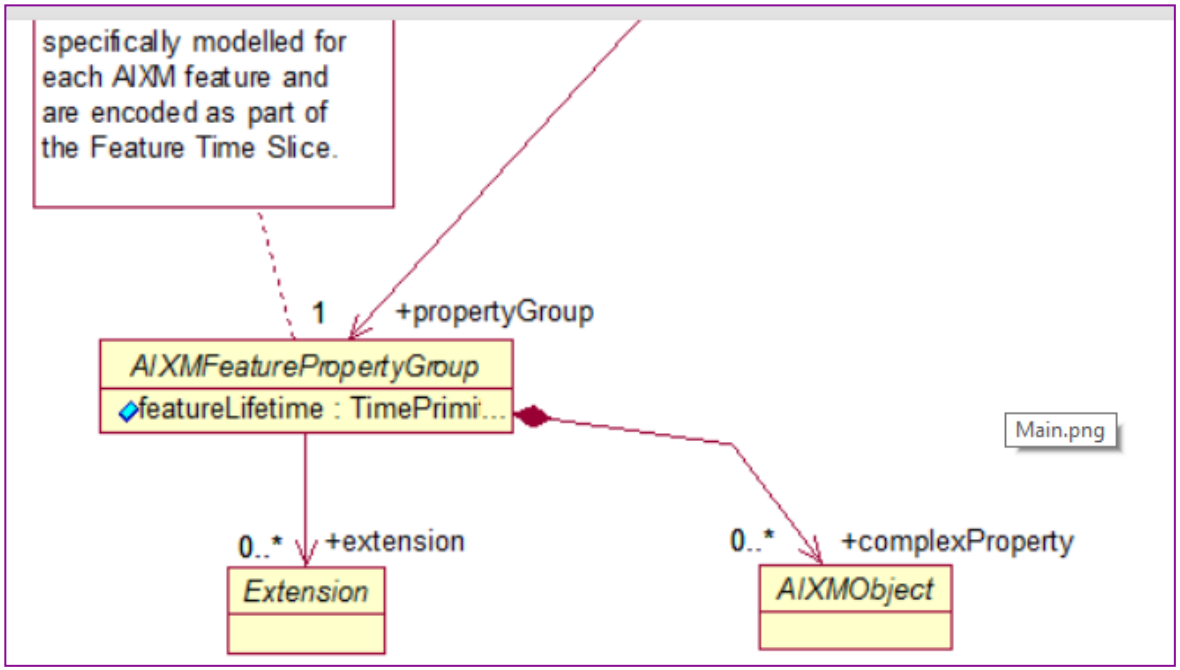
Requirements | Exchange model and AIXM

- Provide an extension mechanism

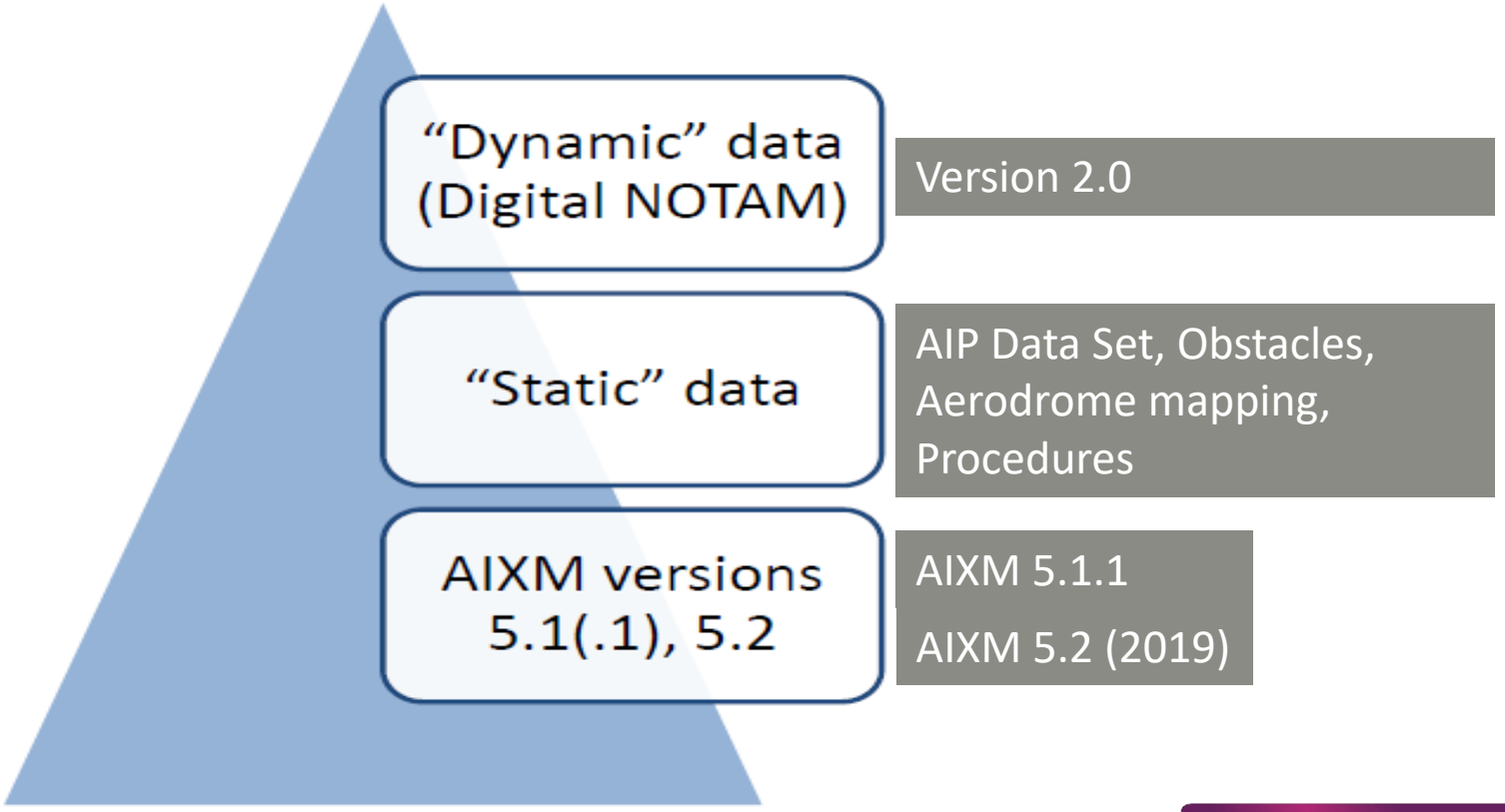


AIXM provides an extension mechanism

AIXM CODING GUIDELINES

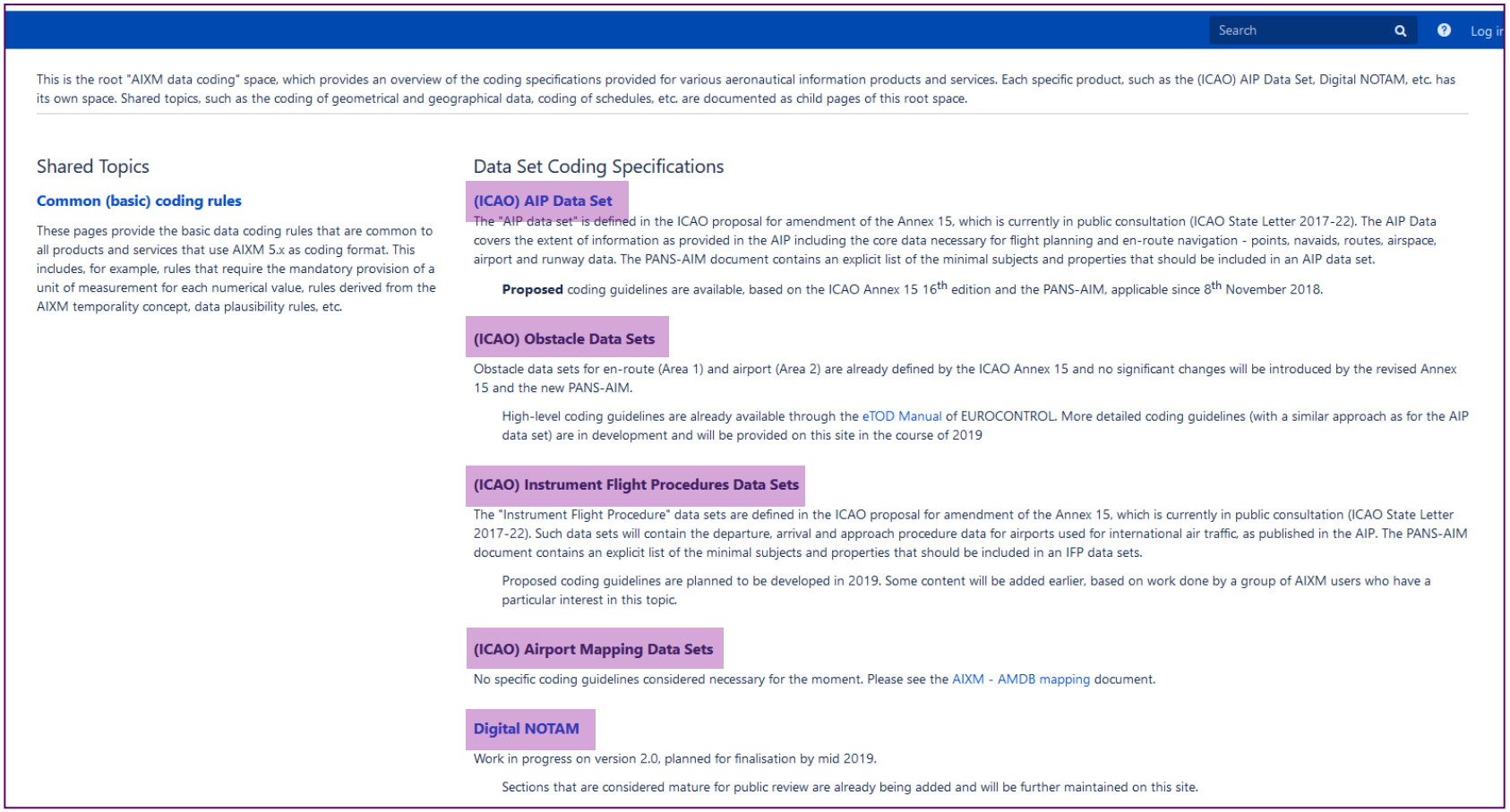
AIXM| Coding guidelines

- May 2016 – Eurocontrol Working Group about AIXM Coding Guidelines
- Objective: develop coding guidelines of global application



AIXM| Coding guidelines

- https://ext.eurocontrol.int/aixm_confluence/display/ACG



Search Log in

This is the root "AIXM data coding" space, which provides an overview of the coding specifications provided for various aeronautical information products and services. Each specific product, such as the (ICAO) AIP Data Set, Digital NOTAM, etc. has its own space. Shared topics, such as the coding of geometrical and geographical data, coding of schedules, etc. are documented as child pages of this root space.

Shared Topics

Common (basic) coding rules

These pages provide the basic data coding rules that are common to all products and services that use AIXM 5.x as coding format. This includes, for example, rules that require the mandatory provision of a unit of measurement for each numerical value, rules derived from the AIXM temporality concept, data plausibility rules, etc.

Data Set Coding Specifications

(ICAO) AIP Data Set

The "AIP data set" is defined in the ICAO proposal for amendment of the Annex 15, which is currently in public consultation (ICAO State Letter 2017-22). The AIP Data covers the extent of information as provided in the AIP including the core data necessary for flight planning and en-route navigation - points, navaids, routes, airspace, airport and runway data. The PANS-AIM document contains an explicit list of the minimal subjects and properties that should be included in an AIP data set.

Proposed coding guidelines are available, based on the ICAO Annex 15 16th edition and the PANS-AIM, applicable since 8th November 2018.

(ICAO) Obstacle Data Sets

Obstacle data sets for en-route (Area 1) and airport (Area 2) are already defined by the ICAO Annex 15 and no significant changes will be introduced by the revised Annex 15 and the new PANS-AIM.

High-level coding guidelines are already available through the eTOD Manual of EUROCONTROL. More detailed coding guidelines (with a similar approach as for the AIP data set) are in development and will be provided on this site in the course of 2019

(ICAO) Instrument Flight Procedures Data Sets

The "Instrument Flight Procedure" data sets are defined in the ICAO proposal for amendment of the Annex 15, which is currently in public consultation (ICAO State Letter 2017-22). Such data sets will contain the departure, arrival and approach procedure data for airports used for international air traffic, as published in the AIP. The PANS-AIM document contains an explicit list of the minimal subjects and properties that should be included in an IFP data sets.

Proposed coding guidelines are planned to be developed in 2019. Some content will be added earlier, based on work done by a group of AIXM users who have a particular interest in this topic.

(ICAO) Airport Mapping Data Sets

No specific coding guidelines considered necessary for the moment. Please see the AIXM - AMDB mapping document.

Digital NOTAM

Work in progress on version 2.0, planned for finalisation by mid 2019.

Sections that are considered mature for public review are already being added and will be further maintained on this site.

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AIXM| Coding guidelines – AIP DS

Overview

Created by Manfred BECKMANN, last modified by EDUARD POROSNICU on 24 May 2019

(ICAO) AIP Data Set - Coding Guidelines

Initial development by EUROCONTROL
Further maintained by the AIXM Community

EUROCONTROL

Co-financed by the European Union
Connecting Europe Facility

This space provides coding guidelines for the ICAO AIP Data Set in AIXM 5.1/5.1.1 format. The objective is to ensure that AIP data sets provided by different States can be effectively used by the downstream AIS data chain actors, particularly by Data Provider (DAT) organisations. This includes a formal mapping into AIXM 5.1/5.1.1 of the AIP Data Set subject/properties, as contained in the new PANS-AIM (ICAO DOC 10066).

Concerning the status of the coding guidelines
The AIP Data Set coding guidelines are in **PROPOSED** status. EUROCONTROL intends to start a formal consultation process, with the objective to release a formal AIP Data Set - AIXM Coding Specification by the end of 2019. Although the exact content and structure of the intended Specification remains to be defined through further consultation with the stakeholders, it is likely that it will include only the mapping to PANS-AIM and the data set verification rules. Guidance on the coding of particular cases will probably continue to be provided through this collaboration area.

Child Pages

- Introduction
- Copyright notice
- Mapping PANS-AIM AIP Data Set to AIXM 5
- Coding Guidelines
- Interoperability rules
- AIP Data Set - Specimen (DONLON)
- File lists
- References
- FAQ

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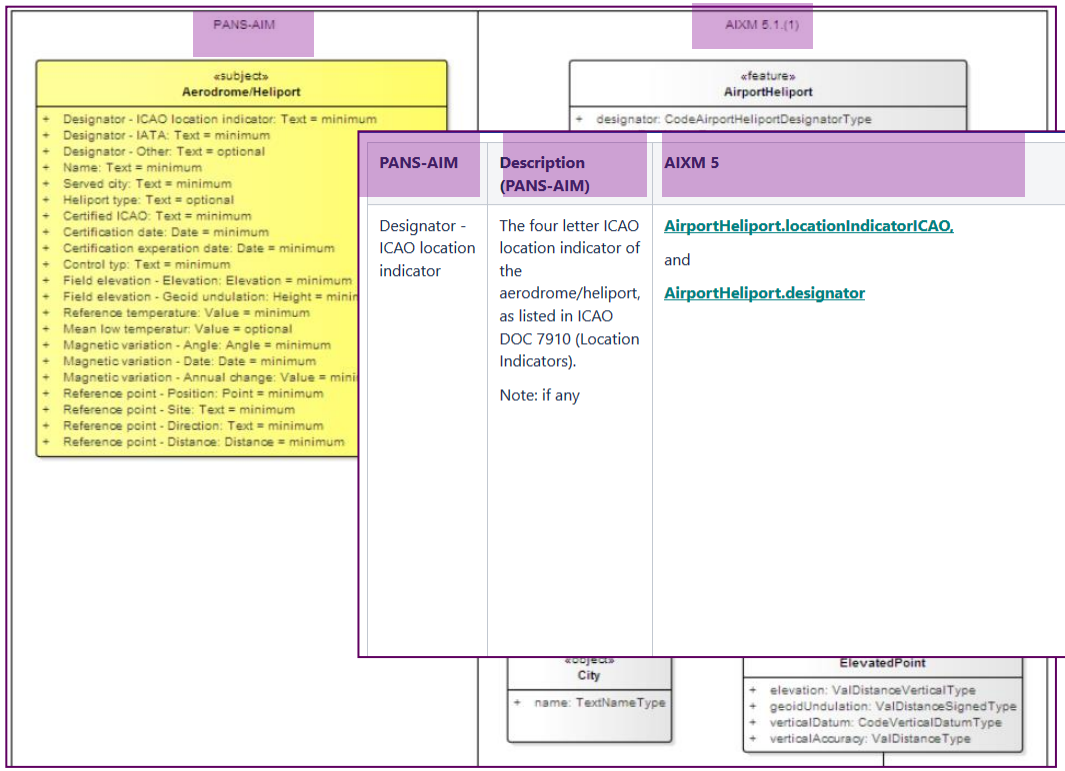
AIXM| AIP DS - PANS-AIM – AIXM (mapping)

- UML Diagrams
- Tables



PANS-AIM	Description (PANS-AIM)	AIXM 5	Definition (AIXM 5.1.1)	Remarks
Designator - ICAO location indicator	The four letter ICAO location indicator of the aerodrome/heliport, as listed in ICAO DOC 7910 (Location Indicators). Note: if any	**AirportHeliport.locationIndicatorICAO,** and **AirportHeliport.designator**	Airport/heliport: A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft/helicopters. locationIndicatorICAO: The International Civil Aviation Organization (ICAO) location indicator of the airport/heliport, as listed in ICAO DOC 7910.	AIXM 5 knows also defines a general **designator** attribute for an Airport/Heliport. See coding rules for the usage of the **AirportHeliport.designator.**

AIXM| AIP DS - PANS-AIM – AIXM (mapping)

- Element category:
  - Minimal Elements:
    - Mandatory according to PANS-AIM 5.3.3.1.1 (part of the mapping)
  - Conditional Elements :
    - Additional to PANS-AIM 5.3.3.1.1. and described in appendix 2 of PANS-AIM (part of the mapping)
    - Additional for compatibility with flight planning or ARINC 424 (part of the mapping)
  - Optional Elements :
    - Additional to PANS-AIM and described in the data catalogue (not part of the mapping)

AIXM| AIP DS – Rules and examples

A **Runway** is situated at maximum one **AirportHeliport**.

The runway is a defined rectangular area on a land aerodrome/heliport prepared for the landing and take-off from aircraft.

> **Note:**
> This includes the concept of Final Approach and Take-Off Area (FATO) for helicopters. The **Runway.type** attribute is used to distinguish if it is a 'RWY' or 'FATO'.

An airport may have an arbitrary number of physical runways associated with it, each of which has -in general- up to two runway directions defined (It is possible to record less or more than two RWY directions if required).

The Runway at an airport will be identified by a **designator**, normally composed of the designators of its runway directions. A runway has a **nominalLength** and a **nominalWidth**.

The **Runway** has a surface that can be described by the attributes of the **SurfaceCharacteristics** class. This includes inter alia the type of the predominant material of which a surface of the movement area is

ent Classification Number).

esignator. Each runway direction will have a defined **trueBearing** and may also have

Coding Examples

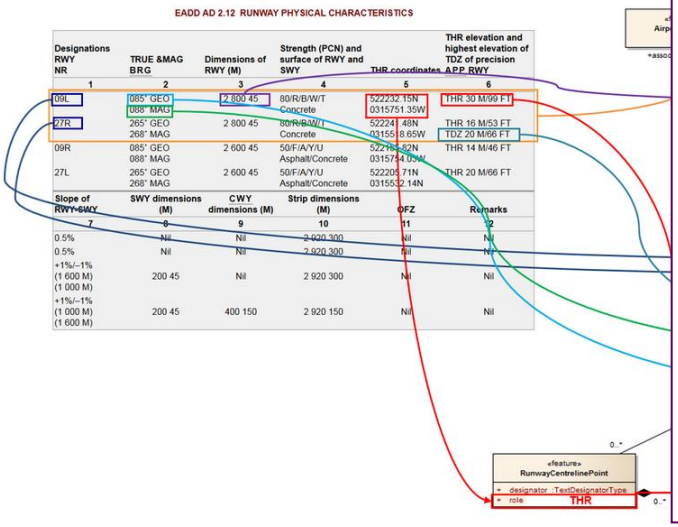
The figure shows a simple example of a Runway with designator "RWY-09L/27R" situated at "EADD".

It is composed of the designators of the runway directions.

The runway has a nominal length of "2800 Meters" and a nominal width of "45 meters".

Each runway direction has a true and magnetic bearing defined.

Each runway direction has also a defined runway centre line point, viz. the threshold with its elevation.



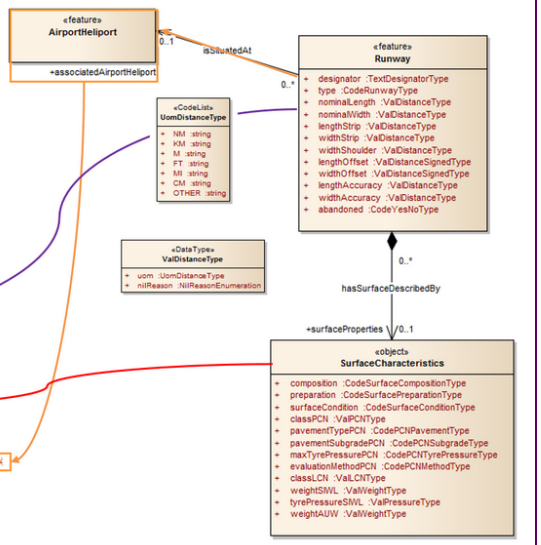
EADD AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

Designations RWY NR	TRUE &MAG BRG	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP. RWY
1	2	3	4	5	6
09L	085° GEO 088° MAG	2 800 45	80/R/B/W/T Concrete	522232.15N 0315751.35W	THR 30 M/99 FT
27R	265° GEO 268° MAG	2 800 45	80/R/B/W/T Concrete	522241.48N 0315518.65W	THR 16 M/53 FT TDZ 20 M/66 FT
09R	085° GEO 088° MAG	2 600 45	50/F/A/Y/U Asphalt/Concrete	522155.82N 0315754.00W	THR 14 M/46 FT
27L	265° GEO 268° MAG	2 600 45	50/F/A/Y/U Asphalt/Concrete	522205.71N 0315532.14N	THR 20 M/66 FT

Slope of RWY+SWY	SWY dimensions (M)	CWY dimensions (M)	Strip dimensions (M)	OFZ	Remarks
7	8	9	10	11	12
0.5%	Nil	Nil	2 920 300	Nil	Nil
0.5%	Nil	Nil	2 920 300	Nil	Nil
+1%/–1% (1 600 M) (1 000 M)	200 45	Nil	2 920 300	Nil	Nil
+1%/–1% (1 000 M) (1 600 M)	200 45	400 150	2 920 150	Nil	Nil

The figure below shows the encoding of some of the Runway properties described above in AIXM 5.1.

```
<aixm:RunwayTimeSlice gml:id="RNWTS2120">
    <gml:validTime>
        <gml:TimePeriod gml:id="vtILURU94">
            <gml:beginPosition>2009-01-01T00:00:00.000</gml:beginPosition>
            <gml:endPosition indeterminatePosition="unknown"/>
        </gml:TimePeriod>
    </gml:validTime>
    <aixm:interpretation>BASELINE</aixm:interpretation>
    <aixm:sequenceNumber>1</aixm:sequenceNumber>
    <aixm:featureLifetime>
        <gml:TimePeriod gml:id="ltILURU94">
            <gml:beginPosition>2009-01-01T00:00:00.000</gml:beginPosition>
            <gml:endPosition indeterminatePosition="unknown"/>
        </gml:TimePeriod>
    </aixm:featureLifetime>
    <aixm:designator>09L/27R</aixm:designator>
    <aixm:nominalLength uom="M">2800.0</aixm:nominalLength>
    <aixm:nominalWidth uom="M">45.0</aixm:nominalWidth>
    <aixm:lengthStrip uom="M">2920.0</aixm:lengthStrip>
    <aixm:widthStrip uom="M">300.0</aixm:widthStrip>
    <aixm:surfaceProperties>
        <aixm:SurfaceCharacteristics gml:id="S-e5eb234d">
            <aixm:composition>CONC</aixm:composition>
        </aixm:SurfaceCharacteristics>
    </aixm:surfaceProperties>
    <aixm:associatedAirportHeliport xlink:href="#urn.uuid.1b54b2d6-a5ff-4e57-94c2-f40
</aixm:RunwayTimeSlice>
```



Presentation Date: September 2019

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AIXM| AIP DS – Interoperability rules

Use of compression

The size of an AIP Data Sets in AIXM format is likely to be in the range between 100 MB and up to 1-2 GB (if provided for an entire region). Such files have very good compression rates (up to 10 times) with widely used standards, such as ZIP. In order to reduce the transmission times and the archiving size on the client side, the AIP Data Sets should be exchanged in compressed formats. The use of compression algorithms provide a side benefit, as they guarantee the integrity of the files, through the use of CRC or similar mechanisms.

Recommendation
When made available as a single XML file, the AIP data set should be compressed using a widely used compression algorithm, such as ZIP.

File name

The ICAO PANS-AIM, item 5.4.1.4 requires a "*checklist of data sets shall be made available through the same distribution mechanism as used for the data sets*". This implies that each data set may be uniquely identified in some way, so that it can be listed. Therefore, a naming convention for the AIP Data Set files is proposed in this section.

Recommendation
An AIP Data Set file should have the following name structure "CC_CC_CC...[Territory]_AIP_DS_Type[_Part]_YYYYMMDD[_AIRAC].xml", where:

- CC represents the 1-letter or 2-letters ICAO Country code(s) of the State(s) under which authority the data set is published, according to the ICAO DOC 7910 - Location Indicator;
  Note: When a Data Set is published for an entire region, as result of a regional database agreement, CC may be replaced by a code representing that region, such as "EU" in the case of the European AIS Database.
- [_Territory] is optional and is the official name of the Territory covered by the data set, if applicable;
- AIP_DS is a fixed text (meaning "AIP Data Set");
- Type is a mandatory element and it can take one of the following values:
  a. FULL - when the file contains a complete AIP data set or a subset thereof;
  b. UPD_BL - when the the file contains an AIP Data Set - Baseline Update or a subset thereof;
  c. UPD_DELTA - when the file contains an AIP Data Set - Delta Update or a subset thereof.
- [_Part] is optional and indicates that the file constitutes a subset of the complete AIP data set provided by the State. Note: the exact split in parts and their names is left at the discretion of each State;
- YYYYMMDD is the start of effective date in the format year, month, date;
- "_AIRAC" is optional and it shall be appended for Data Sets that contain changes complying with the AIRAC cycle rules.

AIXM| AIP DS – Donlon Data Set Specimen

AIP Data Set - Specimen (DONLON)

Created by Wolfgang SCHEUCHER, last modified by EDUARD POROSNICU on 29 Jan 2019

Content

A Specimen AIP Data Set is provided in order to exemplify the coding guidelines on a concrete case. The content of the Specimen AIP Data Set is based on the fictitious Specimen AIP provided with the ICAO AIS Manual (DOC 8126) [1], also known as the "DONLON" data. When needed, the ICAO DONLON data has been altered or extended (e.g. to correct errors such as wrong coordinates or to provide additional features that are not containe threshold, airspace aggregations, etc). It will con examples for various situations that might exist i

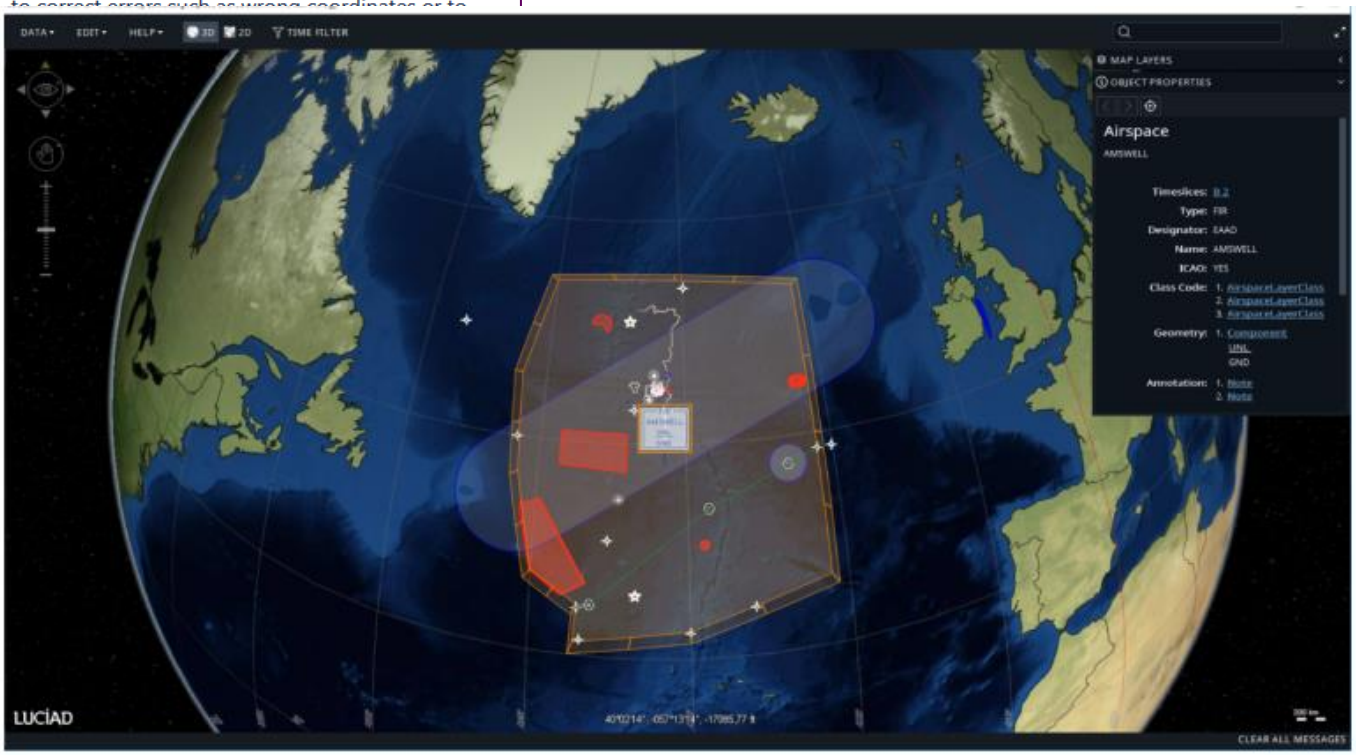
This fictitious set of digital AIS data sets complie PANS-AIM provisions. The DONLON AIP Data Se AIXM coding guidelines.

Note
This data is entirely fictitious, located some NEVER BE USED AS OPERATIONAL DATA. T Atlantic!!!

In addition to an initial Donlon data set, this refe

- a series of fictitious updates, which provid Temporality use cases;
- Digital NOTAM coding examples, which ar NOTAM Specification.

Note
The gml:id and the xlink:title naming appli Specimen file are for the convenience of lc a recommendation of how to code these e



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EXPECTATIONS

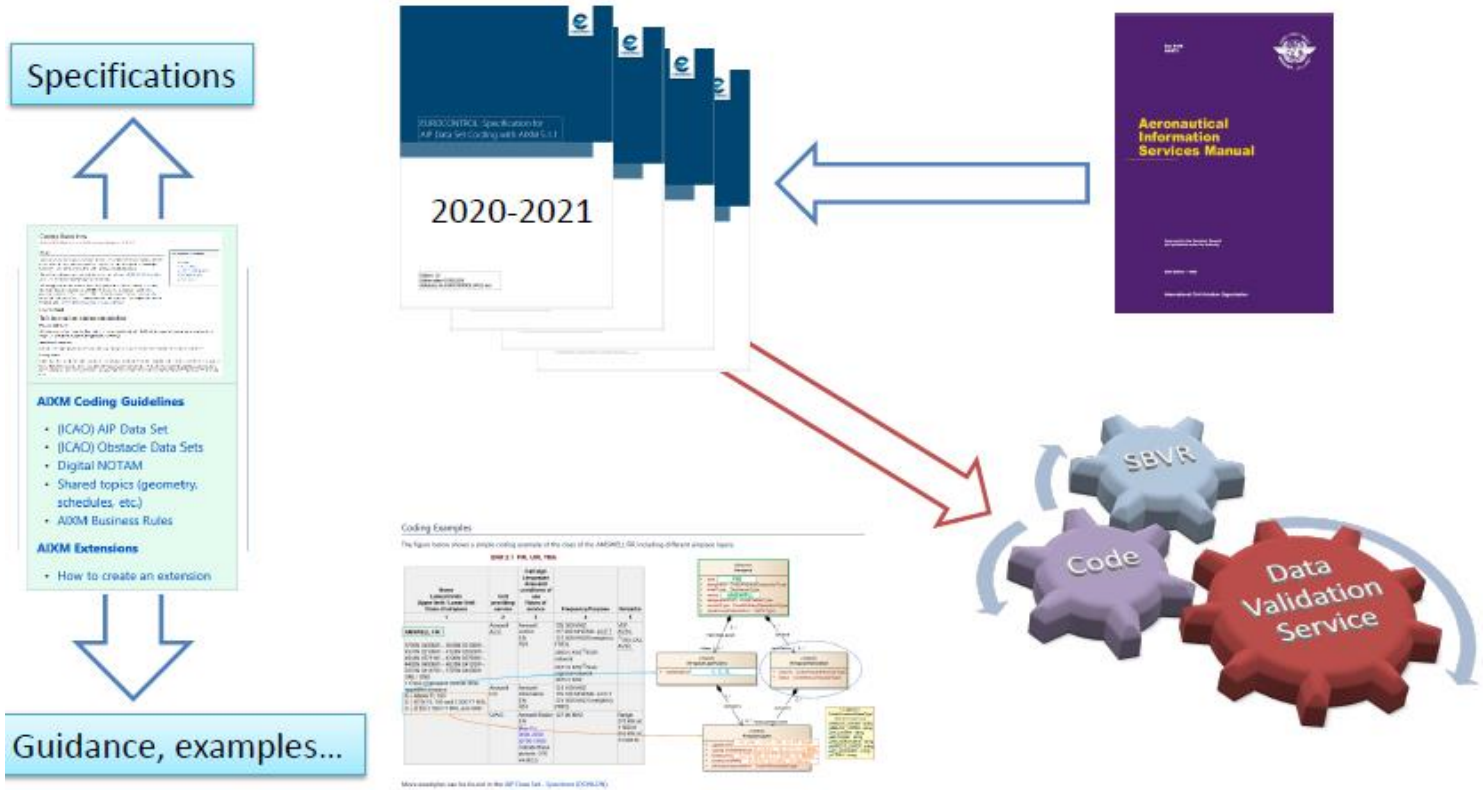
AIXM| WIP

- Obstacle Data Set
  - AIXM Coding Guidelines
  - Mapping of PANS-AIM to AIXM
  - Coding rules and examples
  - Proposed for the end of 2019

- Instrument Flight Procedures Data Set
  - AIXM Coding Guidelines
  - Parallel work with AIXM 5.2
    - SBAS/GBAS, FAS DB, PBN, etc
  - Proposed for mid 2020

AIXM| Data Set - Specifications

- EUROCONTROL Specification for AIP Data Set Coding using AIXM 5.1.1 – 2nd quarter 2020.



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