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NCLB
AIM Workshop

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Integrated Aeronautical Information Database (IAID) & AICM-AIXM

Abbas NIKNEJAD

Regional Officer, AIM/ATM

Annex 15 provisions

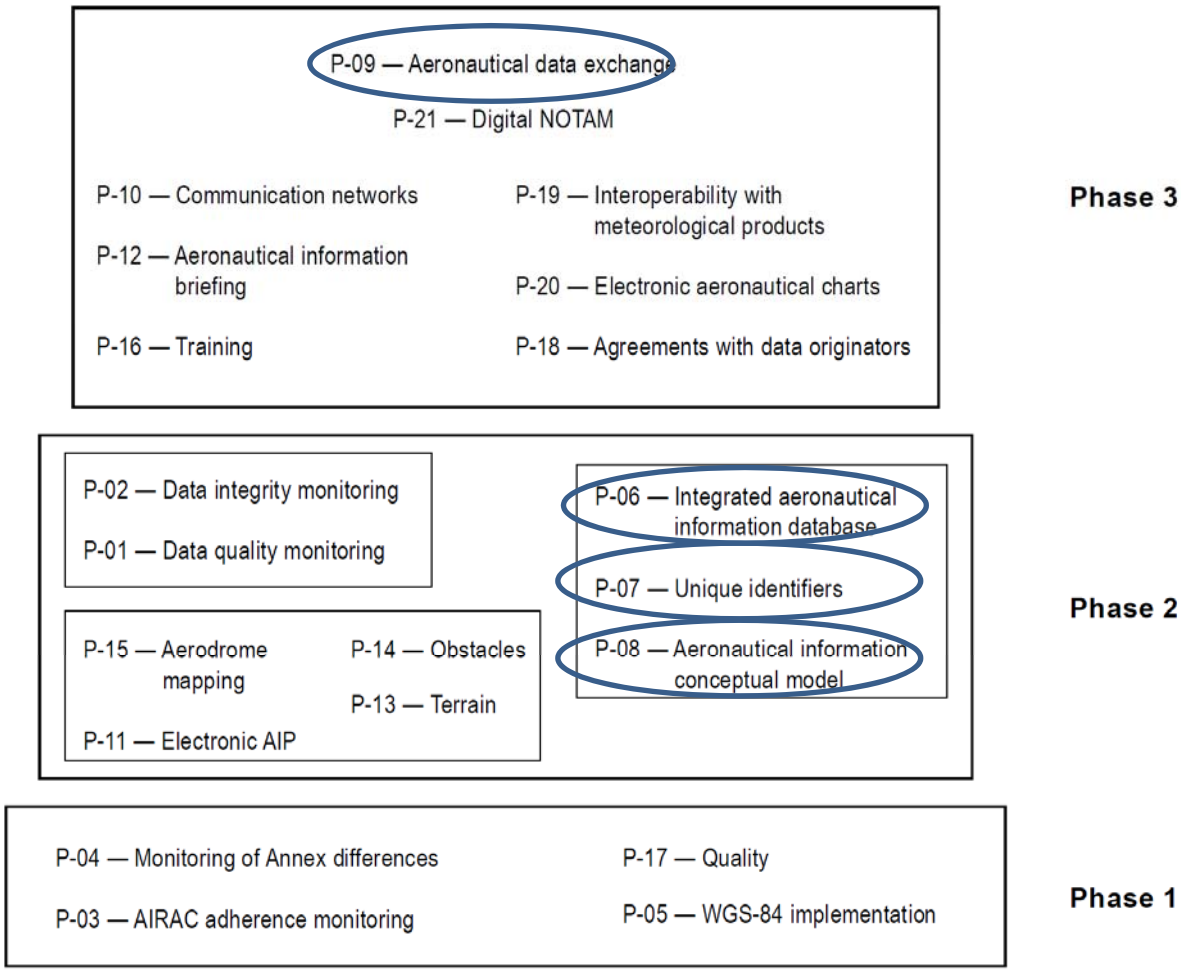
3.5 Use of automation

- 3.5.1 Automation shall be applied in order to ensure the timeliness, quality, efficiency and cost-effectiveness of aeronautical information services.
- 3.5.2 In order to meet the data quality requirements, automation shall:

  a) enable digital aeronautical data exchange between the parties involved in the data processing chain; and

  b) use aeronautical information exchange models and data exchange models designed to be globally interoperable.

ICAO Roadmap – AIS to AIM



What is IAID?

P-06 — Integrated aeronautical information database

- The establishment and maintenance of a database where digital aeronautical data from a State are integrated and used to produce current and future AIM products and services is the main step in Phase 2 of the transition to AIM.
- A database may be operated by States or by regional initiatives under delegation from States. The design of such a database will not be identical in all States or regions because local technical or functional requirements must be considered.

***Description**:*

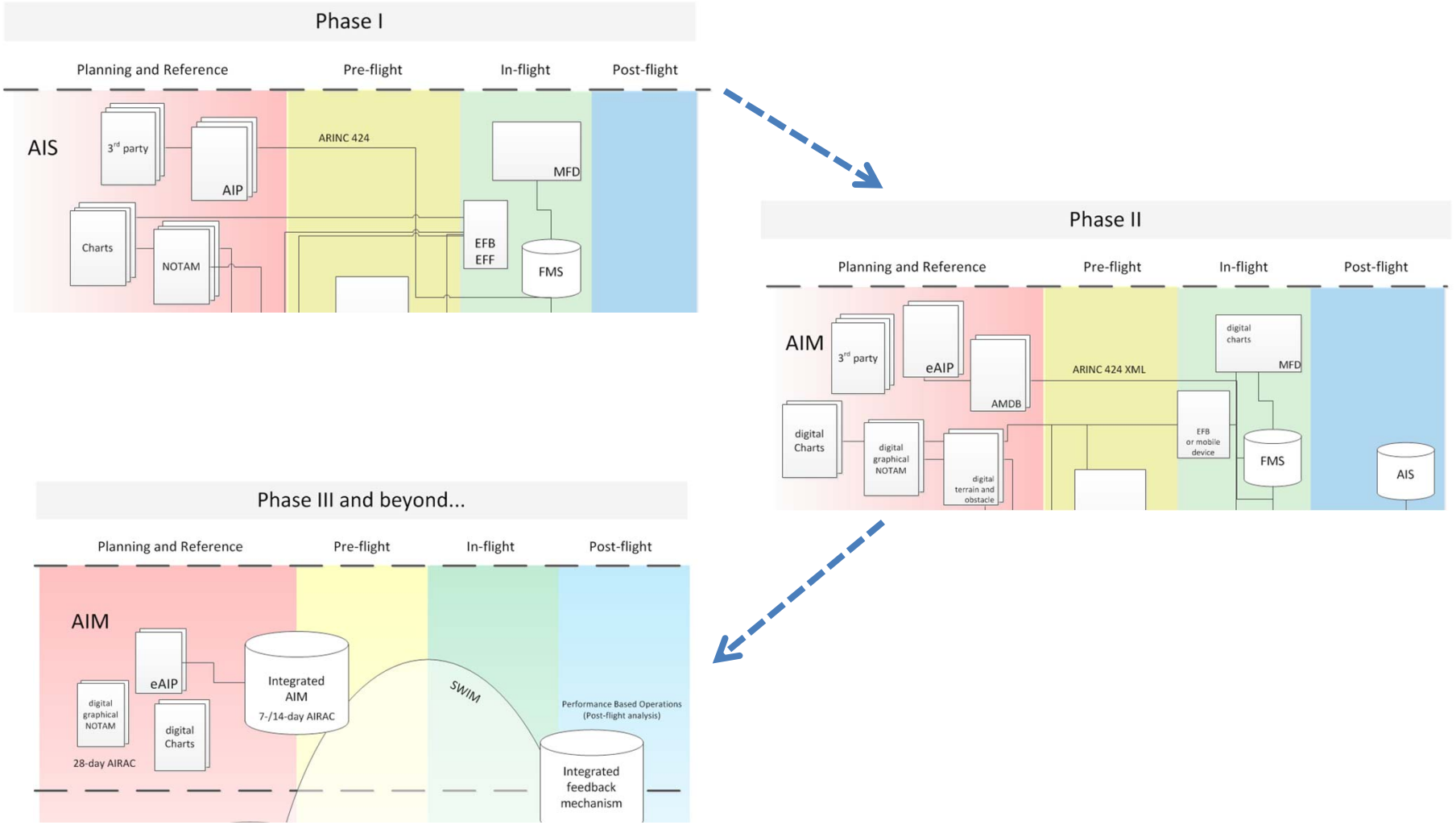
- *An Integrated Aeronautical database is a single, centralized repository of aeronautical information where digital aeronautical data from a State are integrated and used to produce current and future AIM products and services.*
- *This database must be able to exchange information based on the Aeronautical Information Exchange Model (AIXM) with other aeronautical databases.*

Description by MID eANP

(Table B0-DATM 3-1)

- The IAID of a State is a single access point for one or more authoritative databases (AIP, Terrain, Obstacles, AMDB, etc.).

Evolution of IAID



key characteristics of aeronautical information in AIM concept

- Aeronautical data captured digitally at origination
- Aeronautical information is digitally represented, stored in a digital database, from which it can be retrieved in order to be sorted, filtered, graphically displayed, or otherwise manipulated and digitally disseminated;
- Aeronautical information is readily integrated, or integratable with other information domains
- The integrity of aeronautical information is maintained throughout the aeronautical data chain
- Aeronautical information is graphically displayable thereby showing relationships between information and between different information layers
- Aeronautical information is globally harmonized via common data definitions, data models, data exchange formats, measured using agreed upon units of measurement and common frames of reference
- Aeronautical information can be transmitted via data link and ultimately via SWIM among all ATM stakeholders
- The temporality of aeronautical information is adequate for operational decision making throughout all phases of flight, and includes Planning and Reference, Pre-flight, Inflight and Post-flight
- Aeronautical information is operationally relevant and directly supports operational decision making processes

AICM

P-08 — Aeronautical information conceptual model

- Defining the semantics of the aeronautical information to be managed in terms of digital data structures is essential for introducing interoperability.
- The Aeronautical Information Conceptual Model, also known as "AICM", provides a formal description of the aeronautical information items, using a standard data modelling language.
- This standard data model enables the automated processing of aeronautical information by the end users. Automated processing of data limits the occurrence of human induced errors.
- AICM forms the basis of the Aeronautical Information Exchange Model (AIXM).

Need for AICM

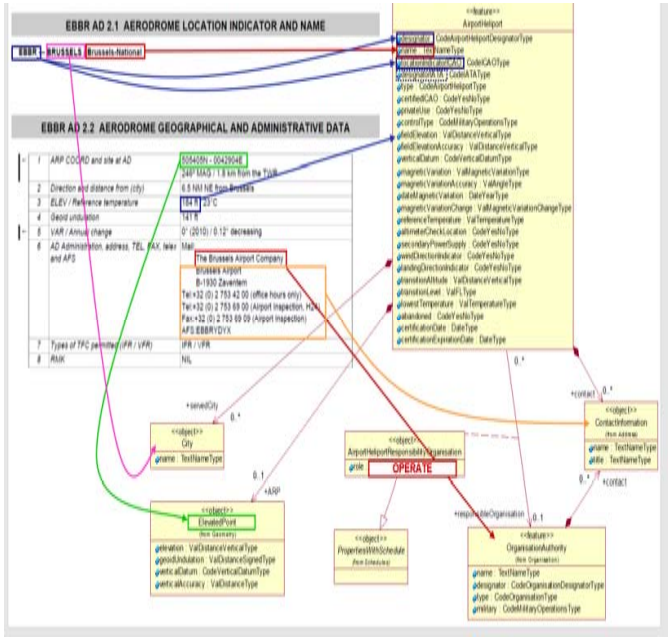
- Data model for the European AIS Database (EAD) (at its introduction)
- Basis for eAIP
- Basis for aeronautical data exchange specification
- Contribution to ICAO (AIS/MAP Divisional Meeting of 1998)
- etc.

AICM 5.1 - Packages

- Logical View
  - AIXM
    - AIXM Abstract Feature
    - AIXM Data Types
    - AIXM Features
      - AirportHeliport
      - Airspace
      - Geometry
      - Holding
      - Navaids Points
      - Notes
      - Obstacle
      - Organisation
      - Procedure
      - Refueling Aerial
      - Routes
      - RulesProcedures
      - Service
      - Shared
      - Surveillance

- AirportHeliport
  - Airport/Heliport
  - Apron
  - Helicopter Surfaces
  - Lighting
  - Markings
  - Runway
  - Seaplanes
  - Surface Contamination
  - Taxiway

- 245 classes
- around 2200 attributes + associations



Unique Identification

- **P-07 — Unique identifiers**
- Improvements to the existing mechanisms for the unique identification of aeronautical features are required to increase the effectiveness of information exchange without the need for human intervention.
- *Data, received by AIS, should receive a unique identifier when the data is processed and stored in the AIS database. Data should already receive a unique identifier when the aeronautical data is entered in the data chain by the original data provider, e.g. surveyor, PANS-OPS designer, etc. That unique identifier shall then be carried through all subsequent processes.*
- *The Aeronautical database should be able to use the cyclic redundancy check (CRC) mechanism during the transfer of data to guarantee that the unique identifiers are not corrupted during the process.*
- *Example: ICAO Location Indicator linked to an internal identifier for unique identification of AD*

AIXM

- The Aeronautical Information Exchange Model (AIXM) is a specification designed to enable the encoding and the distribution in digital format of the aeronautical information, which has to be supplied by the national AIS providers.
- A standard for an aeronautical data exchange model will ensure standardised interfaces between the computers of both providers and users of data.
- Various other forms of data exchange may be incorporated into AIM:
  - iWXXM – Weather Information Exchange Model
  - FIXM – Flight Information Exchange Model

AIXM Development

- AIXM was originally developed by EUROCONTROL to meet the needs of the European AIS Database (EAD). The initial version enabled the encoding in digital format of the static data contained in the national Aeronautical Information Publications (AIP). It also enabled the exchange of this data between the national databases and the centralised EAD reference database and further down to the EAD clients.
- Since 2003, AIXM has become a joint development between EUROCONTROL and the United States Federal Aviation Administration (FAA), with support from the international community. The objective is to go beyond the traditional AIP and NOTAM means for aeronautical information dissemination, by delivering an internationally agreed standard which **enables the provision of real time aeronautical information in digital format**.
- The latest AIXM 5.1 version is the result of this joint effort.

AIXM versions

- AIXM 4.5 is used since 2005.
- Starting from 2010, the data provider systems are gradually moving towards **AIXM 5.1**, which is the latest official AIXM version released on February, 2nd 2010. AIXM 5.1 is the follow-up of the previous version, developed as the data encoding specification that will support the current and future ATM needs for digital aeronautical information, including Digital NOTAM.
- Older versions of AIXM (3, 3.3 and 4.0) were developed before 2005.

AIXM 4.5 vs. AIXM 5.1

Topic	AIXM 4.5	AIXM 5
Data Scope	Only Static Data	Static and Dynamic Data, Enabling Digital NOTAM
Geographical Elements	XML	XML/GML (ISO standard for geometry)
Feature Identification	Natural Keys	Artificial Identifier (UUID concept)
Message Types	Snapshot or Update	Flexible Messages
Communication of Data Changes	All feature attributes and relationships have to be provided.	Only deltas have to be provided
Temporality	Temporality is a property of the message Supports only static data	Temporality is a property of the aeronautical feature; Supports both static and dynamic data
Metadata	Very limited metadata capabilities	Full range of metadata, based on ISO 19115 & ISO/TS 19139 (metadata standards)
Model Extensibility	Limited extensibility (part of local system)	Defined extensibility concept for the AIXM Schema
Business Rules	provided in plain language, included in model	Based on standard for modelling business rules (SBVR), uncoupled from model

AIXM scope

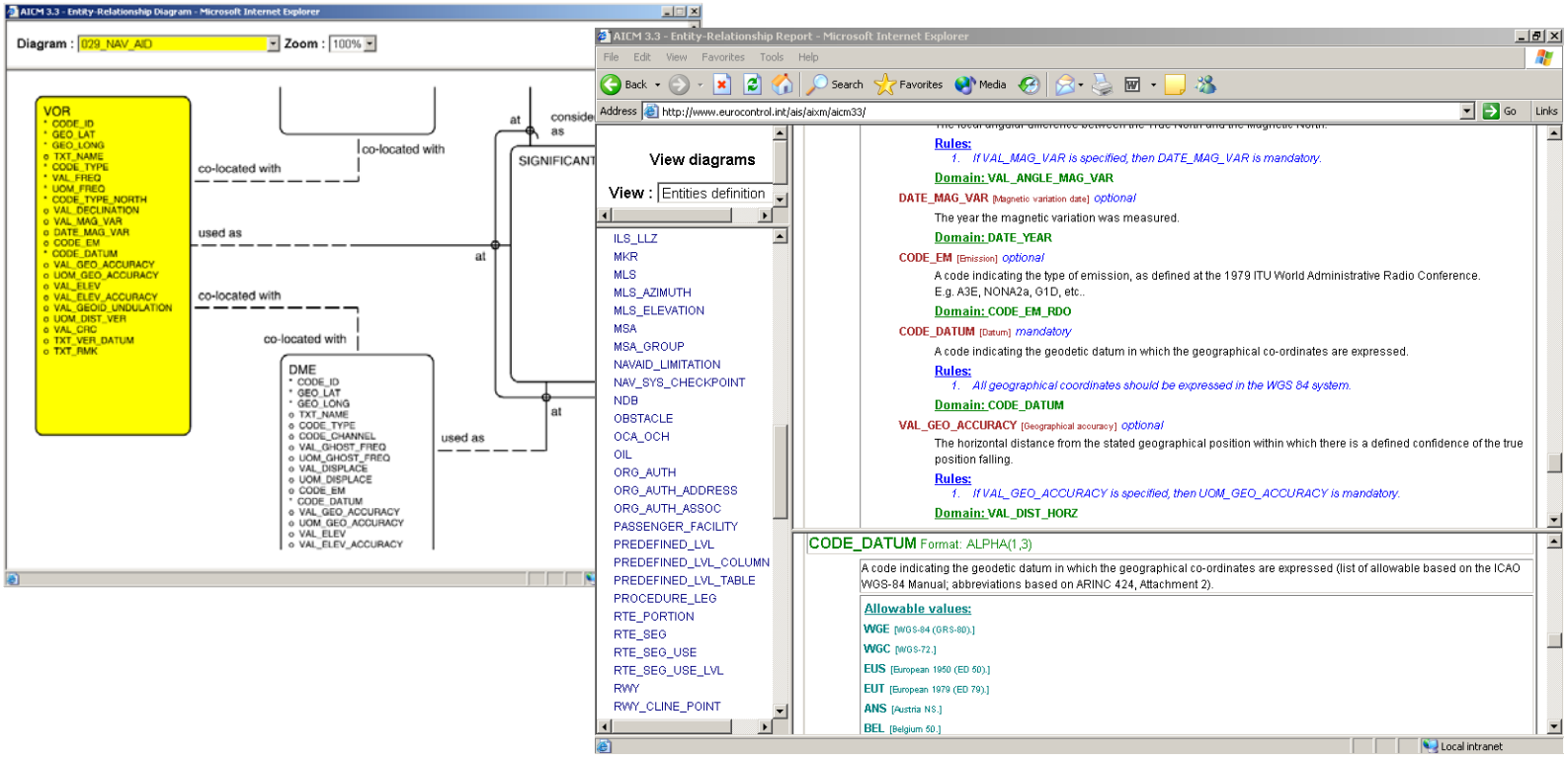
- The AIXM scope is based on the ICAO requirements for provision by the Member States of the “data necessary for the safety, regularity and efficiency of international air navigation”.
- However, the specification goes beyond the strict ICAO Annex 15 requirements, by also taking into consideration existing industry standards (such as ARINC 424) and emerging data needs.

AIXM components

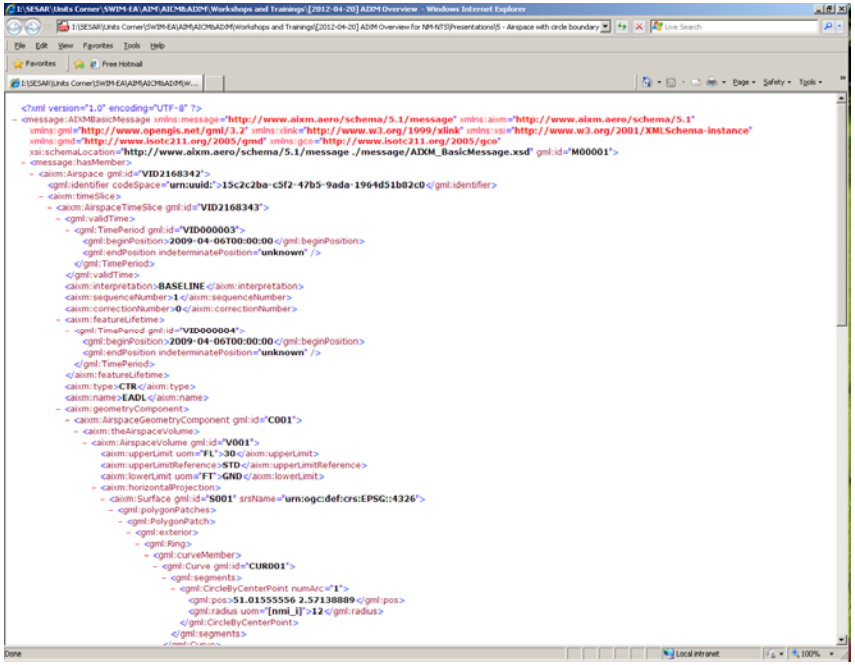
- The **Aeronautical Information Exchange Model** (AIXM) is a specification divided into two components:

1. A logical information model expressed in UML
   - The **AIXM UML Model** provides a formal description of the information managed by the Aeronautical Information Services (AIS). It is based on the ICAO Standards and Recommended Practices, on the content of the real world Aeronautical Information Publications (AIP) and on other relevant documents and industry standards, such as the ARINC 424 Specification.
2. A data exchange format using XML Schema (XSD) technology
   - The **AIXM XML Schemas** are a data encoding specification for aeronautical data. They are an implementation of the AIXM UML Model as an XML (Extensible Markup Language) schema. Therefore, the XSD Schemas can be used to send aeronautical information to others in the form of XML encoded data, enabling systems to exchange aeronautical information.

AIXM Logical Model



AIXM xml example

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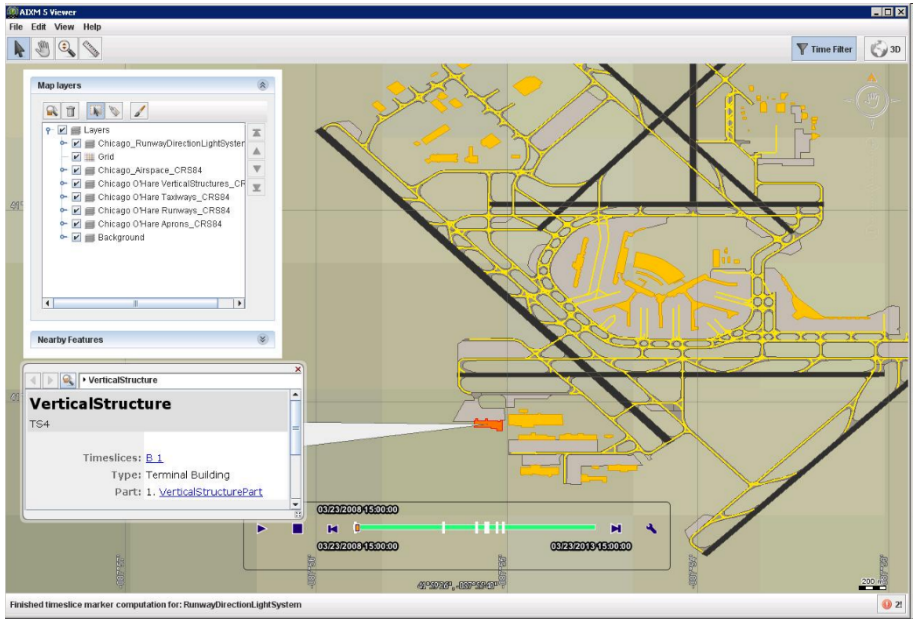
AIXM viewer



XML Advantages

- Industry standard
- Non-proprietary format
- Main stream in IT
- Largely supported by COTS software
- Set of schema languages
  - XML Schema has limitations? use Schematron!
- Human and machine readable
  - Typical for the aviation domain
    - Examples: NOTAM, flight plan, MET messages ...
- Emerging standards such as GML, SVG, etc.

ATM Information Reference Model (AIRM)

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THANK YOU