AICM-AIXM History and Overview

(Dakar, Senegal, 3-5 October 2016)

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RO/AIM

Agenda Items 6a

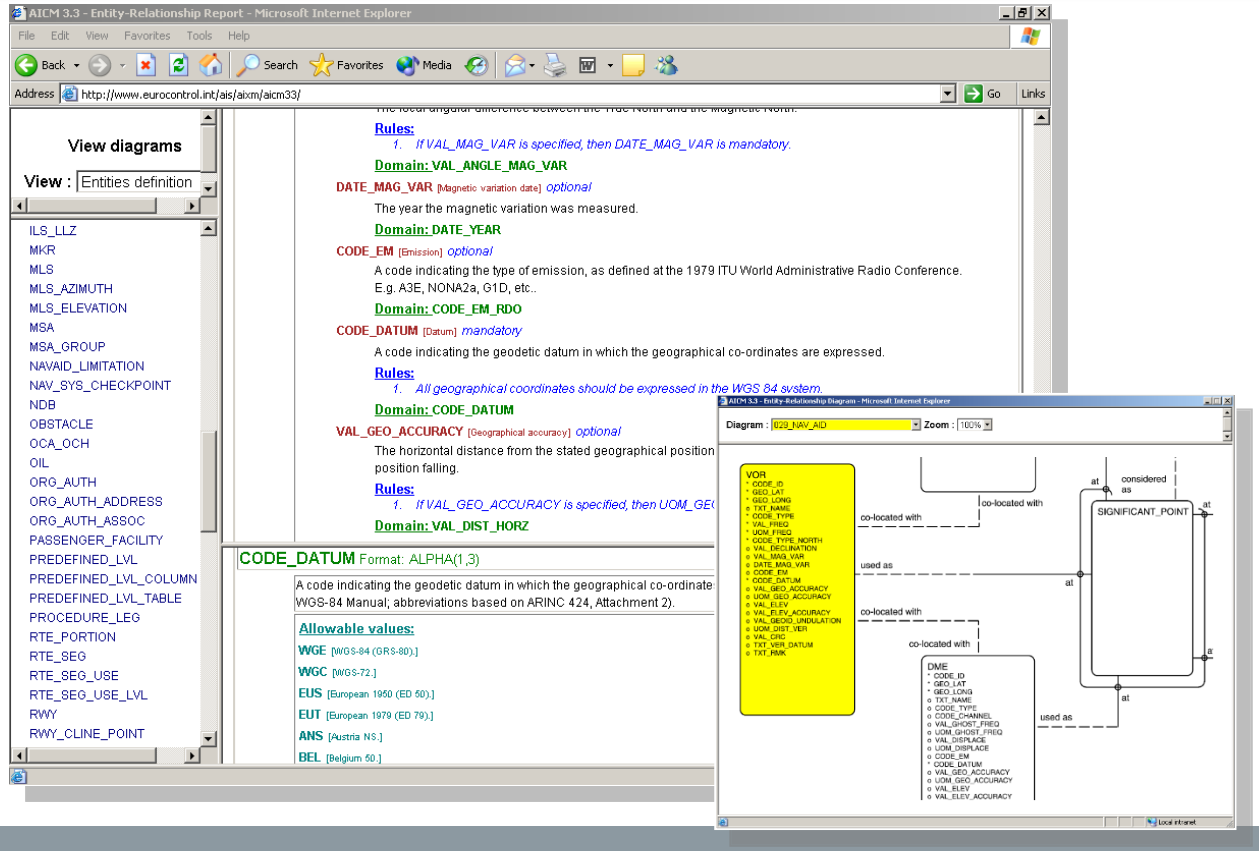
AICM – the beginning

- EAD Feasibility Study (by “CAPdebis”) - 1993
  - “The exchange of static data in an electronic format is rare for ground based systems. Other than ARINC 424 format, which was developed according to the demands of FMS, a state of the art, commonly used standard format for the exchange of static data information […] is not available.”
- Need for aeronautical information conceptual model
  - Data model for the European AIS Database (EAD)
  - Basis for eAIP
  - Basis for aeronautical data exchange specification
  - Contribution to ICAO (AIS/MAP Divisional Meeting of 1998)
  - etc.

AICM – the beginning

- **Aeronautical Information Conceptual Model (AICM)**
  - October 1996 - drafting group established
  - Based on
    - ICAO Annexes
    - “real” AIP
    - ARINC 424
  - Entity-Relationship methodology
- **October 1997, AICM Edition 1.0**
  - Aerodromes, heliports, runways, ...
  - Navaids, significant points, navigation systems, ...
  - Routes, usage restrictions, traffic flow restrictions (RAD), ...
  - SID/STAR/IAP/HOLDING, ...
  - Airspace, Services and Organisations, ...
  - AIS Documents - AIP, AIC, SUP, NOTAM, …

AICM current version - 4.0



AIXM – based on AICM

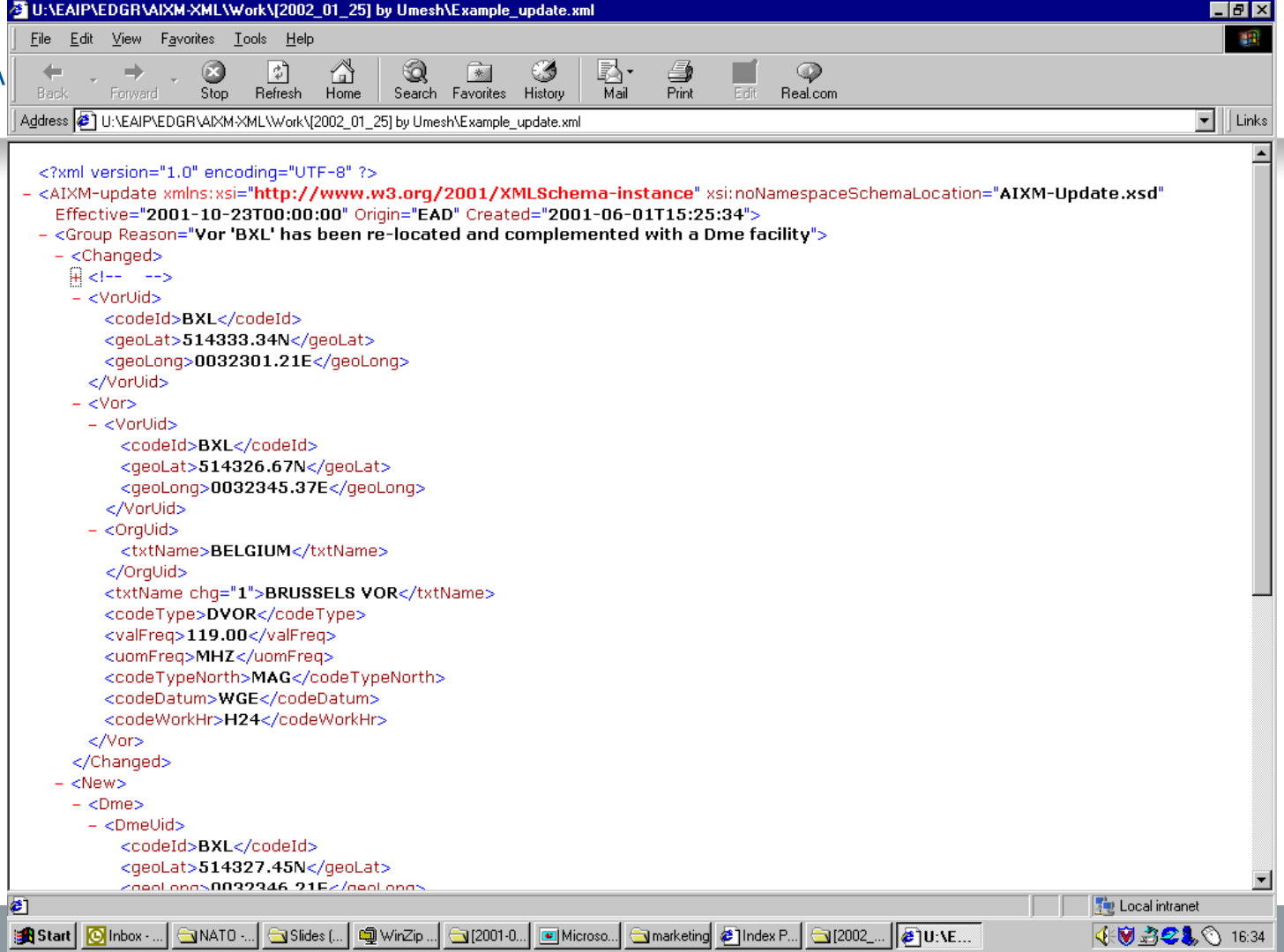
- Aeronautical Information Exchange Model (AIXM)
  - Requirements
    - AIP database update specification
      - Update/snapshot messages
    - Based on AICM
    - Non-proprietary format
  - Possibilities
    - Position based (example: ARINC 424)
    - Keyword based (example: ADEXP), etc.
- March 1998, first draft (MITRE support)
    - Initial approach 'SQL like' messages
- 1999 - discovered the Extensible Markup Language (XML)
    - Early adoption

AIXM – XML

- 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.

AIXM – XML language for AIM

- **XML Schema**
- **Vocabulary – based on AICM**
  - AIXM data types
    - Example: fire fighting category for aerodrome/heliport <codeCatFireAd> = {1, 2, 3, … 9}
  - AIXM Features
    - Example: VOR <Vor>
  - AIXM Feature attributes
    - Example: VOR Frequency <valFreq>, working hours <Vtt> - complex structure
- **Grammar (database update mechanism)**
  - AIXM-Update message type
    - “On … at …, the following VOR, RWY, … will be introduced/changed/withdrawn as follows …”
  - AIXM-Snapshot message type
    - “I have the following information about these VOR, AD, RWY …”


U:\EAIP\EDGR\AIXM-XML\Work\[2002_01_25] by Umesh\Example_update.xml
File Edit View Favorites Tools Help
Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Real.com
Address U:\EAIP\EDGR\AIXM-XML\Work\[2002_01_25] by Umesh\Example_update.xml
Links
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Effective="2001-10-23T00:00:00" Origin="EAD" Created="2001-06-01T15:25:34">
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<Changed>
<!-- -->
<VorUid>
<codeId>BXL</codeId>
<geoLat>514333.34N</geoLat>
<geoLong>0032301.21E</geoLong>
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</OrgUid>
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</Changed>
<New>
<Dme>
<DmeUid>
<codeId>BXL</codeId>
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Local intranet
Start Inbox - ... NATO - ... Slides (... WinZip ... [2001-0... Microso... marketing Index P... [2002_... U:\E... 16:34

AICM/AIXM - documentation

- Main resource: www.eurocontrol.int/ais/aixm
- AICM
  - Entity-relationship model reports and diagrams
  - AICM Manual (0.9) – work in progress for AICM 4.0
  - Tutorials
    - EUROCONTROL (Web Based Training module in development)
    - Commercial companies
  - Mappings
    - ARINC 424 <-> AICM 3.3 (see EAD Web site)
    - AIP <-> AICM (not yet publicly available)
    - …
  - FAA site: www.faa.gov/aixm

AICM/AIXM - documentation

- AIXM
  - XML Schema files
  - AIXM Primer
  - Tutorials
  - Sample files
    - Real examples from EAD
- AIXM Change Descriptions
  - 25 changes between versions 3.3 and 4.0

AICM/AIXM – Evolution

- Original goals
  - initially developed for EAD
  - requirement: fully compliant with ICAO
  - few European specific constructs (ex: FUA)
  - “globally applicable aeronautical data exchange specification, compliant with ICAO SARPS (Standards and Recommended Practices) and satisfying the needs for international aeronautical information dissemination of the ECAC States”

AICM/AIXM – Evolution

- **Current situation**
  - operational systems using AIXM and systems in the final development stage
    - Change requests
    - Need for stability
    - “AIP database update specification”
  - potential AIXM users
    - (aggressive) changes requests
    - “AIXM should be extended to support aeronautical information services in general”
  - xNOTAM – major improvement for AIXM
    - Merge static and dynamic data in a single format
  - Requests for compliance with GIS standards
    - ISO 19100 series
    - GML, WFS

AICM/AIXM – Evolution

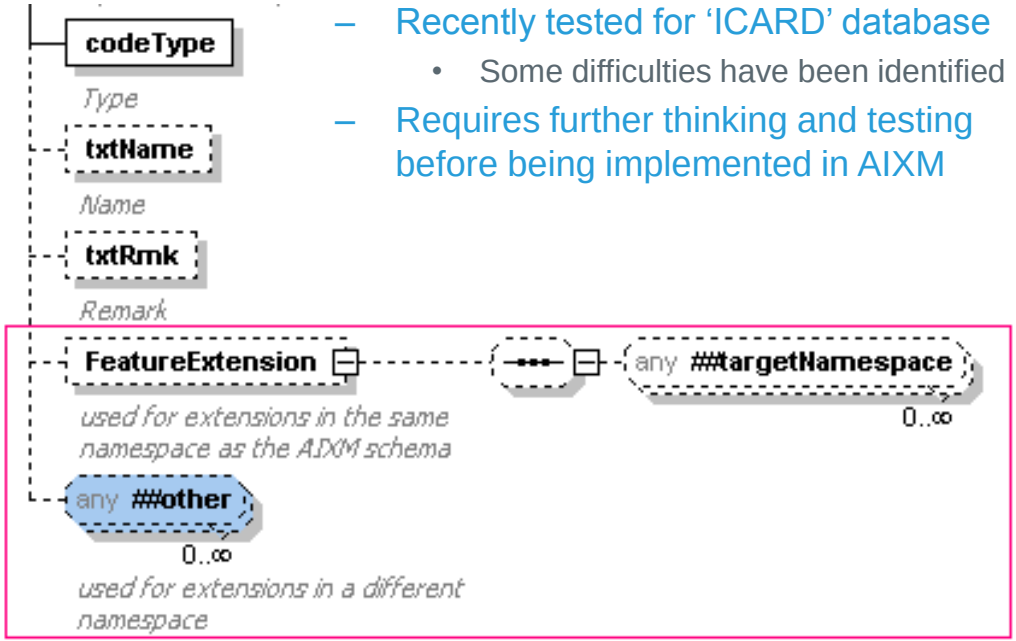
- World-wide adoption of a common aeronautical data exchange specification
  - AIXM has a high potential
- Current objective
  - globally applicable aeronautical data exchange specification
  - compliant with ICAO SARPS
  - satisfying the needs for international aeronautical information dissemination of the stakeholder States
  - including temporary changes (NOTAM)
  - existing investments shall be protected by a full backwards compatibility model
  - a standard extension mechanism shall enable the use of AIXM for a wider spectrum of aeronautical information services applications.

Extensibility

- Enable additions to the format by stakeholders other than the designers
  - “Changing an XML format by creating subsequent versions is usually done by the entity that controls the format, while extensions are typically added by third parties”
- Increasingly necessary
  - have more data in the XML instances than is described by the AIXM schema and still have a valid document
  - advantages
    - increased adoption of AIXM, through applications for which it was not primarily designed
    - reduce pressure on the ACCB to include in the model data local constructs

Extensibility

- One possible mechanism
  - Recently tested for ‘ICARD’ database
    - Some difficulties have been identified
  - Requires further thinking and testing before being implemented in AIXM



AIXM and GML

- AIXM does not have a defined geometrical model
  - Descriptive approach "how the shape was built/defined“
  - For example, the shape of an airspace may be defined:
    - using a series of vertex or
    - using a series of vertex in which we intercalate references to pre-defined open polylines called ‘geographical borders’, such as State political borders or
    - using airspace aggregations: rather than defining a border for it, the airspace is declared as being the result of unions, subtractions and intersections of other airspace or
    - using ‘same horizontal shape as other airspace’ associations.
  - Other features have a simple point by point description, as it is the case for ‘centrelines’
- Inside a database/application, such descriptions are usually converted into geometrical representations specific to that system (Oracle Spatial, ESRI, etc.)

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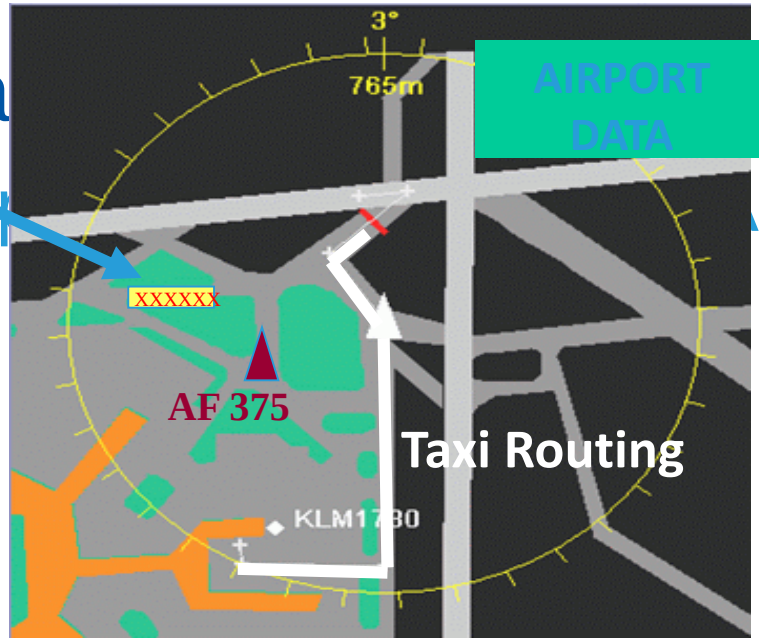
AICM/AIXM 4.5

- Main intended changes
  - New model for obstacles
    - point, line polygon
    - compliant ICAO AMDT 33 to Annex 15
  - Revised model for SID/STAR/IAP procedures
    - RNAV procedures
    - TAA model
  - Other changes
    - Oxygen services, APU units, etc.
  - Full application of the approved principles
    - Extensibility
- Intended publication date – summer 2005

AIXM 5.0

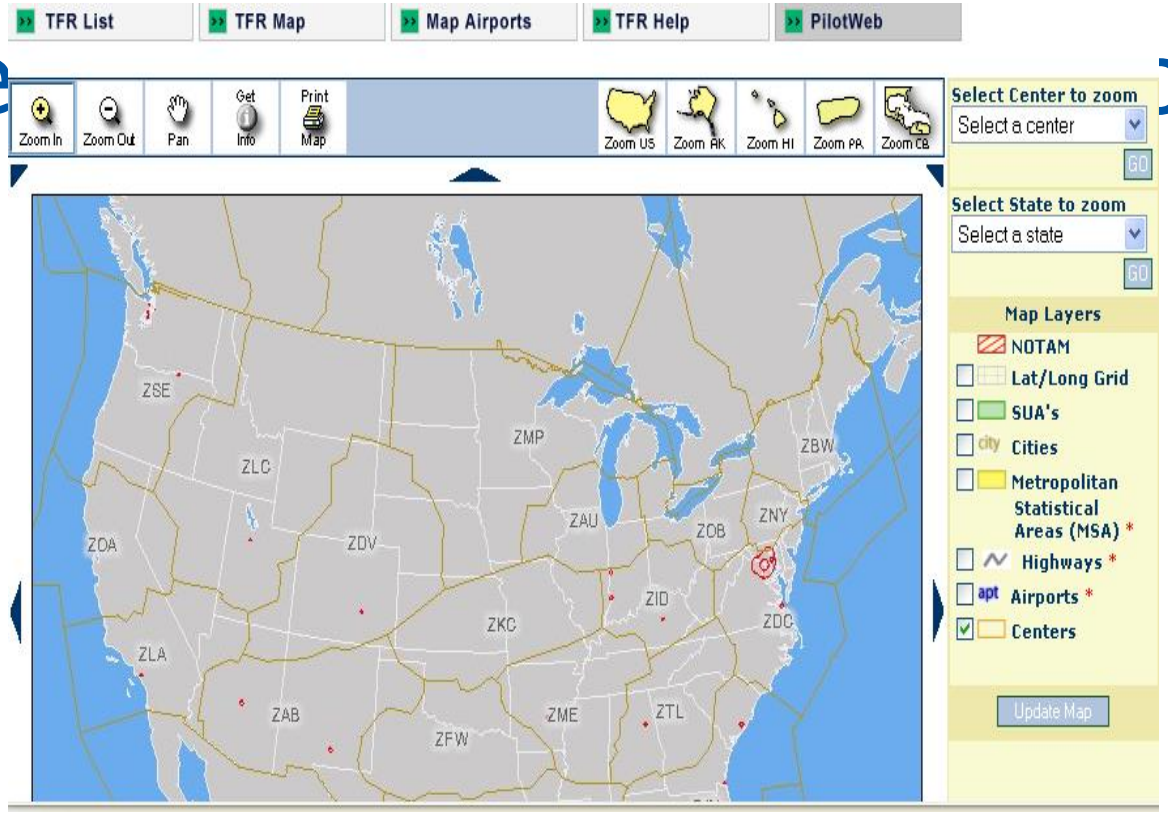
- Main intended cha
  - Notification of temp M)

NOTAM (TWY closed)



Urgent need for fully computer interpretable real-time updates

Te ons


TFR List
TFR Map
Map Airports
TFR Help
PilotWeb
Zoom In
Zoom Out
Pan
Get Info
Print Map
Zoom US
Zoom AK
Zoom HI
Zoom PR
Zoom CB
Select Center to zoom
Select a center
GO
Select State to zoom
Select a state
GO
Map Layers
NOTAM
Lat/Long Grid
SUA's
Cities
Metropolitan Statistical Areas (MSA) *
Highways *
Airports *
Centers
Update Map
ZSE
ZLC
ZMP
ZBW
ZOA
ZDV
ZAU
ZOB
ZNY
ZID
ZKC
ZDC
ZLA
ZAB
ZME
ZTL
ZFW

xNOTAM – example

- Danger area activation – current NOTAM

(A1905/04 NOTAMN
Q) LGGG/QRDCA/IV/BO/W/000/150/3648N02342E028
A) LGGG
B) 0411010600 C) 0412311300
D) NOV 01 TIL DEC 31 DAILY 1600-1930
E) LGD76 KARAVIA ISLANDS ACTIVATED RAC 5-1-9 REF.
F) AMSL G) FL150)

Danger area activation - xNOTAM

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    <Ase>                                                       (affected facility)
     <AseUid><!—Airspace Identifier -->
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     </AseUid>
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     <Att>                                                      (activation time)
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       <Timsh><codeTimeRef>UTC</codeTimeRef>
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     <TEMP until="2004-12-31T11:30:00" />                       (is temporary)
</Changed></Group></AIXM-update>
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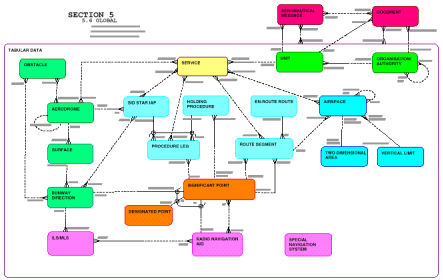
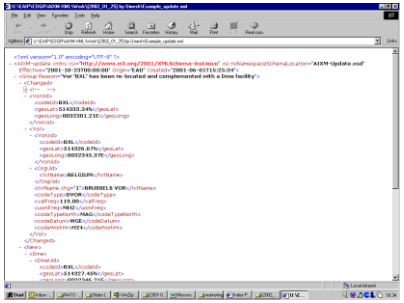
Conclusion

AICM = Aeronautical Information Contual Model

AIXM = data exchange specification based on AICM





AICM

- entity-relationship model
- based on ICAO Annexes, world-wide AIPs, ARINC 424, etc.

AIXM

- XML Schema
- Human and machine readable
  - Typical for the aviation domain
  - Examples: NOTAM, flight plan, MET messages ...

ICAO

THANK YOU