

Global Information Management

IWXXM Experience From Application Developer Perspective

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Federal Aviation
Administration



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Agenda

- Frequentis California
- Introduction to IWXXM
- Problems
- Recommendations
- Conclusion



Frequentis California

- Frequentis California
 - Incorporated in 2010 after the acquisition of Global Weather Dynamics by Frequentis AG
 - **Offers Message Handling (AMHS) and Aeronautical & Weather Information Management Systems**
- Global Weather Dynamics (GWDI)
 - Was created in the 70s and originally provided **weather forecast to the US Navy**
 - In 1990 GWDI developed the application software for the **FAA WMSCR system**
- Staff with strong **domain expertize in weather management**



Our Interest with IWXXM

- **smartWeather-** Weather Information Management System
 - Supports Acquisition, Management, processing data access and visualization all type of weather information
 - Upgrading to support IWXXM/WXXM
- **smartIWXXMconverter-**IWXXM Converter
 - Supports bi-directional conversion between TAC and IWXXM



Introduction to IWXXM

- Managed by ICAO and WMO
- Strict and complete representation of **ICAO Annex 3 products**
- Defined by **XML Schema** (generated from a UML Model)
- Aligned with:
 - **ISO standards** for geospatial information, including the **GML** (Geography Markup Language)
 - **OGC Best Practices for geospatial information**, including the Observation & Measurement model
- Rel 1.1 is the current released version



Advantages of IWXXM

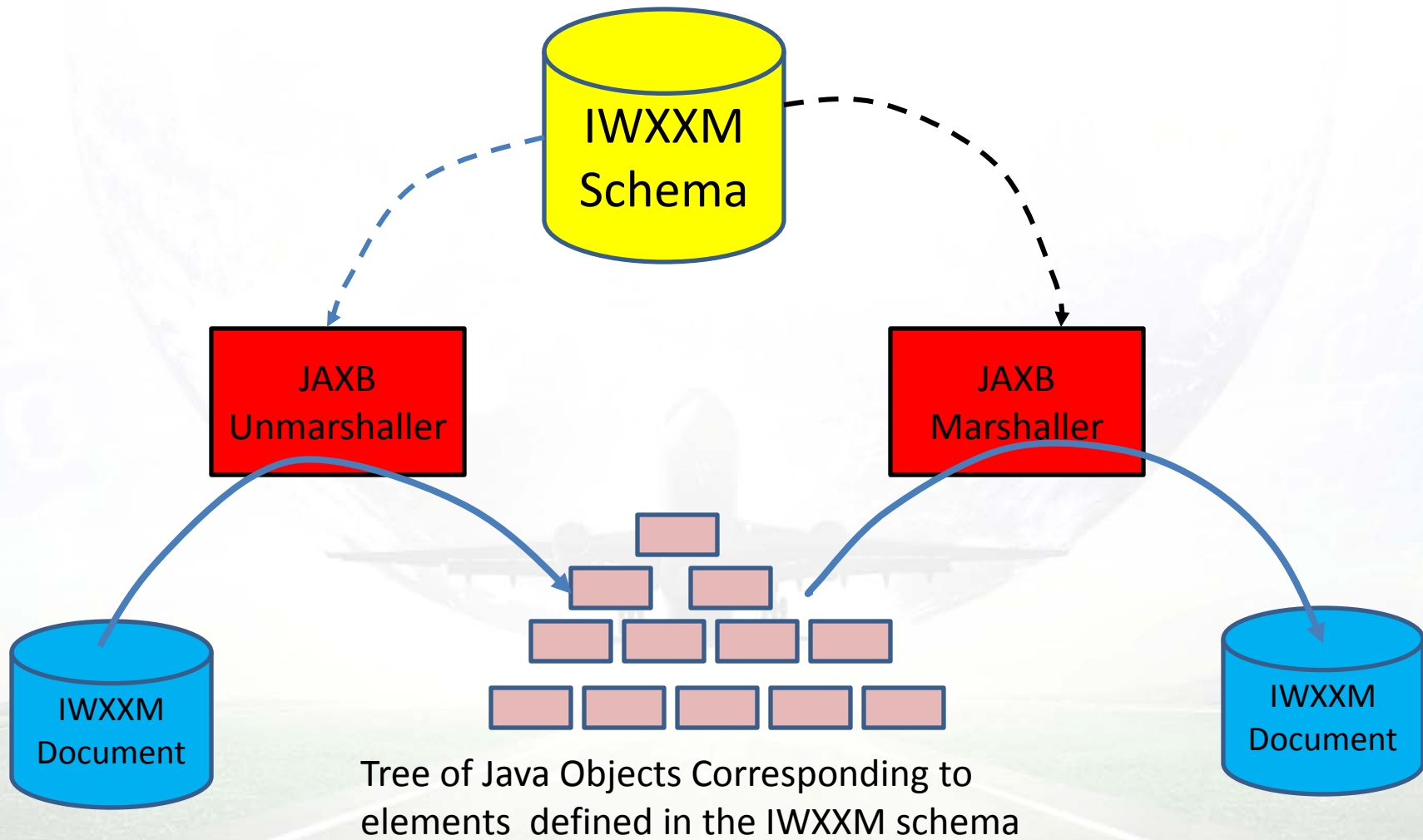
- **Avoid Problems** of badly formatted TAC Data
 - Ensures Valid Data Structure
 - Promotes Valid Content
- **Harmonization** with AIXM and FIXM

Technology Used

- **JAXB**
 - Java Architecture for XML Binding
 - Public Domain Software Package
- **Decode/Encode IWXXM documents**
- Significant **Labor Savings**
- Ensures **Compliance** with IWXXM Schema



JAXB



Tree of Java Objects Corresponding to elements defined in the IWXXM schema

Problems

- **Dual Models:** IWXXM vs WXXM
- **Incomplete** – Currently does not handle all TAC data
- **Complex-** Adoption Of The Full Range Of OGC Standards Makes IWXXM large and complicated
- **Huge Product Size-** 100+ Times Larger Than TAC Data Equivalent

Problems (Continued)

- Carries Large Amounts of Data of **No Operational Significance (Metadata)**
- Offers **No Functional Improvement** Over TAC Data Formats
- **Not Human Readable** – Requires an HMI which is undefined.

Complexity

- The IWXXM standard consists of **4 Parts**:
 - ICAO Defined: 69 Elements
 - WMO defined: 72 Elements
 - OGC Defined OpenGIS: 379 Elements
 - ISO 19139 (Metadata): 293 Element
- 141 Elements
- 672 Elements
- In Theory, Aviation Weather is Geospatial in Nature. In Fact, It is **Only Marginally So**.
 - The Adoption of The OGC Standard Makes IWXXM **difficult To Implement**.

Complexity (an Example)

- TAC Format:

- “W07305 S2705 WI 150NM OF TC CENTER TOP ABV FL500”

- IWXXM:

```

- <iwxxm:geometry>
- <saf:AirspaceVolume gml:id="as1">
  <saf:upperLimit uom="ft">50000</saf:upperLimit>
- <saf:horizontalProjection>
  - <gml:Surface gml:id="tc-obs-N2706-sfc" srsName="http://www.opengis.net/def/crs/EPSSG/0/4326">
    - <gml:polygonPatches>
      - <gml:PolygonPatch>
        - <gml:exterior>
          - <gml:Ring>
            - <gml:curveMember>
              - <gml:Curve gml:id="curve01">
                - <gml:segments>
                  - <gml:CircleByCenterPoint numArc="1">
                    <gml:pos>27.06 -73.06</gml:pos>
                    <gml:radius uom="n.mi">150</gml:radius>
                    </gml:CircleByCenterPoint>
                  </gml:segments>
                </gml:Curve>
              </gml:curveMember>
            </gml:Ring>
          </gml:exterior>
        </gml:PolygonPatch>
      </gml:polygonPatches>
    </gml:Surface>
  </saf:horizontalProjection>
</saf:AirspaceVolume>
</iwxxm:geometry>

```

Data of No Operational Significance

- **Lack of Guidance with FIR Boundaries**
 - Why are FIR boundaries included?
 - How are these thinned (FIR boundaries often consist of thousands of coordinates)?
- **Lack of guidance with Metadata**
 - How are these fields defined?
 - What is to be included and why?

IWXXM is Incomplete

- Only Support **Textual Reports** (does not include binary/image data)
- Currently Only Support METAR, TAF and SIGMET
- **No Support for Other Annex 3 Text Products:**
 - AIRMET
 - Aerodrome Warnings
 - Wind Shear Warnings
 - GAMET
 - Tropical Cyclone and Volcanic Advisory Messages
- **Little information about Roadmap** of future Development

Simple Aeronautical Features

- When originating IWXXM data, **aeronautical reference data must be added** to the document
- SAF is a schema that defines **how this data is to be presented** (formatted) in the IWXXM document
- SAF defines a **small subset of AIXM data**: aerodrome, airspace, runways, and organizational units

SAF (Continued)

- The definition of SAF does not specify **how this data will be made available to IWXXM data originators (Not Defined)?**
 - Is it intended that **some agency will provide a SAF conforming source** for this reference data
 - Is it intended that IWXXM data originators **access an AIXM database** to obtain this data?
- Data defined by SAF is **of little operational use** (FIR boundaries, GML ID)
- Another issue: Is the GML ID in IWXXM documents **supposed to be the same** as defined in AIXM?

WMO Reference Data

- Much of IWXXM Content Refers to **WMO Tables Published in WMO Publication 306** and also Available on the Internet
- The Originator Of IWXXM Data **Needs To Access These Tables** and/or Maintain Local Copies
- These Tables are **Very Static**
- This Reference Data **Should be incorporated into the IWXXM Schema** rather than a reference to an external source

Schematron Validation

- Ensure that the XML follow the validation rules
- These Validation Rules Are Defined in the IWXXM Schema
- The validation are **only high level** and we see **little value** with these rules

Nits

- Examples of IWXXM small problems that need to be corrected or resolved:
 - The IWXXM Schema Is Unable To Support Operators Such as **“Less Than”** or **“Greater Than”** When Applied to Any Parameter Measurement
 - There Is **no possibility to specify** if SIGMET data Is an **observation** or a **forecast**.

Support

- We appreciate the great effort made in the development of the IWXXM model
- We have found the forum for discussion **slow to respond** and ability of the authors to **make adjustments** limited by approval procedures
- The availability of samples of IWXXM Data is **very limited and obsolete**



Recommendations

- Accelerate the inclusion of **all other textual data** formats into IWXXM
- **Resolve the purpose and source** of Aeronautical Reference Data (SAF)
- **Simplify IWXXM Model**
 - **Remove Reference to OGC standards**
 - **Remove data** of little or no operational significance (metadata, FIR boundaries)
 - Alternatively **provide guidelines** for the metadata (what metadata to be included and in what format it should be)



Recommendations (Continued)

- Consider **including WMO reference data** in the IWXXM model itself
- Provide **more example of XML documents**
- Update the IWXXM **primer**
- Establish some **conformance testing procedure**
- Develop **guidelines** for a generic IWXXM HMI
- Improve **responsiveness** to user community by the IWXXM working group

Conclusion

- IWXXM will happen as it is **mandated** by ICAO
- **Problems** outlined in this presentation (technical, documentation, testing) **will be resolved**
- Real Problem- Users do not understand the **operational benefit** of IWXXM -> delay the adoption
- More work needs to be done with data querying/manipulation/visualization **to convince the community of the benefits of IWXXM** -> Frequentis Digital Briefing Prototype with Eurocontrol