xNOTAM/AMDB study

"Study on the applicability of the xNOTAM concept for updating Airport Mapping Database (AMDB) applications"

Darmstadt University under contract of EUROCONTROL

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Funded by and in corporation with EUROCONTROL, we are currently performing a study on the applicability of the xNOTAM concept, which is AIXM messages announcing changes with temporary effectivity for updating AMDB applications.

The objective of this study is to enable and demonstrate one of the many use cases for AIXM 5.

We want to show the additional benefit that can be achieved when even short-term and temporary changes, as they are announced by means of NOTAM today, can be distributed in a computer-readable format.

NOTAM of today have one important drawback. The actual information, contained in Item E as plain text must is subject to human interpretation. It is left to the pilot to merge this textual information with what his onboard systems tell him about his environment, as they are not aware of this short-term change. With AIXM 5, we are able to make our applications aware of this information and, for example, graphically depict it.

Task 1: Gap Analysis AMDB – AICM

- Objective: Extend AICM to incorporate airport mapping data
- Basis: AICM 4.5 and AMDB Specifications
- AICM Extension
  - New/changed entities, attributes, relations
  - Main Extension: Generic Geometry Support (GIS)
- Prototype AIXM schema with AMDB support
  - Based on GML: support of generic geometric constructs

Main Result

AICM/AIXM with generic geometry support is easily extendable to incorporate AMDB data

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The first task of the study was a gap analysis between AICM and AMDB in order to make AICM ready to incorporate AMDB data. We used as a basis for this analysis the latest version of AICM, 4.5, and the RTCA and EUROCAE documents DO-272 and DO-291, specifying user requirements and interchange standards for aerodrome mapping data. As part of this gap analysis we proposed extensions to the model filling the gaps identified. A crucial requirement for this to work was the support of generic geometries as in Geographic Information Systems (GIS) which was foreseen for AIXM 5 anyway.

To materialize the results we created a prototype AIXM schema with all extensions proposed for AICM implemented. This implementation is based on GML as AIXM 5 is. We will hear more about this topic later on this conference.

The main finding of the analysis was that, given the GIS base of AIXM, the gaps could be easily filled and AIXM is now ready to incorporate airport mapping data.

Task 2a: Gap Analysis NOTAM – AICM

- Objective: Extend AICM to support NOTAM information
- Analysis of NOTAM Selection Criteria (NSC) of aerodrome related NOTAM
  - Mapped NSC to AICM entities and attributes
- AICM Extension
  - New/changed entities, attributes, relations

Main Results

- Extended attribute values and use restrictions
- Working hours for objects
- Analysis of NOTAM texts important

CPDLC

ATIS

NOTAM

AIP
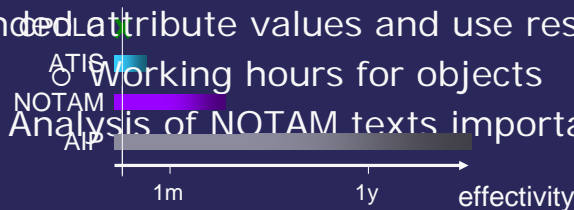
1m   1y   effectivity   4

The second part of the study was the NOTAM – AICM gap analysis where the objective was to find out what has to be added to AICM to store temporary and short-term information as it is announced in NOTAM today.

We started with an analysis on the model level by taking the NOTAM Selection Criteria (the Q-code) from the Q-line of NOTAM as an classification criteria of NOTAM content and mapping this to the entities, attributes and relationships of AICM 4.5 with the AMDB extensions from the former task. This analysis again resulted in some extensions to the model.

The major gaps we identified were based on the fact that AICM until the current version 4.5 was used exclusively to describe AIP data with a life-time of months to years. But NOTAM information with a shorter lifetime (effective only for several days to months) describes the situation more specifically. For instance, if the status of a runway is described in an AIP as "open", a NOTAM could limit this general status for a given time period to "open for landing only", which would not be described in an AIP and was thus not a valid value for the status-attribute of a runway in AICM before.

In order to make this point clear, here are more examples: The same status attribute would have to allow even more values when the lifetime of the information is only in the range of hours as in the Automated Terminal Information Service (ATIS), a broadcast radio service for pilots informing about the current situation at an airport. A possible status of a 2-direction runway would be here, that only direction 25 is currently usable for landing because of the winds, while Controller Pilot Data Link Communication (CPDLC) used for example to give take-off clearance supplies information only valid at a specific point in time and a possible value for the runway status would be here "clear for take-off".

So we found that a couple attributes needed extended lists of values and we added in attributes for use restrictions. Further, NOTAM often announce specific operation times for an object and we thus related the working hours entity that already existed in AICM to many more objects.

Finally, we noted that the classification of NOTAM after NSC is not enough for an in-depth analysis. The actual information contained in Item E) has to be investigated for many NOTAM.

Task 2b: Prototype AIXM 5 Schema

o Objective: Integrate "NOTAM" extensions in AIXM and evaluate AICM temporal model

o First AIXM 5 implementation

o Temporality model based on GML support for dynamic features: "Timeslices"

Main Result
AIXM 5 temporality model based on GML's timeslices seems appropriate for our needs

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As the next step we implemented all the necessary extensions in a prototype AIXM 5 schema for aerodrome data. Within this first implementation of AIXM 5 following the UML model and the White Paper that is presented on this conference we evaluated the temporal model that was proposed for AICM. This model that we will hear more about in a later presentation is based on GML's support for dynamic features, the so-called "timeslices".

We found that this temporality model is sufficient and appropriate to achieve the main objective of this study: updating an airport mapping database application with temporary information.

Task 3: Demonstration of Results

o Scenario: Display temporary change in processed form to cockpit crew
- Use AIXM5 message to announce temporary change
- Merge change information with onboard database
- Display information on airport moving map

AMDB

AIXM5 msg → AIXM Decoder →

Attention: Taxiway P closed!
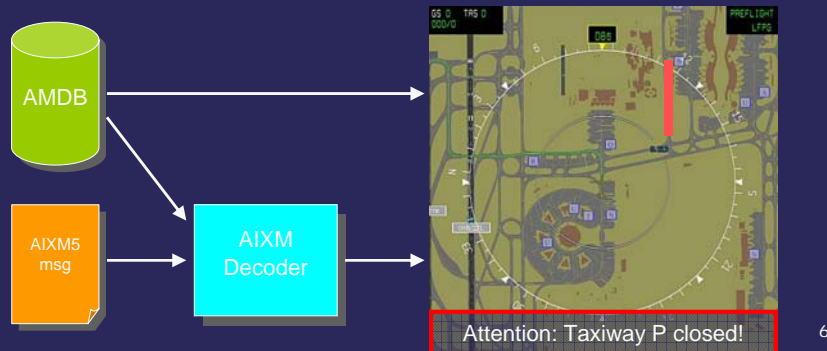
The final task of this study will be the demonstration of the results in the cockpit simulator at Darmstadt University end of March this year.

We want to demonstrate the additional benefit for a pilot when NOTAM information can be graphically depicted within a moving map application for taxi situational awareness. This application operates on static AMDBs.

An AIXM 5 message is used to announce a temporary change.

This dynamic data is merged with the static data from the AMDB

and depicted on the display.

Demonstration Scenario

○ Three typical situations announced in NOTAM

- "Runway Closed" (NSC QMRLC)

  Q)EDBB/QMRLC/IV/NBO/A/000/999/5125N01214E005

  A)EDDP B)0509290600 C)0512312359

  E)RWY 10/28 CLSD.)

- "Taxiway Partially Closed" (NSC QMXLC)

  Q)EDFF/QMXLC/IV/M/A/000/999/5002N00834E005

  A)EDDF B)0512192130 C)0512230500

  E)TWY N BTN TWY M AND TWY Q CLSD.)

- "Obstacle Erected" (NSC QOBCE)

  Q)EDFF/QOBCE/IV/M/A/000/999/5002N00834E005

  A)EDDF B)0512120000 C)0605312159 EST

  E)MOBILE CRANE 1175M BEHIND THR 07R AND 640M S OF RCL,

  ELEV 563FT/229FT GND, ICAO MARKED.

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Three typical situations commonly announced by means of NOTAM were chosen as scenarios: the closure of a runway, the closure of a part of a taxiway and the erection of a new obstacle at an airport. The NOTAM here are real-world NOTAM retrieved from the European AIS Database.

Scenario 1 – RWY Closed

So, the runway-closure announced in this NOTAM here is encoded
in this AIXM 5 message.

This message is used in the moving map application to visually depict the temporary change of the runway status.

Scenario 2 – TWY Partially Closed
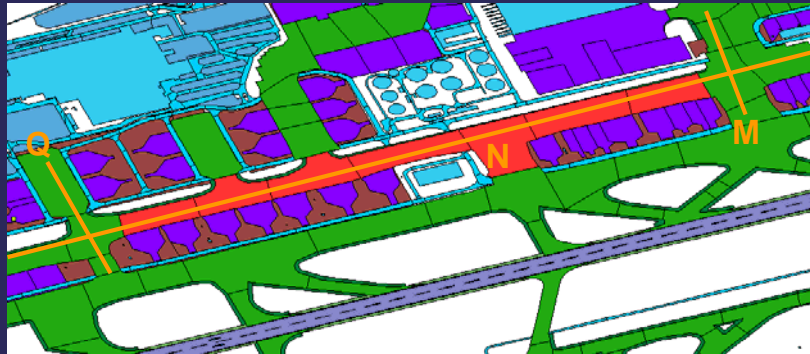
o NOTAM Message
"TWY N BTN TWY M AND TWY Q CLSD."

For the partial closure of a taxiway the situation is a little bit more complex: Since AMDBs provide individual portions of a taxiway as TaxiwayElement features we are able to identify only those elements that are subject to closure.

So, if TWY November is closed between TWY Mike and TWY Quebec,

we can create an AIXM message with the status attribute of just these TaxiwayElements set to "closed".

Scenario 2 – TWY Partially Closed

So, as an enhancement of this free text NOTAM that has to be interpreted by the pilot,

we can now issue an AIXM 5 message and use this message to

depict the respective part of the TWY as closed.

Scenario 3 – Obstacle Erected

In the third scenario, we encode all data of a new obstacle (precise position, height, marking, etc.) in an AIXM 5 message, differing from the first two scenarios where the change of a specific attribute is announced.

This data is – once again – used to visually depict the new obstacle appropriately in the moving map application.

Questions? / Comments!

Thank you very much for your attention. We are at the end of the Case Studies section on this morning and shall now be happy to hear your questions and comments…