International Civil Aviation Organization

MIDANPIRG AIM Sub-Group

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Agenda Item 4: AIM Planning and Implementation in the MID Region

AIM DATA CASCADING EFFECT

(Presented by UAE)

SUMMARY

Generally, one of the essential activity performed by a State AIS is the verification and the validation of the aeronautical data. This is a key component of the AIS Quality Management System (QMS) ensuring the adherence of the aeronautical data provided by the data originators (DOs) to the data quality requirements stipulated in the ICAO Standards and Recommended Practices (SARPS). This Information Paper (IP) scope is to share UAE initiative and practice in the data quality and integrity monitoring.

Action by the meeting is at paragraph 3.

1. INTRODUCTION

1.1 Needless to mention is that the ICAO global roadmap is providing the strategic direction and major principles for the transition to AIM in order for States to move from a product centric to a data centric service provision. The ICAO implementation plan is structured in three main phases i.e. Consolidation, Going-Digital and Information Management stages. However, the global ICAO plan and its 21 steps constitute a minimum list of areas of activities for States to coordinate the transition to AIM between themselves and with ICAO as well as it is the basis for the national information and policy regarding the transition from AIS to AIM.

1.2 For a State AIS, the deciding element in the multi-year ICAO 3-Phase approach plan is to reach the “automation” stage through implementation of an integrated aeronautical information (AIM) database. Definitively, an operational AIM DB is the key differentiator factor for a State in transition process in order to decide between “yesterday” and “tomorrow” of its AIS service provisions level. From this perspective, the ICAO Phase 2 is really THE transition time segment i.e. “today” which is setting the stage for a database centric future.

1.3 Many States have already/due course implemented/implementing an AIM system where the core is precisely a reference database, containing all the data sets necessary to generate (some of) desired output, e.g. electronic AIP (eAIP) and aeronautical charts generation.

1.4 However, so far, a central database is limited in sustaining the required quality of the input data. Therefore, the data quality and integrity monitoring wrapped within the frame of a QMS component shall be the on-going task for organizations producing aeronautical information. Moreover, with the progression to a digital world, the Quality Assurance (QA) aspect should be elevated to an advanced level of importance through all three transition phases, especially in a database repository driven-environment.

1.5 In summary, the QA process significance should be enforced more and more and, finally incorporated into a fully automated IM “ecosystem”!

2. DISCUSSION

Overview

2.1 Data coming from a database are meaningless if not properly manipulated to become a tangible product/application. The data need a context and the context elevates the original data into information. In the ideal world of an automated environment, the data are extracted, temporarily referred, collocated in a specific framework, related to each other and transformed into information. The typical example for a “high end” application should be the data-driven aeronautical chart generation. With the support of an AIM static database repository, the aeronautical chart becomes an information-layered product where each graphical element is synchronized and rigorously linked to the central data stored thru a unique set of attributes (metadata).

2.2 The entire chain, from data origination to end-product/application should be supported by systems that are characterized by a various degrees of automation, hence the ultimate goal is the full automation process. Presently, the existing AIM systems on the market do support to a certain extent only the check of data quality as provided by data originators to the next intended user i.e. AIM office. With other words, a specific piece of data type may be correct in “isolation” from integrity perspective, but in the context of a certain application, e.g. procedure chart, the respective data does not fully cover the inter-relationship with data in correlation.

2.3 To illustrate:

If a data originator is providing a very accurately surveyed to max. feasible resolution degree a set of runway coordinates following a threshold position refinement, it could appear that the updated runway length and bearing are correct, but it may not cover the impact on procedure(s) design, declared distances or obstacle collection surfaces referenced to the respective runway!

2.4 To exemplify the complexity of the review:

The best example is the evaluation of <u>minimum altitude</u> (integrity class = routine data!). The "minimum altitude" term is a very, very generic expression with a variety of meanings depending the specific context of usage. The discussion at the experts level has been reached (almost) a philosophical stage of the debate due to the complexity of data aspects! So far, it has been agreed that the term "minimum altitude" is not posing understanding issues at the expert level when "consuming" Doc. 8168 Vol II as working document, but for other user categories (AIS, ATC, pilots and dispatchers community).

2.5 For this reason i.e. uncertainty of ICAO intention for treating "minimum altitude" in this “all-purpose” way in respect of Appendix 7, Annex 15 listing, it is decided to consider every instance of minimum altitude like, for example, minimum en-route altitude (MEA), minimum holding altitude (MHA), minimum sector altitude (MSA), obstacle clearance altitude (OCA), minimu grid off-route altitude (MORA), TAA, ATC surveillance vectoring altitude, etc. as found in the ICAO SARPS pertaining publication and charting.

2.6 Usually, this task of “data quality check” should be entirely supported by the AIM systems thru verification and data validation assessments performed thru the system build-in, multi-level business rules. To date, the AIM system providers do not satisfactorily fulfil the data validation facet from an “aviation” standpoint, but more focusing on the modelling design (IT) aspects. With other words, from this perspective, there is more room for improvement and the “real life” business rules package development is still pending!

The concept assumption and short description

General

2.7 The topic has been proposed and discussed within the national UAE AIM Technical Committee (AIM TC) meetings. The stakeholders have been expressed the need to have a QA data check in a form of a structured checklist synthesizing, basically, two main information:

a) Where respective data resides i.e. list of AIP text and charts references mindful of the fact that the AIP structure is “redundant” containing same piece of data in multiple locations and,

b) Data dependency i.e. list of affected entity(ies) + AIP/Charts references impacted by the data in a) above;

Assumptions

- Data review has been conducted mainly based on requirements for data publication (Annex 15, Doc. 8126) and charting (Annex 4, Doc. 8697) as well as thru the collateral ICAO/industry documents like Annex 14, Doc. 8168, Vol. II, Doc. 9881 and ARINC 424 standard;
- Consideration is given for both fix-wing and rotor-wing type of operations;
- Review is State “agnostic” i.e. impacted data list contains for the sake of completeness all type of existing and future applications irrespective of the State implementation, so far. For example, HEL PinS operations, SBAS LPV (acft + hel), Aerodrome Mapping Database, Electronic Aeronautical Chart Display or ETOD Area 2 or 3 data collection may not be, to date, implemented by the respective State;
- Data “cascading” effect can be multi-level i.e. frequently, one data type change triggers other type of data which, on its turn generates a deeper, 2nd , 3rd, etc. level of affected data;

  Note – A classic example of a small change (typically within one degree update) with massive and "multi-level" impact is the airport magnetic variation on terminal procedures. Based on this type of effect, ICAO Annex 15 has decided for inclusion in Appendix 4 as major circumstance the "design and structure of a set of terminal procedures bearings due to magnetic variation change".

- Consequently, this document has listed as dependent data, all types of procedure magnetic track e.g. fix formation, segment bearings, reversals, holding track, etc. However, the "consequences" may go deeper into the fix(es) position (lat/long) refinement, hence distances between fixes i.e. 2nd level and then a possible modification of the minimum segment altitude(s) (3rd level) due to fine tuning of the specific protection areas associated to the procedure. Finally, the next affected layer may the ARINC 424 coding where some specific are relying upon update of MVAR.

- From data integrity class perspective, the analysis has been "equally treating" the data. It was obvious that the data impact complexity is not decreasing based on less stringent data integrity class. Repeatedly, critical data had less complex impact in its inter dependency within AIP versus a routine or essential classified data;

Suggestions on Document Usage

2.8 Basically, the spread sheet (Ref. Appendix 1) is a "user friendly" checklist that has to be check marked once the original data is identified in the list. If the review is including the charts, it is suggested to check by plotting and measuring the new/updated position, distance and/or orientation of the data on a Geographic Information System. In this way, the distances and the position coordinates can be measured and any slight change can be detected and reported back. In order to ease the handling of the document, it is also suggested to convert the format from Excel into .html file in order to compress/de-compress the list of data.

Recommendations

2.9 To summarize, the aeronautical data cascade effect document is offering the following benefits:

- Reliable, easy to use guidance material for updating and/or checking "raw" data from DOs;
- Consistent guidance for DOs in order to perform the data check and (possible) impact prior to sending the "raw" information to AIM HQs;
- Increase awareness for detecting "hidden"/less visible data impact;
- Synthesize a basic aeronautical data Entity-Relationship diagram which can be helpful in building the set of business and data check rules for an AIXM database – refer also to paragraph 2.1;
- Constitute the basis for an AIM officer training material;

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note and consider the intention of this information paper; and

b) discuss the conclusions included in this IP.

- END -