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AIS-AIM Study Group Working Status

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TO/AIM

ICAO AFI Region Seminar on Transition to AIM: Phase 1 to 3.

(Dakar, Senegal, 25-26 November 2013)

8 November 2013

Outline

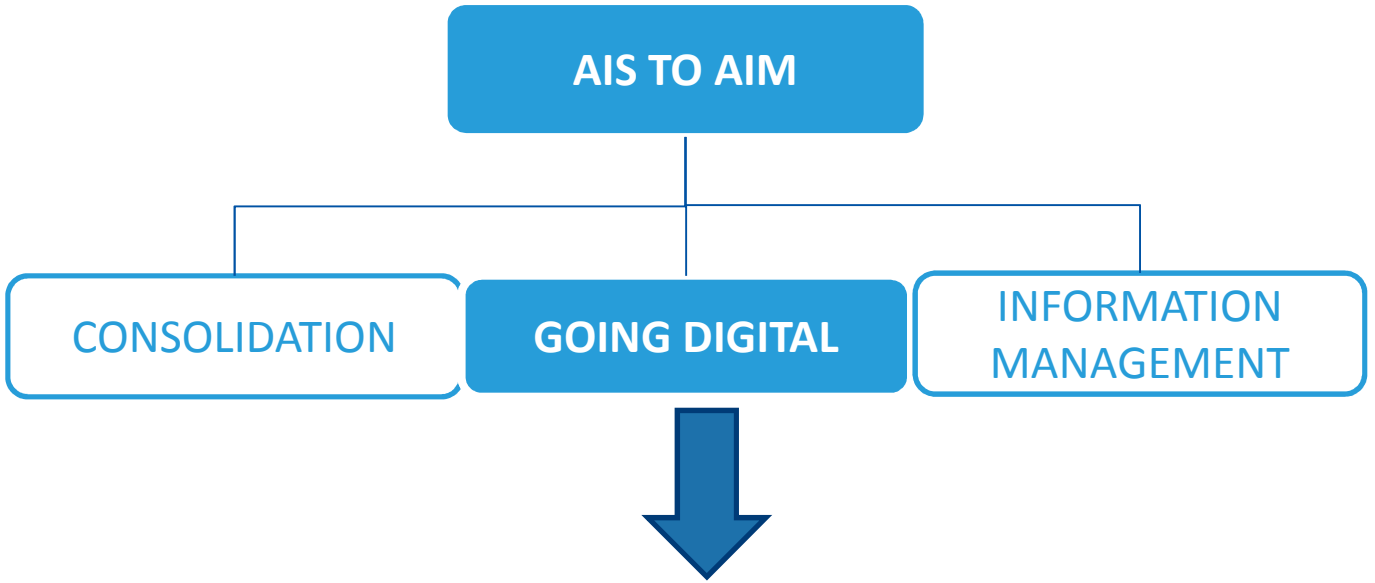
- AIS to AIM Transition Roadmap: Going Digital Phase
- Data Quality Monitoring, Data Integrity Monitoring
- Integrated Aeronautical Information database, Aeronautical information Conceptual Model
- Electronic AIP
- Unique Identifiers
- Terrain Obstacles Aerodrome Mapping
- Summary

Phase II – Going Digital

- During Phase 2 of the transition to AIM, the main focus will be on **the establishment of data-driven processes for the production of the current products in all States.** States that have not yet done so will be encouraged "to go digital" by using computer technology or digital communications and introducing structured digital data from databases into their production processes. **The emphasis will, therefore, not be on the introduction of new products or services but will be on the introduction of highly structured databases and tools** such as geographic information systems.

- An **aeronautical information conceptual model** will provide guidance for States to implement such digital databases. Guidance material will include advice on a minimum data set to begin a phased development of the database.
- Many States are already providing electronic equivalents of their AIPs, e.g. on CD or on the Internet. These electronic AIPs may be accessible for printing and/or for navigation via a web browser tool. Guidance material that will be based on existing best practices will be provided to States to ensure that new types of media will be harmonized for users.

AIS to AIM : Going digital



Going digital

- Introduction of database driven processes
- Provision of data and information products

P-01 Data Quality monitoring
P-02 Data Integrity monitoring
P-06 Integrated aeronautical information database
P-07 Unique identifiers
P-08 Aeronautical Information conceptual model
P11 Electronic AIP
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P15 Aerodrome mapping

2008	2009	2010	2011	2013	2014	2015	2016

P-01: Data Quality Monitoring
P-02: Data Integrity Monitoring

P-01 — Data quality monitoring

An ongoing challenge for organizations producing information is to ensure that the quality of the information suits its intended uses and that data users are provided with the appropriate information about data quality.

P-02 — Data integrity monitoring

Data integrity requirements introduced by safety objectives must be measurable and adequate.

- What is data quality?
- Monitoring aspects

What is Data Quality?

Annex 15 3.7.6. The established quality management system shall provide users with the necessary assurance and confidence **that distributed aeronautical data and aeronautical information satisfy the aeronautical data quality requirements for accuracy, resolution and integrity** […], and that the data traceability requirements are met through the provision of appropriate metadata […]. The system shall also provide assurance of the applicability period of intended use of aeronautical data as well as that the agreed distribution dates will be met.

- **Accuracy**
- **Resolution**
- **Integrity**

Data Quality means:

Real-world alignment – Reflects the perspective of the data provider

Fitness for the purpose of use – Reflects the perspective of the data consumer

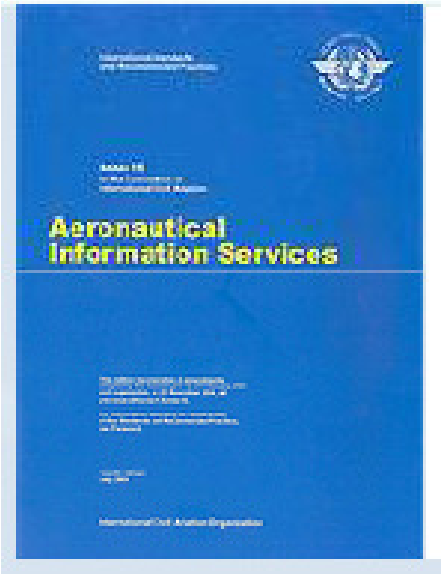
Importance of a QMS

- Within an AIS organization, acceptable data quality is crucial to operational and transactional processes. Data quality is affected by the way data is entered, stored and managed.
- Data process consists of a series of complex functions within a sequential flow, particularly from data origination through to the publication of the AIP and other media derived from the AIP for end-use

As defined in ISO 9000, a **QMS is a management system that directs and controls an organization with regard to quality** (Clause 3.2.3 of ISO 9000). Activities generally include the following:

- Quality Policy
- Quality Planning
- Quality Control
- Quality Assurance
- Quality Improvement

Annex 15 – Data Quality Specifications



3.3 Data quality specifications

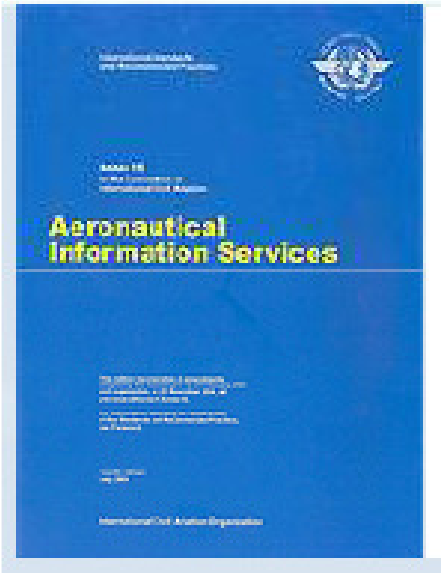
3.3.1 Accuracy

~~3.2.8~~ 3.3.1.1 The order of accuracy for aeronautical data~~, based upon a 95 per cent confidence level,~~ shall be as specified in Annex 11, Chapter 2, and Annex 14, Volumes I and II, Chapter 2. In that respect, three types of positional data shall be identified: surveyed points (runway thresholds, navigation aid positions, etc.), calculated points (mathematical calculations from the known surveyed points of points in space/fixes) and declared points (e.g. flight information region boundary points).

Note.— The accuracy requirements for electronic terrain and obstacle data are specified in Appendix 8.

Accuracy: A degree of conformance between the estimated or measured value and the true value (**HOW CLOSE TO REALITY**)

Annex 15 – Data Quality Specifications



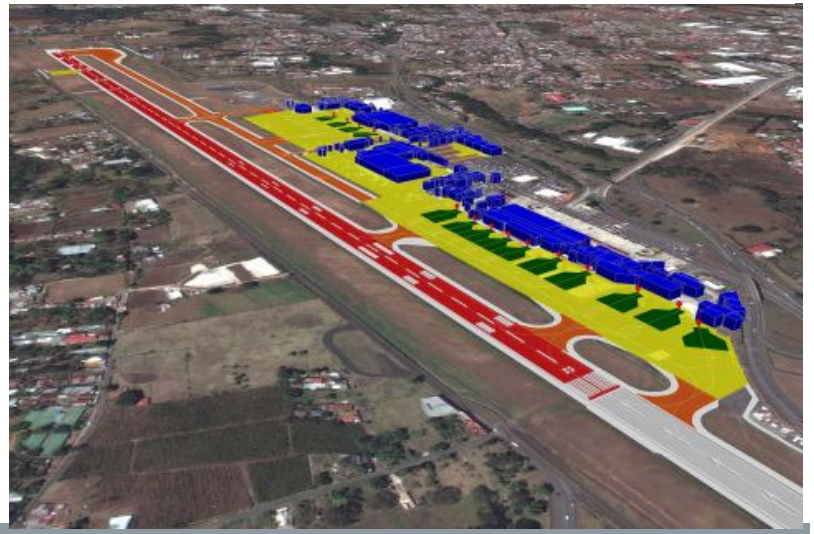
3.3.2 Resolution

~~3.2.9~~ 3.3.2.1 The order of publication resolution of aeronautical data shall be that as specified in Appendices 1 and 7.

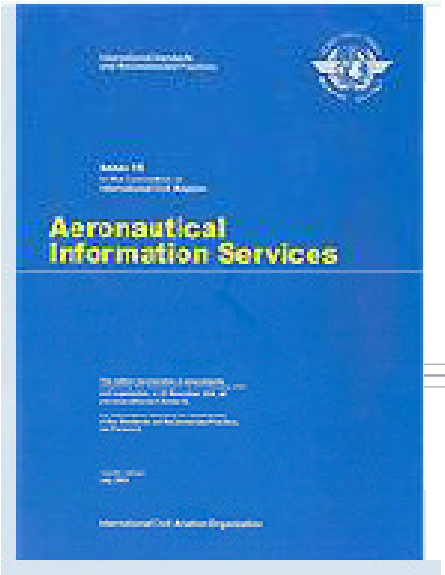
3.3.2.2 **Recommendation.**— *The resolution of the data features contained in the database should be commensurate with the data accuracy requirements.*

Note 1.— The resolution of the data features contained in the database may be finer than the publication resolution.

Resolution: A number of units or digits to which a measured or calculated value is expressed and used **– HOW MANY DIGITS AFTER COMMA**



Annex 15 – Data Quality Specifications



3.3.3 Integrity

~~3.2.11~~ 3.3.3.1 Aeronautical data quality requirements related to integrity classification ~~and data integrity~~ shall be as provided in Tables A7-1 to A7-5 of Appendix 7.

~~3.2.10~~ 3.3.3.2 The integrity of aeronautical data shall be maintained throughout the data process from survey/origin to distribution to the next intended user (the entity that receives the aeronautical information from the aeronautical information service provider). ~~Aeronautical data integrity requirements shall be based upon the potential risk resulting from the corruption of data and upon the use to which the data item is put. Consequently, the following classifications and data integrity levels shall apply~~ Based on

Integrity: A degree of assurance that aeronautical data and its value has not been lost or altered since the data origination or authorized amendment – **HOW GOOD IS THE DATA**

Data Quality Monitoring

QUALITY MANAGEMENT PRINCIPLES (ISO 9001:2008):

Continual improvement. Continual improvement of the organization's overall performance should be a permanent objective of the organization. Specifically, the **effectiveness and suitability of the QMS** have to be evaluated **and areas for improvement identified** and rectified. Management reviews have to be conducted regularly using the data collected from the monitoring and measurement process to identify areas for further improvement. Channels may need to be established to allow all staff in the organization to make suggestions on ways to improve the service.

Process approach :

- the process for review of the requirements related to the products;
- the process for provision of such products; and
- the process for monitoring the quality of the products.

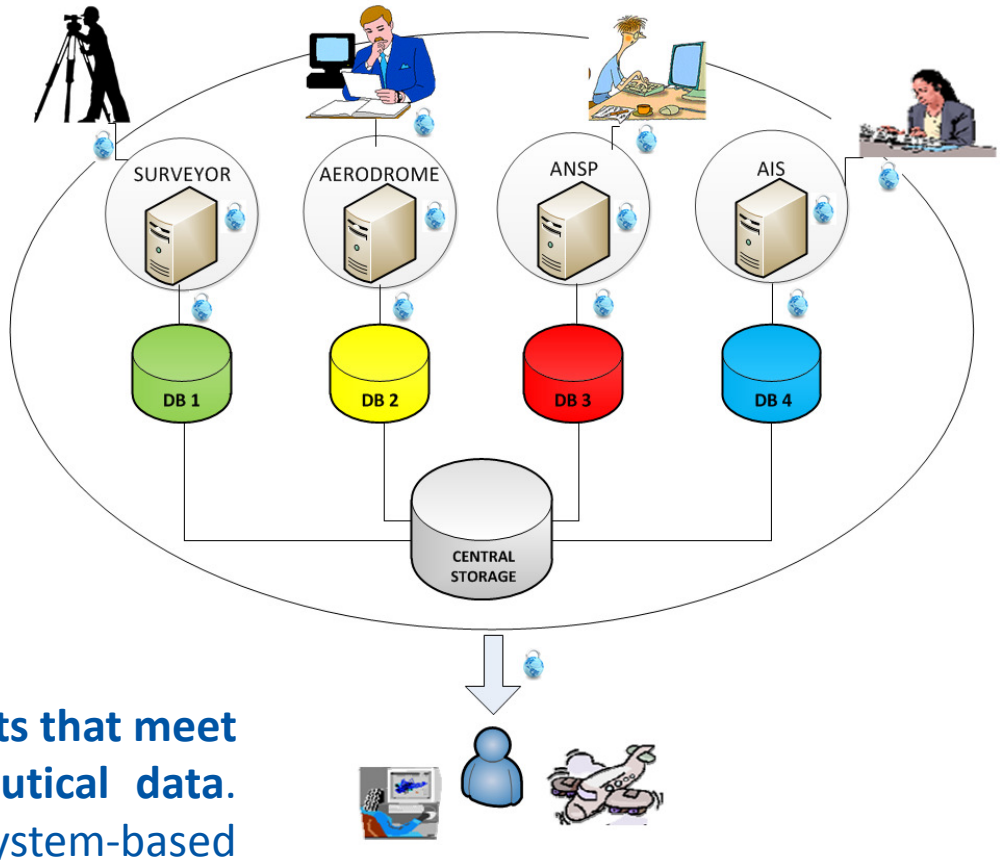
The process approach model and the quality system starts and finishes with the customer. Customer satisfaction is measurable against the initial requirements and specifications. Perhaps the most important feature of the model is the need to obtain information about customer satisfaction, this feeds back into the monitoring and evaluation phase, which are in turn is a measure of overall performance

Data Integrity

- The introduction of complex flows within any element of the Aeronautical Data Chain, such as the transition from data to document or from data import to data export, creates barriers to the maintenance of the quality/integrity of the aeronautical data.
- Although, to an increasing extent, source data is being produced, distributed and stored electronically, transformation from one environment to another provides the greatest challenge to the protection of data integrity throughout the process.
- In order to ensure the end-to-end integrity of aeronautical data, it is essential that **the data process is fully identified, mapped and understood**. The establishment of this process is critical as it identifies the key participants, processes, inputs and outputs that must be addressed in any regularized process.

Data Integrity Monitoring

- Any process is made up of three key elements: **inputs, actions and outputs**. The end-to-end data quality (integrity) process is no exception. Data originators (e.g. surveyors, ATS Personnel, service organizations etc.) will initiate inputs to the process. The activities that are then performed in order to turn inputs into outputs will form actions associated with the process.



- **The outputs of the process will be products that meet the specific needs of users for aeronautical data**. These users may be human-based or system-based (e.g. a pilot using information derived from an AIP or a flight management system using its integrated geospatial data).

Altering Integrity, Altering Quality

The most accurate source of information

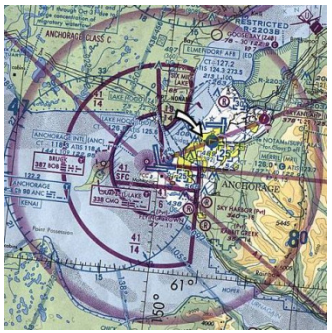
N45° 33` 27.56``
E32° 21` 35.44``

Charting

--ROUNDING--

PUBLICATION RESOLUTION

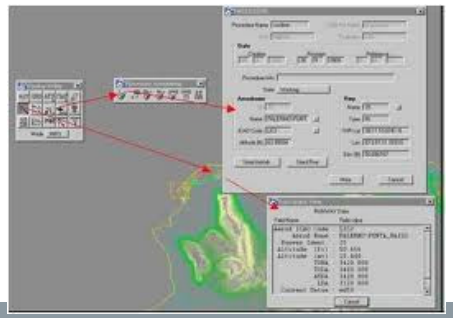
N45° 33` 28``
E32° 21` 35``



Flight Procedure Design

--TRUNCATION--

N45° 33` 27.5``
E32° 21` 35.4``



NOT AN INTEGRITY ALTERATION IF THERE IS A UNIFORMITY OF PROCEDURES!

Altering Integrity, Altering Quality

The most accurate source of information

N45° 33` 27.5``
E32° 21` 35.4``

N45° 33` 27.50``
E32° 21` 35.40``

AS PROVIDED TO THE USER

THIS IS AN ALTERATION OF QUALITY!!!

Integrity Values–not anymore in the SARPS

- Inconsistencies in AIP relating to critical and essential data
- **The values themselves have proven to be problematic**
- For States implementing quality management systems (QMS) the expression of a numeric value of integrity has proven to complicate the effort to develop compliance mechanisms
- ICAO (Secretariat) has concluded that the intent of providing integrity classification can be met by providing **qualitative descriptions of the three levels** (routine, essential, critical) **and developing provisions, which would relate to handling of data that would be incorporated in quality management practices**. The proposal, therefore, has been to delete the numerical expression of integrity classification.
- **The "Data Integrity level" term is changed to "Integrity classification".** The new definition for integrity classification defines the high, low or very low probability for critical, essential or routine data, that when corrupted, would have a potential risk for catastrophe. This corrects the problem of the original specification of numeric requirements for which there was no reasonable means of compliance. Thus, the integrity classification numeric requirements are deleted.

Integrity Values–not anymore in the SARPS

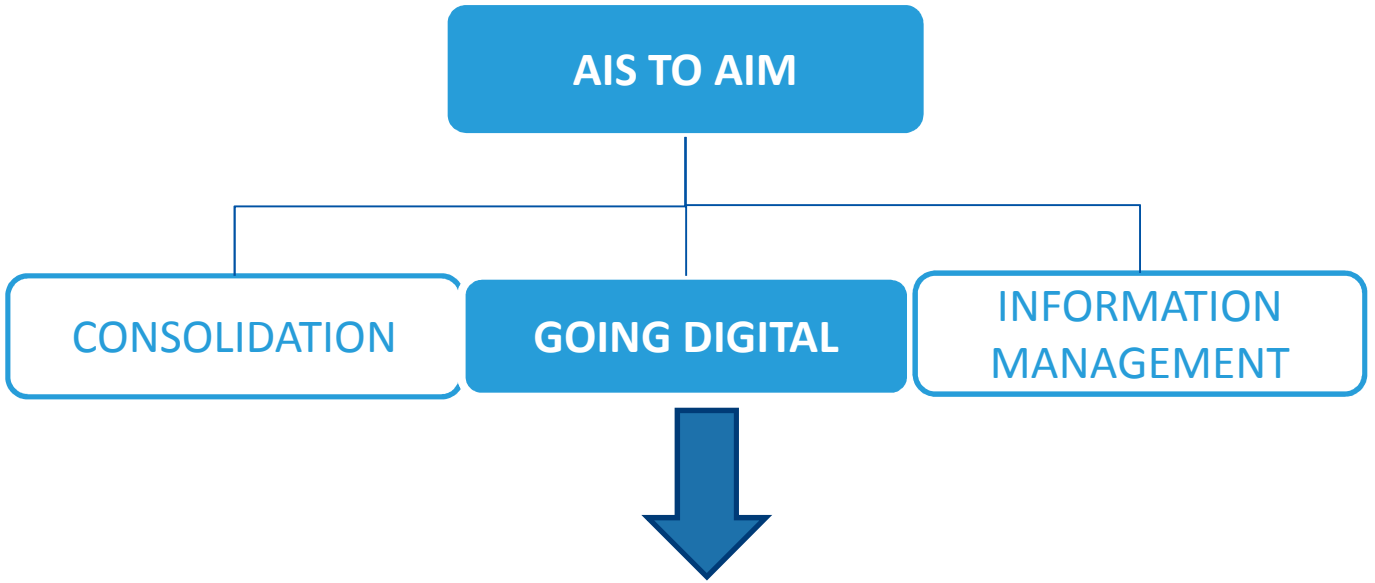
a) For routine data: avoid corruption throughout the processing of the data;

b) For essential data: assure corruption does not occur at any stage of the entire process and may include additional processes as needed to address potential risks in the overall system architecture to further assure data integrity at this level; and

c) For critical data: assure corruption does not occur at any stage of the entire process and include additional integrity assurance procedures to fully mitigate the effects of faults identified by thorough analysis of the overall system architecture as potential data integrity risks.

AMENDMENT 37

AIS to AIM : Going digital



Going digital

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P-06: Integrated aeronautical Information Database
P-08: Aeronautical Information Conceptual Model

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. However, the material that will be provided under Step P-08 will provide guidance that may be used to validate the design for facilitating the future data exchange.

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 existing documentation developed by States and international organizations and considered mature enough for global applicability will be used to produce common guidance material. This may serve as a reference for the database design needed in P-06 for States that do not yet have a database.

Use of automation

Use of automation in Annex 15 has been transformed **from a recommendation to a standard**. New paragraphs are added to address consistency in the formats for delivery and provide performance requirements to enable digital data exchange and the use of aeronautical information and data exchange models to be globally interoperable. Recommendations are provided concerning the performance requirements for the aeronautical information model used and the aeronautical data exchange model that should be used.

3.6 ~~3.6.5~~ Use of automation

3.6.1 ~~**Recommendation.**~~ Automation *~~enabling digital data exchange should~~* shall be introduced with the objective of improving the timeliness ~~speed~~, quality, efficiency and cost-effectiveness of aeronautical information services.

"Automation" in a broader sense → **To get away from paper and undocumented processes**

Use of automation

3.6.2 Where aeronautical data and aeronautical information are provided in multiple formats, processes shall be implemented to ensure data and information consistency between formats.

3.6.3 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.

Note.— Guidance on the aeronautical information and data exchange models may be found in the Aeronautical Information Services Manual (*Doc 8126*).

AMENDMENT 37

Performance requirements

3.6.4 **Recommendation.**— *The aeronautical information model used should encompass the aeronautical data and aeronautical information to be exchanged.*

3.6.5 **Recommendation.**— *The aeronautical information model used should:*

a) use the Unified Modelling Language (UML) to describe the aeronautical information features and their properties, associations, and data types;

b) include data value constraints and data verification rules;

c) include provisions for metadata as specified in section 3.4.2; and

d) include a temporality model to enable capturing the evolution of the properties of an aeronautical information feature during its life cycle.

3.6.6 **Recommendation.**— *The aeronautical data exchange model used should:*

a) apply a commonly used data encoding format;

b) cover all the classes, attributes, data types and associations of the aeronautical information model detailed in paragraph 3.6.5; and

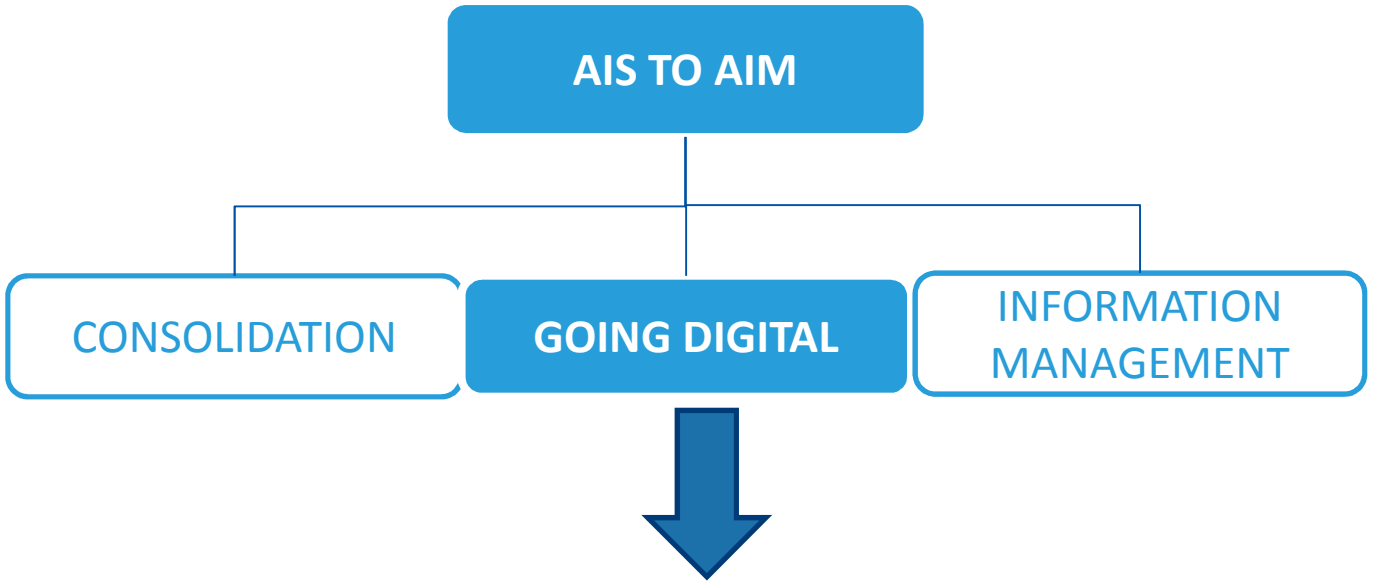
c) provide an extension mechanism, by which groups of users can extend the properties of existing features and add new features which do not adversely affect global standardization.

AMENDMENT 37 TO ANNEX 15

AIXM: example of solution

The US Federal Aviation Administration (FAA) and EUROCONTROL have developed AIXM as a global standard for the representation and exchange of aeronautical information. **AIXM was developed using the OGC Geography Markup Language (GML)** tailored to the specific requirements for the representation of aeronautical objects, including the temporality feature that allows for time dependent changes affecting AIXM features. The overall objectives of the FAA and EUROCONTROL are to use AIXM as a basis for modernizing their aeronautical information procedures and transitioning to a net-centric, global aeronautical management capability. More specifically, AIXM is being used in the net-centric System Wide Information Management (SWIM)-related components of the US NextGen and European Union (EU)'s SESAR programs.

AIS to AIM : Going digital



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P11: Electronic AIP

P-11 — Electronic AIP (eAIP)

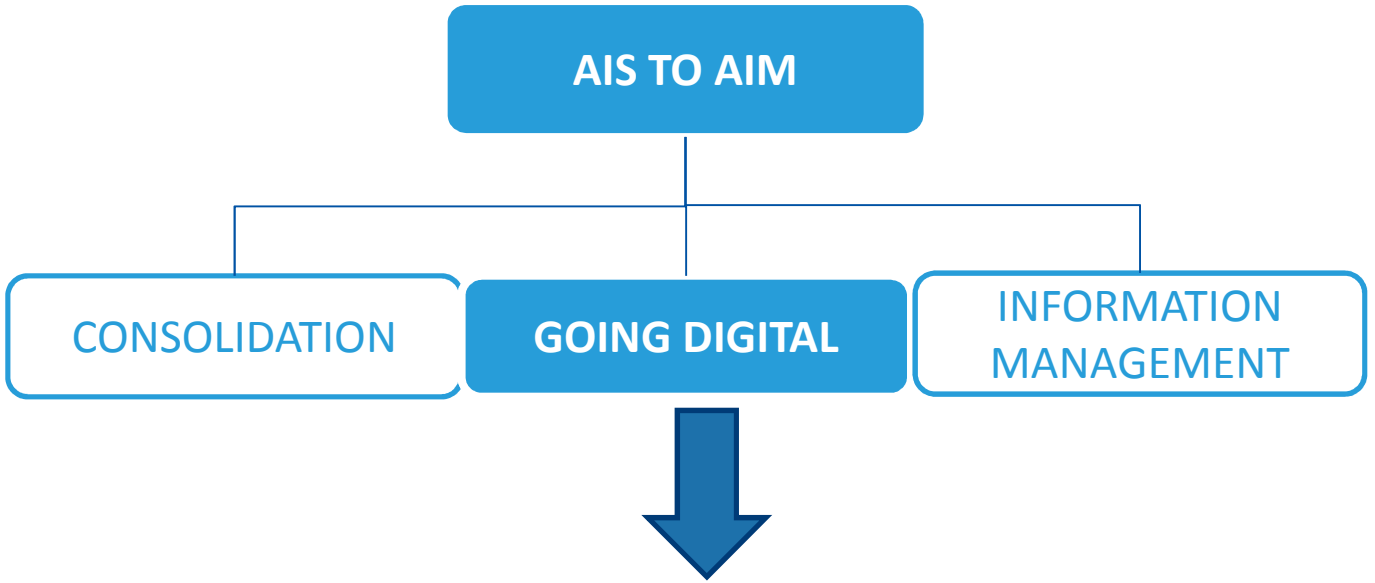
The AIP will not be phased out. On the contrary, **it will be adapted to include the new data products** needed during the transition to AIM.

The electronic version of the AIP will be defined in two forms: **a printable document** and one that can be viewed by **web browsers**.

Guidance material will be required to help States implementing the web browser form of the electronic AIP in order to avoid the proliferation of different presentations of AIP information over the Internet.

- **AIP provides the master source of information about ANS infrastructure**
- **AIP function won`t disappear: the AIP IS THE AUTHORITATIVE SOURCE**
- **From a manually assembled document to a document coming from DATA**

AIS to AIM : Going digital



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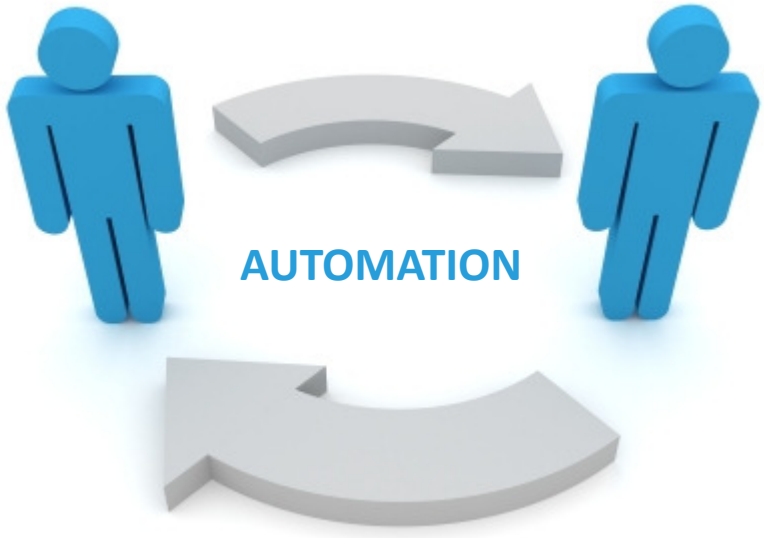
P07-Unique Identifiers

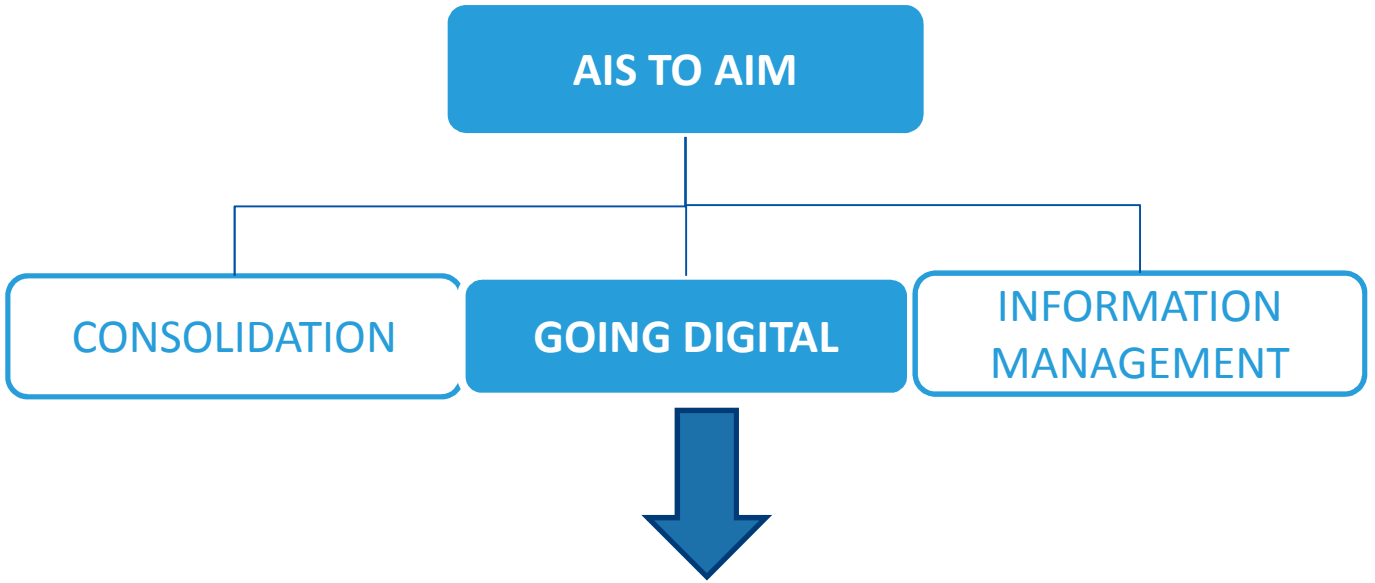
P-07 — Unique identifiers

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.



Make information discoverable!!

AIS to AIM : Going digital



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P13, 14, 15: Terrain, Obstacles, Aerodrome Mapping

P-13 — Terrain

The compilation and provision of terrain data sets is an integral part of the transition to AIM.

P-14 — Obstacles

The compilation and provision of obstacle data sets is an integral part of the transition to AIM.

P-15 — Aerodrome mapping

There is a new requirement emerging from industry for traditional aerodrome charts to be complemented by structured aerodrome mapping data that can be imported into electronic displays

Aerodrome Mapping data

Terrain and Obstacles: Annex 15 Amendment 37 revisions to Chapter 10 and Appendix 8 are limited to simple changes that do not fundamentally change the current requirements that have already been subject to extensive coordination. The purpose is to remove ambiguities by separating the Standards for obstacle data and terrain data in paragraph 10.1.5 into two paragraphs and by clarifying the areas of applicability in other paragraphs and in Appendix 8.

Aerodrome Mapping Data: Chapter 11 is added to support applications that improve situational awareness or supplement surface navigation and thereby provide safety and operational benefits.

AMENDMENT
37

Summary

- **Data Quality Monitoring, Data Integrity Monitoring:** organization's overall performance should be a permanent objective of the organization
- **Integrated Aeronautical Information database, Aeronautical information Conceptual Model**: these are the main steps in Phase 2 of the transition to AIM. Data Driven Architecture.
- **Electronic AIP:** AIP FUNCTION won`t disappear. AIP is the authoritative source.
- **Unique Identifiers:** to make information discoverable
- **Terrain Obstacles Aerodrome Mapping:** importance of datasets


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Thank You