

# AIS to AIM Roadmap Explained

Version 1.0

## REVISION INDEX

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## GLOSSARY

### Terms

**Aeronautical data.** A representation of aeronautical facts, concepts or instructions in a formalised manner suitable for communication, interpretation or processing.

**Aeronautical information.** Information resulting from the assembly, analysis and formatting of aeronautical data.

**<sup>1</sup>Aeronautical information management (AIM).** The dynamic, integrated management of aeronautical information services — safely, economically and efficiently — through the provision and exchange of quality-assured digital aeronautical data in collaboration with all parties.

**<sup>1</sup>Database.** A usually large collection of data stored in structured digital format so that appropriate applications may quickly retrieve and update it.

*Note.— This primarily refers to digital data (accessed by computers) rather than files of physical records.*

**<sup>1</sup>Data set.** Identifiable collection of related digital data.

**<sup>1</sup>Digital.** Involving or relating to the use of computer technology or digital communications.

**<sup>1</sup>Information management (IM).** The processes defined to ensure the collection, utilisation and transmission of quality data that are tailored to the needs of each component of the air traffic management system.

**<sup>1</sup>Interoperability.** The capacity for diverse systems and organisations to exchange information by transferring data and requesting remote services in a manner that requires the client system to have little or no knowledge of the unique characteristics of the server system.

*Note. — This is usually achieved by common understanding of the semantics, the syntax and the protocols for the exchange of data.*

**<sup>1</sup>Metadata.** A structured description of the content, quality, condition or other characteristics of data.

**NOTAM.** A notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

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<sup>1</sup> - Not an official ICAO definition (used in the context of this document only).

## Abbreviations/Acronyms

AICM	Aeronautical Information Conceptual Model
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
AN-Conf/11	Eleventh Air Navigation Conference (2003)
ANSP	Air Navigation Service Provider
ATM	Air Traffic Management
CDM	Collaborative Decision Making
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
GPI	Global Plan Initiative
IM	Information Management
IP	Internet Protocol
PIB	Pre-flight Information Bulletin
RNAV	Area Navigation
RNP	Required Navigation Performance
SARPs	Standards and Recommended Practices
SWIM	System Wide Information Management
WGS-84	World Geodetic System-1984

## ROADMAP STEPS

### INTRODUCTION

1. This document serves to assist states in interpreting and implementing the requirements as listed by the 21 steps of the ICAO AIS to AIM transition roadmap.
2. It should be noted that the 21 steps are linked to one another and failing to implement steps might adversely.
3. The linkages between the steps are similar to those defined in the Aviation System Block Upgrades (ASBU)
4. The 21 steps are defined as:

- P-01 — Data quality monitoring
- P-02 — Data integrity monitoring
- P-03 — AIRAC adherence monitoring
- P-04 — Monitoring of States' differences to Annex 4 and Annex 15
- P-05 — WGS-84 implementation
- P-06 — Integrated aeronautical information database
- P-07 — Unique identifiers
- P-08 — Aeronautical information conceptual model
- P-09 — Aeronautical data exchange
- P-10 — Communication networks
- P-11 — Electronic AIP
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- P-13 — Terrain
- P-14 — Obstacles
- P-15 — Aerodrome mapping
- P-16 — Training
- P-17 — Quality
- P-18 — Agreements with data originators
- P-19 — Interoperability with meteorological products
- P-20 — Electronic aeronautical charts
- P-21 — Digital NOTAM

### THREE PHASES OF THE ROADMAP

1. The phases of the roadmap is not required to be implemented in sequence as some of these elements needs to be implemented in line with others

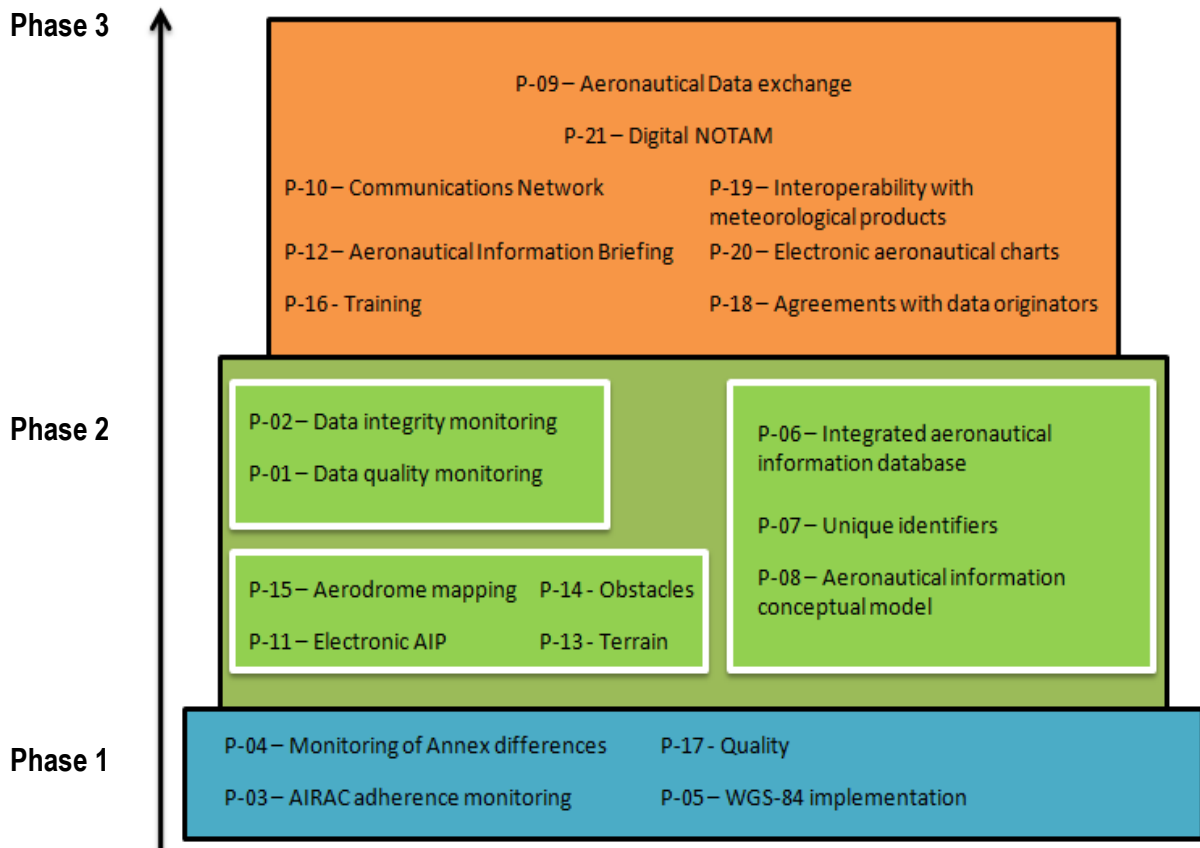


Figure 1. Positioning of the 21 steps of the roadmap in the three phases



## TRANSITION STEPS EXPLAINED

1. Each of the 21 positioning steps from the ICAO AIS to AIM Roadmap is furthermore described below:

### **P-01 — Data quality monitoring**

An on-going challenge for organisations 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.

Description:

*Data quality monitoring is the monitoring of data to ensure it meets the ICAO annex publication resolution and integrity requirements. A quality management system should be implemented to define all activities relating to processing and publication of aeronautical information in procedures and processes.*

*Aeronautical data has 2 components, a static component (information that does not change often, for example AIPs, charts, etc) and a dynamic component (information that changes often, for example NOTAM).*

*The quality of data contained in these components can be measured by the implementation of SLA's (Service Level Agreements) between data originators and Aeronautical Information Service providers, to track the quality of data and to measure it against the ICAO Annex requirements.*

*This can only be enforced by the states regulating authority if adequate national regulations are implemented to ensure accountability for the quality and integrity of aeronautical data.*

*For Dynamic data, Eurocontrol has created guidelines contained in OPADD (Operating Procedures for AIS Dynamic Data) to ensure that NOTAM is issued in a standardised way and to complement the ICAO Standards and Recommended Practices (SARPS) defined in Annex 15 to the International Convention on Civil Aviation and in the Aeronautical Information Services Manual (Doc8126).*

### **P-02 — Data integrity monitoring**

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

Description:

*Data integrity monitoring is the monitoring of the data from originator, through the data process chain, to eventual publication. Data integrity monitoring can be facilitated by the implementation of processes like CHAIN (Controlled and Harmonised Aeronautical Information Network)*

*CHAIN is used to improve the accuracy and quality of the originated aeronautical data and its management from the point of origination to the point of publication and to subsequently enable enhanced processing throughout the entire aeronautical data chain.*

*The purpose of CHAIN is to support aeronautical information regulators and service providers in implementing and maintaining traceable, controlled and auditable processes in compliance with ICAO Annex 15 requirements for data quality with a focus on data integrity.*

### **P-03 — AIRAC adherence monitoring**

The standard regulation and control mechanisms for the distribution of aeronautical information is an essential element ensuring that each person involved makes decisions based on the same information.

Description:

*As defined in Annex 15, AIRAC defines a series of common dates and an associated standard aeronautical information publication procedure for States. This is to allow for the updating of information in electronic systems like Flight Management Systems (FMS) and Air Traffic Control (ATC) Systems.*

*It is essential, for both efficiency and safety, that Pilots, Air Traffic Controllers, Air Traffic Flow Managers, Flight Management Systems and Aviation Charts all have the same data set.*

*The implementation of national regulations and monitoring mechanisms such as auditing in terms of AIRAC adherence would ensure compliance.*

*AIRAC adherence can also be facilitated through the creation of multifunctional teams (Airport companies, ANSP's, CAA's, Airlines, General Aviation, etc) in the planning, design and implementation of airspace, routes, airports, etc.*

### **P-04 — Monitoring of States' differences to Annex 4 and Annex 15**

Adherence to Standards is an ongoing effort. The transition to AIM offers an opportunity to increase the focus on implementation and on reviewing differences in the application of the Standards by States.

Description:

*Differences to ICAO SARP's need to be clearly defined in the AIP of the state under GEN 1.7 as defined in ICAO Doc 8126, chapter 5, section 5.8.*

### **P-05 — WGS-84 implementation**

The target of expressing 100 per cent of coordinates in the WGS-84 reference system is achievable. This is one of the first steps to achieve in the transition to AIM.

Description:

*WGS-84 standard with respect to international civil aviation must be defined in each states national regulation to ensure compliance.*

*Survey requirements for the year survey (full or maintenance survey) needs to form part of the national regulations which would assist not only with data quality but with the implementation of e-TOD as well.*

*The requirement to use a common horizontal, vertical and temporal reference system is essential to facilitate the exchange of data between different systems.*

*Therefore the expression of all coordinates in the AIP and charts using WGS-84 is important and should be enforced by the implementation of national regulations.*

#### **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.

##### Description:

*An Integrated Aeronautical database is a single, centralized repository of aeronautical information where digital aeronautical data from a State are integrated and used to produce current and future AIM products and services.*

*This database must be able to exchange information based on the Aeronautical Information Exchange Model (AIXM) with other aeronautical databases.*

#### **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.

##### Description:

*Data, received by AIS, should receive a unique identifier when the data is processed and stored in the AIS database. Data should already receive a unique identifier when the aeronautical data is entered in the data chain by the original data provider, e.g. surveyor, PANS-OPS designer, etc. That unique identifier shall then be carried through all subsequent processes.*

*The Aeronautical database should be able to use the cyclic redundancy check (CRC) mechanism as defined in ICAO Annex 15 during the transfer of data to guarantee that the unique identifiers are not corrupted during the process.*

#### **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 organisations 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.

New information requirements coming from the Global Air Traffic Management Operational Concept will be analysed and modelled if needed (e.g. airspace sectors, or information related to airspace and route traffic restrictions, or generic information related to aircraft performance, or information related to airline operators' callsigns).

Description:

*The Aeronautical Information Conceptual Model, also known as "AICM", provides a formal description of the aeronautical information items, using a standard data modelling language.*

*This standard data model enables the automated processing of aeronautical information by the end users. Automated processing of data limits the occurrence of human induced errors.*

*AICM forms the basis of the Aeronautical Information Exchange Model (AIXM).*

#### **P-09 — Aeronautical data exchange**

Defining the syntax of the aeronautical data to be exchanged in terms of field names and types is essential for introducing interoperability.

The exchange of data and the mechanisms to exchange or access the new digital products or services will be defined by an exchange model. The content of the model will be driven by the aeronautical information conceptual model (top-down) and by requirements coming from technological choices (bottom-up); the evolution of the model will be coordinated in order to balance the need for innovation with the need for protecting investments.

The use of the Internet as a communication media is, for example, one important bottom-up driver in the definition of the model. The use of well-established, geographic information standards also applied in non-aeronautical domains is another important technological choice.

Description:

*The Aeronautical Information Exchange Model (AIXM) is a specification designed to enable the encoding and the distribution in digital format of the aeronautical information, which has to be supplied by the national AIS providers in accordance with the ICAO Convention.*

*A standard for an aeronautical data exchange model will ensure standardised interfaces between the computers of both providers and users of data.*

*Various other forms of data exchange will be incorporated into AIM:*

*WXXM – Weather Information Exchange Model*

*AOXM – Airport Operations Exchange Model*

*FIXM – Flight Information Exchange Model*

*ENXM – Environmental Information Exchange Model*

## **P-10 — Communication networks**

More data will be exchanged on ground networks and the current data will be exchanged in a form that will require more bandwidth. It is envisaged that a transition of the network to one based on Internet protocol (IP) will be required to cope with these future needs. For the transition to AIM to be effective, the needs of future AIM will have to be declared in terms useable for network specification. Which data network will be used to distribute the new data products and services; what information can be exchanged via the Internet; and what information requires a secured network reserved for aviation are open questions that will need to be answered for the transition to be effective.

### Description:

*Networks utilising Internet protocol for the transmission and dissemination of aeronautical data and information should be implemented.*

*This would also ensure the safety and security of information through the establishment of network security mechanisms and firewalls.*

## **P-11 — Electronic AIP (eAIP)**

The integrated aeronautical information package 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.

### Description:

*The Electronic AIP (eAIP) is a HTML version of the AIP which consists of a set of XML files. (It is not a PDF version of the AIP. The applications used to create the eAIP must be able to create it in accordance with the eAIP specification.*

## **P-12 — Aeronautical information briefing**

Fine tuning of the current NOTAM format by introduction of new selection criteria is needed to improve the selectivity of the information presented to pilots in the pre-flight information bulletin. (This can be done in Phase 1.) The combination of graphical and textual information in a digital net-centric environment will be used to better respond to the airspace users requirements for aeronautical information in all phases of flight when the new digital data products are specified and made available (in Phase 3).

### Description:

*This entails digitalising the traditional paper based pre-flight NOTAM briefing and expanding it to include other aeronautical information/ data elements such as charts and other graphical products as well as metrological data and charts. This also includes using systems that have the capability to filter data to meet specific client product requirements.*

### **P-13 — Terrain**

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

Description:

*States must establish a national digital elevation model (DTM) or digital surface model (DSM) which meets the ICAO Annex 15 requirements for terrain data.*

*The establishment of national regulations would ensure compliance to the terrain data specifications in terms of accuracy, quality and resolution.*

### **P-14 — Obstacles**

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

Description:

*States must establish national regulations for the controlling and monitoring of obstacles in the vicinity of an aerodrome. These regulations should also indicate the four areas (Areas 1, 2, 3 and 4) as specified in Annex 15, chapter 10 and clearly define the process of approval of the obstacle through the Civil Aviation Authority of the state.*

### **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.

Description:

*An AMDB is a Geographic Information System (GIS) database of an airport describing:*

- *the spatial layout of an airport;*
- *the geometry of features (e.g. runways, taxiways, buildings) described as points, lines and polygons;*
- *further information characterising the features and their functions which are stored as attributes (e.g. surface type, name/object identifier, runway slope).*

*As all the information should already be available in AIXM, the GIS system employed by the state should be able to display this information visually.*

### **P-16 — Training**

The training of personnel will be adapted to the new requirements on skill and competencies introduced by the transition to AIM. A new training manual will be developed to reflect the new competencies required.

Description:

*Training requirements for AIS staff must be expanded to include the new requirements of databases, AIXM, XML, HTML, etc.*

## **P-17 — Quality**

Quality management measures will be re-enforced to ensure the required level of quality of the aeronautical information. In order to assist States in the implementation of an efficient quality management system, guidance material for the development of a quality manual will be developed.

### Description:

*States must implement national regulation on the requirement for all organisation involved in aeronautical data processing and publication, to have a Quality Management System in place, which shall manage the safety of all their services.*

## **P-18 — Agreements with data originators**

Data of high quality can only be maintained if the source material is of good quality. States will be required to better control relationships along the whole data chain from the producer to the distributor. This may take the form of template service level agreements with data originators, neighbouring States, information service providers or others.

### Description:

*Agreements with data originators are usually made up in the form of Service level agreements (SLA's). The SLA package is a series of interrelated elements to facilitate the establishment of agreements between aeronautical data originators and Aeronautical Information Services (AIS).*

*The SLA requirement must also be included into the national regulations to ensure compliance.*

## **P-19 — Interoperability with meteorological products**

The meteorological data products of the future will be combined with the AIM data products to form the future flight briefings and the new services provided to all ATM components. This will require that meteorological data be made available in a similar format to the other aeronautical data that are clearly focussing on the use of open standards (such as XML and GML) for the implementation of table-driven data validation built into the data exchange mechanism, whereas current meteorological data products for aviation are based on simple alphanumeric codes.

Now that the bandwidth of telecommunication links and space for digital storage devices are no longer limiting factors, the move towards net-centric and system-wide information management is becoming feasible for the wider distribution of meteorological forecast data from the world area forecast centres in a format that will not require considerable effort for the learning and configuration of decoding software, thereby ensuring true interoperability.

Meteorological information is essential in the compilation of pilot briefings. The transition to AIM will include activities at both the standardisation and the implementation level to find solutions for the interoperability of meteorological data products with the new AIM data products.

Description:

*The established and implementation of an exchange model like WXXM would ensure that data in products like METAR/SPECI/TAF/SIGMET is exchange in digital form in accordance with a globally interoperable information exchange model which will use extensible mark-up language (XML) and geography mark-up language (GML).*

**P-20 — Electronic aeronautical charts**

New electronic aeronautical charts, based on digital databases and the use of geographic information systems, will be defined to complement some paper charts and to replace others that have become obsolete and need to be improved to satisfy user needs. The possibility of deploying these new products over the Internet will be explored.

Description:

A dataset of GML and XML aeronautical, terrain and obstacle data that can be interpreted by systems to produce a graphical representation of the applicable data

**P-21 — Digital NOTAM**

One of the most innovative data products that will be based on the Standard for an aeronautical data exchange model will be a digital NOTAM that will provide dynamic aeronautical information to all stakeholders with an accurate and up-to-date common representation of the aeronautical environment in which flights are operated.

The digital NOTAM will be defined as a data set that contains information included in a NOTAM in a structured format that can be fully interpreted by a computer system for accurate and reliable updates of the aeronautical environment representation both for automated information equipment and for aviation personnel.

Description:

A dataset of AIXM / XML encoded NOTAM that can be exchanged through multiple media and with multiple systems for the updating (temporarily or permanent) of “published”/stored data.



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