efficiently managing air safety

National Roadmap for the Transition from AIS to AIM

FOWARD

The International Civil Aviation Organization (ICAO) has issued the AIS-AIM transition roadmap to serve as a strategic positioning initiative to drive the continuing improvement of aeronautical information services in terms of quality, timeliness and the identification of new services and products to better serve aeronautical users.

The AIS department has analyzed the various steps listed in the ICAO roadmap and prioritized them based on the AIS current status. This National transition roadmap sets a baseline for establishing strategies and other initiatives to advance the AIM objectives and should place the future AIM in a position to better serve airspace users and ATM in terms of their information management requirements.

The expectations are that the transition to AIM will not require many changes in terms of the scope of aeronautical information to be distributed. The major change will be the introduction of new products and services and an increased emphasis on better data distribution in terms of quality and timeliness in order to meet user requirements and contribute to improved safety, increased efficiency and greater cost-effectiveness of the air navigation system.

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GLOSSARY

TERMS

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

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

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.

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.

Data set. Identifiable collection of related digital data.

Digital. Involving or relating to the use of computer technology or digital communications.

Information management (IM). The processes defined to ensure the collection, utilization and transmission of quality data that are tailored to the needs of each component of the air traffic management system.

Interoperability. The capacity for diverse systems and organizations 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.

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.

1. Not an official ICAO definition (used in the context of this document only).
(x) Roadmap for the Transition from AIS to AIM

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

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ATM Air traffic management

EUROCONTROL European Organisation for the Safety of Air Navigation
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

WGS-84 World geodetic system-1984

PROBLEM STATEMNT

We are in the age of the internet, satellite navigation and computer networks. Although the AIS Kenya has automated all its units' i.e NOTAM unit, Flight planning unit, Briefing unit and AIP/MAP unit, the aeronautical information distribution is still based on paper documentation(Paper PIB), paper Maps/Charts, and telex-based text (Text NOTAM).

i) Better aeronautical information is essential if we are to have an integrated and interoperable ATM system that enables air navigation service providers to safely handle more traffic in the same amount of space during the same amount of time. Such a system would effectively link the full range of services from airspace design to flight planning, airport operations planning and flight separation assurance while continuing to maintain the safety and security of the traveling public and lessening the environmental impact on the planet and its population.

ii) Better aeronautical information is essential if we are to have a flexible ATM system that reduces costs and environmental impacts while improving access to congested airspace and remote airports in developing countries. Such a system would allow planners and decision makers to make the right decisions for the development of new tools and techniques based on accurate information available on time and in the right place.

iii) Better aeronautical information is essential if we are to have a system that empowers airspace users by giving them a greater role in shaping the ATM system, and by helping them understand their options and make informed decisions while maintaining public safety and minimizing the impact on the environment. Such a system would be focused on users' needs.

iv) Corrupt or erroneous aeronautical information has the potential to adversely affect the safety of satellite navigation, just as corrupt or malfunctioning navigation aids adversely affect the safety of ground-based navigation.

v) These improvements are central to the Global Air Traffic Management Operational Concept and justify by themselves the name change from AIS to AIM that identifies the new focus on all aspects related to proper information management as opposed to the traditional way of focusing on the provision of standard products to the pilot only.

TRANSITION OBJECTIVES

The main objective of the transition to AIM is to ensure efficient management of quality aeronautical information/data for safe aircraft operations . Other objectives include:

Ensure availability and access, broad-based aeronautical information of a considerably higher quality and in a timelier manner than is generally available today. The provision of aeronautical information is a core element of air navigation services.

EXPECTED CHANGES

The Global Air Traffic Management Operational Concept defines seven interdependent concept components that will be integrated to form the future ATM system. They comprise airspace organization and management, aerodrome operations, demand and capacity balancing, traffic synchronization, conflict management, airspace user operations and ATM service delivery management.

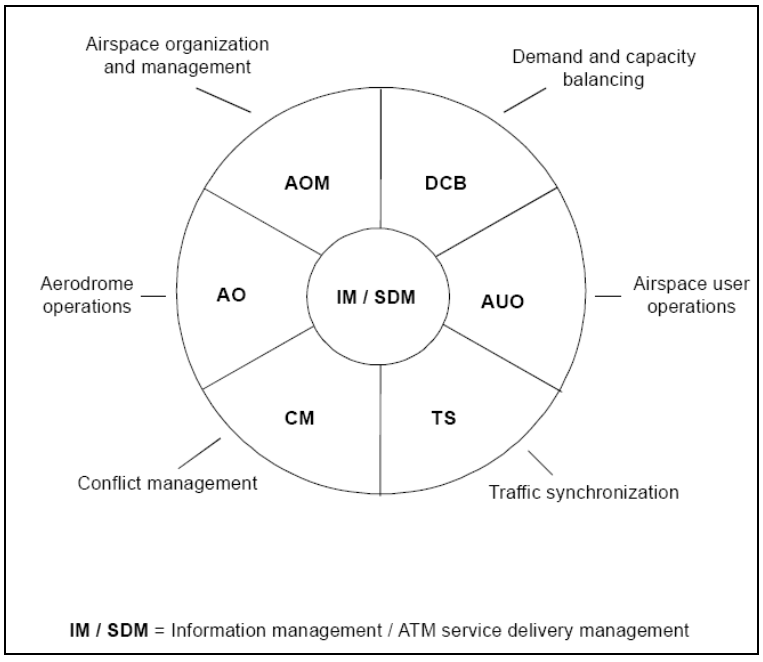

Figure 1:ATM operational Concept

Note: Figure 1 above illustrates how information Management is at the core of air navigation services.

The management, utilization and transmission of data and information are vital to the proper functioning of these components. The exchange and management of information used by the different processes and services must ensure the cohesion and linkage between these seven concept components.

i) **Users**

The provision of aeronautical information today is mainly focused on the requirements of pre-flight briefing. The provision of aeronautical information tomorrow will address the requirements of all components of the ATM system for all phases of flight.

ii) Data

- The shift from standardizing products to standardizing data will enable more freedom in the definition of future products while maintaining a high degree of quality, integrity and coherency of the information contained in these new products. The biggest change in the transition to AIM will be the increased use of computer technology in the management of information, with an increased emphasis on the digital form of data that will drive all processes for the management of information.

- Both graphical and text products will be based on the same underlying, standard definition of georeferenced atomic data. The definition of a Standard for an aeronautical data exchange model will ensure standardized interfaces between the computers of both providers and users of data. This will enable the definition of new products where both text and graphics will be presented in a more readable form. This will enable the definition of new services where the same information will be made available in the decision support tools for all ATM components.

- The current Standard in Annex 15 — *Aeronautical Information Services* is centred on products and does not provide specifications required for digital data exchange. A central element in the transition to AIM will be the precise standardization of atomic data elements in terms of field names, field types and field definitions. This will be provided in the form of an aeronautical data dictionary (also called metadata registry). Furthermore, the definition of standard structured groupings of fields by features, attributes and associations is necessary. This will be provided in the form of a Standard for an aeronautical information conceptual model. Finally, the mechanisms to maintain an up-to-date data set across different components would need to be agreed upon; this will be provided in the form of a Standard for an aeronautical data exchange model. The evolution of these models will be organized at the global level to ensure continuity in the services in a way that allows innovation and new requirements to be taken into account.

By using this approach, the definition of the data products is decoupled from the definition of the end products. The end-user applications, which make use of the information transferred in the form of data sets, do not rely exclusively on the structure and format of the

messages but are free to transform the data and combine it with other data to construct the final view appropriate for the end-user.

iii) Products

- Pre-flight information bulletins are often loaded with information not relevant to the flight because of the limited filtering capabilities that the current NOTAM format has. Pre-flight bulletins are often also difficult to read and interpret because of the lack of graphical capabilities of the current NOTAM format. New products combining textual and graphical information will need to be specified.

- Electronic chart displays are becoming easier and cheaper to install in the cockpit and their functionality is increasing. It is likely that they will progressively complement some paper charts and will replace others, which will require updated Standards and symbols for electronic display capabilities.

- The future capabilities of transferring digital data between the air and the ground will be used for providing new products such as in-flight information bulletins by uploading aeronautical and meteorological information directly aboard aircraft during all phases of flight.

- The AIM concept requires that all aeronautical information, including that currently held in aeronautical information publications (AIPs), be stored as individual standardized data sets to be accessed by user applications.

- The distribution of these data sets will define the new services provided by the future AIM. This will constitute the future integrated aeronautical information package that will contain the minimum regulatory requirement to ensure the flow of information necessary for the safety, regularity and efficiency of international air navigation.

iv) Static versus dynamic information

Stability is essential for proper planning of airspace operations. Examples of changes that must be announced well in advance are:

– the installation or decommissioning of ground-based air navigation aids;
– the opening of a new aerodrome for international flight operations;
– airspace danger and restricted areas; and
– the route structure for major traffic flows.

Events of short duration or with little advance notice are inevitable occurrences. These events must be announced quickly in a manner that is comprehensible by the different components of the ATM system. In an interoperable environment based on data Standards, these two types of information will be transferred by common networks under the same data exchange mechanisms using the same data Standard definitions.

v) AIRAC cycle

- It is expected that the need for aeronautical data to become effective on internationally agreed upon common dates will remain. Coordination and planning constraints require major changes to be announced well in advance and introduced only at regular intervals.

- The quality and integrity requirements of databases will define new roles for human intervention such as verification, monitoring and correction before releasing new data.

- The current cycle is essentially based on the maximum expected time for postal delivery of the paper products. The distribution of data products through data networks will not suffer from the same delay in delivery and shorter cycles will become possible to better match users' needs. Transitioning to a modern distribution mechanism will mean that the specifications for new concepts of operation need not be constrained by a 28-day cycle. The future ATM system will be free to identify a better cycle that will adequately balance the need for improved reactivity with the need for advance planning.

THE ROADMAP TO AIM

The purpose of this roadmap is to develop the AIM concept and associated performance requirements by providing a basis upon which to manage and facilitate the national transition from AIS to AIM inline with ICAO guidance. Three phases of action have been proposed by ICAO to complete the transition to AIM:

Phase 1 — Consolidation
Phase 2 — Going digital
Phase 3 — Information management

Phase 1 — Consolidation

Phase 1, entails ensuring the full implementation of existing Standards as published in ANS Manual of standards. Key elements being:

– Quality requirements;
– AIRAC adherence;
– the provision of terrain and obstacle data (e-TOD).

This involves the introduction of database-driven processes to improve the value of current products by improving their quality and availability for current users.

Phase 2 — Going digital

Phase 2 will involve establishing only one aeronautical database (National database) and also link to the proposed regional databases (AFICAD) in order to produce the existing products and services, with better quality and availability.

The projects in the second phase will be conducted to enhance the quality and availability of existing products within the medium-term of this transition roadmap.

Phase 3 — Information management

During Phase 3, steps will be taken to enable AIM functions to meet the new requirements that will be needed to implement the Global Air Traffic Management Operational Concept in a net centric information environment. The digital databases introduced in Phase 2 will be used for the transfer of information in the form of digital data. This will require the adoption of the AIXM Standard for an aeronautical data exchange to ensure interoperability between national ATM systems not only for the exchange of full aeronautical data sets, but also for short-term notification of changes.

STEPS

Various steps have been proposed to form part of the transition roadmap. These steps listed constitute a minimum list of areas of activities for consideration within the AIS strategic plan. The steps are to be taken as a checklist of high-level actions geared at reducing the duration of the transition.

A close monitoring of the ICAO transition roadmap is necessary as the list may evolve during the transition.

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

Objectives per step

Step 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.

Step 02 — Data integrity monitoring
Data integrity requirements introduced by safety objectives must be measurable and adequate.

Step 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.

Step 04 — Monitoring of differences to Annex 4 and Annex 15
Adherence to Standards is a continuous 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 AIS department.

Step 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.

Step 06 — Integrated aeronautical information database
The establishment and maintenance of a database where digital aeronautical data from a the AIS database 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. The database may be operated by States or by regional initiatives under delegation from States. (E.g. AFICAD) 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 08 will provide guidance that may be used to validate the design for facilitating the future data exchange.

Step 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.

Step 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.

New information requirements coming from the Global Air Traffic Management Operational Concept will be analyzed and modeled 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' call signs).

Step 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.

Step 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.

Step 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.

Step 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).

Step 13 — Terrain
The compilation and provision of terrain data sets is an integral part of the transition to AIM.

Step 14 — Obstacles
The compilation and provision of obstacle data sets is an integral part of the transition to AIM.

Step 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.

Step 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.

Step 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.

Step 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, neighboring States, information service providers or
Others.

Step 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 focusing 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 centers 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 standardization and the implementation level to find solutions for the interoperability of
Meteorological data products with the new AIM data products.

Step 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.

Step 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.

ICAO Roadmap Timelines

The proposed timelines in the roadmap provides a general indication of what the air transport industry may be expecting from States in their implementation of the transition to AIM.

Table below indicates the major milestones that ICAO envisages to support the transition to AIM and the Global Air Traffic Management Operational Concept initiatives related to the management of aeronautical information.

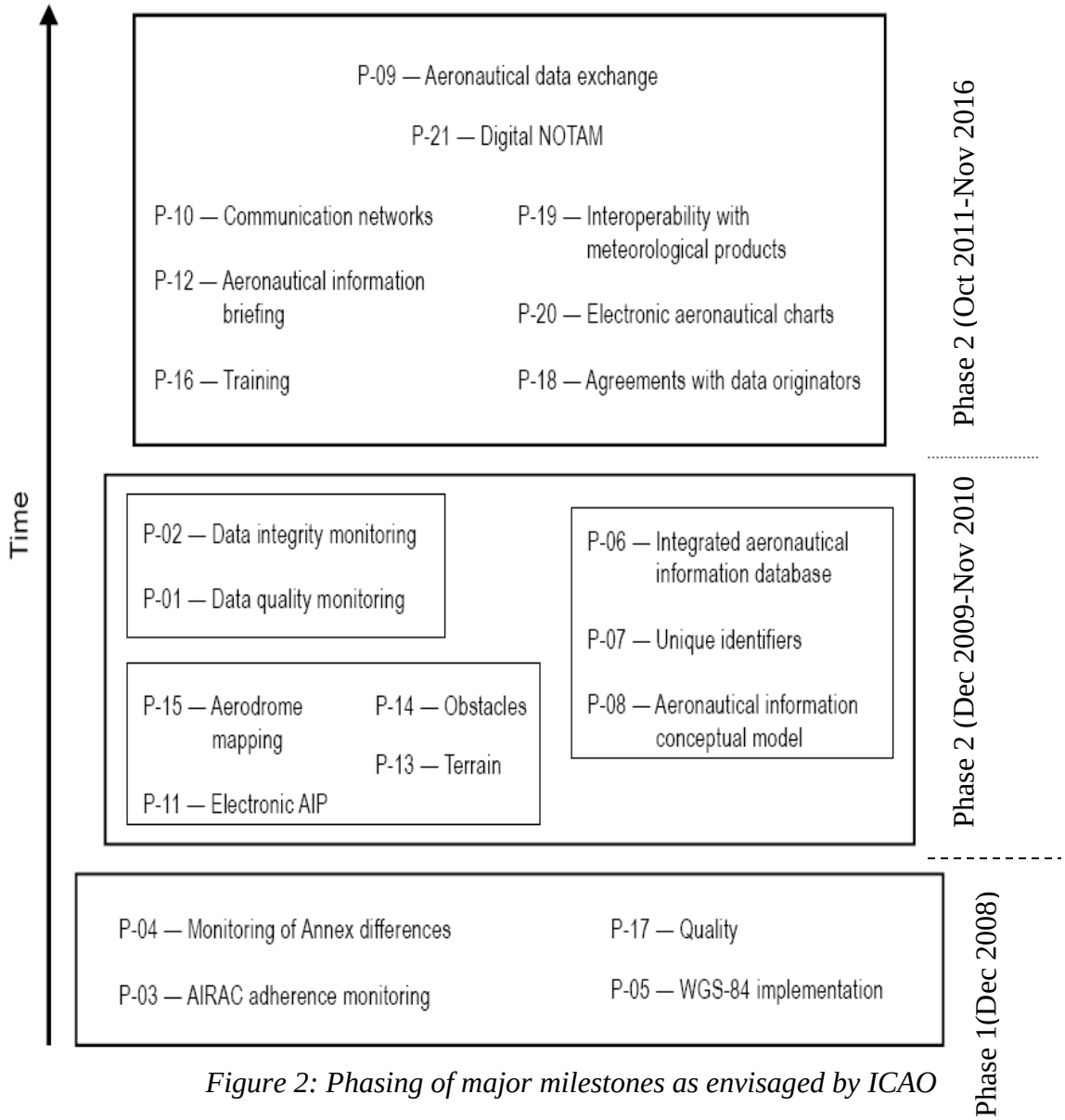

Figure 2: Phasing of major milestones as envisaged by ICAO

National Roadmap Timelines

The below indicates the proposed phasing of the steps within AIS arrived at after a careful analysis of the AIS current status against the proposed ICAO milestones

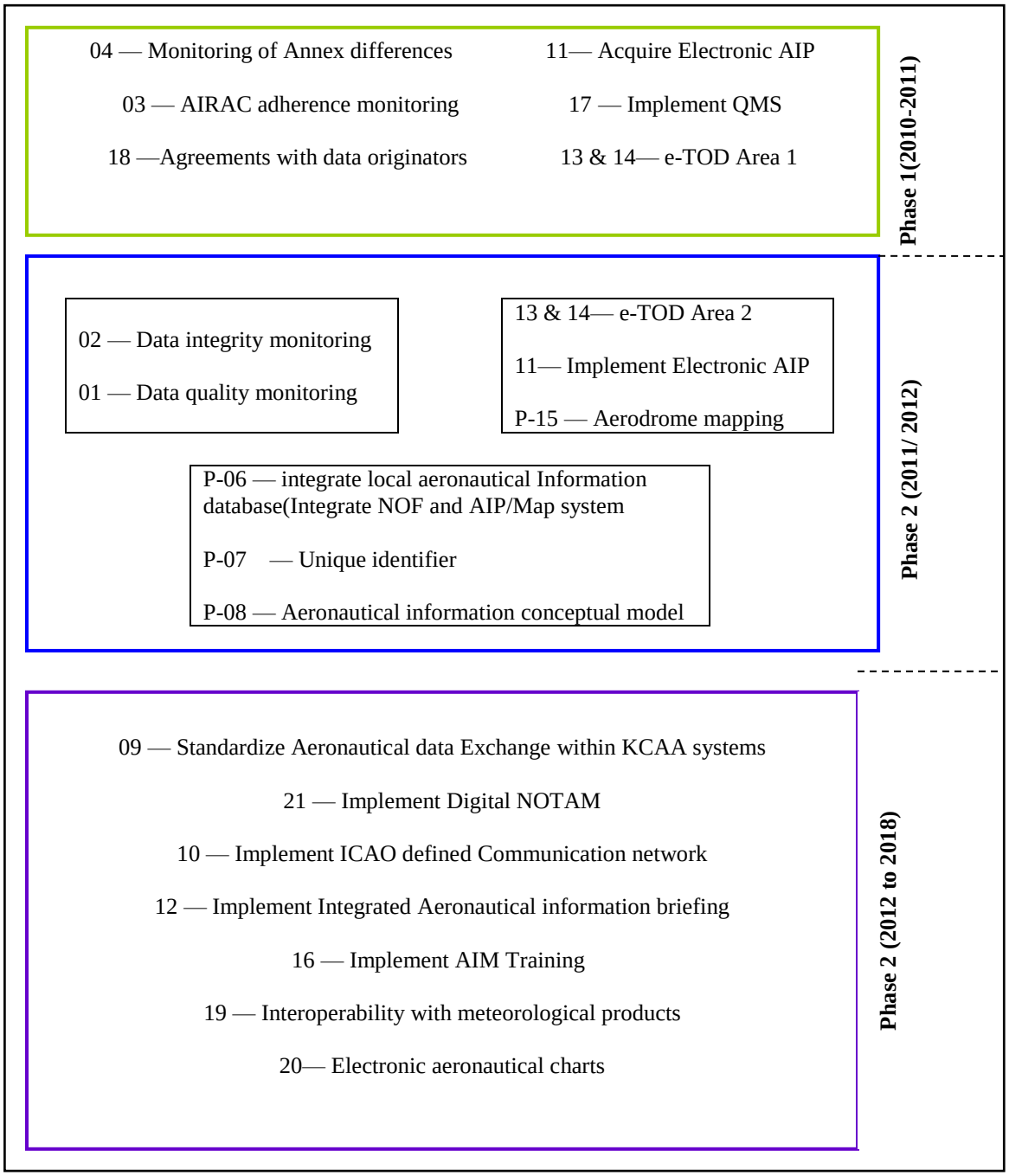

Figure 3: Proposed National Roadmap Timelines

Detailed activities to meet the objective of each step will form part of the ANS strategic plan and Manager AIS performance targets.