ROADMAP FOR THE TRANSITION FROM AIS TO AIM

Noted by the Air Navigation Commission on 10 March 2009

FOREWORD

The *Global Air Navigation Plan* (Doc 9750) was developed as a strategic document to guide the implementation of CNS/ATM systems with respect to the *Global Air Traffic Management Operational Concept* (Doc 9854) and the Strategic Objectives of ICAO.

The *Global Air Navigation Plan* (Doc 9750) contains near- and medium-term guidance on air navigation system improvements necessary to support a uniform transition to the air traffic management system envisioned in the *Global Air Traffic Management Operational Concept* (Doc 9854). More specifically, Doc 9750, Chapter 1, Table 1-1 sets out twenty-three global plan initiatives (GPI). Two are directly related to aeronautical information (*GPI-18 Aeronautical Information and GPI-20 WGS-84*) and many of the others have an indirect impact on the way aeronautical information will be exchanged in the future.

This roadmap has been developed to address more specifically, and in greater detail, the direction given in Doc 9750 for the future development of aeronautical information. The changes foreseen are such this development is being referred to as the transition from aeronautical information services (AIS) to aeronautical information management (AIM).

The roadmap offers practical guidance and advice to regional planning groups and States for development of the implementation and funding strategies which will be required for the global plan initiatives related to aeronautical information. It identifies the major milestones recommended for a uniform evolution across all regions of the world, specific steps that need to be achieved and timelines for implementation.

The roadmap is intended 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 roadmap sets a baseline for establishing strategies and other initiatives to advance the AIM objectives globally. It 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 involve 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.

_____

TABLE OF CONTENTS

GLOSSARY

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.

[1]**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.

[1]**Data set.** Identifiable collection of related digital data.

[1]**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.

[1]**Digital**. Involving or relating to the use of computer technology or digital communications.

[1]**Information management (IM).** The processes defined to ensure the collection, utilization and transmission of quality data which is tailored for the needs of each component of the air traffic management system.

[1]**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 semantic, the syntax and the protocols for the exchange 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]**Metadata**. A structured description of the content, quality, condition or other characteristics of data.

---

1 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(s)
AIRAC	Aeronautical information regulation and control
AIS	Aeronautical information services
AIXM	Aeronautical information exchange model
AN-Conf/11	Eleventh Air Navigation Conference (2003)
ATM	Air traffic management
EUROCONTROL	European Organisation for the Safety of Air Navigation
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

_____

Part I

Roadmap Overview

WHY AERONAUTICAL INFORMATION MATTERS

1.   The Eleventh Air Navigation Conference (AN-Conf/11) held in Montreal in September 2003 endorsed the operational concept and recognized that, in the global air traffic management (ATM) system environment envisioned by the operational concept, aeronautical information service (AIS) would become one of the most valuable and important enabling services. As the global ATM system foreseen in the operational concept was based on a collaborative decision-making environment, the timely availability of high-quality and reliable electronic aeronautical, meteorological, airspace and flow management information would be necessary. Some recommendations of AN-Conf/11 addressed the importance of aeronautical information in particular.

2.   In June 2006, a Global AIS Congress was held in Madrid, Spain. The event was facilitated by the European Organization for Safety of Air Navigation (EUROCONTROL) in partnership with ICAO. The congress considered the essential role of AIS in the evolving world of ATM. It noted that computer-based navigation systems, and area navigation (RNAV), required navigation performance (RNP) and ATM requirements, introduced a need for new corresponding AIS requirements for quality and timeliness of information. The role of AIS would need to transform to an information management service, changing duties, responsibilities and scope to satisfy these new requirements and to cope with and manage the provision of information.

3.   The congress supported the recommendations of AN-Conf/11 dealing with aeronautical information, and began to define a future high-level view as to the shape, nature and content of a strategy for the evolution from traditional product-centric AIS to the enlarged scope of data-centric aeronautical information management (AIM). Realizing the safety-critical nature of aeronautical information, the congress agreed that, in order to prevent diverging developments in the future, it was considered essential that ICAO take the lead at the global level with regard to the transition from AIS to AIM. Accordingly, the congress developed ten recommendations calling for ICAO action or support from States and international organizations.

4.   In September 2007, the 36th Session of the Assembly recognized the need to support the recommendations of the congress and called for further coordination with States and international organizations.

5.   Today, high-quality aeronautical information is often cited in research programmes as a pre-requisite for the development of the many new interoperable tools that future aircraft will carry to improve their effectiveness in navigating safely and efficiently. These new tools will also be used by ATM systems to improve the efficiency while maintaining safety. This will result in the provision of more services to more aircraft in the same airspace at the same time.

HOW INFORMATION IS DISTRIBUTED TODAY

6.   We are in the age of the Internet, satellite navigation and computer networks, yet our approach to aeronautical information distribution is still based on paper charts, paper documentation and telex-based text messages. Systems exist in isolation. Much of the data is entered more than twice in different computers using a keyboard rather than via file transfer or database transactions.

7.   Better aeronautical information is essential if we are to have an integrated and interoperable ATM system which 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 travelling public and lessening the environmental impact on the planet and its population.

8.   Better aeronautical information is essential if we are to have a flexible ATM System which 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 information of the right accuracy, available on time at the right place.

9.   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, understanding their options and helping them making informed decisions while maintaining the public safety and minimizing the impact on the environment. Such a system would be focussed on users needs.

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

11.   These improvements are central to the ICAO 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.

THE OBJECTIVE OF THE TRANSITION TO AIM

12.   Recommendation 1/8 of AN-Conf/11 clearly stated the objective for global aeronautical information as follows:

> "That ICAO, when developing ATM requirements, define corresponding requirements for safe and efficient global aeronautical information management that would support a digital, real-time, accredited and secure aeronautical information environment".

13.   The Global Air Traffic Management Operational Concept, which had been developed to be visionary in scope and not constrained by the level of technology available at the time, was also endorsed by AN-Conf/11.

14.   Much has been done in the community, and the technology has become more mature and more widely deployed. However, some regions are more advanced than others and the need for the adoption of global standards is becoming more evident now than it was in 2003. Present and future navigation systems, and other air traffic management systems, are data dependant. All require

access to global, broad-based aeronautical information of a considerably higher quality and timeliness than is generally available today. The provision of aeronautical information is a core process that underpins all elements of ATM.

15.   To satisfy new requirements arising from the Global Air Traffic Management Operational Concept, aeronautical information services must transition to a broader concept of aeronautical information management, with a different method of information provision and management given its data-centric nature as opposed to the product-centric nature of AIS.

WHAT WILL CHANGE

16.   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. The order of these components implies no priority.

17.   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 the seven concept components described above.

Users

18.   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.
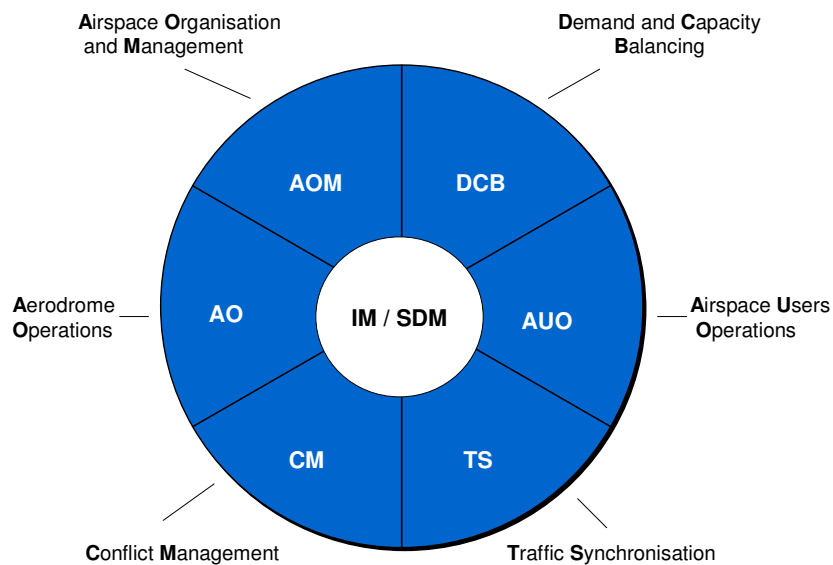
IM / SDM = Information Management / ATM Service Delivery Management

Figure 1. Information Management as a component of the future ATM Operational Concept

Data

19.   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.

20.   The biggest change in the transition to AIM will be the increase use of computer technologies in the management of information. This will be materialised by an increased emphasis on the digital form of data that will drive all processes for the management of information.

21.   Both graphical and text products will be based on the same underlying, standard definition of geo-referenced atomic data. The definition of a standard aeronautical data exchange model will ensure standardized interfaces between computers of 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.

22.   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 a standard 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 conceptual model for aeronautical information. Finally, the mechanisms to maintain a data set, up to date across different components, would need to be agreed. This will be provided in the form of a standard exchange model for aeronautical data. The evolution of these models will be organised at the global level to ensure continuity in the services in a way that allows innovation and new requirements to be taken into account.

23.   By using this approach, the definition of the data products is decoupled from definition of the usage for 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.

Products

24.   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 is offering. Pre-flight briefings are often also difficult to read and interpret because of the lack of graphical capabilities of the current NOTAM format. This will require that new standard products combining textual and graphical information be specified.

25.   Electronic chart displays are becoming easier to install in the cockpit and at lower costs. Their functionality is increasing and it is likely that they will progressively complement some paper charts and replace others. This will require updated standards and symbols for electronic displays capabilities.

26.   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 the aircrafts at all phases of flight.

27.   The AIM concept requires that all aeronautical information, including that currently held in aeronautical information publications (AIP), 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.

Static versus dynamic information

28.   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.

29.   Events of short duration or known 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.

30.   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.

AIRAC cycle

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

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

33.   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. 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 to a twenty-eight-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 advanced planning.

EIGHT GUIDING PRINCIPLES FOR THE TRANSITION TO AIM

34.   The projects undertaken to achieve the steps identified in the roadmap must be specified and conducted in accordance with the following eight guiding principles. The transition from AIS to AIM will have to:

1.   comply with the process for amendments to the Annexes to the Chicago Convention;

2.   support or facilitate the generation and distribution of aeronautical information which serves to improve the safe and cost-effective accessibility of air traffic services in the world;

3.   provide a foundation for measuring performance and outcomes linked to the distribution of quality assured aeronautical information and a better understanding of the determinants of ATM, safety and effectiveness not related to the distribution of the information;

4.   assist States to make informed choices about their aeronautical information services and the future of AIM;

5.   build upon developments in States, international organizations and industry and acknowledge that the transition to AIM is a natural evolution rather than a revolution;

6.   provide over-arching and mature standards, that apply to a wide range of aeronautical information products, services and technologies;

7.   be guided by the *Global Air Navigation Plan* (Doc 9750) and ensure that all development is aimed at achieving the ATM system envisaged in the *Global Air Traffic Management Operational Concept* (Doc 9854);

8.   ensure, to the greatest extent possible, that solutions are internationally harmonized and integrated and do not unnecessarily impose multiple equipment carriage requirements for aircraft or multiple systems on the ground.

THE ROADMAP TO AIM

35.   The purpose of the roadmap is to develop the AIM concept and associated performance requirements by providing a basis upon which to manage and facilitate, on a worldwide basis, the transition from AIS to AIM. The roadmap is based on what we know today but has been developed to provide sufficient flexibility for the new concepts that will emerge from future research.

36.   Three phases of action are envisaged for States and ICAO to complete the transition to AIM:

Phase 1 — Consolidation

Phase 2 — Going digital

Phase 3 — Information management

37.   The roadmap must proceed with caution when advocating more sophisticated information management initiatives to ensure that they do not impede the obligations of States to correct infrastructure and other deficiencies already identified.

38.   In the first phase, existing standards will need to be refined and strengthened and their implementation in all States ensured. This will concern mainly: quality requirements; AIRAC adherence; the implementation of the adopted standard reference system for coordinates (World Geodetic System-1984); and the provision of terrain and obstacle data. The projects in the first phase will be conducted to identify potential gaps in order to focus on near-term work programme activities.

39.   In the second phase, the introduction of database-driven processes will improve the value of current products by improving their quality and availability for current users. This will concern mainly the creation of a national or regional databases used to produce the existing products and services, but with better quality and availability. The global deployment of new, already well specified products

such as electronic AIP will also be initiated. The projects in the second phase will be conducted to enhance the quality and availability of existing products in the medium-term work programme activities.

40.   In the third phase, new products and services will be developed. Quality control and staff training and planning will be applied to current and new products and services. This will support a new AIM function for air navigation service providers which will enable the provision of the new data that will be required by the future ATM components. The projects in the third phase will be conducted to serve new users and to promote continuous improvement by the research community.

41.   The roadmap will identify the main steps to be achieved in the three phases. Each step will require projects of two types of activities: one will be the development of the standards required and the other will be the implementation in States of the standards.

> a)   ***Development of Standards.*** The development of new standards often lie on the critical path of the transition. Amendments to ICAO Standards and Recommended Practices (SARPs) are required for uniform implementation of the transition to AIM in all States. Actions related to the establishment of these standards in Annexes to the Chicago Convention and in guidance material will be led by the ICAO Secretariat with the support of States and International Organisations.

> b)   ***Implementation of Standards.*** Implementation of Standards allowing the transition to AIM will be the responsibility of States. Guidance material will be issued by ICAO to assist in the implementation.

42.   Part II of the roadmap lists numerous steps of varying complexity. Some will result in the establishment of new databases or the expansion of existing ones. Others will seek to foster better data and technical standards for gathering information and data protection. Still others will focus on obtaining consensus on the indicators and determinants of quality aeronautical information. Almost all of the projects will involve collaborative efforts with key stakeholders at the national, regional and inter-regional levels. Securing stakeholder participation at the outset of the process and maintaining it throughout the project implementation phase are critical to ensuring that outcomes are relevant, practical and contribute to improving the efficiency and safety of air travel and of the ATM system.

43.   Accordingly, consultations through various ICAO working arrangements have been and will remain an ongoing feature of the roadmap. The input and feedback of all players is key to ensuring that the roadmap contributes to better aeronautical information and a stronger ATM system for the air transport industry.

Phase 1 — Consolidation

44.   During Phase 1 of the transition to AIM, steps will aim to strengthen a solid base by enhancing the quality of the existing products. Fine-tuning and improvement of SARPs for existing products will continue to be conducted in the usual manner in order to respond to near-term user requirements.

45.   Since the electronic AIP will have the exact same structure as the paper it is important that States make every effort to issue their aeronautical information as specified in Annex 15.

46.   The NOTAM system as it exists today requires on-going upgrades to cope with new types of information (e.g. GNSS navigation) and to respond to the difficulties being reported by the users. It is not clear at this time when and how the current NOTAM system will be changed. Research and trials are underway and their results will be addressed in Phase 3 of the transition to AIM or later. It

is important to continue to improve the current SARPs related to NOTAM to better serve users needs with the current products. It is also important for States to continue to invest the time and effort necessary to comply with these SARPs.

47.   Many ICAO charts types form an integral part of the AIP. Amendments to specifications are also envisaged for electronic chart display but most of the SARPs in Annex 4 — *Aeronautical Charts* will remain applicable after the transition to AIM. It is important that States comply with the existing Annex 4 SARPs.

48.   The requirement to use a common horizontal, vertical and temporal reference system remains essential to facilitate the exchange of data between different systems. The expression of all coordinates in the AIP and charts using WGS-84 is important and should be pursued during the first phase of the transition to AIM.

49.   Provision of terrain and obstacle data becomes applicable during Phase 1 of the transition to AIM. It will be an important project to be conducted by States. Feedback from States on the implementation experience may require adaptation of the relevant SARPs. Since these constitute also digital data sets products, the achievement of these steps will also contribute to phase 2 of the roadmap.

50.   Quality requirements on information are covered by current SARPs in terms of accuracy and integrity. The steps in Phase 1 aim to meet these requirements. Should the requirements prove to be difficult to implement, the requirements would have to be reassessed to verify that the risk of harm to persons or damage to property for not achieving the requirements is reduced to, and maintained at or below, an acceptable level (definition of safety). In addition, States will implement and continuously improve their quality management system in view of its increasing importance for future products and services.

51.   The requirement for States to adhere to the Aeronautical Information Regulation and Control (AIRAC) process must be emphasized. The quality of the future service to be provided under information management will rely on proper mechanism for distribution and synchronisation of information. Shorter response times will be required in the future. This can only be achieved if the current requirements can, at the very least, be met.

Phase 2 — Going digital

52.   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 which have not yet done so will be encouraged "to go digital" by using computer technology or digital communications and introducing the use of structured digital data from databases in their production processes. The emphasis will not, therefore, be on the introduction of new products or services but more on the introduction of highly structured databases and tools like geographic information systems.

53.   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.

54.   Many States are already providing electronic forms of their AIPs, whether on CD or on the Internet. These electronic AIP 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.

Phase 3 — Information management

55.   During Phase 3, the digital databases that will have been introduced in Phase 2, will be used for the transfer of information in the form of digital data. This will require the adoption of a standard aeronautical data exchange model to ensure interoperability between all systems for the exchange of full aeronautical data sets, but also for short term notification of changes.

56.   As new products are introduced, organisational changes will need to be defined to implement better management of information in terms of: staff planning and staff training; formalization of agreements with data providers to ensure high degree of data quality; introduction of an extensive amount of explicit meta-information; impact on cost-recovery mechanisms; and explicit traceability of the changes to information and identification of liabilities.

57.   The third phase will place the future AIM functions of the States in capacity of addressing the new requirements that will be needed to implement the future Global Air Traffic Management Operational Concept in a net-centric information environment.

58.   ATM systems will require a common information reference model with quality procedures for the management of seamless information flow to ensure not only interoperability between States, but interoperability between different systems within the State. New digital data products and services will be specified to serve these interoperability requirements.
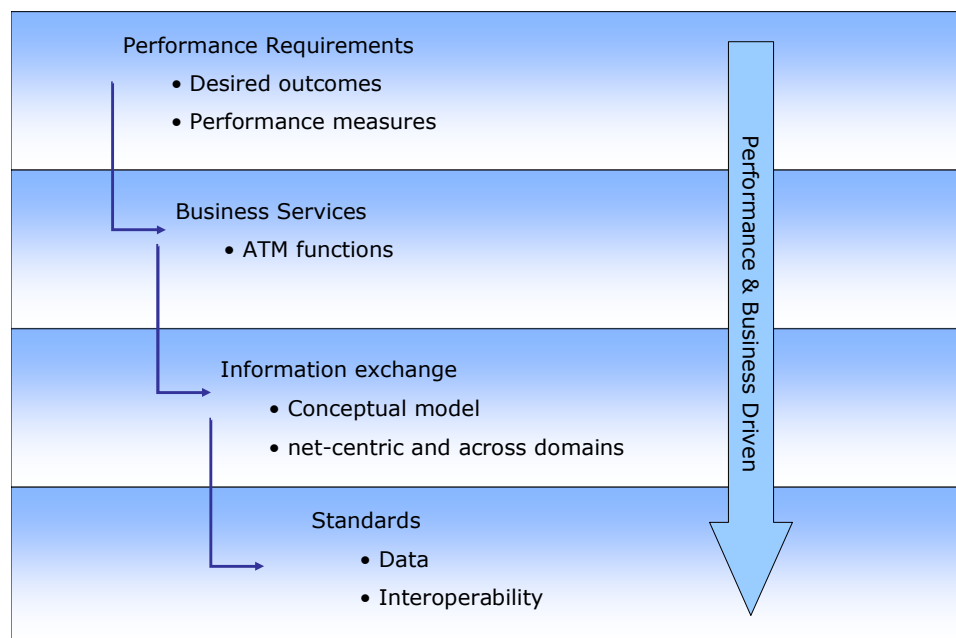
Figure 2. Performance driven approach.

59.   The definition of new AIM data products and services will be based on requirements identified for each ATM Component. A structured approach to the development of these new requirements on AIM will be followed to ensure that any standards recommended for AIM is derived from agreed information exchange models that specify the minimum information required to support business services defined for ATM functions that are identified to fulfil desired outcomes specified in terms of performance requirements. This structured top-down approach of deriving specific data

standards from high level objectives will ensure that the new requirements introduced in the transition to AIM on States will clearly relate to identified enablers for the future ATM system as illustrated in Figure 2.

The regional dimension

60.   During the complex transition to AIM, industry, regulators, manufacturers, service providers and other organizations will need to work together to achieve the best results.

61.   In Europe, the SESAR Master Plan and the Single European Sky initiatives have assembled a multitude of partners to define a modernization programme to significantly reduce costs and increase service capabilities.

62.   In United States of America, the NextGen programme is also underway to modernize the national air transportation system to allow increased capacity and reliability, while improving safety and security and minimizing the environmental impact of aviation.

63.   In many parts of the world States are grouping their resources to introduce new equipment and new structures for the provision of common services over their common airspace.

64.   These are only three of the many examples of modernization programmes that are underway in different regions of the world. All initiatives are primarily directed towards improving safety and security and minimizing the environmental impact of aviation. They all seek a more efficient and reliable exchange of information between the various components of the future ATM system. They refer to new concepts such as system-wide information management, increased automation for collaborative decision making, better integration of systems and 4-D trajectory, to name just a few.

65.   These initiatives are all using the Global Air Traffic Management Operational Concept as a guide to ensure a common reference. They are referring to the Global Air Navigation Plan as a common planning framework. All of these initiatives need some assurance of stability in the development of new techniques. This is the purpose of the Global Air Navigation Plan and this roadmap.

66.   This roadmap provides a structured framework for States to plan and to monitor their progress with reference to other States in the same region and across regions of the world and supports regional and national plans to implement the transition to AIM.

67.   It is not the intention that this roadmap could be used without addition to form a national or a regional plan. No milestones nor description of deliverables are provided in the roadmap, since these will be included via the usual planning process.

_____

Part II

Roadmap Steps

INTRODUCTION

68.   The roadmap overview provides the strategic direction and major principles for the transition to AIM. Three phases have been introduced in Part I of this document, the three phases are not to be followed in a waterfall approach to each of the phases. For example, steps may be taken to introduce the digital elements while the consolidation steps are not all finalised yet. Similarly, it is not necessary that all steps for going digital be achieved to start introducing new measures related to information management. The phases are however giving an indication of the priorities on how to address the transition.

69.   A minimum list of major steps to achieve in order to realise the transition to AIM is provided in Part II. A broad positioning of the steps in relation with the three phases is also provided. The transition to AIM will be effective at the global level when these steps will be achieved. Most steps in Phase 2 and 3 of the transition require new standards and recommended practices to be adopted at the global level, an indication of the time required for these new texts to be made available is provided in Part III.

STEPS

70.   The steps listed in Part 2, constitute a minimum list of areas of activities for States to coordinate the transition to AIM between themselves and with ICAO. The steps are to be taken as a checklist of high level actions to be conducted for realising the transition. Failing to take action on any of those steps would necessarily increase the duration of the transition and negatively affect the enabling role of AIM in the future ATM Concept of operation.

71.   The list may evolve during the transition especially when we get closer to Phase 3. This roadmap will be maintained up-to-date with the further evolution of the overall ATM concepts and system requirements.

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

P-12 — Aeronautical information briefing

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

P-01 — Data quality monitoring

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

P-02 — Data integrity monitoring

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

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.

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 application of the Standards by States.

P-05 — WGS-84 implementation

The target of expressing one hundred 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.

P-06 — Integrated aeronautical information database

The establishment and maintenance of a database where digital aeronautical data from a State is 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 the States. The design of such a database will not be identical in all States or regions to accommodate local technical or functional requirements. 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-07 — Unique identifiers

Improvements to the existing mechanisms for the unique identification of aeronautical features is required to improve the effectiveness of information exchange without the need for human intervention.

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 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 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 call signs).

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) and 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.

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 be 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 usable for network specification. Which data network will be used to distribute the new data products and services;, what information can be exchanged via the public 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.

P-11 — eAIP

The integrated aeronautical information package will not be phased out because new products will be introduced to serve the needs of future systems and new users. On the contrary, the integrated aeronautical information package 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: one will be in the form of a printable document, and the other will be in a form 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 many different presentations of AIP information over the Internet.

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 exploited to better respond to the airspace users requirements of aeronautical information in all phases of flight when the new digital data products will be specified and made available (in Phase 3).

P-13 — Terrain

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

P-14 — Obstacle

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 that traditional aerodrome charts should be complemented by structured aerodrome mapping data which can be imported into electronic displays.

P-16 — Training

The training of personnel will be adapted to the new requirements on skill and competences introduced by the transition to AIM.

A new training manual will be developed to reflect the new competencies required by the transition to AIM.

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.

P-18 — Agreements with data originators

Data of high quality can only be maintained if the source 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.

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 the meteorological data will be made available in a similar format to the other aeronautical data which 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 of digital storage devices are no longer a limiting factor, the move towards net-centric and system-wide information management is becoming feasible for wider distribution of meteorological forecast data from the world area forecast centres in a format that

will not require considerable efforts for the learning and configuration of a decoding software thereby ensuring true interoperability.

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

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 paper charts and replace others that have become obsolete and need to be improved to satisfy user needs. The possibility to deploy these new products over the Internet will be exploited.

P-21 — Digital NOTAM

One of the most innovative data product that will be based on the standard 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 which can be fully interpreted by an automated computer system for accurate and reliable update of the aeronautical environment representation both for automated information equipments and for human actors.
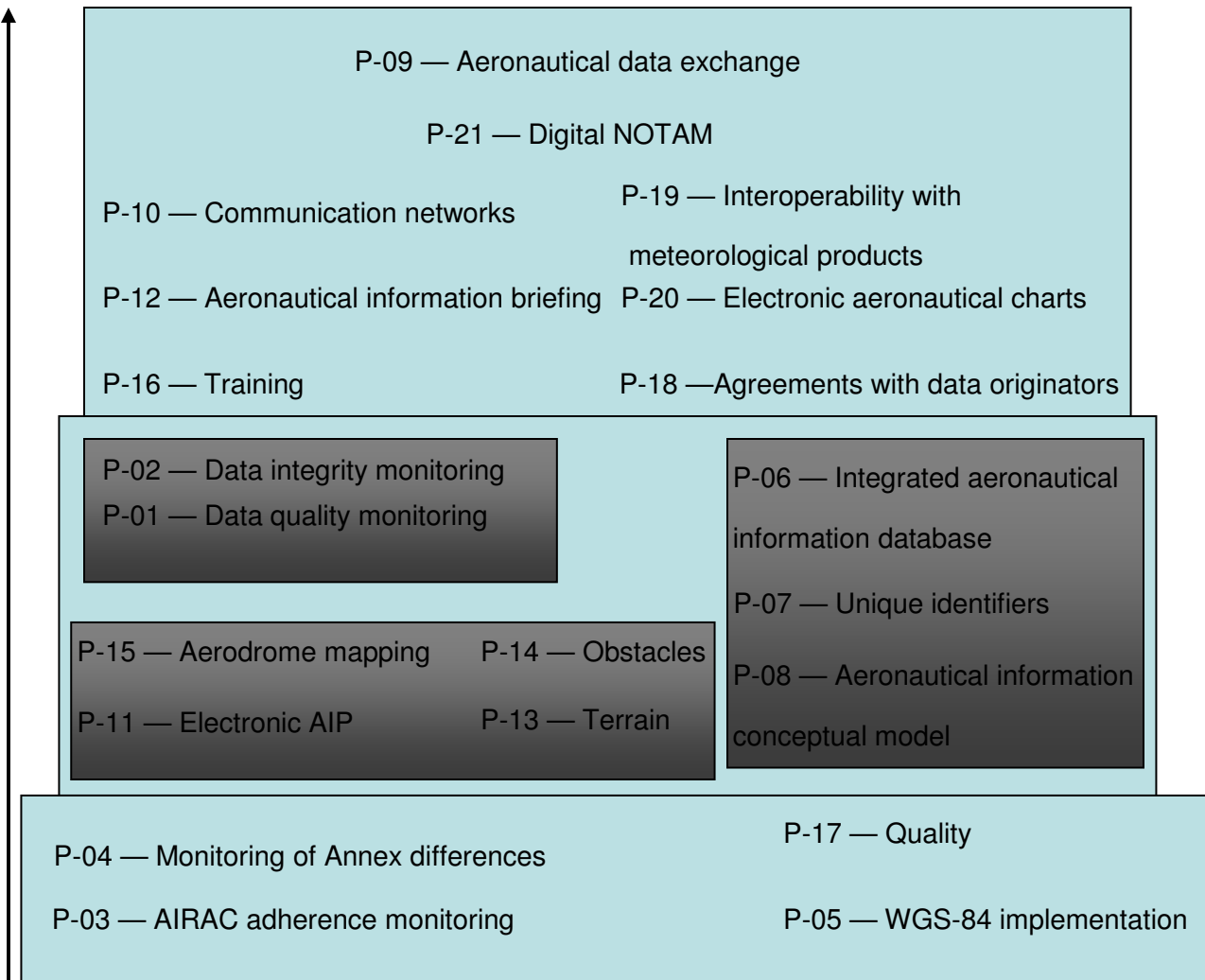
P-09 — Aeronautical data exchange

P-21 — Digital NOTAM

P-19 — Interoperability with

P-10 — Communication networks

meteorological products

P-12 — Aeronautical information briefing   P-20 — Electronic aeronautical charts

P-16 — Training   P-18 —Agreements with data originators

P-02 — Data integrity monitoring   P-06 — Integrated aeronautical

P-01 — Data quality monitoring   information database

                                            P-07 — Unique identifiers

P-15 — Aerodrome mapping   P-14 — Obstacles   P-08 — Aeronautical information

P-11 — Electronic AIP   P-13 — Terrain   conceptual model

P-17 — Quality

P-04 — Monitoring of Annex differences

P-03 — AIRAC adherence monitoring   P-05 — WGS-84 implementation

Figure 3. Positioning of the 21 steps of the roadmap in the three phases.

Part III

Roadmap Timeline

1.   The roadmap serves as general indication of what the air transport industry may be expecting from States in their implementation of the transition to AIM. In this part III, the timeline indicates to States, the major milestones that are envisaged in ICAO to support the transition to AIM and the Global Air Traffic Management Operational Concept initiatives related to the management of aeronautical information.

December 2008	**Phase 1 — Consolidation**, has begun with the establishment of the AIS-AIM Study Group, more information on the work and planned actions of the group may be found on the ICAO website under the Air Navigation Bureau, MET/AIM link.
	The consultation process for Amendment 36 to Annex 15 and Amendment 56 of Annex 4 are initiated in the first quarter of 2009.
	The development of Amendment 2 to the AIS Manual (Doc 8126) and Amendment 30 to the PANS-ABC (Doc 8400) has begun to introduce guidance on best practices already available.
November 2009	**Phase 2 – Going digital** will begin by the development of new guidance material related (electronic AIP, aeronautical information conceptual model, training, quality) that will be developed with the support of the AIS-AIMSG which will hold its second meeting end of 2009.
November 2010	Amendment 36 of Annex 15 and Amendment 56 of Annex 4 would become applicable. The preparation of Amendment 37 to Annex 15 and Amendment 57 to Annex 4 plus any consequential amendments required in other annexes will have progresses with the help of the AIS-AIMSG.
October 2011	**Phase 3 — Information management**, will begin with the fourth meeting of the AIS-AIMSG which will finalise the proposals for amendment 37 to Annex 15 and amendment 57 of Annex 4. These amendments will be setting the scene for the future requirements on States to produce data sets. It is not envisaged that new data products will be required for mandatory provision by the future ATM systems at this date, but if States choose to provide the data identified in scope at that time, they will be able to base their development on recommendations ensuring a global harmonisation.

The consultation process of Amendment 37 to Annex 15 and Amendment 57 to Annex 4 will be initiated in the first quarter of 2012.

November 2013   Amendment 37 to Annex 15 and Amendment 57 to Annex 4 would become applicable,

Possible divisional-type meeting should a substantial number of subjects of worldwide scope involving meteorological, aeronautical information and supporting communication network fields need to be agreed in order to finalize the transition to AIM. This could include a substantial enlargement of the scope of aeronautical information required by ATM and an obligation to provide the information in the form of digital data.

November 2016   Amendment 38 to Annex 15 and Amendment 58 to Annex 4 would become applicable including the recommendations of the divisional meeting.

_____