Organización de Aviación Civil Internacional
Grupo Regional de Planificación y Ejecución CAR/SAM (GREPECAS)
Décimo Segunda Reunión del Subgrupo Gestión de la Información Aeronáutica del GREPECAS
(AIM/SG/12)
Lima, Perú, 23 al 27 de noviembre de 2009

Cuestión 3 del Orden del Día: **Planificación de la Transición del AIS al AIM**
3.2 Hoja de Ruta para la transición del AIS al AIM

HOJA DE RUTA PARA TRANSICIÓN DEL AIS AL AIM

(Presentada por la Secretaría)

RESUMEN

La Hoja de Ruta ofrece una guía práctica y asesoramiento para el desarrollo de la implantación y estratégicas de financiamiento que serán necesarios para las iniciativas del Plan Mundial relacionadas con la Información Aeronáutica para los planes de los grupos regionales y de los Estados/Territorios y Organizaciones Internacionales. Define lo más significativo recomendado para una evolución uniforme en todas las regiones del mundo, se necesitan alcanzar medidas específicas y plazos para su implantación.

Referencias:

- Primera Reunión del Grupo de Estudio sobre los Servicios de Información Aeronáutica-Gestión de la Información Aeronáutica (AIS-AIMSG), Montreal, Canadá, 2 al 4 de diciembre de 2008.

Objetivos Estratégicos	*Esta nota de estudio se relaciona con el Objetivo Estratégico D (Eficiencia).*

1. Introducción

1.1 Se reconoce de una manera muy extendida, que la comunidad aeronáutica requiere de una transición del AIS al AIM. La transición del AIS al AIM se caracteriza de la siguiente manera:

- A través de la transición de un producto manual impreso en papel, hacía un producto en ambiente digital basado en la normatividad respectiva.

- El establecimiento de nuevos servicios que soporten directamente los requisitos para los servicios Operacionales ATM actuales y futuros.

2. Discusión

2.1 Los nuevos servicios proporcionados por el AIM, se desarrollan sobre la información de seguridad AIS tradicional, que incluye los servicios de información que respaldan la eficiencia de los sistemas de aviación, la capacidad y los requerimientos del ambiente de performance. La Hoja de Ruta que se describe en el **Apéndice A** a esta nota de estudio, ha sido desarrollada para tratar de una manera más específica y con mayores detalles, la orientación proporcionada en el Doc 9750 *Plan Mundial de Navegación Aérea* para el desarrollo de la Gestión de Información Aeronáutica.

2.2 La hoja de ruta para la transición del AIS al AIM, ha sido desarrollada por la OACI en consulta con el Grupo de Estudio AIS-AIM, el cual fue conformado por expertos representantes de varios Estados a nivel mundial y fue conocido por la Comisión de Navegación Aérea. Específicamente, esto trata de manera más detallada las orientaciones que proporciona el Plan Mundial de Navegación Aérea (Doc 9750) para los servicios de información aeronáutica (AIS) a la gestión de información aeronáutica (AIM) para reflejar la importancia de la evolución.

2.3 La Hoja de Ruta ofrece una guía práctica y asesora a los grupos regionales de planificación y a los Estados para desarrollar la implantación y estrategias de financiamiento que serán necesarias para las iniciativas del plan mundial, relacionadas a la información aeronáutica.

2.4 La hoja de ruta identifica los puntos más importantes recomendados para una evolución uniforme en las regiones a nivel global, e identifica los pasos específicos a ser alcanzados y el calendario para su implantación. El Formato del Marco de Performance (PFF) para AIM detallado en el **Apéndice B** a esta nota, identifica los pasos específicos iniciales para los Estados y Territorios de la CAR/SAM de acuerdo con la siguiente conclusión del GREPECAS/15:

CONCLUSIÓN 15/1 *DESARROLLO DE PLANES REGIONALES Y NACIONALES BASADOS EN LA PERFORMANCE*

Que,

a) *el GREPECAS desarrolle un plan regional basado en la performance, de conformidad con el Plan Mundial de Navegación Aérea y el Concepto Operacional ATM Mundial. Este plan debería incluir la identificación de los objetivos regionales de performance y formularios del marco de performance a ser completados para todas las áreas de navegación aérea, tales como ATM, CNS, AIM, MET y AGA/AOP; y,*

b) *los Estados, Territorios y Organismos Internacionales desarrollen planes nacionales basados en la performance, teniendo en consideración las necesidades de los usuarios, de conformidad con los objetivos regionales de performance incluidos en el Plan Regional de Navegación Aérea. Estos planes nacionales deberían incluir la identificación de los objetivos nacionales de performance y los formularios del marco de performance a ser completados para todas las áreas de navegación aérea, tales como ATM, CNS, AIM, MET y AGA/AOP.*

3. **Acción sugerida**

3.1 Se invita a la Reunión a tomar nota de la importancia de la información contenida en los Apéndices A y B a esta nota de estudio y adoptar el siguiente proyecto de conclusión:

PROYECTO DE CONCLUSIÓN 12/XX HOJA DE RUTA PARA LA TRANSICIÓN DE AIS A AIM

Que los Estados y Territorios CAR /SAM:

a) Implementen orientaciones, pasos y el calendario para la Transición del AIS al AIM que se presenta en la "**Hoja de Ruta para la transición del AIS al AIM";**

b) informar a la correspondiente Oficina Regional de la OACI el progreso y/o dificultades de la guía de implantación, no más tarde del **5 de mayo de 2010**;

c) desarrollen los respectivos planes nacionales de navegación aérea en el campo AIM con sus correspondientes PFFs, tomando como referencia los planes regionales de conformidad a la Conclusión 15/1 del GREPECAS en sus incisos a) y b), así como en la Hoja de Ruta AIM; e,

d) informar de los avances en la implementación solicitada en el inciso anterior a las Oficinas Regionales CAR y SAM de la OACI, **a más tardar el 29 de octubre de 2010**.

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APÉNDICE A

(Disponible únicamente en el idioma inglés)

Roadmap for the Transition from AIS to AIM

First Edition — 2009

International Civil Aviation Organization

Published in separate English, Arabic, Chinese, French, Russian and Spanish editions
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999 University Street, Montréal, Quebec, Canada H3C 5H7

For ordering information and for a complete listing of sales agents
and booksellers, please go to the ICAO website at www.icao.int

First edition 2009

Roadmap for the Transition from AIS to AIM
NOT FOR SALE

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by

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). Doc 9750, Chapter 1, Table 1-1, sets out 23 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 expand upon the direction given in Doc 9750 for the future development of aeronautical information. The changes foreseen are such that this development is being referred to as the transition from aeronautical information services (AIS) to aeronautical information management (AIM).

This roadmap offers practical guidance and advice to regional planning groups and States for development of the implementation and funding strategies that 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.

This publication 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. It sets a baseline for establishing strategies and other initiatives to advance the AIM objectives globally 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.

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

[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 that are tailored to 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 semantics, the syntax and the protocols for the exchange of data.

[1]***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).

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)
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

PART I

ROADMAP OVERVIEW

WHY AERONAUTICAL INFORMATION MATTERS

1. The Eleventh Air Navigation Conference (AN-Conf/11) held in Montréal 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 Organisation for the 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 therefore need to transition 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 and in order to prevent diverging developments in the future, the Congress agreed that ICAO should 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 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 once in different computers using a keyboard rather than by file transfer or database transactions.

7. 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 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 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.

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, 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 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 affect the safety of ground-based navigation.

11. 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.

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-dependent. All require access to global, broad-based aeronautical information of a considerably higher quality and in a more timely manner than is generally available today. The provision of aeronautical information is a core element of air navigation services.

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. Roles and responsibilities may need to be adapted as the transition progresses.

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.

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 these seven concept components. Figure 1 illustrates how information management is at the core of air navigation services.

Users

18. The provision of aeronautical information today is mainly focussed 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.

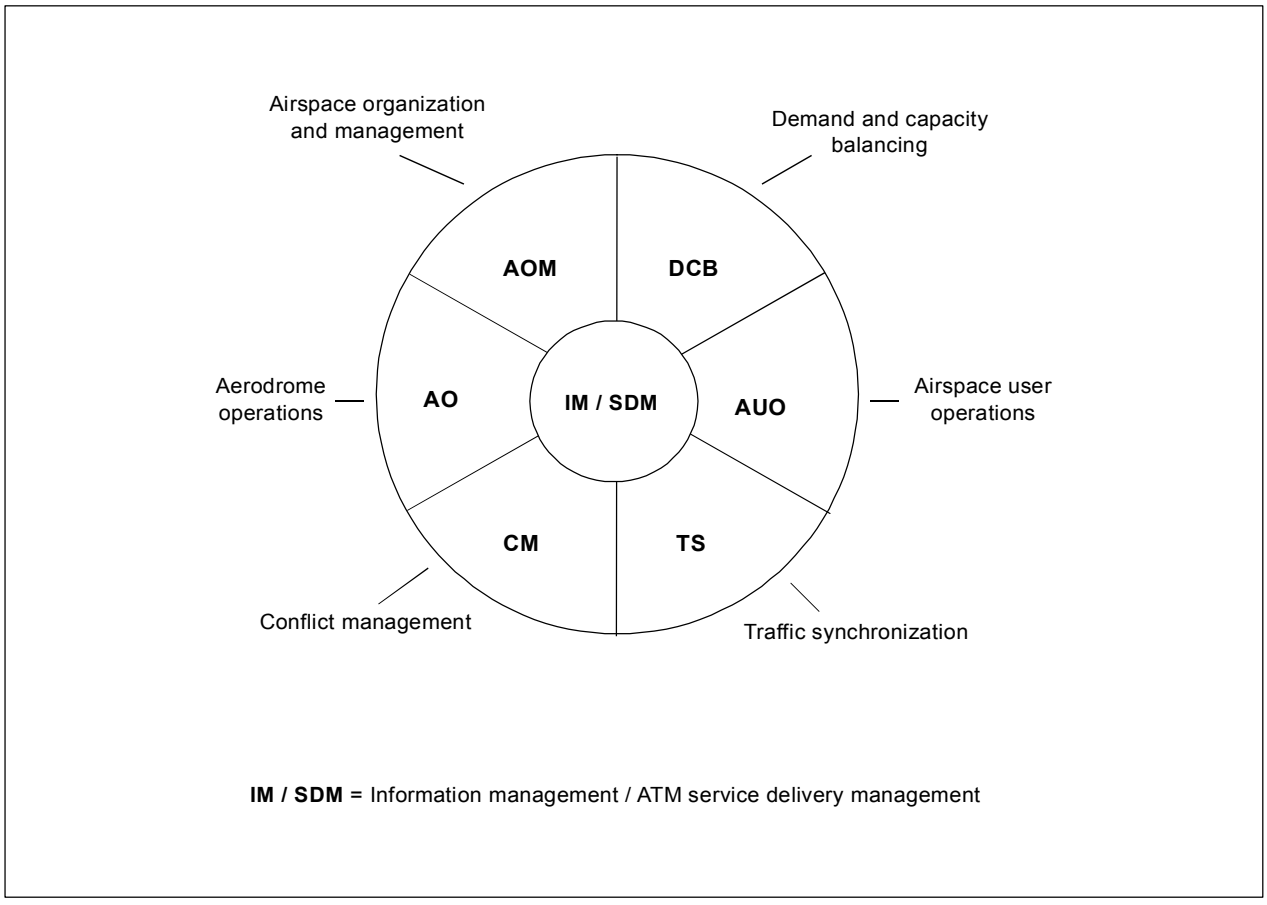

Figure 1. Information Management as a component of the future ATM Operational Concept

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 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.

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 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.

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 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.

23. 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.

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 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.

25. 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.

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 aircraft during all phases of flight.

27. 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.

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 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 upon 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 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.

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:

a) comply with the process for amendments to the Annexes to the Convention on International Civil Aviation;

b) 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;

c) 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;

d) assist States in making informed choices about their aeronautical information services and the future of AIM;

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

f) provide over-arching and mature Standards that apply to a wide range of aeronautical information products, services and technologies;

g) 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); and

h) 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 this 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 with 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 database or regional databases to produce the existing products and services, but with better quality and availability. The global deployment of new, already well-specified products such as the 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 enabling 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 those Standards.

a) ***Development of Standards.*** The development of new Standards often lies 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 Convention on International Civil Aviation and in guidance material will be led by the ICAO Secretariat with the support of States and international organizations.

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 and 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 of and feedback from all players are 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 be taken 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 version, 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 ongoing 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 under way 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 investing the time and effort necessary to comply with these SARPs.

47. Many ICAO chart 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. Therefore, 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 and 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 SARPs also relate to digital data set products, the achievement of these steps will also contribute to Phase 2.

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 difficult to implement, they 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 the proper mechanism for distribution and synchronization of information. Shorter response times will be required in the future and 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 that have not yet done so will be encouraged “to go digital” by using computer technology or digital communications and introducing structured digital data from databases into their production processes. The emphasis will, therefore, not be on the introduction of new products or services but will be on the introduction of highly structured databases and tools such as geographic information systems.

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 equivalents of their AIPs, e.g. on CD or on the Internet. These electronic AIPs may be accessible for printing and/or for navigation via a web browser tool. Guidance material that will be based on existing best practices will be provided to States to ensure that new types of media will be harmonized for users.

Phase 3 — Information management

55. During Phase 3, steps will be taken to enable future AIM functions in States to address the new requirements that will be needed to implement the Global Air Traffic Management Operational Concept in a net-centric information environment.

56. 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 a Standard for an aeronautical data exchange model to ensure interoperability between all systems not only for the exchange of full aeronautical data sets, but also for short-term notification of changes.

57. As new products are introduced, organizational changes will need to be made to implement better management of information in terms of:

– staff planning and staff training;

– formalization of agreements with data providers to ensure a 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.

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 also interoperability between different systems within the State. New digital data products and services will be specified to serve these interoperability requirements.

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 for AIM will be followed to ensure that any Standards recommended for AIM are derived from agreed information exchange models; these models will specify the minimum information required to support business services defined for ATM functions that are identified to fulfil desired outcomes 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 for States introduced in the transition to AIM will clearly relate to identified enablers for the future ATM system as illustrated in Figure 2.

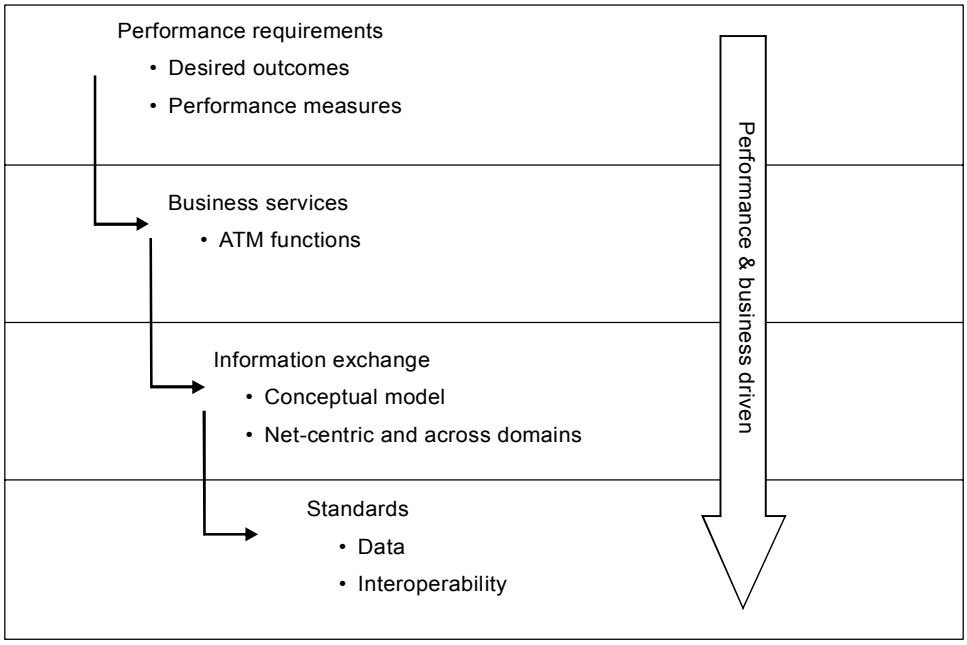

Figure 2. Performance-driven approach

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. 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. In the United States, the NextGen programme is also under way 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. 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.

61. These are only three of the many examples of modernization programmes that are under way 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.

62. These initiatives are all using the Global Air Traffic Management Operational Concept as a guide to ensure a common reference and 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.

63. 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.

64. It is not the intention that this roadmap be used alone to formulate a national or a regional plan. Neither milestones nor description of deliverables are provided in the roadmap since these will be included through the usual planning process.

PART II

ROADMAP STEPS

INTRODUCTION

1. This roadmap provides the strategic direction and major principles for the transition to AIM. The three phases introduced in Part I need not be followed in a waterfall approach; for example, steps may be taken to introduce the digital elements even though the consolidation steps have not all been finalized. Similarly, it is not necessary that all steps for going digital be achieved before introducing new measures related to information management. The phases, however, give an indication of how to address the transition.

2. A minimum list of major steps to achieve the transition to AIM is provided in Part II. A broad positioning of the steps in relation to the three phases is also provided in Figure 3. The transition to AIM will be effective at the global level when these steps have been achieved. Most steps in Phases 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 available is provided in Part III.

STEPS

3. The steps listed in Part II 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. Failure to take action on any of these steps would increase the duration of the transition and negatively affect the enabling role of AIM in the future ATM concept of operation.

4. The list may evolve during the transition, especially when we get closer to Phase 3. This roadmap will be updated 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

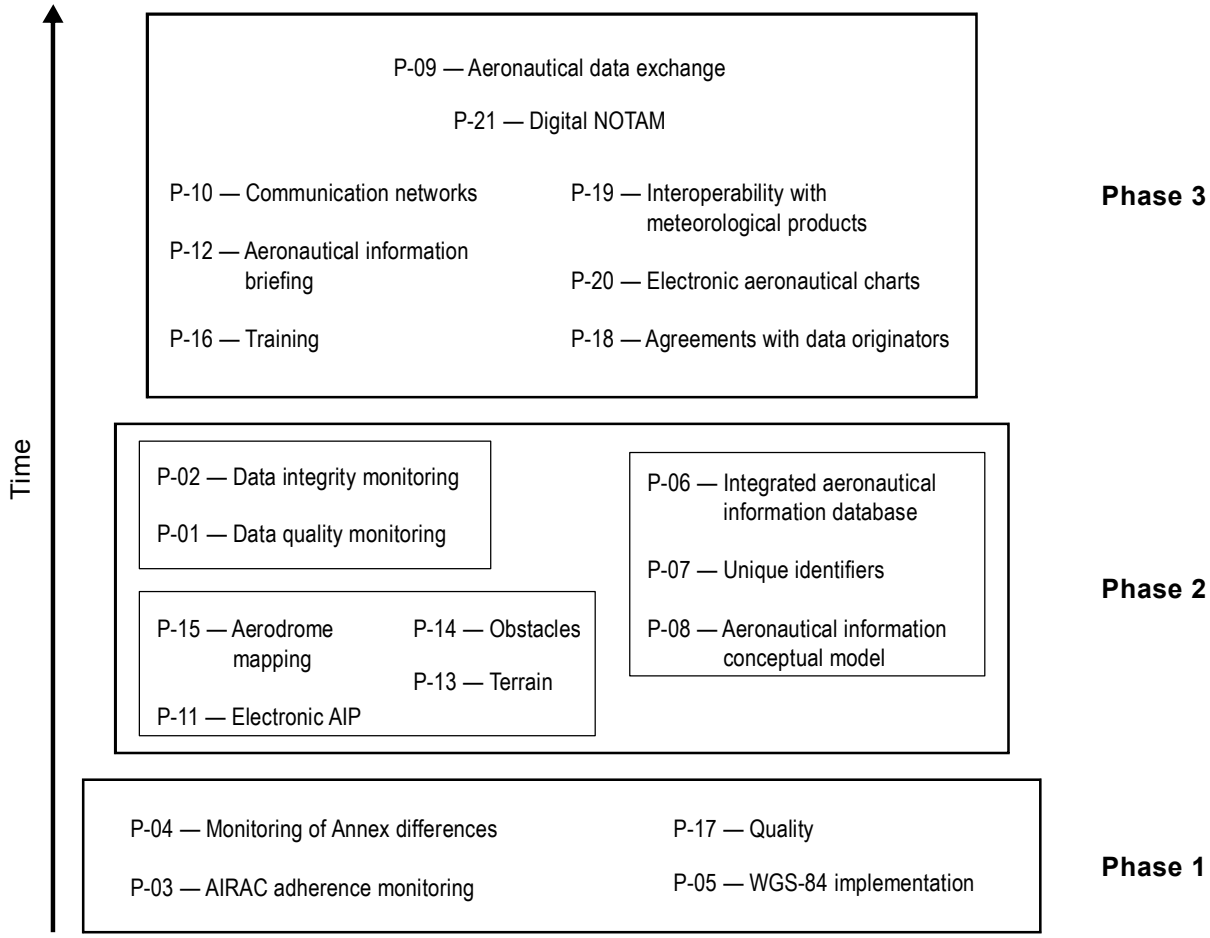

Figure 3. Positioning of the 21 steps of the roadmap in the three phases

P-01 — Data quality monitoring

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

P-02 — Data integrity monitoring

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

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 the application of the Standards by States.

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.

P-06 — Integrated aeronautical information database

The establishment and maintenance of a database where digital aeronautical data from a State are integrated and used to produce current and future AIM products and services is the main step in Phase 2 of the transition to AIM.

A database may be operated by States or by regional initiatives under delegation from States. The design of such a database will not be identical in all States or regions because local technical or functional requirements must be considered. However, the material that will be provided under Step P-08 will provide guidance that may be used to validate the design for facilitating the future data exchange.

P-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.

P-08 — Aeronautical information conceptual model

Defining the semantics of the aeronautical information to be managed in terms of digital data structures is essential for introducing interoperability.

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

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' 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); 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 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.

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.

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).

P-13 — Terrain

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

P-14 — Obstacles

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

P-15 — Aerodrome mapping

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

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.

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 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.

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 standardization and the 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 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.

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.

PART III

ROADMAP TIMELINE

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

December 2008 **Phase 1 — Consolidation** began 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 at www.icao.int/anb/aim.

The consultation process for Amendment 36 to Annex 15 and Amendment 56 to Annex 4 was 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) introduced guidance material on best practices already available.

November 2009 **Phase 2 — Going digital** will begin by the development of new, related guidance material (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 at the end of 2009.

November 2010 Amendment 36 to Annex 15 and Amendment 56 to Annex 4 will become applicable. The preparation of Amendment 37 to Annex 15 and Amendment 57 to Annex 4 and any consequential amendments required in other annexes will progress 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 finalize the proposals for Amendment 37 to Annex 15 and Amendment 57 to Annex 4. These amendments will set the scene for the future requirements for States to produce data sets. It is not envisaged that new data products will be required for mandatory provision by the future ATM systems by 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 global harmonization.

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 will become applicable,

A divisional-type meeting may be held, should a substantial number of subjects of worldwide scope involving meteorological, aeronautical information and supporting communication network fields need to be agreed upon 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 will become applicable including the recommendations of the divisional meeting.

— END —

APPENDIX B

12. IMPLEMENTATION OF WGS-84 AND e-TOD				
Benefits				
Efficiency **Safety**	• implementation of WGS-84 is a requirement for the performance based navigation, benefits are described in the PBN performance objectives • support to the approach and departure procedures design • improve aircraft operating limitations analysis • support aeronautical chart production and on-board databases (FMS) • improve situational awareness • improve electronic terrain and obstacle data in cockpit display • CFIT reduction • support technologies such as ground proximity and minimum safe altitude warning systems (GPWS) • observe the benefits described in the PBM performance objectives			
Strategy				
ATM Component	**TASK DESCRIPTION**	**START -END**	**RESPON-SIBLE**	**STATUS**
SDM-CM	***Electronic terrain and obstacle data (eTOD)*** a) Share experience and resources in the implementation of e-TOD through the establishment of an e-TOD Regional project.	2011-2015	GREPECAS States	Valid
	b) Technical requirements	2010-2015	GREPECAS States	
	c) Report requirements and monitor implementation status of e-TOD using electronic media to ICAO NACC Regional Office.	2010-2011	States	
	d) Develop a high level policy for the management of a national eTOD programme.	2010-2011	States	
AUO	e) Establish WGS-84 implementation goals in coordination with the national PBN implementation.	2010-2012	GREPECAS States	Valid
	f) Define technical requirements.	2010-2011	GREPECAS States	

	g) Report requirements and monitor implementation status of WGS-84 using the AIS-5 Table of the FASID and take remedial action if required.	On going	GREPECAS States	
GPIs	GPI-5: Performance-based navigation; GPI-9: Situational awareness; GPI-11: RNP and RNAV SIDs and STARs; GPI-18: Aeronautical Information; GPI-20: WGS-84; GPI-21: Navigation systems			

— END —

APÉNDICE B

12. IMPLEMENTACIÓN DEL WGS-84 Y e-TOD

Beneficios

Eficiencia	• El WGS-84 es un prerrequisito para la navegación basada en el performance, los beneficios están descritos en objetivos de performance para el PBN. • Apoyo al diseño e implementación de procedimientos de aproximación y despegue. • Mejora al análisis de las limitaciones operacionales de las aeronaves. • Apoyo a la producción de cartas aeronáuticas y bases de datos de abordo (FMS).
Seguridad Operacional	• Mejoras a la conciencia situacional. • Mejoras al despliegue en cabina de los datos electrónicos del terreno y datos • Reducción del CFIT. • Apoyo a las tecnologías tales como proximidad al terreno y sistemas de alarma de la altitud mínima de seguridad (GPWS). • Observar los beneficios descritos in objetivos de performance para PBN.

Estrategia
Corto plazo (2010)
Medio plazo(2011 – 2015)

COMPONENTE ATM	DESCRIPCIÓN DE TAREA	INICIO – FIN	RESPON-SABLE	ESTADO
SDM-CM	***Datos Electrónicos del terreno y los obstáculos (e-TOD)*** a) Compartir la experiencia y recursos en la implementación del e-TOD a través del establecimiento de un proyecto regional e-TOD.	2011–2015	GREPECAS Estados	Válida
	b) Requerimientos Técnicos.	2010-2015	GREPECAS Estados	
	c) Reporte a las Oficinas Regionales de la OACI de requerimientos y monitoreo de la implementación del estado del e-TOD usando medios electrónicos.	2010-2011	Estados	
	d) Desarrollo a nivel político alto para la gestión de un programa nacional e-TOD.	2010-2011	Estados	
AUO	***WGS-84*** e) Metas de implementación y establecimiento del WGS-84 en coordinación con la implementación nacional del PBN.	2010-2012	GREPECAS Estados	Válida
	f) Definición de requerimientos Técnicos.	2010-2011	GREPECAS Estados	
	g) Reporte de requerimientos y monitoreo del estado de la implementación del WGS-84 usando la tabla AIS-5 del FASID y tomar las acciones remédiales si se requiere.	En proceso	GREPECAS Estados	
IPM	IPM-5: Navegación basada en Performance; IPM -9: Consciencia Situacional; IPM-11: IPM y RNAV SIDs y STARs; IPM-18: Información Aeronáutica; IPM-20: WGS-84; IPM-21: Sistemas de Navegación.			

- FIN -