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Punta Cana, Dominican Republic, 8-12 September 2008

Agenda Item 2: 2.1 AERONAUTICAL INFORMATION MANAGEMENT (AIM)
Transition Plan to AIM

(Presented by the Secretariat)

SUMMARY

This working paper provides information on the strategic framework for the evolution and development of Aeronautical Information Management within CAR/SAM States, Territories and International Organizations in a harmonized and integrated manner from 2008 to 2015. It discusses achievement of future ATM/CNS operational target objectives, the requirements for transition from Aeronautical Information Services (AIS) to Aeronautical Information Management (AIM), and proposes a work programme to enable that transition.

References:

- Annex 4
- Annex 15
- Doc 8126, *Aeronautical Information Services Manual*
- Doc 8697, *Aeronautical Chart Manual*
- Doc 9674, *World Geodetic System – 1984 (WGS-84) Manual*
- Doc 9828, *Report of the Eleventh Air Navigation Conference (2003)*
- Doc 9881, *Guidelines for Electronic Terrain, Obstacle and Aerodrome Mapping Information*
- AIS QM/TF/3 Meeting Report

ICAO Strategic Objectives: **A – Safety** and **D – Efficiency**

1. Introduction

1.1 As one of the most significant results of the 11th Air Navigation Conference (AN-Conf/11) held in Montreal in 2003, the ATM Operational Concept was approved, and it was recognized that in the global ATM system environment envisioned by the operational concept, AIS would become one of the most valuable and important enabling services. The global ATM system foresaw that it would be necessary to base the operational concept in a collaborative decision-making (CDM) environment where timely availability of high quality electronic aeronautical, meteorological, airspace and flow management information is necessary.

2. Evolution of requirements for transition from AIS to AIM

2.1 It was also agreed that quality-assured aeronautical information should ultimately be available in real-time through seamless interchange between parties in an interoperable, flexible and adaptable manner. To ensure the cohesion and linkage between different components of the operational concept and accomplish the role of AIS, the need for the interchange and management of aeronautical information for use by different services and users was recognized, taking into account interoperability of existing and future systems.

2.2 The Global AIS Congress was held in Madrid, Spain, in June 2006. The event was facilitated by the European Organization for Safety of Air Navigation (EUROCONTROL) in partnership with ICAO, and the essential role of AIS in the global evolution of ATM was considered. The key drivers for change were identified, the complex issues associated with the evolution were reviewed, and the next steps were examined. The Congress supported Recommendation 1/8 of the AN-Conf/11 and began to define a future high-level view as to the shape, nature and content of a strategy for the evolution from AIS to AIM. These recommendations are attached as **Appendix A.**

3. Work programme to enable the transition from AIS to AIM

3.1 It is considered essential that ICAO develop a global strategy/document with a detailed plan that manages and facilitates the transition from AIS to AIM. This transition should be supported by the Global Air Navigation Plan, regional plans and State implementation plans that describe the progressive intermediate steps.

3.2 Recommendation 7 of the Global AIS Congress stated that as a pre-requisite for the transition to AIM, States that have not yet done so should give high priority to the implementation of existing SARPs in Annex 15 and, in particular, those related to WGS-84 and the implementation of automation and the quality management system.

3.3 The current ATM system is based upon isolated civil and military, AIS, MET and ATFM data. This implies a series of transaction points where aeronautical information integrity is potentially reduced as the same information is manually re-entered a number of times in discrete systems. AIM will ensure the integrity of aeronautical information throughout the ATM/CNS system.

3.4 In view of the complexity of the issues involved in the transition from AIS to AIM, ICAO Headquarters is considering several tasks that could provide States with guidelines and specific activities to assist with the transition. Those guidelines and activities will be prepared by an international group (AIS-AIM/SG) composed of experts in the field. The principal outputs are contained in **Appendix B.** AIM is a "system of systems" based upon the networking of various database components, through a middleware[1] concept architecture. The migration from AIS to AIM will require addressing a set of interrelated aspects including information architecture, safety and new SARPs.

4. Suggested action by the Meeting

4.1 That NAM/CAR States review the first version of the "*Strategic Project for the Transition to AIM*" to ensure implementation of appropriate actions for the transition from AIS to AIM prepared by the Aeronautical Information Quality Management Task Force (AIM/QM/TF), and contained in **Appendix C** to this working paper.

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[1] Middleware. - Connectivity software that offers services for application distributed in or over heterogeneous aprons orientated to networks.

APPENDIX A

GLOBAL AIS CONGRESS
Madrid, Spain, 27–29 June 2006

RECOMMENDATIONS

Recommendation 1: ICAO adopt the AICM/AIXM as the standard aeronautical information conceptual model and the standard aeronautical information exchange model, and

- develop appropriate means of compliance, and
- global mechanisms to manage and develop the AICM/AIXM.

Recommendation 2: ICAO should evolve the AIM Concept and associated performance requirements and develop a road map to plan, manage and facilitate on a world-wide basis the transition from AIS to AIM.

Recommendation 3: ICAO instigate an urgent review of Annex 4 and Annex 15 in accordance with the recommendation of the 11th Air Navigation Conference.

Recommendation 4: ICAO should incorporate transition activities into the Global Air Navigation Plan in order to ensure broad-based development of AIS/AIM capabilities across all ICAO Regions

Recommendation 5: ICAO should, as a matter of urgency address legal and institutional issues including those associated with an expansion of service from AIS to AIM that could constrain the adoption and implementation of AIM.

Recommendation 6: States working in close coordination with international organizations should support ICAO in any activity to accommodate the transition from AIS to AIM.

Recommendation 7: Recognising the critical nature of aeronautical information in the present and future ATM systems, States should give high priority to the implementation of existing Standards such as WGS-84 and Quality Management Systems and should, if necessary, request assistance from ICAO or if appropriate international organisations to do so.

Recommendation 8: Recognising the social dimension associated with change, ICAO working with States and international organisations determine the required Staff Profile(s) for AIM and determine appropriate skills and competencies and amend existing guidance material and develop new guidance and training material, under the TRAINAIR programme perhaps, to assist States and other AIS organisations in the transition process.

Recommendation 9: ICAO should promote open access to information.

Recommendation 10: That ICAO consider as a matter of priority how a Global Forum could be established.

APPENDIX B

EXPECTED OUTPUTS OF THE ICAO HEADQUARTERS AIS-AIM TRANSITION SUBGROUP

– Aeronautical Information Management

ID	*Expected output*	*Source*	*Final results*	*Completed*
1.	Global strategy/roadmap for the transition from AIS to AIM	Global AIS Congress 2006, Rec 2 ; A36–WP/51; ANC	State letter/Guidance material	2008
2.	SARPs and guidance material related to the provision of a standard aeronautical information conceptual model and standard aeronautical information exchange model to enable the global exchange of data in digital format. Definition of a means to allow the further evolution of these models in a managed and supportable manner.	Global AIS Congress 2006, Rec 1; A36–WP/51; ANC	Amendments 36/37 to Annex 15 Amendments 56/57 to Annex 4 New manual and amendment Defined means to allow the further evolution of the models	2010/13 2010/13 2010/13 2010
3.	SARPs and guidance material related to an appropriate presentation of digital aeronautical information to the end user, including the electronic AIP (eAIP) and electronic charts.	Global AIS Congress 2006; Rec 3; A36–WP/51; ANC	Amendments 36/37 to Annex 15 Amendments 56/57 to Annex 4 Amendments to Doc 8126 Amendments to Doc 8697	2010/13 2010/13 2010/13 2010/13
4.	Guidance material and further development of SARPs related to the quality system to support AIM.	Global AIS Congress 2006, Rec 7; A36–WP/51; ANC	New AIM quality system manual Amendment 36 to Annex 15	2010 2010
5.	Review of SARPs and guidance material related to electronic terrain and obstacle data to determine if refinement of SARPs or additional guidance material is necessary.	EANPG C49/39	Amendment 36 to Annex 15 Amendment to Doc 9881	2010 2010
6.	Guidance and training material related to staffing and training for the transition from AIS to AIM.	Global AIS Congress 2006, Rec. 8; A36–WP/51; ANC	New AIM training manual Amendment to Doc 8697	2010 2010
7.	Development of a proposed work plan to address key legal and institutional issues raised during the Worldwide Symposium on Enabling the Net-Centric Information Environment (Montreal, 2 to 4 June 2008).	Global AIS Congress 2006, Rec. 5; A36–WP/51; ANC	AN-WP	2009

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ATTACHMENT C

DRAFT STRATEGY FOR THE TRANSITION TO AERONAUTICAL INFORMATION MANAGEMENT IN THE CAR/SAM REGIONS

INTERNATIONAL CIVIL AVIATION ORGANIZATION

DRAFT STRATEGY FOR THE TRANSITION TO AERONAUTICAL INFORMATION MANAGEMENT (AIM) IN THE CAR/SAM REGIONS

CAR/SAM REGIONAL PLANNING AND IMPLEMENTATION GROUP (GREPECAS)

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DRAFT STRATEGY FOR AERONAUTICAL INFORMATION MANAGEMENT (AIM) IN THE CAR/SAM REGIONS

1. Introduction

The Regional Plans for transition to CNS/ATM clearly define how ATM information is automatically exchanged through the use of a huge, precise and safe aeronautical database that is updated in real time and that serves as the support for the entire air navigation service. This new form of display, distribution and exchange of aeronautical information should implicitly lead to a substantial and profound change in the entire AIS/MAP of the Regions.

Thus far, AIS/MAP has evolved successfully and has adapted to meet changes imposed by the technological development of civil aeronautics. New, much more serious challenges have arisen, not only with regard to resources and working methods, but also to the culture and behaviour of human resources. The introduction of computerised air-ground systems and confidence in the accuracy, availability, safety, and quality of aeronautical information are generating new and significant demands in the provision of AIS/MAP services.

As a result, aeronautical information has become a crucial and critical component of the present and future ATM system and must be developed to meet AIS/MAP service needs, covering all flight phases.

This strategy for gradual AIM implementation in the Regions has been developed with a view toward identifying the important requirements and components of an Aeronautical Information Management system that is able and sufficient to support CNS/ATM navigation demands, by establishing stages for gradual compliance starting in 2008 and up until 2015, including the issues of human resources and investment planning.

2. Status of AIS/MAP in the CAR/SAM Regions

The AIS/MAP function can be defined as the preparation, storage and distribution of AIS Integrated Documentation. This is a broad process that covers various publications, both printed and digital, in a semi-automated environment that still requires considerable manual intervention. These publications help keep the main document, the AIP, up to date, changes to which are made known through printed or digital amendments or supplements posted in web pages or NOTAMs distributed through the AFTN network and which are generally published, stored, and disseminated automatically by NOTAM data banks.

Despite harmonious AIS operation, the current situation requires long, inflexible periods of time to produce and distribute permanent information and the NOTAMs, which perform the function of enacting temporary short-term changes, require a maximum period of time as of the moment originators request their publication until the time they are transmitted through the AFTN network. Once in effect, the information is supplied mainly during the pre-flight phase, leaving other flight phases at a disadvantage insofar as the provision of up-to-date aeronautical information is concerned.

The flexibility and uptodateness of and ease of access to aeronautical information in real time are crucial CNS/ATM requirements and it is clear that the current AIS structure and operation will be incapable of fulfilling such requirements unless its operating concepts evolve toward AIM establishment.

2.1 Current limitations

It is a known fact that the AIS Integrated Documentation Packet is a complete product. The “static” permanent information in the AIP is consulted, and “dynamic” variations can be introduced over a relevant period of time and communicated *via* NOTAMs and Supplements. Although the NOTAM format allows for some degree of information filtering tailored to individual requirements, the retrieval of information from an integrated packet as a whole involves a considerable amount of manual selection. The "production unit” of the future must consist of individual data elements, facts that are available through highly automated means for retrieval by users in any combination for individual information.

Users are informed of short-term changes *via* NOTAMs. These do not permit the transmission of extensive information or graphic data because of limitations in rules, application, flexibility, and message size. As a result, printed AIP Supplements are used to report extensive changes in text or graphic data. Despite the progressive introduction of automated aeronautical information processes, such as the NOTAM data banks, there are transaction points in the production and use of integrated aeronautical information that require different forms of manual action. Such actions inevitably entail the risk of human error in transcription, which means that data integrity is more easily susceptible to violation. Improvement of both data quality and the automated systems is vitally important to meet aeronautical information integrity requirements, an essential prerequisite for navigation strategy.

3. AIS Projection

ATMs will continue to develop, implement and use new technologies and techniques that will allow for more flexible airspace use. Such systems are and will continue to be dependant upon aeronautical data. Immediate access to high-quality aeronautical information will be an essential element of ATM systems.

The development of systems that will allow for on-line global access in real time to aeronautical information of the required quality will provide the necessary support for the future ATM system. Traditional aeronautical information will necessarily have to be provided temporarily in parallel as automated systems are developed and the text and graphic domains, now separate, are combined.

There is an obvious need for other categories of information to be available. The information to be supplied by this complex system of databases will require the progressive merging of traditional AIS, MET, FIS, and AFTM information to provide for a data flow in the ATM system.

Users have a declared need to transition to an environment in which the management of aeronautical information is wide-based, and where civil - military information is harmonised.

Broad global aeronautical information exchange is an AIM prerequisite, making it important to establish global standards and recommended practices for originating, storing, exchanging and distributing information during all flight phases.

Eight strategic objectives have been designed on the basis of this vision and have, in turn, given rise to 13 actions for developing this AIM transition strategy.

4. AIM Transition Strategy

4.1 Scope

This strategy will extend to the boundaries of the FIR in each particular State.

This document and its subsequent development will cover all AIS/MAP areas, namely: AIS Publications, NOTAM Office, and AIS AD and Aeronautical Chart Units and, indirectly, will also involve other AIS-related units, such as: ATS units in general and Air Navigation Top Management.

The present AIM strategy covers all flight phases:

1. Flight planning
2. Pre-flight
3. Departure
4. In flight
5. Arrival
6. Post-flight.

4.2 Strategic objectives

The following strategic objectives must be fulfilled in order to achieve efficient and uniform aeronautical information management and a broad information management system that would cover all flight phases:

4.2.1 Establish AIM as the core ATM process

The AIM concept must be fully understood and accepted by all as the essential and basic step toward ATM, and actions must be taken to extend to other neighbouring regions this concept, including the proposal to develop new ICAO procedures (SARPS).

4.2.2 Ensure the supply of updated and quality aeronautical information for all flight phases

New specifications will be established for originating, maintaining, and exchanging electronic aeronautical information, including data on the terrain and obstacles, with the necessary precision, integrity, safety and confidentiality, given their importance for flight safety.

4.2.3 Ensure access to aeronautical information during all flight phases

Although a large volume of aeronautical information is available today, most of it is pre-flight information, making it necessary to have flexible access to such information during any flight phase.

4.2.4 Evolve from the publication of aeronautical information products to the supply in electronic format of individual data on each of the aeronautical information elements

At present, the supply of aeronautical information is based on a group of elements of the integrated AIS documentation, from which users manually extract the aspects they are interested in. In the AIM strategy, users will be able to extract their own parameters, independently of the element in which the data is published, and to accede by automated means to material that is relevant for their purposes. The main reference information, together with temporary changes, will be kept electronically and updated within

the particular element in which it is published, thereby minimising the chance of error. Even when information is kept in digital form, printed information can be provided upon request.

4.2.5 Adopt database procedures, structures and contents that have been globally harmonised in a fully digitalised aeronautical information environment

In order to accomplish this, ICAO must adopt standard database models that will guarantee the exchange of information worldwide.

4.2.6 Define the human resource activities needed to ensure the future AIM environment

Operating AIS/MAP personnel should be given the necessary training to guarantee the exchange of electronic aeronautical information of the required quality.

4.2.7 Resolve issues concerning intellectual property, and financial, legal, organisational and institutional aspects connected with AIM

4.2.8 Harmonise and integrate all civil-military aeronautical information

4.3 Strategic actions

In order to achieve the aforementioned strategic objectives, it is necessary to take actions like the following:

4.3.1 Maintain and improve the Quality Management System implemented and certified in the AIS/MAP service

This AIM strategy aims to guarantee the integrity levels of critical, essential and regular flight data, as specified in ICAO Annex 15, which will require the implementation and certification of a total quality management system.

4.3.2 Plan and develop the electronic AIP

Transition to an electronic AIP must be planned and achieved within an appropriate time frame. Even so, the replacement should replicate the existing format and aeronautical information should be updated on that basis.

4.3.3 Revise the existing NOTAM concept since AIM will permit automatic database access

The future of the NOTAM must be considered for the following reasons:

- The existing format does not allow for the exchange of digital data.
- The time needed today in the AIS to publish and distribute NOTAMs does not meet AIM information immediacy requirements.
- The new system will allow for data management within the document in which they are published and their updating in real time, on-line.

4.3.4 Study, plan and arrange for terrain and obstacle data, electronic aeronautical charts and mapping databases to be available in digital format

Terrain and vertical obstacle data should be available and support all flight phases, especially the landing and post-flight phases, since the only publication of obstacles near the RWY that is available today is insufficient for the growing needs of the industry, according to ICAO recommendations.

4.3.5 Define the scope and nature of and methods used to display aeronautical information, bearing in mind modifications and new requirements

The modified display methods include the consideration of how aeronautical charts could be incorporated into digital data, together with text information. Developments in hardware, software and telecommunications have produced tools that increase the speed and accuracy of geospatial data input, performance, and output. The growing use being made of graphic information display should be noted. Virtually all information on board will be electronically supported, using graphic monitors. The automated exchange of aeronautical information during the flight and the necessary specifications for its development will be an important new aspect.

These activities will be based on geographic information systems (GIS) and spatial data banks, with associated benefits of accuracy, reliability, uptodateness and quality systems.

4.3.6 Diversify and expand the means of access to aeronautical information auto-briefing

Aeronautical information is accessed mainly from AIS AD units and consists of an aeronautical information packet printed expressly for each flight. This situation is not conducive to flexibility of access to information and does not provide for its updating in real time. The crew must be given options, such as creating auto-briefing stations at airports that will allow for on-site access to information in any flight phase.

4.3.7 Plan and carry out training for transition to AIM and, at the same time, provide training in traditional AIS services, so long as the two exist in parallel.

4.3.8 Promote the licensing of AIS personnel and study and apply requirements for the hiring of new personnel

AIS transition to AIM will take place over a period during which present and future working styles, operations and procedures will exist in parallel, until such a time as personnel in the future cease to be involved in providing a detailed daily information product in the traditional way. Over the next few years, it will be necessary for AIS/MAP to train existing personnel and to adopt these new requirements for skills to be considered when hiring new personnel. A draft AIS profile must be developed to provide trained personnel and to apply this methodology to future skill requirements for hiring purposes. Efforts will accordingly be made to accomplish the following:

- Quality assurance and specialisation in the traditional AIS service while both are provided in parallel.
- Plan training in the introduction and transition to AIM.
- Study and implement new hiring requirements for AIS/MAP personnel.
- Promote licensing or other formal means of assessing and accepting AIS personnel.

4.3.9 Plan a harmonious AIS/MAP service structure in an AIM environment, as well as its linkage with other specialised ATM areas

It is necessary to study, plan and gradually implement the change in mentality and working methods that must necessarily take place in AIM service, even during the period when AIS and AIM operate in parallel.

4.3.10 Identify and resolve the legal and financial aspects involved in the origination, exchange and management of data

Problems such as the following will need to be resolved:

- Legal (ownership of the information, its control and obligations in an environment of shared information);
- Institutional (regulatory aspects of shared information);
- Business (information on the cost of the associated effectiveness, the recovery cost and profit and loss in general);
- Organisational (regulatory mechanisms, documents and responsibilities of all persons who handle the information).

4.3.11 Undertake the expanded development of AIXM and AICM for the adoption of a global database

Aeronautical information will be obtained from many originators and kept in a network of distributed global data banks. A standard aeronautical information model is a requirement for the development of the data banks and other aeronautical information systems. An initial version of an aeronautical information conceptual model (AICM) exists and, as a result, an aeronautical information exchange model (AIXM) has been developed. Both of these are needed to have information available in any data bank, regardless of structure or language, in order to communicate with other banks.

4.3.10 Identify the need to amend ICAO SARPs as a requirement for accomplishing the objectives and moving through the ICAO machinery

The specification, maintenance and progressive improvement of the AICM/AIXM models is critically important for AIS-to-AIM transition and thus it is essential to make the necessary efforts to secure the adoption by ICAO of a model for the exchange of common data. This undertaking must also take into account the additional identified categories of information that are needed for the future ATM system.

4.3.11 Plan civil-military harmonisation

The flexible use of airspace requires the availability of aeronautical information for all airspace users and the use of common and compatible exchange systems. Military aspects will continue to be a sovereign issue for each of the States, but actions must be defined to guarantee the interoperability of both means and automatic systems.

4.4 Contribution of the actions to the accomplishment of the strategic objectives

The following table shows the contribution of the strategic actions to each strategic objective.

Strategic actions	Strategic objectives							
	1	2	3	4	5	6	7	8

Strategic actions	Strategic objectives							
	1	2	3	4	5	6	7	8
1- Maintain and improve the implemented and certified Quality Management System in the AIS/MAP service.	x	x		x	x			
2- Plan and develop the electronic AIP.	x	x	x	x	x			
3- Revise the existing NOTAM concept because AIM will permit automatic database access.	x	x	x	x	x			
4- Study, plan and arrange for terrain and obstacle data, electronic aeronautical charts and mapping databases to be available in digital format.	x	x	x	x	x			
5- Define the scope and nature of and methods used for displaying aeronautical information, bearing in mind modifications and new requirements**.**	x	x	x	x	x			
6- Diversify and expand the means of access to aeronautical information auto-briefing.	x	x	x	x				
7- Plan and carry out training for transition to AIM and, at the same time, provide training in traditional AIS services, so long as the two exist in parallel.	x					x		
8- Promote the licensing of AIS personnel and study and apply new personnel hiring requirements.	x					x		
9- Plan a harmonious AIS/MAP service structure in an AIM environment and its linkage with other specialised ATM areas.	x						x	
10- Identify and resolve the legal and financial aspects of data origination, exchange and management.	x						x	
11- Undertake the expanded development of AIXM and AICM for the adoption of a global database.	x	x	x	x				
12- Identify the need to amend ICAO SARPs as a requirement for accomplishing the objectives and moving through the ICAO machinery.	x		x	x				
13- Plan civil-military harmonisation	x	x	x					x

Strategic objectives:

1- Establish AIM as the core ATM process.
2- Ensure the provision of updated and quality aeronautical information for all flight phases.
3- Ensure access to aeronautical information during all flight phases.
4- Evolve from the publication of aeronautical information products to the supply in electronic format of individual data for each of the aeronautical information elements.
5- Adopt database procedures, structures and contents that have been globally harmonised in a fully-digitalised aeronautical information environment**.**
6- Define the human resource activities needed to ensure the future AIM environment.
7- Resolve issues concerning intellectual property, and financial, legal, organisational and institutional aspects connected with AIM.
8- Harmonise and integrate all civil-military aeronautical information**.**

4.5 Timetable for AIM implementation in the Regions

The following table describes the timetable of the strategic actions for AIM implementation in the Regions.

Strategic actions	2008	2009	2010	2011	2012	2013	2014	2015
1- Maintain and improve the Quality Management System implemented and certified in the AIS/MAP service.								
2- Plan and develop the electronic Cuba/AIP.								
3- Revise the existing NOTAM concept because AIM will permit automatic database access.								
4- Study, plan and arrange for terrain and obstacle data, electronic aeronautical charts and mapping databases to be available in digital format								
5- Define the scope and nature of and methods used for displaying aeronautical information, bearing in mind modifications and new requirements.								
6- Diversify and expand the means of access to aeronautical information auto-briefing.								
7- Plan and carry out training for transition to AIM and, at the same time, provide training in traditional AIS services, so long as the two exist in parallel.								
8- Promote the licensing of AIS personnel and study and apply new personnel hiring requirements.								
9- Plan a harmonious AIS/MAP service structure in an AIM environment and its linkage with other specialised ATM areas.								
10- Identify and resolve the legal and financial aspects concerning data origination, exchange and management.								
11- Undertake the expanded development of AIXM and AICM for the adoption of a global database.								
12- Identify the need to amend ICAO SARPs as a requirement for accomplishing the objectives and moving through the ICAO machinery.								
13- Plan civil-military harmonisation.								

4.6 Aeronautical information exchange network