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CAR/SAM REGIONAL PLANNING AND IMPLEMENTATION GROUP (GREPECAS)

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Agenda Item 6: Other Business, within the Terms of Reference of the AIS/MAP/SG

NETWORK-CENTRIC ENVIRONMENT IN EUROPE

(Presented by the Secretariat)

SUMMARY

This information paper presents an important document regarding implementation of a NETWORK-CENTRIC ENVIRONMENT with regard to the AIM concept. It points out the critical role of aeronautical information and especially the global trend of aeronautical information. It is a priority to keep the AIS community informed.

References:

- EURO CONTROL web site AIM information

1. Introduction

1.1 An AIM implementation strategy was developed from the Air Traffic Management (ATM) concept, and ratified at the 11th Air Navigation Conference in 2003. This was the starting point for the transformation of AIS structure, product and services improvement to ensure inter-operability and compliance with users demands. The Secretariat of the Subgroup and its tasks forces must establish an information network for its members and the CAR/SAM Regions AIS/MAP community for AIM that sends information on the progress, documents, decisions, work, etc., in support of the transition to AIM through electronic means.

2. Suggested Action

2.1 The Meeting is invited to note the contents of this information paper and its **Appendix** containing the document "Towards a Common Understanding."

APPENDIX

"Towards a Common Understanding" Implementing the Network-centric environment in Europe Digital Avionics Systems Conference Portland, 17-19th October 2006

EUROCONTROL – The Organization

EUROCONTROL is the European Organization for the Safety of Air Navigation. This civil and military Organization which currently numbers 37 Member States has as its primary objective the development of a seamless, pan-European Air Traffic Management (ATM) system. The achievement of this objective is a key element to the present and future challenges facing the aviation community, which are to cope with the forecast growth in air traffic, while maintaining a high level of safety, reducing costs, and respecting the environment.

EUROCONTROL develops, coordinates and plans for implementation of short-, medium- and long-term pan-European air traffic management strategies and their associated action plans in a collective effort involving national authorities, air navigation service providers, civil and military airspace users, airports, industry, professional organizations and relevant European institutions.

EUROCONTROL's core activities span the entire range of gate-to-gate air navigation service operations - from strategic and tactical flow management to controller training; from regional control of airspace to development of leading-edge, safety-proofed technologies and procedures, and the collection of air navigation charges.

Ken REID, Head of AIM Division, EUROCONTROL

Presently Head of the AIM Division and the Chairman of the Aeronautical Information Services (AIS) Team of the EUROCONTROL European Air Traffic Management Programme (EATMP). His current responsibilities include the development and implementation of near, medium and long-term policies for AIS, Meteorology and System-wide Information Management (SWIM).

Responsible for the EUROCONTROL "Aeronautical Information Management (AIM) Strategy for the years 2000+" published in 2000 which was adopted as European policy. The recently released second edition has been used as the basis for the "From AIS to AIM – A Strategic Road Map for Change" booklet published to coincide with the Global AIS Congress held in Madrid in June 2006 to provide a basis for further engaged debate.

AIM is a new function of ATM/CNS that broadens the current scope of Aeronautical Information. It encompasses the control of the origination, storage, retrieval, exchange and delivery of digital Aeronautical Information in an interoperable format to meet the needs of Gate-to-Gate flight operations, from the strategic flight-planning phase, through support to collaborative decision making, to the post-flight archiving of information.

INTRODUCTION

Air Traffic Management (ATM) operations constitute a complex interaction of many dissimilar activities undertaken by a myriad of diverse organisations ranging from Air Navigation Service providers (ANSP), airlines, air and ground crews, handling agents, engineering support, fuel, catering suppliers, and the providers of safety and security services. Many of these services are provided under contract and no physical links exist between the partners. A simple example of complexity is that the 100 main airports of the EUROCONTROL¹ member States are connected by approximately 600 airspace sectors, controlled by 65 Air Traffic Control Centres and operated by 37 ANSP's. In consequence, the organisation, co-ordination and management of these different entities is frequently dysfunctional, and a demanding and complex task made more challenging by the absence of a common situational picture. The absence of the common picture means that asset deployment is frequently not harmonised with real-time traffic movement and in consequence, inefficiencies are introduced and capacity is lost.

The absence of a common picture, the lack of effective in-time communication and cooperation, the hoarding of information results in a somewhat confused "picture" which when events run to schedule has little impact. The converse is true when even minor changes to the plan occur. If effective means of understanding and cooperation were available, then improved situation awareness would benefit all within the airport operations and ATM constructs and the benefits would be available at little or no cost.

Improved awareness and effective management of assets will result in reduced capacity loss and an increase in system through-put particularly at airports and a direct return to the bottom-line of all the agencies involved.

In the longer term and to meet the demanding targets set by the European Commission, ATM will be faced by a major change in the operating paradigm. One way may be to establish the means to provide a "time-ordered" system to reduce the uncertainties associated with and increase the predictability of flight. The efficient management of Gate-to-Gate operations require that all who need it have the same accurate, maintained, predictive picture, one that is progressively refined closer to the event to provide finally real time data.

The "time-ordered" system is a theoretical concept which, given the many and diverse vagaries and failure points of ATM, cannot be achieved in its entirety. Yet a substantial element of it could be established with the benefit flowing through to all but the most difficult major failure cases. Moreover, if the concept of interactive, collaborative management system, the Network-Centric Environment based on common information sharing were to be implemented, then its continued use would lead to greater efficiencies based on the growing experience of all the actors involved.

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THE PARADIGM SHIFT

Individual (national) airspaces and airports cannot continue to be regarded as singular and isolated components of ATM. For instance an event at one airport or a delay in en-route airspace all have “knock-on” effects within the ATM system as a whole. A transition to a service-centric approach within a pan-European business framework is clearly required. Future ATM must be managed on a holistic basis rather than the fragmented approach of today.

COLLABORATIVE INFORMATION SHARING IN EUROPE – THE NETWORK-CENTRIC APPROACH

Concept in Europe. The concept of a common (collaborative) information sharing has been under development in Europe for almost a decade. It was born from a clear recognition that future ATM will be managed on a “Network-Centric” (Net-Centric) basis, with each airport and each aircraft being considered as a node interlinked with all others within the system.

Collaborative Decision Making (CDM). Europe is making considerable investment in developing the means to implement CDM at airports as a first step towards system-wide efficiency. Substantial progress has been made with the individual actors at an airport identified and the information needs and flows mapped. Site specific trials at a number of airports are yielding positive results and CDM will be progressively rolled-out in Europe.

Nevertheless it is clearly recognised that individual (national) airspaces and airports cannot continue to be regarded as singular and isolated components of ATM but each will serve as a node interlinked with all others within the system. A transition to a service-centric approach within a pan-European business framework is clearly required. Future ATM must be managed on a “Net Centric” basis, and CDM and the “time-ordered” system will be practical instantiations of this.

THE NETWORK-CENTRIC APPROACH

Further initiatives are being undertaken in Europe. Three key activities, System-wide Information Management (SWIM), Overall ATM/CNS Target Architecture (OATA), Aeronautical Information Management (AIM), together with one completed implemented programme, the European Aeronautical Information Services Database (EAD) perhaps clearly demonstrate the commitment of Europe to the establishment of a viable, economic, interoperable Net-Centric environment.

SWIM. SWIM is a concept that originated in Europe in 1998. It has now been adopted by the International Civil Aviation Organization (ICAO), the Federal Aviation Administration (FAA) and others. In the ICAO Global Air Traffic Management Operational Concept SWIM is described thus: "System-wide information management aims at integrating the ATM network in the information sense, not just in the systems sense".

The ICAO view accords with the Department of Defense definition of the Network-Centric Environment: “Exploitation of advancing technology that moves from an application centric to a data-centric² paradigm – that is, providing users the ability to access applications and services through Web services – an information environment comprised of interoperable computing and communication components”.

Perhaps both definitions can be simply repackaged as the establishment of a managed and regulated Intranet of ATM.

OATA. The OATA project has been initiated to detail an architectural structure to support SWIM implementation. It provides guidance on moving from policies and strategy to implementation. While developing common ATM Concepts of Operation for the near future, OATA defines a number of logical building blocks for the required ATM/CNS functionality and provides the standardisation framework and guidelines needed for those building blocks to interoperate. The overall target architecture will address all the operational and technical issues at a conceptual level of the gate-to-gate approach to air traffic management.

Taken together, SWIM and OATA define the Net-centric environment of the future at the conceptual level. Yet SWIM, despite its global recognition and the architectural support from OATA remains a vaguely defined concept and can be interpreted in many ways from the linking of legacy systems to the realisation of the “global information pool”. As such it can be likened to fog: all can see it, none can hold it. Work is ongoing in Europe linked directly to the concept of AIM to put substance and structure into the acronym, SWIM and to implement a Network-Centric environment.

AIM. AIM is the tangible first demonstration of the means by which Europe intends to move to the Network-Centric environment and it is therefore to concentrate on this. The concept of AIM originated in the Aeronautical Information Services (AIS) environment in parallel to but independent from SWIM. It was and remains a practical response to a perceived growing need. Yet the description given in the ICAO ATM Concept could have been written to describe AIM.

In 2000 a EUROCONTROL developed AIM Strategy was adopted as European policy in which many of the key issues of change were addressed. The concept was endorsed by the 11th Air Navigation Conference in the Autumn 2003 and adopted as core policy of the United States in a paper submitted to the Conference.

Central to this strategy is the notion of transition from a product specific, manually processed and paper-based environment to one in which data would be made available in a managed, interoperable form. It recognized that the old order of aeronautical information as instantiated in ICAO Annex 15 (Aeronautical Information service – AIS) lacked the scope to satisfy the needs of an automated ATM system and envisaged a growing family of interoperable, platform free data exchange models to fill the vacuum. (Figure 1).

² Data-Centric—focusing on the central design data repository as the foundation or starting point. In a data-centric system, the data is primary and services manipulate the data envisaged a growing family of interoperable, platform free data exchange models to fill the vacuum. (Figure 1).

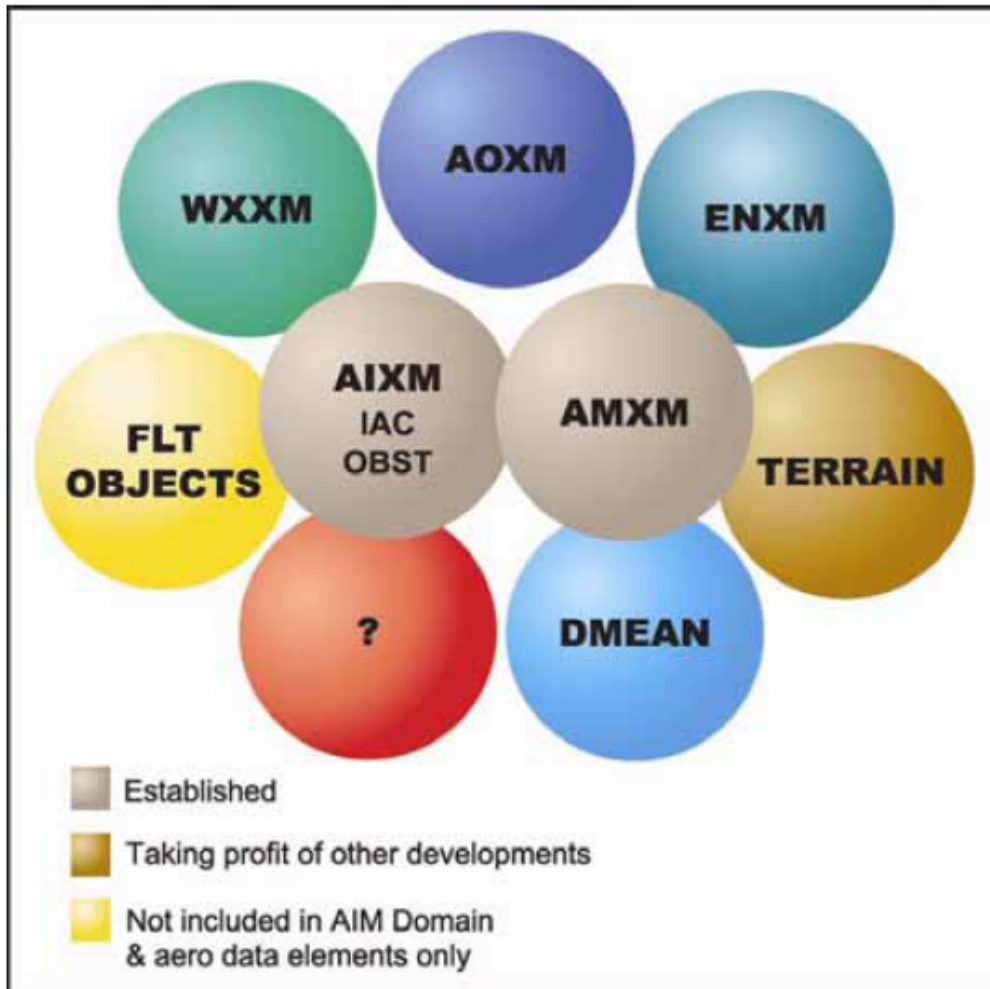


Fig. 1

The diagram represents pictorially the scope of AIM and a start has been made to achieve its objectives. An Aeronautical Information Exchange Model (AIXM) was developed for and is at the centre of the European AIS database (EAD). The EAD is a central repository of AIS data maintained by the individual European States and made available to all to use. It was declared operational in June 2003. EAD is the first element of the European implementation of NET-Centric ATM. The EAD and the ATM environmental database of the EUROCONTROL Central Flow Management Unit (CFMU) will be combined into a central data repository under the auspices of the EUROCONTROL Dynamic Management of Airspace framework programme circa 2010.

AIXM. The AIXM continues to evolve as a globally applicable aeronautical information exchange standard, which can satisfy the requirements of the current and future applications for automated aeronautical data management. Version 5 (V5.0) of this model will be made publicly available in November this year. AIXM V5.0 is intended to be the global model. It is the result of very close cooperation between Eurocontrol, the Federal Aviation Administration (FAA) and the National Geospatial Intelligence Agency (NGA) and its implementation will facilitate the development and introduction of a digital augmentation of the venerable Notice To Airmen (NOTAM) change message format and allow the delivery of change information in digital format directly to the end-user systems on the ground or in the air. And the concept could be extended to other similar forms of change information

such as the aviation meteorology (MET) Terminal Approach Forecast (TAF). The aim of the xNOTAM is to provide a generic message format to reduce the complexity of transmitting, receiving, interpreting and using data from very different disciplines for avionics use.

The major design principles of AIXM 5.0 are mature and have been available for public review since February 2006. The design team is currently working on refreshing some of the conceptual areas of the model (obstacle data, terminal procedures, airspace usage, etc.). The aim is to issue AIXM 5.0 as a candidate release by November 2006.

The AIXM is a powerful demonstration of the benefits to be obtained from a fundamental common understanding, finely harmonized project definition and a shared strong will to succeed. The AIXM was submitted to the Global AIS Congress held in Madrid in June this year. The Congress unanimously recommended that it should be adopted by ICAO as the global standard for the exchange of AIS and some related data. The adoption by ICAO is essential for global harmonization as many States will only respond to ICAO required need.

In parallel to the AIXM, there is an airport mapping model. The Airport Mapping Exchange Model (AIXM) has been developed from a common RTCA/EUROCAE requirement and as with the AIXM, it is publicly available for use. And a start has now been made on models for Aviation Meteorology (MET) and Airport Operations, and terrain is under consideration with cooperation with the military under discussion to make leverage of common need.

Flight Data Management. The final component of the AIM Concept, Flight Data Management (FDM) is also being developed. The essence of the FDM Concept is that for each flight which is planned, is currently active, or has taken place, there will be a 'flight object' which contains the latest confirmed information about the flight, including trajectory (estimated or actual), equipment, performance data, weight, etc. The Flight Object Concept will resolve the most significant flight data inconsistencies existing today in stakeholder systems and will ensure a system-wide availability of complete, up-to-date, consistent and accurate flight data, including trajectory information to all authorized users.

Work is currently underway to develop a Flight Object Interoperability Proposed Standard (FIOPS) the aim of which is to provide the basis for a new standard for flight data exchange in Europe. Its scope includes all ATM related flight data, pertaining to an individual flight that is of interest to more than one stakeholder system. It includes the data requirements of Air Traffic Control, Air Traffic Flow and Capacity Management, Airport Operations, Airline Operations, and the Military. The FOIPS project will define the "Flight Object". It will deliver an object oriented model of the flight object and a standard set of services that it must provide. This model will form a significant input to the further standardization work to define a new standard for flight data interoperability and contribute significantly to the development of a 4D view of ATM.

TOWARDS THE NET-CENTRIC ENVIRONMENT

So how does Europe intend to move to this brave new world? The need for the holistic provision and management of aeronautical information instantiated in SWIM has been recognised at the highest levels in Europe and included in the proposal for the joint EUROCONTROL/European Commission ATM Master Plan project – SESAR. SESAR, which equates to the Next Generation ATM System (NGATS) in the USA will take this high level vision and develop it into more detailed and practical concepts for change. It is anticipated that once validated these will form the basis of a major progressive implementation programme circa 2010-2020.

Evolving AIM. At the practical level and in the short-to-medium term, aeronautical information provision will be through an evolutionary approach starting with the implementation of AIM. AIM is the essential enabler that will establish the foundation for the provision and management of aeronautical information in Europe. It will evolve in a structured and incremental way. The means by which the technical viability of and the benefits to be obtained from the concept of AIM can be demonstrated at the technical level will be available in 2008. This proof-of-concept of the AIM will be based on the availability and synthesis of diverse data sets such as AIS, MET, Terrain and Airport Operations conditioned by the xNOTAM. In parallel activity shall be undertaken to establish the:

- Business case;
- Safety requirements;
- Security requirements (including protection against Cyber attacks);
- Access rules, etc.

Institutional challenges. But technology is not thought to be the problem. A number of presentations made during the Global AIS Congress on Regulatory, Legal and Security issues served to highlight the very significant challenges that institutional changes pose. And it is submitted that the resolution of the issues of who shall provide to whom with what quality, security and cost etc are the foundation on which the Net-centric Environment will be built and are essential for the implementation of SWIM. In consequence, parallel developments to determine the rules (institutional) and outline the problems that exist will be undertaken.

Implementation of AIM. Taken together, the technical and the institutional components will be developed into a business case for the implementation of AIM which is anticipated to happen circa 2012. The implementation of AIM will provide the proof-of-concept for SWIM and given that the Universal rules and best practices at the fundamental level will have been established, the implementation of SWIM will be a more technically oriented programme to achieve.

The AIM Strategy is, therefore an important first step on the road to SWIM. Significant activity is ongoing in Europe where operational needs dictate the pace of change. But ATM is increasingly considered as the global village and the rules and best practices envisaged under AIM will need to be tailored for universal application, and therefore global cooperation is clearly required.

GLOBAL COOPERATION

A global version of the AIM Concept was published to coincide with the Global AIS Congress to serve as a foundation and catalyst for the change debate. The Congress recommended this course of action and EUROCONTROL will actively sponsor further and extensive activity both at the European and Global levels in this respect.

In addition, it is clearly recognised that rules, standards and technical specifications need to be commonly developed and agreed. Europe will maintain its commitment and contribution to the development of industry such as those currently underway in RTCA Sc-206 whose members are developing air-ground datalink services for AIS and MET. The xNOTAM project will have great significance in this respect.

The role of EUROCONTROL and other international agencies is to coordinate and facilitate change. By contrast, and once the common rules have been established the development of applications and services is for industry alone to undertake

But such cooperation is not enough. A much closer relationship between aeronautical information providers, system designers and end-users must be forged for it is submitted that the trio are far from establishing a common picture of the essential components of a Network-Centric Environment. Without this common understanding the aspirations articulated earlier in this paper will never be achieved.

CONCLUSION

The paper has demonstrated the extent and the commitment of Europe to the realization of a sufficient aeronautical information environment to support the needs of ATM. Activity has been ongoing for a number of years and substantial progress is being made. But the globalization of such activity has not kept pace. Recognizing the necessity of a global approach, the Global AIS Congress was held earlier this year in Madrid. A start has been made and the need to change clearly recognized by the community that was present. But the challenge is to widen the audience to ensure the understanding of the need for a Net-centric Environment is fully understood and the benefits clearly articulated and demonstrated. For without such buy-in, the Net-Centric Environment and the truly efficient ATM system that it will enable will remain just a dream.

And this would be a shame. A recent report published in Europe put the cost of system inefficiency at €3.4B (\$4.4B) and concluded that there is little point in applying new technology to provide the required efficiencies unless fragmentation was addressed first. And the challenge is not just in improving efficiency but in adding substantially to the airport and airspace capacities in Europe. Successive studies have shown that demand in Europe will increase two-fold between now and 2025. Clearly something must be done and this is the aim of SESAR.

The EC and Eurocontrol expectations of SESAR is that it will deliver a future ATM system for 2020 and beyond which can, relative to today's performance, enable up to a three-fold increase in air traffic movements whilst reducing delays, improve the safety performance by a factor of ten, enable a ten percent reduction in environmental effect and provide ATM services at a cost to the airspace users which is fifty-percent or less than today. The bar has been set very high indeed.

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Taken together, the prize to be obtained is enormous, but its attainment is reliant on a universal or common picture enabled by good quality, timely, accurate and sufficient information. The rules for the Network-Centric Environment must be developed now to meet the challenges of 2020 and beyond.

- END -