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Operational Services and Environment Definition (OSED) for Aeronautical Information Services (AIS) and Meteorological (MET) Data Link Services

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FOREWARD

The original report was prepared by RTCA Special Committee 206 (RTCA SC-206) and approved by the RTCA Program Management Committee (PMC) on December 6, 2007.

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PREFACE

Within both the Next Generation Air Transportation System (NextGen) developed in the United States and the Single European Sky ATM Research (SESAR) initiative, it is acknowledged that Aeronautical Information Services (AIS) and Meteorological (MET) information are essential for the entire Air Traffic Management (ATM) system, and essential to its efficient operation. New means for AIS and MET services support collaborative decision making processes using efficient end-user applications to exploit the power of shared information.

In this framework, this document presents the AIS and MET data link services that are envisaged to be implemented within the next decade in both the USA and Europe. It is presented in an Operational Service and Environment Definition (OSED) form, which was developed based on the criteria set forth in RTCA DO-264 / EUROCAE ED-78A "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications". The OSED describes the intended AIS and MET data link services and the assumptions about the environment in which they operate.

This document will be subsequently completed by Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP) for these AIS and MET data link services. The SPR and INTEROP are necessary to provide adequate assurance that the elements of the relevant Communication, Navigation and Surveillance (CNS) and/or ATM system, when operating together, will perform their intended function in an acceptably safe manner for the operations defined in this OSED.

Achieving the goal of AIS and MET data link services will be evolutionary. This OSED is written to provide a foundation for comprehensive AIS/MET data link services to meet the emerging operational needs of ATM in its broadest sense. This is why this OSED may need updates in the future, in particular as a result of SPR and INTEROP developments. It is also recognized that in addition to this overarching document, more short-term and focused services encompassing some parts of AIS and MET are being developed.

In this document, the background and common functions and attributes of AIS and MET data link services are presented in the first five sections. The details for the data link services are then described in Section 6 for AIS and Section 7 for MET. Additional background and explanatory material are provided in the Appendices: Definition of Terms in Appendix A; References in Appendix B; Illustrative Examples in Appendix C; and Membership in Appendix D.

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1 INTRODUCTION

Air transport has evolved to become a key enabling component of the world economy. As the global economies expand, the demand for air transportation grows apace. Airspace and airport capacity must be increased to accommodate this demand. Since traditional methods of increasing capacity are near exhaustion, new and improved methods and concepts are needed to maximize the exploitation of existing capacity and to add capacity wherever possible. In order to release the latent capacity in the Air Traffic Management (ATM) system and to create new capacity, ATM is required to evolve and implement the means to provide the necessary capacity in a safe, timely, efficient and cost-effective way.

ATM will depend extensively on the provision of timely, relevant, accurate, and quality assured information that allows the ATM Community to make informed decisions. These decisions will need to be taken on an executive basis or in collaboration with others (Collaborative Decision Making - CDM). When shared on a system-wide basis and using advances in the corresponding technologies, information will allow the ATM community members to conduct their business and operations safely and efficiently. AIS/MET data link will enable the sharing of data between aircraft and ground. This will permit adequate contract negotiations of 4D trajectories as targeted by the SESAR and NextGen initiatives.

1.1 Background

The availability of timely, accurate and relevant aeronautical information in the cockpit is critical to the safe conduct of flight and forms the basis of aeronautical decision making. The ability to create a truly temporal aeronautical information environment is an essential component of the future ATM system. The data link of aeronautical information directly into the cockpit, irrespective of the aircraft's location, constitutes a notable advantage over current practices. It is assumed that this data will be continuously updated and maintained by ground-based systems and will be made available for use by the aviation community, on the ground, and in the air by all onboard data systems. The ultimate vision and goal of the aviation community is the real-time update of aeronautical data by data link.

The traditional product-centric provision of aeronautical information, in its most general sense however, has to be replaced by data-centric and service-oriented architecture systems. In such systems, the focus is on providing the information required by the aircraft and users in a timely and reliable manner, permanently or dynamically; and is less focused on the combinations in which the information is presented. The systems on the ground or onboard the aircraft are used to provide the information in combinations suited for a particular task, such as flight planning, flight management, navigation, separation assurance, CDM or any other strategic or tactical ATM activity. These changes in ATM concepts will enable enhanced capacity as well as increased safety in flight operations, and will become components of the future performance-based ATM system.

The data link of Aeronautical Information Services (AIS) and Aviation Meteorological (MET) information is one component of this system change. Derived from a network of databases on the ground and in the air, such data link service(s) will facilitate the creation of a common picture of the airspace situation for all pilots and controllers. Without current, up-to-date information onboard the aircraft that is accessible to the flight crew, it

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is virtually impossible for pilots to adequately discharge their pilot-in-command responsibilities effectively. Change notifications and timely warnings and alerts of operational hazards to the safe and efficient conduct of flight will be enabled by these data link service(s).

The management of aeronautical information is part of the foundation upon which the International Civil Aviation Organization's (ICAO) global ATM operational concept is being built. This global ATM concept provides a foundation for the Next Generation Air Transportation System (NextGen) developed in the United States by the Joint Planning and Development Office (JPDO), and the parallel Single European Sky ATM Research (SESAR) initiative. This Operational Services and Environment Definition (OSED) includes service descriptions for two major categories of Aeronautical Information Management (AIM) information: AIS and MET information.

In writing this OSED, it is recognized that the goal of creating the information network comprised of a fusion of terrestrial and ground-air data links will be evolutionary and will take many years to achieve. This OSED is written to provide a foundation for the evolution of comprehensive data link services to meet the emerging operational needs of ATM in its broadest sense.

1.2 Aeronautical Information Services (AIS)

Today, the State is responsible for publishing and maintaining aeronautical information in accordance with the Aeronautical Information Regulation and Control (AIRAC) system's 28-day cycle defined in ICAO Annex 15 (Aeronautical Information Services). It is disseminated to the international aviation community by post, often incurring delays in the delivery process. In consequence, States are increasingly utilizing electronic means to make change information available by the required dates using, for example, CD-ROM or the internet.

Irrespective of the individual means of delivery, the aeronautical information is then manually processed (validated, assembled, and revalidated) before being transformed into aeronautical databases or published in paper form as charts and flight guides. The intent of synchronizing the navigation databases is to ensure that at the time of changeover of aeronautical information, in accordance with the AIRAC system, every aircraft worldwide has a current and valid database.

The AIRAC system was established in 1966 to manage long-term changes to aeronautical information. Shorter term changes are published through Notices to Airmen (NOTAM), a text message reminiscent of a telegram in style. The NOTAM system currently constitutes the main mechanism for the dissemination of this temporary data. The present NOTAM system has a number of limitations. For instance, NOTAMs of short duration or Aeronautical Updates that are received after the cut-off date for database assembly will not be included in the revised navigation and airport mapping database or in amended aeronautical charts. Consequently, pilots are required to obtain and review such changes during the preflight briefing. The assembly of such information is a complex and time-consuming task and one in which essential information may be missed. The transition to a fully digital environment with change information enabled through data link is needed to rectify the shortcomings of today and to enable the ATM system of the future.

The focus of the AIS section of this document is to identify the evolutionary steps necessary to implement the real-time distribution of aeronautical information through the establishment of AIS data link services (AISLINK). The intent is to augment and

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eventually replace the current AIRAC system based on the 28-day cycle and textual NOTAMs. It is also recognized that in addition to current aeronautical data, there are additional data, e.g., airport mapping databases, that may be made available and considered for the AIS data link services. Clearly there will be significant benefits to be obtained in providing pilots with timely aeronautical information that is easily interpreted by computer-based systems.

1.3 Aviation Meteorological (MET) Services

A broad portfolio of Aviation Meteorological (MET) products and services is used by pilots to support aircraft operations as described in ICAO Annex 3, Meteorological Service for International Air Navigation. Today, MET information is mainly provided in paper form for preflight planning and by voice radio contact during flight. In writing this document it is recognized that once pilots depart the briefing environment and with the exception of broadcast information obtained from the Automatic Terminal Information Service (ATIS), VOLMET, D-VOLMET and similar services, they generally lack the means to access timely and up-to-date MET information. This lack of availability has significant consequences in terms of enhanced flight safety, efficiency, and economy. The ability to have in-flight access to MET information that was previously available only during preflight briefings will also greatly enhance the ATM CDM processes.

Today, there is no one standard set of MET information that will meet the pilot's need for flight planning and near-term or immediate decision making. MET information is highly dynamic and time sensitive and includes meteorological reports (observations), analyses, forecasts, and other statements relating to existing or expected meteorological conditions. Stored and transmitted in a variety of formats, MET information is provided to end users in many different forms (e.g., verbal, textual, and graphical) and numerous formats.

In addition to providing ground-based MET information to aircraft, the aircraft may also collect and report MET data through automation using onboard sensors and data link communications. The value of timely reporting of such aircraft MET data has been long recognized and such reports are currently provided by many commercial aircraft. These automated aircraft reports of existing weather conditions are downlinked and provide valuable input to weather forecast models and other aviation weather support applications. Such reports could also be transmitted directly to other aircraft in the vicinity (crosslinked), providing timely updates of existing, especially hazardous, weather conditions.

The focus of the MET section of this document is to identify meteorological data link (METLINK) services that will provide timely distribution of MET information both to and from aircraft. These METLINK services will support pilot decision applications (i.e., flight planning decisions, near-term decisions and/or immediate decisions) as well as provide aircraft MET data for use by aircraft in the vicinity and for use in ground weather applications. Clearly there will be significant benefits to be obtained in providing timely MET information to and from aircraft that is easily interpreted by computer-based systems.

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2 SCOPE AND OBJECTIVE

The objective of this OSED is to provide the background to define the Safety and Performance Requirements (SPR) and Interoperability (INTEROP) documents for data link service(s) incorporating AIS and/or MET information. As shown in Figure 2-1, the aim is to provide aeronautical information for:

- Pilot decision support; and
- Collaborative Decision Making (CDM) between ground services, the flight deck, Air Traffic Control (ATC) and, as appropriate, Airline Operations Centers (AOCs) in all flight environments for flight efficiency and/or hazard avoidance.

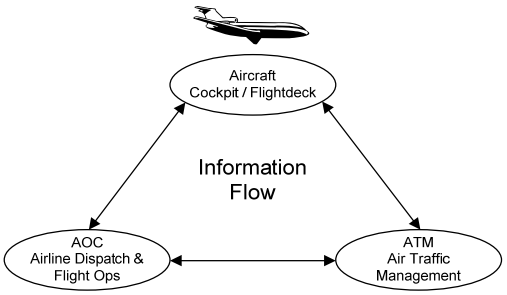


Figure 2-1 Sharing of Information is Key

The data link service descriptions are media independent and cover both one-way (broadcast) and two-way (demand and/or contract) data link system architectures for transmitting AIS and/or MET information to and from the aircraft. Section 5 contains more detailed descriptions of the various data link modes to include the downlink transmissions of aircraft MET data to the ground or the crosslink transmissions to other aircraft in the vicinity.

The data link services that provide ground-based information to the aircraft are classified by either the type of AIS information provided, or for MET information, by the time available to support a pilot decision making process. The decision time factor is based on the time between when information is made available and when the aircraft will potentially encounter the operational constraints or opportunities to be addressed by the pilot decision.

The data link services defined in this document are AISLINK and METLINK services as listed below:

AISLINK services (described in terms of how the data is changed or updated):

- Aeronautical Update Service
- Baseline Synchronization Service

and

METLINK services (described in terms of the immediacy of the decisions they support for WPDS, WNDS and WIDS listed below):

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- Weather Planning Decision Service (WPDS)
- Weather Near-Term Decision Service (WNDS)
- Weather Immediate Decision Service (WIDS)
- Weather Downlink and Crosslink Service

There are many common functions and attributes that will be included in the provision of data link service(s) for AIS and MET information. These common functions and attributes are described in Sections 3 through 5; and the details for the data link services are described in subsequent Section 6 for AISLINK and Section 7 for METLINK.

It is anticipated that operational deployments of AIS/MET data link system(s) may incorporate combinations of AIS and MET information derived from several, if not all of the AISLINK/METLINK services described in this OSED. Under such circumstances, the SPR and INTEROP requirements describing the capabilities of the data link would be driven by the most stringent requirements of the services offered over that link.

2.1 Assumptions

This OSED assumes that the information made available by data link is also available to the appropriate and authorized actors on the ground (for example, ATC, AOC). It is further assumed that the ground data system(s) and the aircraft data system(s) share the same time reference. This document addresses the provision of data link services between ground and aircraft data systems, while other standards describe the necessary aircraft systems, cockpit displays, and related human factors.

2.2 Disclaimers

This OSED does not address the following:

a. **Disclaimer:** This document does not address the roles and responsibilities of the various stakeholders (e.g., ANSP, ATC, AOC, avionics, users, pilot) and how these roles and responsibilities may change with the introduction of data link services.

b. **Disclaimer:** This document does not address data link related issues and concerns applicable to Unmanned Aerial Systems.

c. **Disclaimer:** This document does not address flight data recording requirements.

d. **Disclaimer:** This document does not address actions necessary to make flight plan changes that may result from pilot review of AIS/MET data link information. Those resulting actions will be conducted as a separate ATC service and are not considered part of these data link services.

e. **Disclaimer:** This document does not address the data quality (accuracy, resolution and integrity) of the source AIS/MET information.

f. **Disclaimer:** Despite numerous examples given, this document does not prescribe specific implementations as to how the AIS/MET data shall be used.

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