



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

SAFETY AND PERFORMANCE REQUIREMENTS (SPR) for AERONAUTICAL INFORMATION SERVICES (AIS) and METEOROLOGICAL (MET) DATA LINK SERVICES

This document is the exclusive intellectual and commercial property of EUROCAE.

It is presently commercialised by EUROCAE.

This electronic copy is delivered to your company / organisation for internal use exclusively

In no case it may be re-sold, lent or exchanged outside your company.

ED-175

January 2011

SAFETY AND PERFORMANCE REQUIREMENTS (SPR) for AERONAUTICAL INFORMATION SERVICES (AIS) and METEOROLOGICAL (MET) DATA LINK SERVICES

This document is the exclusive intellectual and commercial property of EUROCAE.

It is presently commercialised by EUROCAE.

This electronic copy is delivered to your company / organisation for internal use exclusively

In no case it may be re-sold, lent or exchanged outside your company.

ED-175

January 2011

FOREWORD

1. This document was prepared jointly by EUROCAE Working Group 76 and RTCA SC-206 and was approved by the Council of EUROCAE on 14 January 2011.
2. EUROCAE is an international non-profit making organisation in Europe. Membership is open to manufacturers and users of equipment for aeronautics, trade associations, national civil aviation administrations, and, under certain conditions, non-European organisations. Its work programme is principally directed to the preparation of performance specifications and guidance documents for civil aviation equipment, for adoption and use at European and world-wide levels.
3. The findings of EUROCAE are resolved after discussion amongst Members of EUROCAE. The content of this document is identical to the equivalent RTCA document, although the wording may not be the same in the introduction.
4. EUROCAE performance specifications and other documents are recommendations only. EUROCAE is not an official body of the European Governments. Its recommendations are valid as statements of official policy only when adopted by a particular government or conference of governments.
5. Copies of this document may be obtained from:

EUROCAE

102, rue Etienne Dolet
92240 MALAKOFF
France

Telephone: 33 1 40 92 79 30

Fax: 33 1 46 55 62 65

Email: eurocae@eurocae.net

Website: www.eurocae.net

PREFACE

This document specifies minimal baseline operational, safety and performance requirements for the data link delivery of AIS and MET information as the primary means of communications between the air and the ground. The aim of the AIS and MET data link services is to provide aeronautical and meteorological information for flight efficiency and/or hazard avoidance in all flight environments.

Key components of Next Generation Air Transportation System (NextGen) and Single European Sky Air Traffic Management Research (SESAR) ATM future concepts are data sharing and collaborative decision making (CDM). In NextGen and SESAR, the traditional product-centric provision of aeronautical and weather information will be replaced by data-centric and service-oriented architecture systems. Providing timely (and continuous) updates of data-centric information will facilitate the creation of a common picture of the airspace situation for all involved in the planning and execution of flights (e.g. pilots, controllers, dispatchers). It is expected there will be an increased need for information on the flight deck that can be integrated into flight decision support tools and/or visualized on systems such as the Navigation Display or Electronic Flight Bags.

Achieving the goal of AIS and MET data link services will be evolutionary. The feasibility of providing timely updates from dynamic digital AIS and MET data has already been partly demonstrated through projects like the European and US Digital NOTAM systems, the developing SESAR and NextGen Four Dimensional Weather Cube and by the Digital Aeronautical Information Management (D-AIM) project conducted by LFV (Luftfartsverket) Sweden and EUROCONTROL.

This document is based on the joint EUROCAE ED-151/RTCA DO-308 document, "Operational Services and Environment Definition (OSED) for Aeronautical Information Services (AIS) and Meteorological (MET) data link services." It was developed jointly by EUROCAE Working Group 76 and RTCA Special Committee 206 and follows the criteria for SPR documents set forth in EUROCAE ED-78A/RTCA DO-264, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications." In addition to the qualitative safety assessment methodology in EUROCAE ED-78A/RTCA DO-264, a quantitative safety assessment has been performed to meet the requirements of the EUROCONTROL Safety Regulatory Requirement ESARR 4, "Risk Assessment and Mitigation in ATM". The Operational Performance Analysis and resulting performance requirements were determined through the application of the Required Communications Performance (RCP) approach and a comparison with other services within the DFIS application.

Four AIS/MET data link services are covered in this SPR: an aeronautical update service that provides current updates of aeronautical information; and three weather decision services that provide current updates of meteorological information designed to support flight crew decisions in three time categories (planning, near term and immediate decisions). While the data elements and the intended uses of the AIS and MET data differ, there are many common features related to the operating methods for the AIS and MET data link services. The common and specific features of the four AIS/MET data link services are described in Section 4. A summary of the SPR requirements and recommendations is provided in Section 5.

This document is based on a notional architecture and is not intended for implementation and operational use until validation activities are completed. It provides a framework and a methodology to be used as the basis for assessing implementation of new data link systems or architectures as candidates for AIS and/or MET data link services.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	Purpose	3
1.2	Scope.....	3
1.3	Approval Documentation	5
1.3.1	ICAO Material.....	5
1.3.2	Approval Material	5
1.3.3	Provision for Requirements and Guidance Material Supporting Approvals.....	5
1.4	Assumptions	6
1.5	Disclaimers	6
1.6	Document Description	7
1.6.1	Document Organization.....	7
1.6.2	Requirements and Recommendations Numbering Methodology	7
1.6.3	Glossary, Abbreviations and Acronyms	8
1.7	References	12
2	AIR TRAFFIC SERVICES.....	13
2.1	Operational Capabilities Provided by Data Communications.....	13
2.2	Relationship of Air Traffic Service (ATS) Data Link Applications and Data Link Services, to ATS Procedures	14
2.3	Provision and Use.....	15
3	ENVIRONMENT TYPES AND CHARACTERISTICS.....	16
3.1	Airspace Domains.....	17
3.2	ED1 Managed Airspace.....	17
3.2.1	ED1 Operations.....	18
3.2.2	ED1 CNS/ATM Capabilities	18
3.2.3	ED1/IP1 Operations	19
3.2.4	ED1 Traffic Considerations	19
3.3	ED2 Unmanaged Airspace	20
3.3.1	ED2 Operations.....	20
3.3.2	ED2 CNS/ATM Capabilities	20
4	THE DFIS APPLICATION FOR AIS AND MET DATA LINK SERVICES.....	22
4.1	AIS/MET Data Link Common Features	22
4.1.1	AIS/MET Data Link Modes.....	22
4.1.2	AIS/MET Data Link Operational Service Description (OSD) and Service Operations.....	27
4.2	AIS/MET Data Link Services Specific Features	27
4.2.1	Data Link Aeronautical Update Service Specific OSD and Service Operations.....	27
4.2.2	Data Link Weather Planning Decision Service Specific OSD and Service Operations.....	29

	4.2.3	Data Link Weather Near-term Decision Service Specific OSD and Service Operations.....	29
	4.2.4	Data Link Weather Immediate Decision Service Specific OSD and Service Operations.....	30
	4.3	AIS/MET Data Link Services Operational Requirements.....	31
	4.3.1	AIS/MET Data Link Services Common Operational Requirements..	31
	4.3.2	AIS/MET Data Link Services Specific Operational Requirements....	32
	4.4	AIS/MET Data Link Services Operational Recommendations	32
	4.4.1	AIS/MET Data Link Services Common Operational Recommendations	32
	4.4.2	AIS/MET Data Link Services Specific Operational Recommendations	33
5		SUMMARY.....	34
	5.1	AIS/MET Data Link Services Common Requirements and Recommendations	35
	5.1.1	AIS/MET Data Link Services Common Operational Requirements..	35
	5.1.2	AIS/MET Data Link Services Common Operational Recommendations	35
	5.1.3	AIS/MET Data Link Services Common Safety Recommendations...	36
	5.2	AIS/MET Data Link Services Specific Requirements and Recommendations..	37
	5.2.1	D-AUS Specific Requirements and Recommendations.....	37
	5.2.2	D-WPDS Specific Requirements and Recommendations	41
	5.2.3	D-WNDS Specific Requirements and Recommendations	46
	5.2.4	D-WIDS Specific Requirements and Recommendations.....	50
ANNEX A		OPERATIONAL SAFETY ASSESSMENT (OSA) APPROACH FOR ED1 (MANAGED AIRSPACE).....	54
	A.1	Approach	54
	A.2	OSA Purpose and Scope.....	54
	A.3	Factors Considered	54
	A.4	Description of Factors Considered	55
ANNEX B		AIS/MET OSA FOR ED1 (MANAGED AIRSPACE)- DETAILED	60
	B.1	Operational Safety Assessment Methodology	60
	B.2	Operational Hazard Assessment.....	60
	B.3	MET – Operational Hazard Identification.....	79
	B.4	Allocation of Safety Objectives and Requirements	115
ANNEX C		OPERATIONAL PERFORMANCE ASSESSMENT (OPA) APPROACH FOR ED1 (MANAGED AIRSPACE)	121
	C.1	Introduction	121
	C.2	OPA Purpose and Scope.....	121
	C.3	Transactions	122
	C.4	Determination of RCP Type.....	125
	C.5	RCP TYPE ALLOCATIONS	128

ANNEX D	AIS/MET OPA FOR ED1 (MANAGED AIRSPACE)– DETAILED.....	130
	D.1 Purpose and scope.....	130
	D.2 Structure	130
	D.3 RCP parameters specifications and allocations for AIS data link services	130
	D.4 RCP parameters specifications and allocations for MET data link services	133
ANNEX E	AIS/MET OSA AND OPA – PRELIMINARY ANALYSIS FOR ED2 (UNMANAGED AIRSPACE).....	139
	E.1 Background.....	139
	E.2 AIS/MET Data Link Services Availability	139
	E.3 Operational Safety Analysis (OSA)	139
	E.4 Operational Performance Analysis (OPA)	142
APPENDIX A	LIST OF PARTICIPANTS	143

LIST OF FIGURES

Figure 1-1:	Scope of SPR	4
Figure 3-1:	Time frame for the NextGen and SESAR programs	16
Figure 4-1:	Broadcast Mode	23
Figure 4-2:	Demand Mode	24
Figure 4-3:	Contract Mode	25
Figure 4-4:	AIS temporal data	28
Figure B-1:	OHA Steps in OSA	60
Figure B-2:	Probability “Pe” per Hazard-Effect Pair Scheme	63
Figure B-3:	Event Tree modeling	67
Figure B-4:	Sample AIS Event Tree	69
Figure B-5:	Sample MET Event Tree (partial)	82
Figure B-6:	ASOR Steps	115
Figure B-7:	Notional Architecture of Data Link System	115
Figure B-8:	AIS/MET Generic Fault Tree	116
Figure C-1:	Broadcast Mode Time Sequence	124
Figure C-2:	Demand Mode Time Sequence	124
Figure C-3:	Contract Time Sequence Diagram	125

LIST OF TABLES

Table 1-1: Requirements and Recommendations Identifiers	7
Table 2-1: Relationship of Data Link Services to ICAO Material	14
Table 3-1: Separation Minima in Continental Airspace Domains	19
Table 3-2: Representative Traffic Characteristics in ED1	20
Table 4-1: Operating Method – Broadcast Mode	23
Table 4-2: Operating Method – Demand Mode	24
Table 4-3: Operating Method – Contract Mode	26
Table B-1: Severity Classification Matrix	62
Table B-2: Derivation of European Safety Targets	66
Table B-3: Safety Targets Based on the FAA SMS Approach	66
Table B-4: External Mitigation Means	68
Table B-5: AIS Update Severity Class Justification - Aerodrome	70
Table B-6: AIS Update Severity Class Justification - Terrain and Obstacle	71
Table B-7: AIS Update Severity Class Justification - Comm and Nav Aids	71
Table B-8: AIS Update Severity Class Justification - Airspace	72
Table B-9: Worst Credible Effect of AIS hazards concerning Aerodrome	72
Table B-10: Worst Credible Effect of AIS hazards concerning Terrain and Obstacle	73
Table B-11: Worst credible effect of AIS hazards concerning Comm and Nav Aids	73
Table B-12: Worst credible effect of AIS hazards concerning Airspace	74
Table B-13: How to read the EMM performance tables	74
Table B-14: Performance of EMM relating to AIS Aerodrome scenario	75
Table B-15: Performance of EMM relating to AIS Obstacle scenario	75
Table B-16: Performance of EMM relating to AIS navigation unavailability scenario	76
Table B-17: Performance of EMM relating to AIS Airspace scenario	76
Table B-18: AIS Safety Objectives – European	77
Table B-19: Summary of European Safety Objectives for AIS	77
Table B-20: Safety Objectives – U.S.	78
Table B-21: Summary of US Safety Objectives for AIS	78
Table B-22: AIS Safety Objectives for ED1	79
Table B-23: MET Severity Class Justification - Turbulence	83
Table B-24: MET Severity Class Justification - Convection	84
Table B-25: MET Severity Class Justification - Icing	84
Table B-26: MET Severity Class Justification - Volcanic Ash	85
Table B-27: MET Severity Class Justification - Tropical Cyclone	85
Table B-28: MET Severity Class Justification - Microburst	86
Table B-29: MET Severity Class Justification - Wake Avoidance	86
Table B-30: MET Severity Class Justification - METAR/TAF	87

Table B-31: MET Severity Class Justification - RVR	88
Table B-32: MET Severity Class Justification – Winds and Temps (ED1/IP1)	89
Table B-33: MET Severity Class Justification – Winds and Temps (ED1/IP2)	89
Table B-34: Worst Credible Effect of MET hazards in ED1 when in Turbulence	90
Table B-35: Worst Credible Effect of MET hazards in ED1 when in Convection	90
Table B-36: Worst Credible Effect of MET hazards in ED1 when in Icing	91
Table B-37: Worst Credible Effect of MET hazards in ED1 when in Volcanic Ash	91
Table B-38: Worst Credible Effect of MET hazards in ED1 when in Tropical Cyclone	92
Table B-39: Worst Credible Effect of MET hazards in ED1 when in Microburst	92
Table B-40: Worst Credible Effect of MET hazards in ED1 with Wake Avoidance	93
Table B-41: Worst Credible Effect of MET hazards in ED1 with METAR/TAF	93
Table B-42: Worst Credible Effect of MET hazards in ED1 with RVR	94
Table B-43: Worst Credible Effect of MET hazards in ED1/IP1 with Winds/Temps	94
Table B-44: Worst Credible Effect of MET hazards in ED1/IP2 with Winds/Temps	95
Table B-45: Performance of EMM relating to MET Planning Service Mode in ED1	96
Table B-46: Performance of EMM relating to MET Near Term Service in ED1	97
Table B-47: Performance of EMM relating to MET Immediate Service in ED1	98
Table B-48: European Safety Objectives for OH1 – Unavailable MET information	100
Table B-49: European Safety Objectives for OH2 – Incorrect MET information	101
Table B-50: European Safety Objectives for OH3 – Delayed MET information	102
Table B-51: European Safety Objectives for OH4 – Outdated MET information	103
Table B-52: European Safety Objectives for OH5 – Not applicable MET information	104
Table B-53: European Safety Objectives for OH6 – Incomplete MET information	105
Table B-54: Summary of European Safety Objectives for MET in ED1	106
Table B-55: US Safety Objectives for OH1 – Unavailable MET information	107
Table B-56: US Safety Objectives for OH2 – Incorrect MET information	108
Table B-57: US Safety Objectives for OH3 – Delayed MET information	109
Table B-58: US Safety Objectives for OH4 – Outdated MET information	110
Table B-59: US Safety Objectives for OH5 – Not applicable MET information	111
Table B-60: US Safety Objectives for OH6 – Incomplete MET information	112
Table B-61: Summary of US Safety Objectives for MET in ED1	113
Table B-62: MET Safety Objectives for ED1	114
Table B-63: Internal Mitigation Means	117
Table B-64: Proposed Allocation of IMMs to Data link Components in ED1	118
Table B-65: Data link Safety Objective Allocation for AIS in ED1	118
Table B-66: Data link Safety Objective Allocation for MET in ED1	119

Table D-1: RCP Timing parameters for D-AUS Broadcast	131
Table D-2: RCP Timing parameters values for D-AUS Demand	131
Table D-3: RCP2/RCTP2 Timing parameters for D-AUS Contract	132
Table D-4: Continuity, Availability and Integrity RCP parameters for D-AUS Broadcast	132
Table D-5: Continuity, Availability and Integrity RCP parameters for D-AUS Demand	132
Table D-6: Continuity, Availability and Integrity RCP parameters for D-AUS Contract	133
Table D-7: Timing RCP parameters for D-WPDS (Planning) Broadcast	134
Table D-8: Timing RCP parameters for D-WNDS (Near-Term) Broadcast	134
Table D-9: Timing RCP parameters for D-WIDS (Immediate) Broadcast	134
Table D-10: Timing RCP parameters for D-WPDS (Planning) Demand	135
Table D-11: Timing RCP parameters for D-WNDS (Near-Term) Demand	135
Table D-12: Timing RCP parameters for D-WIDS (Immediate) Demand	135
Table D-13: RCP2/RCTP2 Timing parameters for D-WPDS (Planning) Contract	136
Table D-14: RCP2/RCTP2Timing parameters for D-WNDS (Near Term) Contract	136
Table D-15: RCP2/RCTP2Timing parameters for D-WIDS (Immediate) Contract	136
Table D-16: Continuity, Availability and Integrity RCP parameters for D-WPDS Broadcast	136
Table D-17: Continuity, Availability and Integrity RCP parameters for D-WNDS Broadcast	137
Table D-18: Continuity, Availability and Integrity RCP parameters for D-WIDS Broadcast	137
Table D-19: Continuity, Availability and Integrity RCP parameters for D-WPDS Demand	137
Table D-20: Continuity, Availability and Integrity RCP parameters for D-WNDS Demand	137
Table D-21: Continuity, Availability and Integrity RCP parameters for D-WIDS Demand	138
Table D-22: Continuity, Availability and Integrity RCP parameters for D-WPDS Contract	138
Table D-23: Continuity, Availability and Integrity RCP parameters for D-WNDS Contract	138
Table D-24: Continuity, Availability and Integrity RCP parameters for D-WIDS Contract	138

CHAPTER 1

INTRODUCTION

NOTE: *This document has been developed to support user and provider validation activities associated with the data communications needs of future Air Traffic Management concepts e.g., Next Generation Air Transportation System (NextGen) and Single European Sky Air Traffic Management Research (SESAR) initiatives. A key component of NextGen and SESAR ATM future concepts is data sharing and collaborative decision making (CDM). The traditional product-centric provision of aeronautical and weather information will be replaced by data-centric and service-oriented architecture systems. Providing timely (and continuous) updates of data-centric information will facilitate the creation of a common picture of the airspace situation for all involved in the planning and execution of flights (e.g. pilots, controllers, dispatchers). It is expected there will be an increased need for information on the flight deck that can be integrated into flight decision support tools and/or visualized on displays such as the Navigation Display or Electronic Flight Bags (EFB).*

This document specifies safety and performance requirements for the data link delivery of AIS and MET information that is the primary means of communications between the air and the ground. The application of the AIS and MET information supports tactical as well as strategic decisions. The safety and performance analyses in this specification assume that voice is the secondary means of communication and is one of many mitigation means for failures of the data link service.

This document is based on a notional data link architecture. It is NOT intended for implementation and operational use until validation activities are completed based on candidate implementation data communications architectures. The methodology in this document can be used to support the intermediate application of AIS and MET data link services subject to revalidation of the assumptions and the environments described herein.

This document establishes the baseline operational, Safety, and Performance Requirements (SPR) for the implementation of Aeronautical Information Services (AIS) and Meteorological (MET) data link services as described in the joint EUROCAE ED-151/RTCA DO-308 document, "Operational Services and Environment Definition (OSED) for Aeronautical Information Services (AIS) and Meteorological (MET) data link services" [Ref. 1.]. In this document focus is on the uplink of AIS (Aeronautical Updates) and MET data in managed continental airspace (Environment Description 1 – ED1) and unmanaged airspace (Environment Description 2 – ED2) as described in Section 3. The other AIS/MET data link services described in the OSED are deferred for consideration by appropriate committees; specifically the baseline synchronization of aircraft AIS databases by data link as well as the downlink and crosslink of MET data.

This document establishes the requirements for providing timely updates of AIS and MET information from dynamic digital data. That dynamic data could be in the form of full featured product delivery, in the form of composable data elements, or any combination depending on the individual architecture employed. The feasibility of such an approach has already been partly demonstrated through projects like the European and US Digital NOTAM systems, the developing SESAR and NextGen Four Dimensional Weather Cube and by the Digital Aeronautical Information Management (D-AIM) project conducted by LFV (Luffartsverket) Sweden and EUROCONTROL.

This document was developed jointly by RTCA Special Committee 206 and EUROCAE Working Group 76 and is based on the criteria for SPR documents set forth in EUROCAE ED-78A/RTCA DO-264, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications" [Ref. 2.]. In addition to the qualitative safety assessment methodology in EUROCAE ED-78A/RTCA DO-264, a quantitative safety assessment has been performed to meet the requirements of the EUROCONTROL Safety Regulatory Requirement ESARR 4, "Risk Assessment and Mitigation in ATM" [Ref. 3.]. The provisions of FAA Safety Requirements Risk Management Guidance on System Acquisition (SRMGSA), Version 1.4 [Ref. 6.], were also considered as appropriate.

The format and approach of this document follow the Data Communications Safety and Performance Requirements (SPR), Version H, being developed concurrently by the joint EUROCAE Working Group 78 and RTCA Special Committee 214. The Data Communications SPR addresses implementation of Air Traffic Services (ATS) data link communications and includes several AIS and MET text products in its data link Flight Information Services (DFIS) Applications. In contrast, this document focuses on the transfer of valid AIS or MET data in digital form from approved¹ ground-based AIS or MET data sources to support automated processing and/or graphic as well as text display.

This document provides the minimum baseline AIS and MET data link services requirements - and example allocations thereof - based on a notional architecture and the results of a coordinated requirements determination process for the first two phases of the data communications evolution through the NextGen Mid Term implementation, and the corresponding SESAR Implementation Package 2 (IP2) (circa 2018). The notional system described here includes ground and airborne elements as illustrated in FIGURE 1-1. These elements include the aircraft onboard transceiver and data link processing system(s), the ground transceiver and data link processing system(s) as well as the AIS/MET and Flight Plan (or Trajectory) data source(s). The AIS/MET data link services may be provided by State organization(s) or approved commercial vendor(s) - including an Air Navigation Service Provider (ANSP). The ground-air-ground communications services may be provided by a State or an approved commercial provider (Communication Service Provider or ANSP as well).

For ED1, detailed safety analyses of both AIS and MET applications were conducted using selected operational scenarios. Given the notional architecture, the performance requirements were determined through a comparative survey analysis of existing data communications performance requirements. For ED2, the analysis was conducted by comparison with ED1, based on the differences in CNS/ATM capabilities between the two environments.

¹ In the whole document, the expression "approved source" should be understood as "a data source that has been officially recognized by the relevant State authority"

1.1 PURPOSE

The aim of AIS and MET data link services is to provide aeronautical and meteorological information for flight efficiency and/or hazard avoidance in all flight environments. This information provides a common operating picture between the aircraft and the ground. It is intended to meet operational and regulatory requirements for flight crew decision support (i.e. enabling informed flight crew participation in CDM) and other actors on the ground who will be enabled, through a concept like SWIM to share the same information.

This document defines and allocates the set of baseline minima for the operational, safety, and performance requirements for implementation of AIS and MET Data Link services. These requirements are based on the data link delivery being the primary means of communication between the air and the ground, and the application of the AIS and/or MET information supporting tactical as well as strategic decisions. Voice is considered the secondary means of communications.

This document provides a framework and a methodology to be used as the basis for assessing implementation of new data link systems or architectures as candidates for AIS and/or MET data link services. It can also be used to support the processes that are required to enable Air Traffic Services (ATS) provider operational approval for the AIS/MET data link services.

1.2 SCOPE

This document supports the provision of AIS and MET data link services as components of the Data Link Flight Information Services (DFIS) application as defined in ICAO Doc 9694, Manual of Air Traffic Services Data Link Applications [Ref. 7.]. The AIS/MET data link services are intended to be provided to airspace users in various airspace environments, i.e. managed continental airspace (ED1) and unmanaged airspace (ED2), see Section 3.

The operational concept describes the delivery of digital AIS/MET data to aircraft within the area of responsibility of the AIS/MET Data Link Service Provider (DLSP). For the provision of its service(s), the DLSP relies on data / information from approved source(s)² and on the most suitable data link communications means between the ground and the aircraft from Communications Service Provider(s). The service provision is independent of the air traffic control service and may be provided by State as well as commercial providers.

The operational concept assumes that the AIS/MET data will be the same as used by air traffic control. This will, in particular, ensure consistent information is shared by the various users participating in air traffic management (ATM). A typical application example is CDM.

The AIS/MET data source(s) are considered outside the scope of this SPR document and the data they provide are assumed correct. In addition, sources providing other data types (e.g. Flight Plan) necessary for an efficient implementation of the AIS/MET data link services are also outside the scope and their data are assumed correct. This SPR, notably in its Safety analysis, only considers errors in the AIS/MET data that are introduced by the data link system components. On the aircraft side, the flight crew interaction as well as the end use of the information performed by cockpit avionics (i.e. Flight Management System or display system) were considered in the analyses but are outside the scope of this SPR.

² In the whole document, the expression “approved source” should be understood as “a data source that has been officially recognized by the relevant State authority.”

This document provides Safety and Performance Requirements for the following AIS/MET data link services based on the service descriptions provided in the OSED [Ref. 1.] and outlined in this document:

a. AIS service:

- Data Link Aeronautical Update Service (D-AUS); Section 4.2

b. MET services :

- Data Link Weather Planning Decision Service (D-WPDS); Section 4.3
- Data Link Weather Near-Term Decision Service (D-WNDS); Section 4.4
- Data Link Weather Immediate Decision Service (D-WIDS); Section 4.5

NOTE: The OSED includes two additional AIS/MET Data Link services: the AIS Baseline Synchronization Service (Complete Synchronization and Update Synchronization) and the MET Weather Downlink / Crosslink Service. The basic concepts for these services are sound but the safety and performance analyses for these services have been deferred until a clear need is identified and candidate architecture(s) for implementation defined. Development of the corresponding SPR will then have to be considered by appropriate committees / working groups.

FIGURE 1-1 presents a notional architecture of the system considered during the development of this SPR. This notional architecture illustrates a four component system used to support the safety and performance analyses and does not preclude the implementation of a different architecture.

The four components considered for the development of this SPR are:

- Ground Data Link Processing (GDLP);
- Ground Transceiver (GDLP/tr);
- Onboard Data Link Processing (ODLP);
- Onboard Transceiver (ODLP/tr).

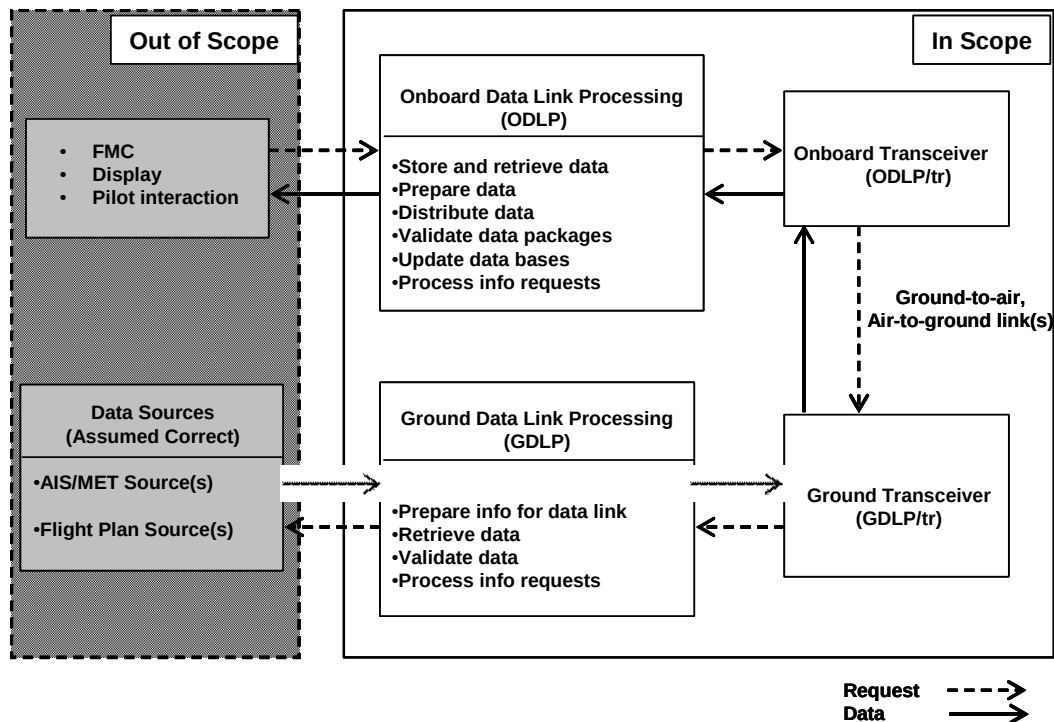


FIGURE 1-1: SCOPE OF SPR

Because this SPR is based on a notional architecture, the content and format of AIS/MET messages cannot be specified at this stage. These will have to be addressed at the time of the implementation of candidate data communications architectures and may be the subject of future standards documents.

NOTE: *The security assessment for the transmission of AIS and MET data is out of the scope of this document.*

1.3 APPROVAL DOCUMENTATION

1.3.1 ICAO Material

This SPR standard considers the International Civil Aviation Organization (ICAO) material identified in paragraph 1.7. Terminology used in this standard is consistent with ICAO use.

NOTE: *This SPR standard is intended to be operationally oriented and is not based on any particular technology. When ICAO material refers to a specific technology, this standard only considers the operational intent.*

1.3.2 Approval Material

This SPR standard is intended to provide the baseline minimum standards to support approval of AIS and MET data link services as CNS/ATM system elements. After validation of its applicability for a candidate data communications architecture, it may be used with INTEROP standards and, where appropriate, other SPR standards, as evidence of a coordinated requirements determination process which is defined in EUROCAE ED-78A / RTCA DO-264. These standards provide the basis for qualifying the operational, safety, and performance aspects of an element of the CNS/ATM system. To qualify, the selected INTEROP standards have to be shown to be compatible with the SPR standards.

1.3.3 Provision for Requirements and Guidance Material Supporting Approvals

This document uses the word "shall" to indicate a mandated criterion; i.e. compliance is mandatory and no alternative may be applied.

NOTE: *In an approval context, the "shalls" are considered a mandated criterion if the:*

- *Applicant defines this standard, in conjunction with relevant INTEROP standards, and any adaptation (refer to EUROCAE ED-78A/RTCA DO-264, paragraph 1.3.3), as the approval basis, and*
- *Approval authority accepts this approval basis, which then defines the criteria for compliance.*

This document uses the word "should" to indicate that although the criterion is regarded as the preferred option or recommendation, alternative criteria may be applied. In such cases, alternatives should be identified in appropriate approval plans and agreement sought from the approval authority.

1.4 ASSUMPTIONS

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. This SPR is based on a notional architecture and covers the first two phases of NextGen/SESAR data communications through 2018. It is not intended for implementation and operational use until validation activities are completed based on candidate implementation data communications architectures. This SPR also assumes the following:

- a. The AIS/MET data link services are considered to be Normal Communications, i.e. required by the ATS function;
- b. States may need to assess the impact on the institutional safety assessment results based upon the local conditions, when the characteristics of the types or conditions provided in this document are not appropriate for an implementation;
- c. The AIS/MET information made available by data link is also available to the appropriate and authorized actors on the ground (for example, ATC, AOC);
- d. The ground data system(s) and the aircraft data system(s) share the same time reference.

1.5 DISCLAIMERS

This SPR does not address the following:

- a. This document does not address the roles and responsibilities of the various stakeholders (e.g., ANSP, ATC, AOC, avionics, users, and pilot) and how these roles and responsibilities may change with the introduction of data link services.
- b. This document does not address data link related issues and concerns applicable to Unmanned Aerial Systems.
- c. This document does not address flight data recording requirements.
- d. 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. This document does not address the data quality (accuracy, resolution and integrity) of the source(s) of AIS/MET information or other data source(s) used in providing the AIS/MET data link service(s) (e.g. Flight Plan).
- f. Despite numerous examples given, this document does not prescribe specific implementations as to how the AIS/MET data shall be used.
- g. This document does not cover the Baseline Synchronization Service (AIS) nor the Aircraft Downlink and Crosslink of Meteorological Data (MET) as described in [Ref. 1].
- h. This document does not address the security assessment for the transmission of AIS and MET data,

1.6 DOCUMENT DESCRIPTION

1.6.1 Document Organization

- Section 1: Introduction to the AIS/MET data link services SPR.
- Section 2: Description of the operational objectives for the AIS/MET data link services in terms of the ATS objectives, as provided by ICAO Annex 11 and ATS functions related to implementing data communications services.
- Section 3: Overview of the environment and identification of conditions related to the provision and use of the AIS/MET data link services.
- Section 4: Flight Information Services Application: Operational Service Descriptions (OSDs) for AIS and MET data link services and associated Operational Safety Assessment (OSA) and Operational Performance Assessment (OPA) results.
- Section 5: Summary: List of Operational, Safety and Performance Requirements and Recommendations.
- Annex A: Summary of the approach used for the Operational Safety Assessment for ED1 (Managed Airspace).
- Annex B: Detailed AIS/MET OSA for ED1 (Managed Airspace).
- Annex C: Summary of the approach used for the Operational Performance Assessment for ED1 (Managed Airspace).
- Annex D: Detailed AIS/MET OPA for ED1 (Managed Airspace).
- Annex E: AIS/MET OSA and OPA – Preliminary Analysis for ED2 (Unmanaged Airspace).
- Annex F: Templates for AIS and MET Reports – Deferred.
- Appendix A: List of participants who contributed to the development of this SPR standard.
- Appendix B: EUROCAE Improvement suggestion form.

1.6.2 Requirements and Recommendations Numbering Methodology

To provide traceability, a standard schema has been used to identify all Operational, Safety and Performance Requirements and Recommendations. TABLE 1-1 identifies the labels used in this document.

TABLE 1-1: REQUIREMENTS AND RECOMMENDATIONS IDENTIFIERS

Label	Description
"SVC"-OR-##	Service specific Operational Requirement ("shall") Example: DAUS-OR-1
"SVC"-ORec-##	Service specific Operational Recommendation ("should") Example: DAUS-ORec-1
AMDS-ORec-##	AIS/MET Data link system Operational Recommendation ("should" or "may") Example: AMDS-ORec-1
"SVC" -SR-##	Service specific Safety Requirements ("shall") Example: DAUS SR-1
AMDS-SRec-##	AIS/MET Data link system Safety Recommendation ("should") Example: AMDS-SRec-1
"SVC"-PR-##	Service specific Performance Requirements ("shall") Example: DAUS-PR-1

"SVC"	Service
DAUS	AIS Updates
DWPDS	MET Planning
DWNDS	MET Near Term
DWIDS	MET Immediate

1.6.3 Glossary, Abbreviations and Acronyms

ACAS	Airborne Collision Avoidance System
ADS-B	Automatic Dependent Surveillance-Broadcast
ADS-C	Automatic Dependent Surveillance - Contract
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation And Control
Airspace Classifications	ICAO Annex 11, Air Traffic Services, 13th edition July 2001:
Class E	IFR and VFR flights are permitted, IFR flights are provided with air traffic control service and are separated from other IFR flights. All flights receive traffic information as far as is practical. Class E shall not be used for control zones.
Class F	IFR and VFR flights are permitted, all participating IFR flights receive an air traffic advisory service and all flights receive flight information service if requested.
Class G	IFR and VFR flights are permitted and receive flight information service if requested.
AIS	Aeronautical Information Services
AMDS	AIS/MET Data link Services
ANSP	Air Navigation Service Provider
AOC	Airline Operations Center
APT	Airport
ASAS	Airborne Separation Assistance/Assurance System
ASOR	Allocation of Safety Objectives and Requirements
ASOS	Automated Surface Observing System
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
ATN	Aeronautical Telecommunication(s) Network
ATS	Air Traffic Services
AWOS	Automatic Weather Observing System
CDA	Continuous Descent Arrival (ICAO) / Continuous Descent Approach
CDM	Collaborative Decision Making

CNS	Communication, Navigation and Surveillance
COCR	Communications Operating Concept and Requirements for the Future Radio System
CPDLC	Controller-Pilot Data Link Communications
CRC	Cyclic Redundancy Check
Data Link Application	Implementation of data link technology to achieve specific air traffic management (ATM) operational functionalities. Within each application, there may be several (sub) services. Example: DFIS is a Data Link Application. Ref: ICAO Document 9694, <i>Manual on Air Traffic Services Data Link Applications</i> , 1999.
Data Link Report Type	Designation for one of several data link services that have been packaged into another designated data link service in order to achieve cockpit workload efficiencies.
Data link service	(Sub) service under a Data Link Application that describes a particular service from an operational point of view. Within each service, there may be several Data Link Report Types. Example: Data Link Aeronautical Update Service (D-AUS) is a Sub-service of the DFIS Application.
D-AUS	Data Link Aeronautical Update Service
DFIS	Data Link Flight Information Service (DFIS) is a top level data link application. DFIS includes sub-services described in this SPR (D-AUS, D-WPDS, D-WNDS, D-WIDS)
DL	Data Link
DLSP	Data Link Service Provider
D-NOTAM	Digital NOTAM
D-WIDS	Data Link Weather Immediate Decision Service
D-WNDS	Data Link Weather Near-Term Decision Service
D-WPDS	Data Link Weather Planning Decision Service
EC	Environmental Conditions
ED1	Environment Description 1 (Managed Airspace)
ED2	Environment Description 2 (Unmanaged Airspace)
EFB	Electronic Flight Bag
EMM	External Mitigation Means
ESARR	EUROCONTROL Safety Regulatory Requirement
ETSO	European Technical Standard Orders
EUROCAE	European Organisation for Civil Aviation Equipment
EUROCONTROL	European Organisation for the Safety of Air Navigation
FAA	Federal Aviation Administration
FIS	Flight Information Service
FMS	Flight Management System

GDLP	Ground Data Link Processing
GDLP/tr	Ground Transceiver
GPS	Global Positioning System
HIWAS	Hazardous In flight Weather Advisory Service
ICAO	International Civil Aviation Organization
IMM	Internal Mitigation Means
INTEROP	Interoperability
IP1 - IP2 - IP3	Denotes the Implementation Phases of the SESAR Programme
ITU	International Telecommunication Union
LFV	Luftfartsverket (Swedish ANSP)
MASPS	Minimum Aviation System Performance Standards
MET	Meteorology / Meteorological
MET data element	Specific meteorological data related to individual meteorological phenomenon. MET data elements (may also called MET elements) may be combined to result in a MET product. Examples include measurements of wind, temperature, visibility, pressure, cloud cover and present weather NOTE: The combination of all the MET data elements examples would result in the METAR Product.
MET Product	Meteorological information (observations, analyses and/or forecasts) that are produced and distributed in accordance with a published or defined format. Examples include METARs, TAFs, SIGMETs.
METAR	METeorological Aerodrome or Aeronautical Report
MoG	Moderate or Greater (turbulence)
MOPS	Minimum Operational Performance Standards
NCAR	National Center for Atmospheric Research
NextGen	Next Generation Air Transportation System
NOTAM	Notice To Air Men
ODLP	Onboard Data Link Processing
ODLP/tr	Onboard Transceiver
OE	Operational Effect
OH	Operational Hazard
OHA	Operational Hazard Assessment
OI	Operational Improvement
OPA	Operational Performance Assessment
ORP	Oceanic, Remote, Polar
OSA	Operational Safety Assessment
OSD	Operational Service Description

OSED	Operational Services and Environment Definition
PANS-ATM	Procedures for Air Navigation Services - Air Traffic Management
Pe	Probability of Effect
pfh	Per flight hour
PIREP	Pilot REPort
RCP	Required Communication Performance
RCTP	Required Communication Technical Performance
RNAV	Area Navigation
RNP	Required Navigation Performance
RTCA	RTCA Inc. formerly Radio Technical Commission for Aeronautics
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minima
RWY	Runway
SC	Severity Classification
SC206	(RTCA) Special Committee 206
Service Provider (AIS and/or MET)	A government agency or commercial vendor that is approved to provide AIS and/or MET data to aircraft via data communications from approved AIS and/or MET data sources.
SESAR	Single European Sky ATM Research
SIGMET	SIGNificant METeorological information
SLD	Supercooled Large Droplet
SMS	Safety Management System
SO	Safety Objective
SPR	Safety and Performance Requirements
SRMGSA	FAA Safety Requirements Risk Management Guidance on System Acquisition
SUA	Special Use Airspace
TAF	Terminal Area (Aerodrome) Forecast
TFR	Temporary Flight Restrictions
TMA	Terminal Control Area (ICAO) also Terminal Manoeuvring Area
TSA	Temporary Segregated Area
TSO	Technical Standard Orders
VDL2	VHF Data Link Mode 2
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

VOLMET	Routine voice broadcasts of MET information for aircraft in flight
WCE	Worst Credible Effect
WG76	(EUROCAE) Working Group 76

1.7

REFERENCES

- [Ref. 1.]** EUROCAE ED-151/RTCA DO-308, Operational Services and Environment Definition (OSED) for Aeronautical Information Services (AIS) and Meteorological (MET) Data Link Services;
- [Ref. 2.]** EUROCAE ED-78A/RTCA DO-264, Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications;
- [Ref. 3.]** EUROCONTROL Safety Regulatory Requirement (ESARR4) – Risk Assessment and Mitigation in ATM – Ed 1.0 – April 2001;
- [Ref. 4.]** ED-125, Process for Specifying Risk Classification Scheme and Deriving Safety Objectives in ATM “in compliance” with ESARR 4;
- [Ref. 5.]** FAA Safety Management System (SMS), Version 2.1;
- [Ref. 6.]** FAA Safety Requirements Risk Management Guidance on System Acquisition (SRMGSA), Version 1.4;
- [Ref. 7.]** ICAO Doc 9694, Manual on Air Traffic Services Data Link Applications;
- [Ref. 8.]** ICAO 4444-ATM/501, Procedures for Air Navigation Services - Air Traffic Management; 15th Edition.
- [Ref. 9.]** ICAO Annex 3, Meteorological Service for International Air Navigation
- [Ref. 10.]** ICAO Annex 11, Air Traffic Services
- [Ref. 11.]** ICAO Annex 15, Aeronautical Information Services
- [Ref. 12.]** ICAO Doc 8126, Aeronautical Information Services Manual
- [Ref. 13.]** ICAO Doc 9869, Manual on Required Communication Performance; 1st edition – 2006
- [Ref. 14.]** Data Communications Safety and Performance Requirements, EUROCAE WG-78/RTCA SC-214 (SPR Draft H)
- [Ref. 15.]** FAA/EUROCONTROL Communications Operating Concept and Requirements for the Future Radio System (COCR) Version 2.0
- [Ref. 16.]** EUROCAE ED-120/RTCA DO-290, Safety and Performance Requirements Standard for Air Traffic Data Link Services in Continental Airspace (Continental SPR Standard)
- [Ref. 17.]** EUROCAE ED-122/RTCA DO-306, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (Oceanic SPR Standard)
- [Ref. 18.]** RTCA DO-267A, Minimum Aviation System Performance Standards (MASPS) for Flight Information Services-Broadcast (FIS-B) Data Link
- [Ref. 19.]** Safety Analysis Methodology for ADS-B Based Surveillance Applications (Hammer, Caligaris, Llobet); Paper presented at the 7th USA – Europe ATM Seminar (Barcelona, July 2007)

CHAPTER 2

AIR TRAFFIC SERVICES

Air Traffic Services (ATS), as defined in ICAO Annex 11, consist of three services: Air Traffic Control (ATC) Service, Flight Information Service and Alerting Service. This SPR mainly addresses AIS and MET data link services in support of the Flight Information Service. The AIS and MET data link services will assist the pilot throughout the planning and execution of the flight and provide essential input for pilot participation in NextGen and SESAR applications. Implementation and initiation of any of the AIS and/or MET data link services described in this SPR will need to consider any additional procedures associated with the specific operational data link technology being used.

2.1 OPERATIONAL CAPABILITIES PROVIDED BY DATA COMMUNICATIONS

AIS and MET data link services support the ATS Flight Information Service in the manner of Supplemental or Normal communications as defined by the Data Communications SPR [Ref. 14.]:

- a. Normal communications, i.e. required by the ATS function. Normal is characterized as follows:
 1. Qualified to the operational, safety, and performance requirements required for supporting the ATS function.
 2. When data communications can no longer be provided, procedures are established and in place onboard the aircraft and on the ground to transition to a degraded operation by ATC voice communications within acceptable time limits and without degradation to safety during the transition.
 3. Approved for use.
- b. Supplemental communications, i.e. use is not required by the ATS function it supports. Supplemental is characterized as follows:
 1. Data communications used for situations where the delay or loss of data link messages has no effect on the safety of operations and does not significantly affect the performance of operations, e.g. effects of loss are within tolerable limits of controller workload to enable safe transition to alternative procedures.
 2. Data communications are not required to achieve the ATS function since ATC voice can exclusively support the ATS function, i.e. use of ATC voice or data communications is at the discretion of the pilot/controller and provides an equivalent level of service.
 3. When data communications can no longer be provided, procedures are established and are in place onboard the aircraft and on the ground to sustain operations by ATC voice communications within acceptable time limits and without degradation to safety during the transition.
 4. Data communications provide sufficient integrity to avoid the need for procedural mitigation of anomalous behavior of the system (e.g., voice read-back of the data message).

This SPR considered the AIS/MET data link services to be Normal Communications in the context of the ED1 (managed airspace) environment in providing essential information to support Route Planning and the associated NextGen and SESAR concepts such as 4Dimensional Trajectory Based Operations (TBO), Continuous Descent Arrival (CDA) and Functional Airspace Blocks (FAB).

2.2 RELATIONSHIP OF AIR TRAFFIC SERVICE (ATS) DATA LINK APPLICATIONS AND DATA LINK SERVICES, TO ATS PROCEDURES

TABLE 2-1 shows the relationship of the Flight Information Service (FIS) data link application, the AIS/MET data link services, the associated air traffic service, and related international procedures as defined in ICAO PANS-ATM. The table signifies those international procedures for which the data link services described in this document are intended.

NOTE: States that adapt this standard to apply to international procedures not indicated in the table will need to assess the applicability of the data link services to those procedures. That assessment should include review of the operational safety assessment and associated assumptions, recommendations and operational requirements.

Prior to operational use of data link services in a particular airspace, operators, the State and its ATS provider shall establish the means to provide and use the AIS and/or MET data link services as described in Section 4.

TABLE 2-1: RELATIONSHIP OF DATA LINK SERVICES TO ICAO MATERIAL

Data Link Application	Data link service	Related Annex 11 air traffic services	Related PANS-ATM procedure
FIS	D-AUS	FIS	Examples: 7.5.3, Essential information on aerodrome conditions shall be given to every aircraft ... in sufficient time for the aircraft to make proper use of it ... 9.1.3, Transmission of temporary information and weather information given for safe and efficient conduct of flight
FIS	D-WPDS	FIS	Examples: MET information concerning aerodrome conditions plus significant changes: 6.4, Information for departing aircraft 6.6, Information for arriving aircraft MET information regarding en route adverse weather conditions: 8.6.9, Issued in sufficient time to permit the flight crew to decide on an appropriate course of action
FIS	D-WNDS	FIS	
FIS	D-WIDS	FIS	

2.3 PROVISION AND USE

The following basic procedures are essential for providing and using AIS and MET data link services. Additional procedures may be required based on the specific operational data link technology being used.

- a. The DLSP obtains approval to provide the service;
- b. Using the Aeronautical Information Publication (AIP), the ATS provider notifies aircraft operators of data link services to include details essential for service activation and support;
- c. The operating manual(s) clearly define the company rules for the operation of such services;
- d. Based on this and relevant regulations, the aircraft operator determines whether:
 1. Aircraft are properly equipped and approved for intended use of the data link services; and
 2. Flight crews are qualified to use these data link services.

NOTE: *It is assumed that Annex 15 will be revised to include such information in the AIP.*

CHAPTER 3

ENVIRONMENT TYPES AND CHARACTERISTICS

This section defines the types of operational environment, including related CNS/ATM capabilities, that support the establishment of the operational analyses (OSA and OPA) and the safety and performance requirements in this document. The CNS/ATM capabilities referred to in this document are provided as environmental assumptions, based on the reference material in the OSED [Ref. 1.] or on the SESAR and NextGen framework programs as explained below.

Two environments were defined for the purpose of this document: Environment Description 1 (ED1 Managed Airspace) and Environment Description 2 (ED2 Unmanaged Airspace). The ED1 and ED2 environments are related to the ICAO definitions as described in their respective sections below.

To address future traffic growth and increasing environmental constraints while ensuring safety, SESAR and NextGen programs have recently developed ATM modernization plans. These programs will progressively introduce new capabilities for all ATM stakeholders (ANSP, airports, aircraft, Flight / Wing Operations Centers) to implement Operational Improvements (OI) necessary to support the broad spectrum of shared situational awareness and collaborative decision making. This phased timeline translates into three Implementation Packages (IP), IP1, IP2 and IP3 for SESAR and Near Term, Mid Term and Long Term for NextGen.

FIGURE 3-1 shows the three timeframes of the SESAR and NextGen programs, as well as the period allocation for the operational environments defined in this standard (ED1 and ED2). ED1 is further split into ED1/IP1 to address IP1 and Near Term OIs. For comparison and harmonization, the related WG-78/SC-214 ATS [Ref. 14.] data link environments (ENV A and B) are also shown.

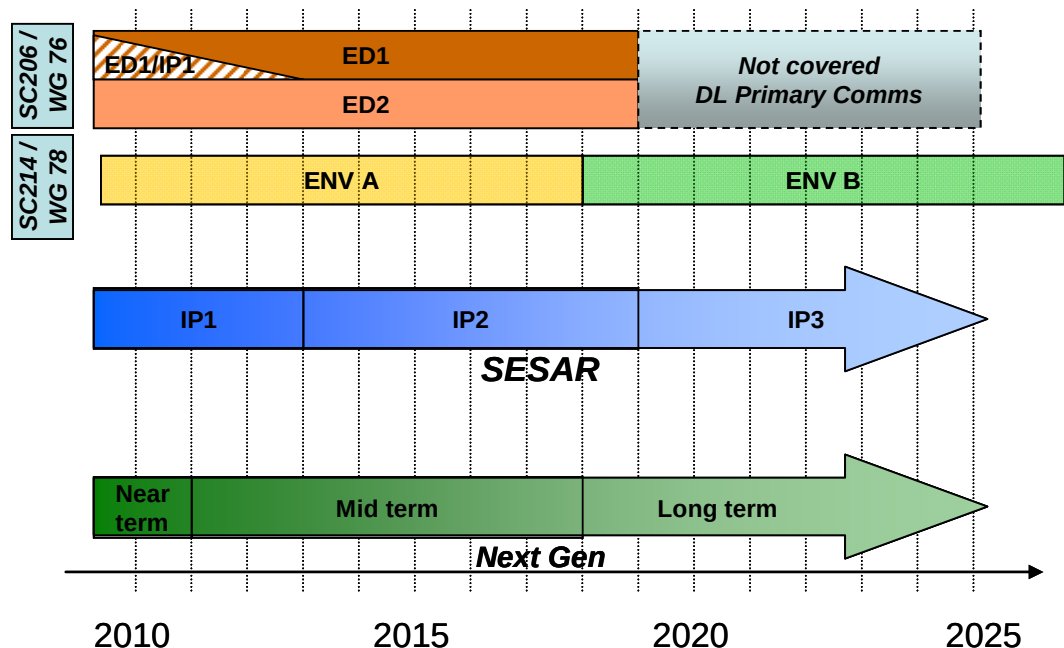


FIGURE 3-1: TIME FRAME FOR THE NEXTGEN AND SESAR PROGRAMS

Within the timeframe of this SPR, there are two transition points:

- One around 2012-13 (end of SESAR IP1): Before this date, current capabilities, operations, technologies and solutions are predominant.
- One around 2018-19 (end of SESAR IP2 and NextGen Medium Term): Before this date, the foreseen SESAR and NextGen capabilities are in transition to full implementation. Avionics and ATM automation are of mixed performance.

The period after 2019 is not covered in this document as it is assumed that the rate of equipage will be at such a high level that data link will be the primary means of communications. It is assumed, nonetheless, that the requirements stated in this SPR will remain valid for that period.

NOTE: *When the characteristics or conditions of the environment types (ED1 and/or ED2) provided in this document are not appropriate for implementation of one or more AIS/MET data link service(s), States (and implementer(s)) may need to assess the impact on the Safety and Performance Assessments based upon the local conditions.*

3.1 AIRSPACE DOMAINS

For the purposes of this document, the airspace domain definitions listed below are used. These definitions are based on the FAA/EUROCONTROL Communications Operating Concept and Requirements for the Future Radio System (COCR) Version 2.0 [Ref. 15.], and are used primarily to support the operational performance assessment. It is recognized that specific regional differences in the domain definitions exist.

- ENR (Enroute):** The ENR domain consists of the airspace that surrounds the TMA domain starting at ~FL245 to ~FL600. It is the continental (or domestic) airspace used by ATC for the cruise portion of the flight.
- TMA (Terminal Control Area):** The TMA domain consists of the airspace surrounding an airport, typically starting at ~5000 ft AGL up to ~FL245. This is the transition airspace used by ATC to merge and space aircraft for landing or for entrance into the ENR domain. The TMA typically radiates out ~50 nautical miles (NM) from the center of an airport.
- APT (Airport):** The APT domain consists of an area 10 miles in diameter and up to ~5000 ft AGL, consisting of the airport surface and immediate vicinity of the airport. This is the airspace and airport domain used by ATC for predeparture, taxi, takeoff and landing portions of the flight.
- ORP (Oceanic, Remote, Polar):** The ORP domain is the same as the ENR domain, except that it is associated with geographical areas generally outside of continental airspace.

3.2 ED1 MANAGED AIRSPACE

This environment covers the transitional phase of the ATM modernization plans, i.e. mixed performance airspace in continental airspace. Key characteristics are the mixed equipage of the avionics, the progressive enhancement of ATM automation and the introduction of data communications. For the data communications equipped aircraft, there will be differing capability levels including those defined by ED-120/DO-290 [Ref. 16.] and WG-78/SC214 [Ref. 14.] as well as capabilities to support the services defined in this document.

To further discriminate within ED1 and highlight the limitations of current operations reflected in the initial implementation of data communication, the early phase has been identified as ED1/IP1. ED1/IP1 covers early data communications initiatives in NextGen and SESAR (up to 2013) to establish the infrastructure for full data communications support. In ED1/IP1, voice communications remains primary and limited numbers of aircraft are data link equipped.

The main focus of this SPR is the latter portion of ED1 (ED1/IP2) when a majority of aircraft is equipped so that data link becomes the primary means for communications while still addressing legacy aircraft primarily by voice.

3.2.1 ED1 Operations

In transitioning to the future ATM system operations, the controller's primary responsibilities will be similar to current operations as aircraft capabilities are mixed, i.e. not all aircraft will have the ability to fly more accurately along their cleared flight paths, or provide state and intent information to the ATC automation, enabling aircraft based conformance monitoring. The controller remains responsible for separation assurance while using automation tools to assist in problem detection. As some aircraft will support enhanced operations, a likely consequence will be a decrease in the number of problems (e.g. weather diversion requests) to be handled by the controller and presentation of more efficient resolutions. Finally, mixed performance airspace may co-exist with routes or blocks of high-performance airspace, according to the respective SESAR and NextGen concepts.

AIS/MET data link services are crosscutting capabilities supporting all the ATM/CNS capabilities described in the following section.

3.2.2 ED1 CNS/ATM Capabilities

The following gives an overview of the CNS/ATM capabilities in terms of key performance indicators as well as operational improvements. Whenever possible, an example of function enabled in this environment is provided.

3.2.2.1 ATC Communication Capabilities

Voice is the normal means of ATC communications. The use of data communications is required to meet the operational objectives for non time-critical ATC communications. Aircraft data communications equipage is expected to reach 75% by the end of ED1 and support applications such as CPDLC and ADS-C.

Functions enabled include initial 4D trajectory management with uplink of constraints (e.g., Gate Holds) and downlink of aircraft intent and trajectory information. Other data communications services include D-NOTAM and D-Taxi.

For AIS and MET information, the primary means for delivery to the aircraft is via data link as normal communications given the high number of aircraft equipage. Voice is considered a mitigation means.

3.2.2.2 Navigation Capabilities

Navigation capabilities include: precision landing system for the airport domain, RNAV/RNP1 within the TMA, RNAV/RNP4 and RVSM Enroute.

Functions enabled include initial 4D trajectory management with avionics/FMS auto-load, enhanced CDA, prediction trajectory clearances in 2D and enhanced 2D RNP in TMA, weather re-planning, etc.

3.2.2.3 Surveillance Capabilities

Visual separation is applied by flight crews in the airport domain and runway occupancy is controlled by the tower controller. ADS-B based Air Traffic Situation Awareness applications are implemented, the initial delegated spacing (interval management) and delegated separation applications arrive progressively. Onboard surface collision warning system (including runway incursion alerts) and ACAS functions are provided to the flight crew.

3.2.2.4 ATM

In the airport domain, runway occupancy is controlled by the tower controller and, runway incursion alerts are provided to ATC as replacement of or complementary to flight crew alerts.

For TMA and Enroute performance based operations, aircraft are sequenced / deconflicted 20 minutes ahead (using queuing tools and medium-term and short-term conflict detection safety nets), real-time monitoring of performance compliance is conducted and exceptions will be alerted and handled tactically.

The currently existing separation minima are given in TABLE 3-1.

TABLE 3-1: SEPARATION MINIMA IN CONTINENTAL AIRSPACE DOMAINS

	APT Domain	TMA Domain	ENR Domain
Horizontal	2 or 3 nm or wake turbulence criteria (whichever is greater)	3-5 NM	5 NM
Vertical	Not Applicable	1000 ft	1000-2000 ft

3.2.3 ED1/IP1 Operations

ED1/IP1 was defined to support the safety and performance analyses, especially for MET data link services. This environment covers the early implementation of AIS and MET data link services up to 2013.

This environment assumes current capabilities in Communications (to include voice and data), Navigation and Surveillance. In IP1 environment, there are no significant new ATM capabilities such as 4D Trajectories or ASAS, but these new ATM capabilities are assumed available in the rest of ED1.

Safety and Performance analysis of ED1/IP1 provided a basis for comparing the transition to ED1 and the more advanced ATM capabilities.

3.2.4 ED1 Traffic Considerations

The following traffic characteristics are defined for ED1. They are based on and harmonized with those listed in the WG-78/SC-214 SPR document [Ref. 14.] for the Environment A (see FIGURE 3-1).

TABLE 3-2: REPRESENTATIVE TRAFFIC CHARACTERISTICS IN ED1

Characteristics	Airport	TMA	Enroute
Traffic complexity	Complex with visual guidance	Complex route structure with complex arrival and departure routes. Multiple levels of controller to aircraft communications (i.e. voice, CPDLC). Potential reduction in separation	RNAV complex route structure Multiple levels of controller to aircraft communications (i.e. voice, CPDLC) Potential reduction in separation
Aircraft Flight Duration per Sector (minutes)	20.5	5.5	11.25
Average Aircraft Count per Sector (during busy hour)	61 (19 Ramp, 31 Ground, and 11 Tower)	16	26
Peak Instantaneous Aircraft Count per Sector	96 (30 Ramp, 48 Ground, and 18 Tower)	27	41
Aircraft Handled per Sector Hour (average)	179	175	139

3.3 ED2 UNMANAGED AIRSPACE

The unmanaged airspace ED2 can be associated with ICAO airspace classes F and G, (and also for VFR flights in class E airspace). The applicable timeframe extends beyond 2020. Two subcategories of ED2 are defined: denoted ED2a and ED2b.

3.3.1 ED2 Operations

In the ED2a airspace, ATC communication is available, however, no ATC surveillance is provided.

In the ED2b airspace, no ATC communication is available and no ATC surveillance is provided.

3.3.2 ED2 CNS/ATM Capabilities

The following provides an overview of the CNS / ATM capabilities for both sub-categories ED2a and ED2b.

3.3.2.1 Communication Capabilities

ED2a	ED2b
ATC communication via voice is available, but not required	ATC communication via voice is NOT available
Supporting communications are possible in both ED2a and ED2b: • Overhearing other aircraft voice communications on a common frequency (i.e. the “party line”) • Alternative voice/data services (e.g. ATIS, VOLMET) • Aircraft data link communications through satellite or ground-based systems (could include data link services provided by a State, ANSP or commercially)	

3.3.2.2 Navigation Capabilities

ED2a	ED2b
Class 1 and / or 2 navigation is assumed	Electronic navigation is assumed

3.3.2.3 Surveillance Capabilities

ED2a	ED2b
No ATC surveillance systems available (e.g. radar services, ADS-B).	No ATC surveillance systems available (e.g. radar, ADS-B).

3.3.2.4 ATM

The oceanic separations referenced in ICAO Document 4444 [Ref. 8.] are listed below in Table 3-3.

TABLE 3-3: SEPARATION MINIMA IN OCEANIC AIRSPACE

ORP Domain	
Lateral	90 NM, 60 NM, 50 NM, 30 NM
Longitudinal (time based)	20 minutes 15 minutes (primary for oceanic) 10 minutes (ATC assigned Mach number cruise speed)
Longitudinal (distance based)	50 NM, 30 NM

NOTE: *In various oceanic Control Areas (CTAs), the route spacing and/or navigation performance criteria will vary as published in the AIP.*

CHAPTER 4

THE DFIS APPLICATION FOR AIS AND MET DATA LINK SERVICES

The Flight Information Services Application in this SPR consists of the following services:

- The Data Link AIS Update Service (D-AUS),
- The Data Link Weather Planning Decision Service (D-WPDS),
- The Data Link Weather Near-Term Decision Service (D-WNDS), and
- The Data Link Weather Immediate Decision Service (D-WIDS).

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

In this document, the four services are described and analyzed as independent services but they have many common features. Section 4.1 provides a description of the common methods and features for how AIS/MET data link services operate in the various data link modes. In Section 4.2, the background and service specific features for each AIS/MET service are described separately. Finally, Sections 4.3 and 4.4 respectively provide the resulting Operational Requirements and the Operational Recommendations, both common and service specific.

4.1 AIS/MET DATA LINK COMMON FEATURES

4.1.1 AIS/MET Data Link Modes

There are three data link modes that may be used for transmitting AIS and MET information. The modes are independent of the supporting data link system architecture which may be ground based or include satellite communications.

The AIS/MET data link services support the following data link modes:

- a. The Broadcast Mode;
- b. The Demand Mode;
- c. The Contract Mode.

4.1.1.1 The Broadcast Mode

A broadcast data link is a one-way interaction. AIS/MET updates applicable to a limited geographical area are continuously transmitted or transmitted at repeated periodic intervals to all aircraft capable of receiving that information within a certain service volume defined by the system network architecture. The broadcast network has no knowledge of which aircraft are receiving the data link transmissions.

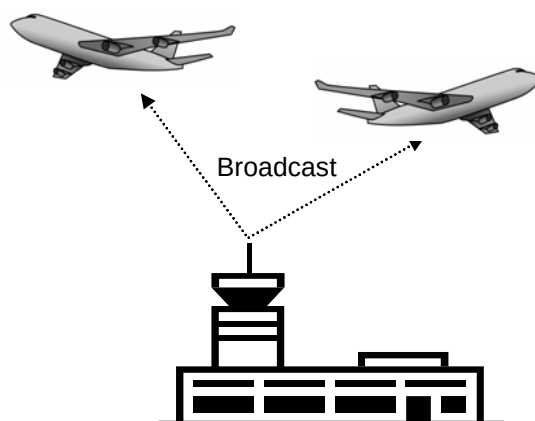


FIGURE 4-1: BROADCAST MODE

TABLE 4-1 identifies the basic steps for the operations of the Broadcast mode. Additional steps may be defined at the implementation stage of a candidate architecture.

TABLE 4-1: OPERATING METHOD – BROADCAST MODE

Step	Operating Method
1	The service provider broadcasts valid information continuously or at regular intervals to ensure that any aircraft entering the service volume receives the information.
2	The aircraft data system monitors the broadcast communications frequency and receives the AIS/MET information.
3	Upon receipt of the broadcast information, the aircraft system makes it available for use by cockpit applications.
4	The service provider continues to broadcast valid information per the published schedule.
5	Upon receipt of each broadcast, the aircraft system makes the information available for use by cockpit applications.
6	On-board the aircraft, reception of Broadcast AIS/MET information is terminated either by the flight crew (or avionics system) at any stage of the flight, or when the aircraft leaves the coverage area where the Broadcast mode is implemented.

NOTES: *If no cancellation or replacement for specific AIS/MET information is received by the aircraft, the existing specific information might be deactivated in the aircraft system after the effective (valid) time period has elapsed.*

A unique identifier may have to be associated with each information set disseminated by the AIS/MET data link services.

4.1.1.2

The Demand Mode

The Demand Mode is a two-way interaction in which AIS/MET information is transmitted to an aircraft in response to its specific, one-time request.

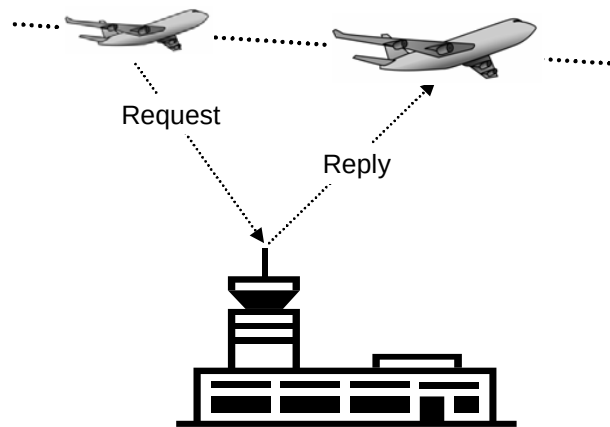


FIGURE 4-2: DEMAND MODE

TABLE 4-2 identifies the basic steps for the operations of the Demand mode. Additional steps may be defined at the implementation stage of a candidate architecture.

TABLE 4-2: OPERATING METHOD – DEMAND MODE

Step	Operating Method
1	The flight crew (or avionics system) initiates the Demand Mode by making a request to a service provider. The request contains selection criteria identifying the AIS/MET information the flight crew wishes to receive.
2	Upon receipt of a Demand request, the service provider: a) Verifies the request. If the request is valid, then: b) Sends the appropriate reply within the required response time; or, c) Detects that the requested information is not available yet, but can be retrieved for timely delivery, then: - Sends an acknowledgement indicating that the request is being processed, and - Sends the appropriate reply, when available; or, d) Detects that the requested information cannot be retrieved and sends a "Reject" message e) Detects that not all the requested information is available, then sends the available information and a "Not Available" message for the missing information If the Demand request is not valid, sends a "Reject" message...
3	Upon receipt of the reply, the aircraft system makes the reply available for use by cockpit applications.
4	The Demand Mode is completed upon receipt of the reply or "Reject" message.

NOTE: *If no cancellation or replacement for specific AIS/MET information is received by the aircraft, the existing specific information might be deactivated in the aircraft system after the effective (valid) time period has elapsed.*

4.1.1.3 The Contract Mode

The Contract mode is an extension of the Demand mode. It allows the flight crew to receive initial AIS/MET reports and to automatically receive subsequent updates or changes to AIS/MET reports that meet the Contract criteria.

The Contract request may be for sending specific data types at specified time intervals, sending only updates to the requested information, providing flight monitoring support (i.e. transmitting data link information that impacts the intended flight), or whatever criteria the data link service provider has identified in its published service catalogue.

If the flight crew wants to receive only updates to AIS/MET information that may affect the flight, the AIS/MET DLSP will need to correlate the geographical 3D area of updates of the AIS/MET information to the aircraft flight path. Thus implementation of a Contract service may require that the AIS/MET DLSP monitors the aircraft flight plan execution while monitoring changes to the requested AIS/MET information.

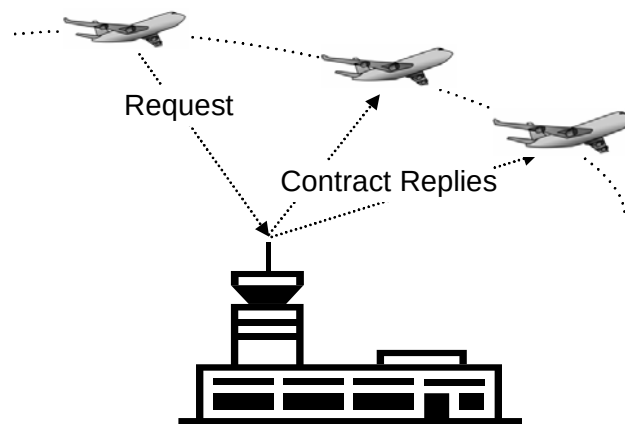


FIGURE 4-3: CONTRACT MODE

TABLE 4-3 identifies the basic steps for the operations of the Contract mode. Additional steps may be defined at the implementation stage of a candidate architecture.

TABLE 4-3: OPERATING METHOD – CONTRACT MODE

Step	Operating Method
1	The flight crew (or avionics system) initiates the Contract Mode by making a request to a service provider. The request contains: 1) Selection criteria identifying the AIS/MET Information the flight crew wishes to receive; and 2) Contract criteria for receiving update transmissions (i.e., at specified time or distance intervals, upon receipt of new or amended information, etc)
2	Upon receipt of a valid Contract request, the service provider: a) Verifies the request. If the request is valid, then: b) Accepts and activates the Contract; c) Sends the appropriate reply within the required response time; or, d) Detects that the requested information is not available yet, but can be retrieved for timely delivery, then: - Sends an acknowledgement indicating that the request is being processed, and - Sends the appropriate reply, when available; or, e) Detects that the requested information cannot be retrieved, then sends a "Reject" message; f) Detects that not all the requested information is available, then sends the available information and a "Not Available" message for the missing information. If the Contract request is not valid, sends a "Reject" message...
3	The ground system continues to transmit the requested information to the aircraft per the criteria of the Contract.
4	Upon receipt of each reply (or update information), the aircraft system makes the reply or update available for use by cockpit applications.
5	Contract termination: - Occurs if a Reject message is sent by the ground system - Can be requested by the flight crew at any time though the transmission of a "Termination" message; - Can be requested by the ground system at any time though the transmission of a "Termination" message, or - Occurs upon expiration of the contract as specified in the contract, or - Upon landing. In this case, a "Termination" message is sent by the aircraft"

NOTE: *If no cancellation or replacement for specific AIS/MET information is received by the aircraft, the existing specific information might be deactivated in the aircraft system after the effective (valid) time period has elapsed.*

4.1.2 AIS/MET Data Link Operational Service Description (OSD) and Service Operations

The AIS/MET information can be obtained upon request, or when updates occur, or through broadcast (receive only) transmissions. Note that Demand mode is not appropriate for D-WIDS since the flight crew will not know when such immediate D-WIDS information is needed and/or available.

The overall service is available prior to departure and in all phases of flight; however, some report types may not be available in all environments.

The AIS/MET data link services include aeronautical / meteorological information that impacts flight operations in the Enroute, terminal and airport environments. Information received by the flight deck avionics may be stored and made available for later use by the flight crew (or cockpit applications) or displayed directly on cockpit displays except for D-WIDS where it should be made available or displayed immediately. All information is temporal in nature and the information shall include effective (or validity) times.

The DLSP shall be capable of sorting and processing the information based on the product effective (or valid) time(s) to ensure that only current and valid information is transmitted to the aircraft. For the contract mode, monitoring the flight plan or the flight path are options to be considered by the DLSP in order to provide information tailored to the contract criteria that is relevant for the aircraft position.

The onboard aircraft system(s) may also be capable of sorting and processing the information received based on effective time(s) and location. This will support identifying the information relevant to the flight for display to the flight crew and/or use by aircraft applications (e.g., for flight plan or trajectory calculations).

The flight crew can request the AIS/MET data link service during any phase of operation to provide updates on any AIS/MET information that has changed. Recurring report of AIS/MET information can be specified by Contract, based on criteria such as threshold values, event occurrence or specified time intervals.

The existence and general operating parameters of the AIS/MET services will be indicated in relevant official means (e.g. web pages) and documents (e.g. AIP).

4.2 AIS/MET DATA LINK SERVICES SPECIFIC FEATURES

4.2.1 Data Link Aeronautical Update Service Specific OSD and Service Operations

The need exists for all ATM community members to share aeronautical information and to have access to the same up-to-date data. It is envisioned that the ground-based aeronautical data systems are kept accurate and up-to-date by the State Aeronautical Information Services (or third party service provider designated by one or more States) as new or modified aeronautical data becomes available. Currently, these data are collected and maintained under the AIRAC system by the data houses and avionics providers and then uploaded manually to the aircraft every 28 days. This presents a challenge to keep those airborne databases current.

The D-AUS is a data link service that provides temporary aeronautical data to the cockpit throughout the 28-day AIRAC cycle where the flight crews can then include that information in their decision making process. D-AUS does not physically modify or change any data contained within the onboard navigation or charting databases. It provides up-to-date data that may supplement or even amend the data contained in those databases or paper copies. For further information, see the OSED [Ref. 1.] paragraph 6.1.

Current regulations require that flight crews, prior to beginning a flight, have access to all pertinent information concerning that flight. While this is focused on the preflight planning process, it also requires that flight crews stay aware of changes related to the flight environment until the intended or alternate destination is reached. The issuance of temporary, restricted and segregated areas while the flight is in progress, or the closing of a runway or taxiway at the destination airport, are examples of why a flight crew needs to stay abreast of changes to aeronautical data. By receiving aeronautical updates in the cockpit via data link, flight crews would have access to up-to-date aeronautical data needed for the conduct of flight.

The service provider manages an aeronautical database which is updated on a continuous basis with both permanent changes and temporary changes. All the updates are tracked and referenced to the time when they are issued (regardless of the effective time(s) of the changes).

The D-AUS information includes the entire range of AIS information (temporary or permanent changes) that support flight crew decisions for flight planning and execution.

NOTE: NOTAMs also include hazards to aircraft from space vehicle operations. These could include depictions of the launch and recovery trajectories or depictions of debris hazard areas should in-flight failure of a space vehicle generate falling debris.

FIGURE 4-4 depicts the temporal nature of the AIS data.

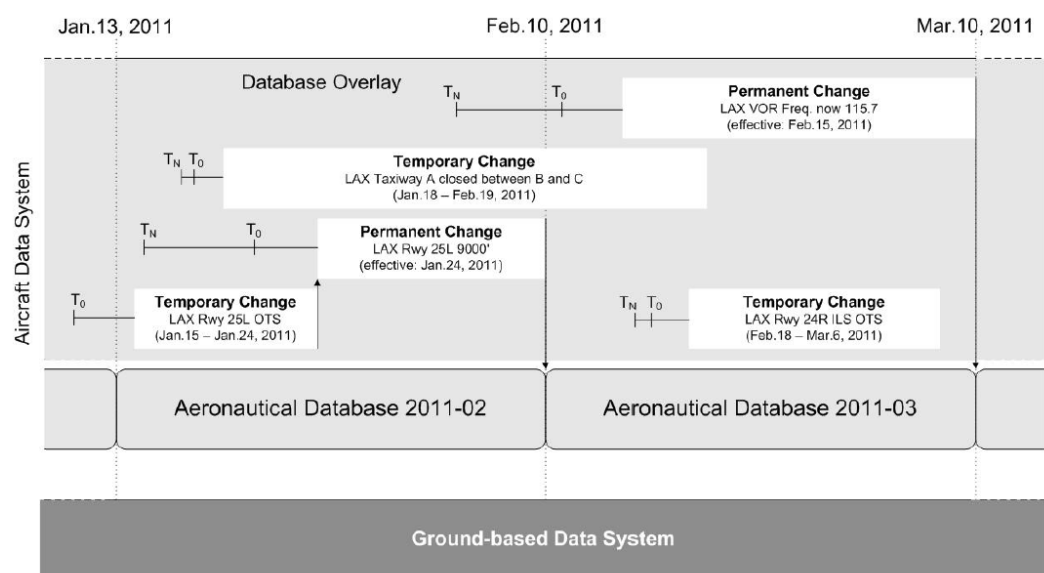


FIGURE 4-4: AIS TEMPORAL DATA

Some aeronautical updates have a different time of notification (T_N) and time of issue (T_0). This means that aeronautical updates that result in wide ranging impacts to the airspace structure (for example, opening of a new runway at a major airport) require the aviation community to be notified several months prior to these permanent changes actually being implemented. On the other hand, primarily for low impact temporary changes, the difference between the time of notification and time of issue can be negligible, or even coincide. For the most part, temporary changes are issued with little to no advance notification.

D-AUS encompasses the entire range of AIS information useful for flight planning and execution, and in-flight monitoring and/or re-planning. The D-AUS includes AIS information that is based on temporary or permanent changes to the AIS ground source data.

4.2.2 Data Link Weather Planning Decision Service Specific OSD and Service Operations

D-WPDS includes weather information that impacts flight operations in the Enroute, terminal and airport environments. It is designed to provide MET information to support flight crew decisions for flight planning and execution with lead time to decision of 20 minutes or greater. Pilot action is typically a change in routing or altitude in advance of a potential impact or opportunity related to the current planned flight trajectory. Time is available to identify and evaluate alternative courses of action, and to seek additional information to support the decision.

The MET information will have validity times of at least 20 minutes or greater. For this SPR and D-WPDS, the MET information is grouped into four representative categories as listed below. These groupings are not all inclusive but, rather, are aligned with traditional data communications architectures and used as a notional means to identify various categories of MET information that may be provided by D-WPDS. These groupings may also be used to assess the operating performance requirements.

1. Flight Level Winds/Temperatures – flight levels grid point data for flight optimization and 4D trajectory applications;
2. Profile Winds/Temperatures – grid point data for arrival and/or departure operations such as CDA applications;
3. Hazardous Weather – current text/graphic or future grid point data for hazardous weather avoidance of convection, turbulence, icing, cyclones and volcanic ash;
4. Airport Weather – current text/graphic or future grid point data of airport METAR, RVR and TAF information for surface and arrival/departure operations.

D-WPDS information which is provided as gridded data fields or graphics will be rendered through cockpit applications. Supporting text for graphical information may be provided as appropriate.

4.2.2.1 Voice Weather Planning Decision Reports

Limited voice reporting of D-WPDS information is currently provided via ATS and/or AOC services. Voice broadcasts of ATIS, VOLMET, and HIWAS (in the USA) provide airport METARs, TAFs and en route SIGMET reports. AWOS / ASOS messages provide current conditions data at airports. Flight crews may also overhear such information when it is issued by (or to) other aircraft on the same frequency (party line).

4.2.2.2 Data Link Weather Planning Decision Reports

In the end state, D-WPDS will be the primary means to deliver such weather information.

4.2.3 Data Link Weather Near-term Decision Service Specific OSD and Service Operations

D-WNDS is designed to provide MET information to support flight crew decisions for hazardous weather avoidance and arrival/departure operations with lead times to decisions from 3 to 20 minutes. Such near-term flight crew decisions are generally of a planning nature, but with limited time available for comprehensive deliberation and/or coordination with ATC/AOC. Near-term decisions can take the form of reroutes, altitude changes, speed adjustments, or operational status changes such as alerting and securing the aircraft cabin prior to a possible encounter with turbulence. With D-WNDS information, there is usually time to identify and evaluate available alternative courses of action, and perhaps to seek additional information.

The D-WNDS MET information includes MET information useful for hazardous weather avoidance and terminal area operations and will have validity times of about 5-20 minutes or longer. For this SPR and D-WNDS, the MET information is grouped into four representative categories as listed below. These groupings are not all inclusive but, rather, are aligned with traditional data communications architectures and used as a notional means to identify various categories of MET information that may be provided by D-WNDS. These groupings may also be used to assess the operating performance requirements.

1. Flight Level Winds/Temperatures – flight levels grid point data for reroute and altitude changes;
2. Profile Winds/Temperatures – profile grid point data for arrival and/or departure operations such as CDA or ASAS applications;
3. Hazardous Weather – current text/graphic or future grid point data for hazardous weather avoidance of convection, turbulence, icing, and volcanic ash;
4. Airport Weather – current text/graphic or future grid point data of airport METAR, RVR and TAF information for surface and arrival/departure operations

D-WNDS information which is provided as gridded data fields or graphics will be rendered through cockpit applications. Supporting text for graphical information may be provided as appropriate.

By the nature of the decisions supported, new or updated D-WNDS information should be transmitted to the cockpit as soon as it is available at the approved source and the required communications performance should be less than 3 minutes.

4.2.3.1 Voice Weather Near-Term Decision Reports

Limited voice reporting of D-WNDS information is currently provided via ATS and/or AOC services. Voice broadcasts of ATIS, VOLMET, and HIWAS (in the USA) provide airport METARs, TAFs and en route SIGMET reports. Flight crews may also overhear such information when it is issued by (or to) other aircraft on the same frequency (party line).

4.2.3.2 Data Link Weather Near Term Decision Reports

In the end state, D-WNDS will be the primary means to deliver such weather information.

4.2.4 Data Link Weather Immediate Decision Service Specific OSD and Service Operations

D-WIDS is designed to provide MET information to support flight crew immediate decisions with a lead time of less than 3 minutes. Immediate decisions are those taken by the flight crew within a few seconds to 3 minutes in order to avoid or mitigate an in-flight MET hazard, or to make a commitment to land or take off. They are generally unilateral decisions made by the flight crew with very little or no deliberation. Such decisions are generally rule-based or procedural in nature.

The D-WIDS MET information includes MET information for hazardous weather avoidance, and take-off and landing decisions; and will have validity times of about 1-5 minutes. For this SPR and D-WIDS, the MET information is grouped into three representative categories as listed below. These groupings are not all inclusive but, rather, are aligned with traditional data communications architectures and used as a notional means to identify various categories of MET information that may be provided by D-WIDS. These groupings may also be used to assess the operating performance requirements.

1. Profile Winds/Temperatures – profile grid point data for arrival and/or departure operations such as ASAS applications;
2. Hazardous Weather – current text/graphic or future grid point data for hazardous weather avoidance of convection, turbulence and icing, volcanic ash;
3. Airport Weather – current text/graphic or future grid point data of airport RVR or wind shear information for arrival/departure operations.

D-WIDS information which is provided as gridded data fields or graphics will be rendered through cockpit applications. Supporting text for graphical information may be provided as appropriate.

By the nature of the decisions supported, D-WIDS information should be immediately transmitted to the cockpit as soon as it is available at the approved source and the required communications performance should be less than 2 minutes.

4.2.4.1 Voice Weather Immediate Decision Reports

Limited voice reporting of D-WIDS information is currently provided via ATS services. Flight crews may also overhear such information when it is issued by (or to) other aircraft on the same frequency (party line).

4.2.4.2 Data Link Weather Immediate Decision Reports

In the end state, D-WPDS will be the primary means to deliver such weather information.

4.3 AIS/MET DATA LINK SERVICES OPERATIONAL REQUIREMENTS

4.3.1 AIS/MET Data Link Services Common Operational Requirements

4.3.1.1 System and Service Provider Operational Requirements

- AMDS-OR-1.** Excluding the Demand mode for D-WIDS, the AIS/MET data link services shall support any one, or combination of the following data link modes:
1. Broadcast;
 2. Demand mode;
 3. Contract mode
- AMDS-OR-2.** The AIS/MET DLSP shall track and reference all AIS/MET updates using the time they are issued (regardless of the effective time(s) of the changes) to identify the most up-to-date information.
- AMDS-OR-3.** The AIS/MET data link services shall be available during all phases of flight and surface operations as indicated in the appropriate documents.
- AMDS-OR-4.** The AIS/MET data link service availability to include AIS/MET information available and operating parameters such as data link characteristics and coverage shall be published in appropriate documents such as the AIP.
- AMDS-OR-5.** In the Broadcast mode, the AIS/MET data link services shall operate as outlined in TABLE 4-1.
- AMDS-OR-6.** In the Demand mode, the AIS/MET data link services, excluding D-WIDS, shall operate as outlined in TABLE 4-2.
- AMDS-OR-7.** In the Contract mode, the AIS/MET data link services shall operate as outlined in TABLE 4-3.

4.3.1.2 Ground System Component Operational Requirements

AMDS-OR-8. The AIS/MET data link services shall use AIS/MET information only from source(s) approved by the State civil aviation authority or national supervisory authority.

AMDS-OR-9. In the Demand and Contract modes, the AIS/MET DLSP shall provide the AIS/MET information in accordance with the flight crew or aircraft system request.

4.3.1.3 Airborne System Component Operational Requirements

AMDS-OR-10. The aircraft system shall track and reference all AIS/MET updates using the time they are issued (regardless of the effective time(s) of the changes) to identify the most up-to-date information.

AMDS-OR-11. The aircraft systems shall be capable of processing the information received from AIS/MET data link services for display to the flight crew and/or use by aircraft applications.

4.3.2 AIS/MET Data Link Services Specific Operational Requirements

4.3.2.1 D-AUS Specific Operational Requirements

4.3.2.1.1 System and Service Provider Operational Requirements

DAUS-OR-1. For D-AUS, the DLSP shall manage an aeronautical database which is updated on a continuous basis with both permanent changes and temporary changes.

4.3.2.1.2 Airborne System Component Operational Requirements

DAUS-OR-2. The aircraft system shall supplement the onboard aeronautical databases with permanent and temporary changes received as AIS updates.

4.3.2.2 D-WPDS Specific Operational Requirements

None identified

4.3.2.3 D-WNDS Specific Operational Requirements

None identified

4.3.2.4 D-WIDS Specific Operational Requirements

None identified

4.4 AIS/MET DATA LINK SERVICES OPERATIONAL RECOMMENDATIONS

4.4.1 AIS/MET Data Link Services Common Operational Recommendations

4.4.1.1 System and Service Provider Operational Recommendations

AMDS-ORec-1. A unique identifier may have to be associated with each information set disseminated by the AIS/MET data link services.

AMDS-ORec-2. In order to provide the most appropriate information, more particularly in Contract mode, the AIS/MET DLSP may need to monitor the aircraft flight plan execution to correlate the aircraft position and the geographical 3D area of updates of the AIS/MET information.

4.4.1.2 Airborne System Component Operational Recommendations

AMDS-ORec-3. If no cancellation or replacement for specific AIS/MET information is received by the aircraft, the existing specific information might be de-activated in the aircraft system after the effective (valid) time period has elapsed.

- AMDS-ORec-4.** When AIS/MET information is provided as gridded data fields or graphics, supporting text for graphical information may be provided as appropriate.
- AMDS-ORec-5.** Information received by the flight deck avionics may be stored and made available for later use by the flight crew (or cockpit applications) or displayed directly on cockpit displays except for D-WIDS where it should be made available or displayed immediately.
- AMDS-ORec-6.** To support identifying the information relevant to the flight for display to the flight crew and/or use by aircraft applications (e.g., for flight plan or trajectory calculations), the onboard aircraft system(s) may be capable of sorting and processing the information received based on effective time(s) and location.

4.4.2 AIS/MET Data Link Services Specific Operational Recommendations

4.4.2.1 D-WPDS Specific Operational Recommendations

- DWPDS-ORec-1.** New or updated D-WNDS information should be transmitted to the cockpit as soon as it is available at the approved source.

4.4.2.2 D-WNDS Specific Operational Recommendations

- DWPDS-ORec-2.** New or updated D-WNDS information should be transmitted to the cockpit as soon as it is available at the approved source.
- DWPDS-ORec-3.** The D-WNDS provider should ensure that the communications performance for transmission of the D-WNDS information from the data source to the cockpit is less than 3 minutes.
- DWPDS-ORec-4.** The aircraft system should be capable of sorting and processing the D-WNDS reports to provide operationally tailored weather information for display to the flight crew and/or use in cockpit applications.

4.4.2.3 D-WIDS Specific Operational Recommendations

- DWIDS-ORec-1.** New or updated D-WIDS information should be immediately transmitted to the cockpit as soon as it is available at the approved source.
- DWIDS-ORec-2.** The D-WIDS provider should ensure that the communications performance for transmission of the D-WIDS information from the data source to the cockpit is less than 2 minutes.
- DWIDS-ORec-3.** The aircraft should be capable of sorting and processing the D-WIDS reports to provide operationally tailored weather information for display to the flight crew and/or use in cockpit applications.

CHAPTER 5

SUMMARY

This section provides summary tables gathering the various types of requirements and recommendations (operational, safety and performance) for each of the AIS and MET Services defined in ED1. The details and background for the requirements and recommendations are contained in the following sections: Operational (Section 4); Safety (Annex B) and Performance (Annex D).

The tables in this Section 5 provide independent listings of the operational, safety and performance requirements of the AIS and MET data link services. Should an ANSP choose to provide combined AIS and/or MET data link services, the most stringent requirements would apply to that combined service.

These requirements and recommendations are based on a notional architecture and are provided as a baseline to be validated prior to the implementation and operational use of candidate data communications architectures. This SPR specifies the safety and performance requirements for the delivery of AIS and MET information as the primary means of communication (normal communications) between the air and the ground. The application of the AIS and/or MET information supports tactical as well as strategic decisions. The safety and performance analyses in this document assume that voice is the secondary means of communication and is one of many mitigation means for failures of the data link service. The methodology in this document can be used to support the intermediate application of AIS and MET data link services subject to revalidation of the assumptions and the environments described herein.

In this SPR, the allocation of the safety requirements between the air and ground components is notional and may be adjusted in an operational implementation whilst ensuring that the overall safety objective is achieved. Similarly, the performance objectives may also be adjusted as long as the overall system performance, defined herein, is maintained.

Section 5.1.3 lists Safety recommendations resulting from the identification of Internal Mitigation Means (IMMs) (see Annex B paragraph B.4.1.2). These recommendations are common to all four AIS/MET services considered in this SPR, namely D-AUS, D-WPDS, D-WNDS and D-WIDS. They are offered only as recommendations for manufacturers to consider since this SPR is based on a notional architecture.

Further, these safety recommendations are allocated equally to the four components of the notional architecture (see FIGURE 1-1) to provide examples which illustrate the results from an ASOR process. No consideration was given of any system mitigators. The Safety Targets and allocations will need to be reviewed and adjusted as necessary when a candidate architecture is identified for implementation. See A.4.13 and B.4.1 for details on the safety allocation approach and analysis

NOTE: *A preliminary analysis of an approach for determining the Safety and Performance requirements for ED2 is contained in Annex E.*

5.1 AIS/MET DATA LINK SERVICES COMMON REQUIREMENTS AND RECOMMENDATIONS

5.1.1 AIS/MET Data Link Services Common Operational Requirements

AMDS-OR-01	Excluding the Demand mode for D-WIDS, the AIS/MET data link services shall support any one, or combination of the following data link modes: 1. Broadcast; 2. Demand mode; 3. Contract mode.
AMDS-OR-02	The AIS/MET DLSP shall track and reference all AIS/MET updates using the time they are issued (regardless of the effective time(s) of the changes) to identify the most up-to-date information.
AMDS-OR-03.	The AIS/MET data link services shall be available during all phases of flight and surface operations as indicated in the appropriate documents.
AMDS-OR-04	The AIS/MET data link service availability to include AIS/MET information available and operating parameters such as data link characteristics and coverage shall be published in appropriate documents such as the AIP.
AMDS-OR-05	In the Broadcast mode, the AIS/MET data link services shall operate as outlined in TABLE 4-1.
AMDS-OR-06.	In the Demand mode, the AIS/MET data link services, excluding D-WIDS, shall operate as outlined in TABLE 4-2.
AMDS-OR-07	In the Contract mode, the AIS/MET data link services shall operate as outlined in TABLE 4-3.
AMDS-OR-08	The AIS/MET data link services shall use AIS/MET information only from source(s) approved by the State civil aviation authority or national supervisory authority.
AMDS-OR-09	In the Demand and Contract modes, the AIS/MET DLSP shall provide the AIS/MET information in accordance with the flight crew or aircraft system request.
AMDS-OR-10	The aircraft system shall track and reference all AIS/MET updates using the time they are issued (regardless of the effective time(s) of the changes) to identify the most up-to-date information.
AMDS-OR-11	The aircraft system shall be capable of processing the information received from AIS/MET data link services for display to the flight crew and/or use by aircraft applications.

5.1.2 AIS/MET Data Link Services Common Operational Recommendations

AMDS-ORec-01	A unique identifier may have to be associated with each information set disseminated by the AIS/MET data link services.
AMDS-ORec-02	In order to provide the most appropriate information, more particularly in Contract mode, the AIS/MET DLSP may need to monitor the aircraft flight plan execution to correlate the aircraft position and the geographical 3D area of updates of the AIS/MET information.
AMDS-ORec-03	If no cancellation or replacement for specific AIS/MET information is received by the aircraft, the existing specific information might be de-activated in the aircraft system after the effective (valid) time period has elapsed.
AMDS-ORec-04	When AIS/MET information is provided as gridded data fields or graphics, supporting text for graphical information may be provided as appropriate.

AMDS-ORec-05	Information received by the flight deck avionics may be stored and made available for later use by the flight crew (or cockpit applications) or displayed directly on cockpit displays except for D-WIDS where it should be made available or displayed immediately.
AMDS-ORec-06	To support identifying the information relevant to the flight for display to the flight crew and/or use by aircraft applications (e.g., for flight plan or trajectory calculations), the onboard aircraft system(s) may be capable of sorting and processing the information received based on effective time(s) and location.

5.1.3

AIS/MET Data Link Services Common Safety Recommendations

AMDS-SRec-01	The airborne system should report when a response to an information request has not been received within the required time interval (e.g. yy seconds) - DEMAND ONLY
AMDS-SRec-02	The flight crew should be informed when the ODLP or ODLP/tr malfunctions (e.g. not functioning optimally).
AMDS-SRec-03	The ground service provider should be informed when the GDLP or GDLP/tr malfunctions (e.g. not functioning optimally)
AMDS-SRec-04	The airborne system should report when no information has been received in the expected interval - BROADCAST ONLY
AMDS-SRec-05	The airborne system should be regularly provided with an indication of the service availability (e.g. keep-alive message)
AMDS-SRec-06	The ground system should reject any request that fails the integrity check - DEMAND/CONTRACT ONLY
AMDS-SRec-07	The airborne system should reject any received transmission that fails the integrity check
AMDS-SRec-08	The ground system should not transmit any information that has been superseded or is beyond its operationally valid period
AMDS-SRec-09	The airborne system should not process any update information that has been superseded or is beyond its operationally valid period
AMDS-SRec-10	The ground system should be able to verify the broadcasted information is applicable to the intended service volume(s).
AMDS-SRec-11	The ground system should be able to verify the response / information to be transmitted is for the intended aircraft.
AMDS-SRec-12	The airborne system of a given aircraft should be able to verify the received response is for that aircraft.
AMDS-SRec-13	The airborne system should verify that the received information is appropriate to what was requested
AMDS-SRec-14	The ground system should verify that the response / information to be transmitted corresponds to what was requested
AMDS-SRec-15	The ground system should reject incomplete responses received from the external database source.