



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

GUIDELINES FOR TEST AND VALIDATION RELATED TO AIRPORT CDM INTEROPERABILITY

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TABLE OF CONTENTS

CHAPTER 1	GENERAL	1
1.1	Introduction	1
1.2	Airport CDM Documents	1
1.3	Purpose, Scope, Applicability	2
1.4	Terminology	3
1.5	Glossary of Defined Terms	4
1.5.1	Airport CDM Definitions	4
1.5.2	General Definitions	4
1.6	Abbreviations	4
1.6.1	Airport CDM Abbreviations	4
1.6.2	General Abbreviations	4
1.7	Applicable Documents	4
1.8	Reference Documents	4
CHAPTER 2	SYSTEM DESCRIPTION	5
2.1	The Airport CDM System	5
2.1.1	Operational Context	5
2.1.2	Airport CDM System Goals	5
2.1.3	Airport CDM Data Base	6
2.2	Airport CDM: the Logical View	6
2.2.1	External Logical Elements	6
2.2.2	Logical Data Flows	7
2.2.2.1	Aircraft Operations	8
2.2.2.2	Airport Operations	8
2.2.2.3	Ground Handling	8
2.2.2.4	De-icing Operations	8
2.2.2.5	ATC	8
2.2.2.6	ATFCM	9
2.2.3	Internal Logical Elements	9
2.2.3.1	Operational Supervision	9
2.2.3.2	Technical Supervision	9
2.2.3.3	Post Operational Analysis	9
2.2.3.4	Data Preparation	9
2.3	Functional Groups	10

CHAPTER 3	TEST METHODOLOGY.....	11
3.1	Test Plan.....	11
3.2	Test Process.....	12
3.2.1	Requirements Validation	12
3.2.2	Requirements Documentation.....	12
3.2.3	Test Procedure Development	12
3.2.4	System Verification Tests.....	13
3.2.5	Test Results	13
3.2.6	Test After Failure.....	14
3.2.7	Test Report.....	14
CHAPTER 4	ED-141 SUGGESTED TEST GROUPS	15
4.1	Group 1 – System Operation and Configuration	15
4.2	Group 2 – TSAT calculation	16
4.3	Group 3 – Data Integrity, Priority, Logging, Recovery.....	16
4.4	Group 4 – Security.....	16
4.5	Group 5 – Performance, Capacity, Availability.....	17
4.6	Group 6 – System Time.....	17
4.7	Group 7 – User Interface	18
4.8	Group 8 – Evolution and Modularity	18
CHAPTER 5	ED-145 SUGGESTED TEST GROUPS	19
5.1	Group 1 – General Interface Requirements	19
5.2	Group 2 – General Requirements on Data Transmission	19
5.3	Group 3 – Event Time	20
5.4	Group 4 – Event Date.....	21
5.5	Group 5 – Event Duration.....	21
5.6	Group 6 – Airport Resource.....	22
5.7	Group 7 – Alert	22
5.8	Group 8 – Other Flight Information.....	23
5.9	Group 9 – CFMU Message.....	24
APPENDIX A	AIRPORT CDM DEFINITIONS	25
APPENDIX B	LIST OF ACRONYMS.....	28
APPENDIX C	LIST OF CONTRIBUTORS.....	34
	ED-146 IMPROVEMENT SUGGESTION FORM.....	36

FOREWORD

1. This document, prepared by EUROCAE Working Group 69, was accepted by the Council of EUROCAE on 6 October 2008.
2. EUROCAE is an international non-profit making organisation. Membership is open to European manufacturers of equipment for aeronautics, trade associations, national civil aviation administrations, users, and 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 worldwide levels.
3. The findings of EUROCAE are resolved after discussion among its members and in cooperation with RTCA Inc., Washington DC, USA and/or the Society of Automotive Engineers (SAE), Warrendale PA, USA through their appropriate committees.
4. During the preparation of this document, coordination took place with the EUROCONTROL Airport CDM Task Force. Further revision of the document may be appropriate when definitive documents or manuals on Airport CDM are published by EUROCONTROL.
5. EUROCAE performance specifications 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. The inclusion of references to standards published by other standardisation bodies, or extracts from those standards, does not imply any safety or regulatory liability.
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CHAPTER 1

GENERAL

1.1 INTRODUCTION

Airport Collaborative Decision Making (CDM) is an important enabler of Air Traffic Management (ATM) capacity and efficiency. The concept of Airport CDM does not imply any particular system or architecture. Rather, it is an approach to using aeronautical data, based on sharing data between all Partners, ensuring a common view of the ATM and airport environment on all levels. Airport CDM also addresses the need for operational decisions to be made collaboratively thus providing a substantial contribution to maximising capacity and efficiency.

Although Airport CDM is applicable to all phases of flight, the Airport CDM concept has seen its first prototypes and trials at airports and this document is therefore dedicated to Airport CDM. An Airport CDM Task Force was created under the EATM Airport Throughput Business Division (APT) of EUROCONTROL, and documents created by this Task Force have contributed significantly to the development of this document.

Airport Collaborative Decision Making is about improving the way operational Partners at airports and the European ATM network work together at an operational level.

Airport CDM allows an Airport CDM Partner to make the right decisions in collaboration with other Airport CDM Partners, knowing their preferences and constraints and the actual and predicted situation. The decision making by the Airport CDM Partners is totally dependent upon the sharing of accurate and timely information and upon adapted Airport CDM procedures, mechanisms and tools.

While the implementation of the Airport CDM concept requires first and foremost a change in culture regarding the way that data is used and decisions are made, it nevertheless requires that the Airport CDM Partners¹ possess certain capabilities or systems that enable them to share data and make and implement decisions collaboratively.

The EUROCONTROL: Airport CDM Implementation Manual [doc ref. [3]] points out that..."To enable the operational use of Airport CDM, Partners' existing systems will have to be adapted at least to a level where they can seamlessly communicate with each other".

1.2 AIRPORT CDM DOCUMENTS

Much of the key development work in the Airport CDM field has been conducted by EUROCONTROL and in particular the EUROCONTROL Airport CDM Task Force. This document therefore builds upon the key outputs of the Task Force, namely the EUROCONTROL: Airport CDM Operational Concept Document [doc ref. [1]], the EUROCONTROL: Airport CDM Functional Requirements Document [doc ref. [2]] and the EUROCONTROL: Airport CDM Implementation Manual [doc ref. [3]], to derive this set of EUROCAE standards (comprising this document, ED-145 and ED-146).

The principle input to this work is the EUROCONTROL: Airport CDM Functional Requirements Document [doc ref. [2]], which has continued to develop in parallel with this document, the former identifying functionalities and the latter identifying technical means of achieving these functionalities.

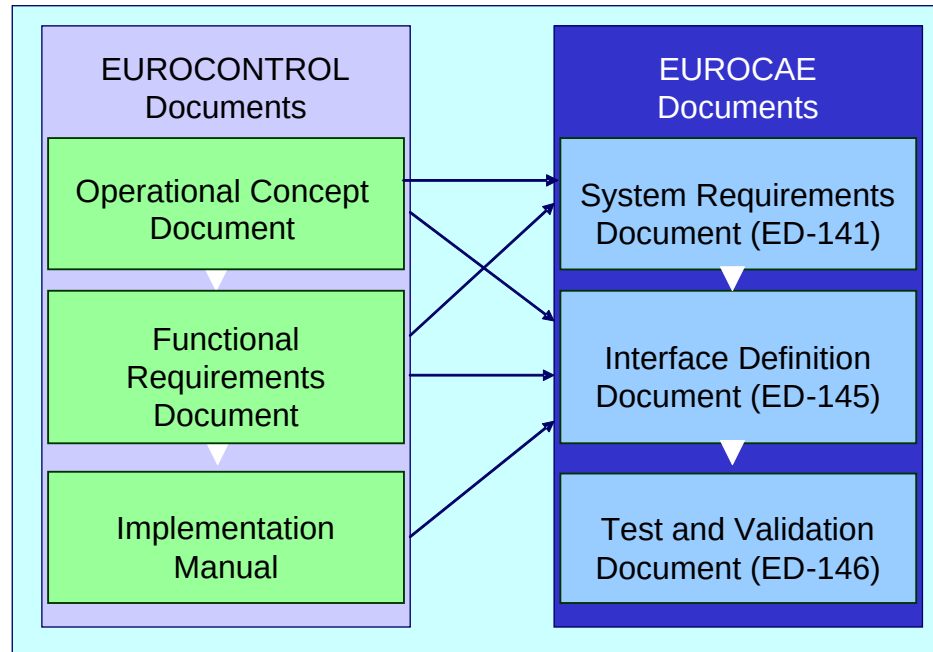
The first document of the EUROCAE Airport CDM set is the Minimum Specifications for Airport CDM systems (ED-141).

¹ For terms definition please refer to section 1.5 Glossary of Defined Terms. Airport CDM Partner is defined in Appendix A.

The second document of the EUROCAE Airport CDM set is the Airport CDM Interface Specification (ED-145). It describes the minimum requirements on the data exchanged with an Airport CDM system.

The final document of the EUROCAE Airport CDM set is the Test and Validation Document (ED-146) that provides a basis from which an Airport CDM implementer can develop testing specifications to ensure his/her installation is compliant with ED-141 and ED-145.

The relationship between the relevant documents described above is captured in the figure below.



1.3

PURPOSE, SCOPE, APPLICABILITY

This document provides guidance to support the development and execution of test procedures necessary to verify that an implemented Airport CDM (A-CDM) system operates according to the standards outlined by related requirements documents and the needs of A-CDM partners at any specific airport.

The extent of this document is limited to test procedures for the minimum requirements of a generic A-CDM system as specified by the following EUROCAE documents:

ED-141 Minimum Specifications For Airport CDM Systems

ED-145 Airport CDM Interface Specification

Only those requirements identified as necessary for compliance with one of the aforementioned documents or standards will be addressed. Further, only those requirements identified as mandatory, via "shall" statement, are considered.

Since, each A-CDM system can be implemented as a "System of Systems" using existing airport assets, the design, development, deployment, and acceptance of an A-CDM system for any given airport and set of partners will be unique. Given that each A-CDM system will be realized differently, no single test document can cover all cases and variations of software, support systems and new equipment. Consequently, the procedures documented herein are limited to test recommendations that each A-CDM system should address and be uniquely tested against. It is expected that the actual number of tests performed for any single A-CDM system will be far greater than the tests enumerated in this document. The scope and nature of the actual tests to be conducted for a specific A-CDM system are left to the responsible A-CDM partners involved in each A-CDM system design, development, and deployment.

NOTE: *This document references requirements by a number prefixed by the document ID, for example [ED141-0080] refers to requirement number 80 found in ED-141.*

This document, ED-146, is organized as follows:

Chapter 1 presents this document, the terminology, terms, conventions and references used.

Chapter 2 presents the Airport CDM system, proposes a high-level system description, introduces the system logical view, outlines system data flows and presents the functional elements.

Chapter 3 discusses generic test methodologies and identifies the validation methods referenced in the following chapters

Chapter 4 describes suggested test groups for requirements found in ED-141.

Chapter 5 describes suggested test groups for requirements found in ED-145.

Appendix A provides a list of Airport CDM definitions.

Appendix B provides a list of acronyms.

Appendix C provides a list of contributors.

1.4

TERMINOLOGY

When used in this document, the following words have the meaning specified hereunder:

Shall – Denotes a mandatory requirement that must be met if the Functional Group to which it belongs is implemented.

Should – means that this requirement constitutes good practice and is therefore recommended.

Best practice – In some cases, already existing CDM implementations may have identified cost efficient ways of meeting particular requirements. These are listed as Best practice for guidance only. Best practices shall not be considered as representing a requirement.

Note – Denotes explanatory text that supports the requirement to which it belongs but is not part of the requirement.

Procedure – Refers to procedures defined for use of a given Functional Group. Procedures are not part of the Functional Requirements; however, they may impact the processing in which case the corresponding Functional Requirements are included.

Abbreviations – Abbreviations and acronyms used in this document shall have the meaning specified in Abbreviations and Acronyms list at the beginning of the document.

Appendix – Appendices contain text supporting this document but are not considered to be part of the functional requirements.

Figures and Diagrams – Figures and diagrams in this document are used to illustrate a concept and/or relationships and data flows. In NO case do they imply a particular architecture or implementation solution.

1.5 GLOSSARY OF DEFINED TERMS

1.5.1 Airport CDM Definitions

Please refer to FRD definitions. See Appendix A.

1.5.2 General Definitions

For general definitions, please refer to EATM glossary of terms (See <http://www.eurocontrol.int/eatm/gallery/content/public/library/terms.pdf>)

1.6 ABBREVIATIONS

1.6.1 Airport CDM Abbreviations

Please refer to **EUROCONTROL: Airport CDM Functional Requirements** Document definitions [doc ref. [2]]. See Appendix B. List of acronyms

1.6.2 General Abbreviations

For general abbreviations, please refer to EATM glossary of acronyms and abbreviations (See <http://www.eurocontrol.int/eatm/gallery/content/public/library/acronyms.pdf>)

1.7 APPLICABLE DOCUMENTS

- [1] EUROCONTROL: Airport CDM Operational Concept Document, Final Edition, October 2005.
- [2] EUROCONTROL: Airport CDM Functional Requirements Document, Final Edition, October 2005 – *Note: A new version will be available by the time this document is released.*
- [3] EUROCONTROL: Airport CDM Implementation Manual – *Note: A new version will be available by the time this document is released.*

1.8 REFERENCE DOCUMENTS

- [4] EUROCONTROL: CFMU Flight Progress Messages V1.5, 31 Jan 2008, Hans Koolen, Ref.: URB/USD/MSG_INTF. (*Note that this document is being updated on a regular basis*)
- [5] DPI summary document, V1.2, CFMU, June 2006.
- [6] EUROCONTROL, ATS Data Exchange Presentation (ADEXP), Edition 3.1
- [7] Safety Assessment of Airport Collaborative Decision Making (Airport-CDM), V1.2, December 2006
- [8] EUROCONTROL Experimental Centre, Munich AIRPORT CDM, EEC Note No. 03/06, February 2006
- [9] ICAO DOC7910 - ICAO Location Indicator
- [10] ICAO DOC8585 - ICAO Designator for Aircraft Operation Agencies and Aeronautical Authorities and Services
- [11] ICAO DOC8643 - ICAO Aircraft Type Designator

CHAPTER 2

SYSTEM DESCRIPTION

2.1 THE AIRPORT CDM SYSTEM

No two airports are alike as they vary in terms of geography, capacity and other attributes. Nevertheless there is a need to provide a common approach to Airport CDM to ensure interoperability. The intention of this document is to provide such guidance for an Airport CDM system

In its basic form Airport CDM can be enabled through simple technology such as a maintained spreadsheet commonly available to all Partners, through to the federation of advanced applications such as Arrival Manager (AMAN), Departure Manager (DMAN), Surface Manager (SMAN) etc. Airport CDM could be seen as a federation of information and applications of varying sophistication. It is therefore in essence a network of systems tailored to meet the needs specific to an individual airport.

2.1.1 Operational Context

The Air Transport Network is the result of the combination of flight segments, where CFMU performs the flow and capacity management functions, ATC performs the tactical control functions while ground segments are managed by airport Partners.

The efficiency of the Air Transport System is highly dependent on traffic predictability and the ability to take tactical decisions based on a common understanding of Partner's needs. There must be an effective flow of information between the different Airport CDM Partners if the delays and alterations occurring during one phase of flight are to be successfully managed during subsequent phases. The knock-on effect that deviations from the plan produce on the ATN (Air Transport Network) are not anticipated downstream. This results in missed ATFCM slots or non-compliance with the slot allocation requirements and as such in inefficient use of the available en route and airport network capacity.

Airport CDM links and ensures the sharing of consistent data and collaborative decisions among Airport CDM Partners (airport operator, aircraft operators, ATC, ground handlers, de-icing companies and CFMU), greatly enhancing traffic predictability and overall efficiency.

2.1.2 Airport CDM System Goals

The goals of the Airport CDM system are to support Human Roles executing their task and supporting their decision making as defined in the EUROCONTROL: Airport CDM Operational Concept Document [doc ref.[1]] to:

- Improve predictability,
- Improve performance,
- Reduce costs,
- Optimise/enhance use of airport resources,
- Reduce wastage of ATFCM slots,
- Reduce airport congestion.
- Reduce pollution

These improvements and optimisations should not be regarded as a “one-off” activity. Continuous process improvement is a very important goal, particularly in the light of continuing upgrades to airport infrastructure and operating practices.

2.1.3 Airport CDM Data Base

The Airport CDM system links users together via some form of shared database. It can be implemented as either a centralized or distributed capability dependent upon the needs of Airport CDM users and the pre-existing information systems found at any particular airport.

Information sharing is the prime focus of Airport CDM. The aim is to deliver information to the Airport CDM system for each phase of aircraft operation such that other users can access the shared information and plan appropriately. Delivering information to the Airport CDM system on each inbound and outbound flight is an ongoing process throughout the day.

2.2 AIRPORT CDM: THE LOGICAL VIEW

In order to provide an overview of the Airport CDM context, the notion of Logical Elements has been created.

The “External” Logical Elements depict a possible distribution of responsibilities amongst Airport CDM Partners.

The “Internal” Logical Elements depict a possible division of Airport CDM System core capabilities.

2.2.1 External Logical Elements

The Airport CDM processes establish cooperation with the External Logical elements. The following External Elements are defined according to the responsibilities of each Airport CDM Partner:

- Aircraft Operations (responsibility of Aircraft Operators)
- Airport Operations (responsibility of Airport Operator)
- Ground Handling (responsibility of Ground Handlers)
- De-icing Operations (responsibility of De-icing Companies)
- Air Traffic control -ATC-, (responsibility of ATC)
- Air Traffic Flow and Capacity Management -ATFCM- (responsibility of CFMU)

The Airport CDM system generates a coherent situational picture, plans through e.g. Milestones², monitors the Milestones, and generates warnings and alerts. It for example provides taxi-times and departure planning information and triggers the distribution of this information.

The exact role of these External Logical Elements is dependent on local issues; a particular process may not be managed by the same External Logical Element in all airports, or may be shared between more than one External Logical Element. The description below is a generic example.

Local implementation must take the local sharing of responsibilities into consideration.

² For the definition of Milestones, please refer to ED-141 Minimum Specifications For Airport-CDM Systems, Section 3.2.2.2

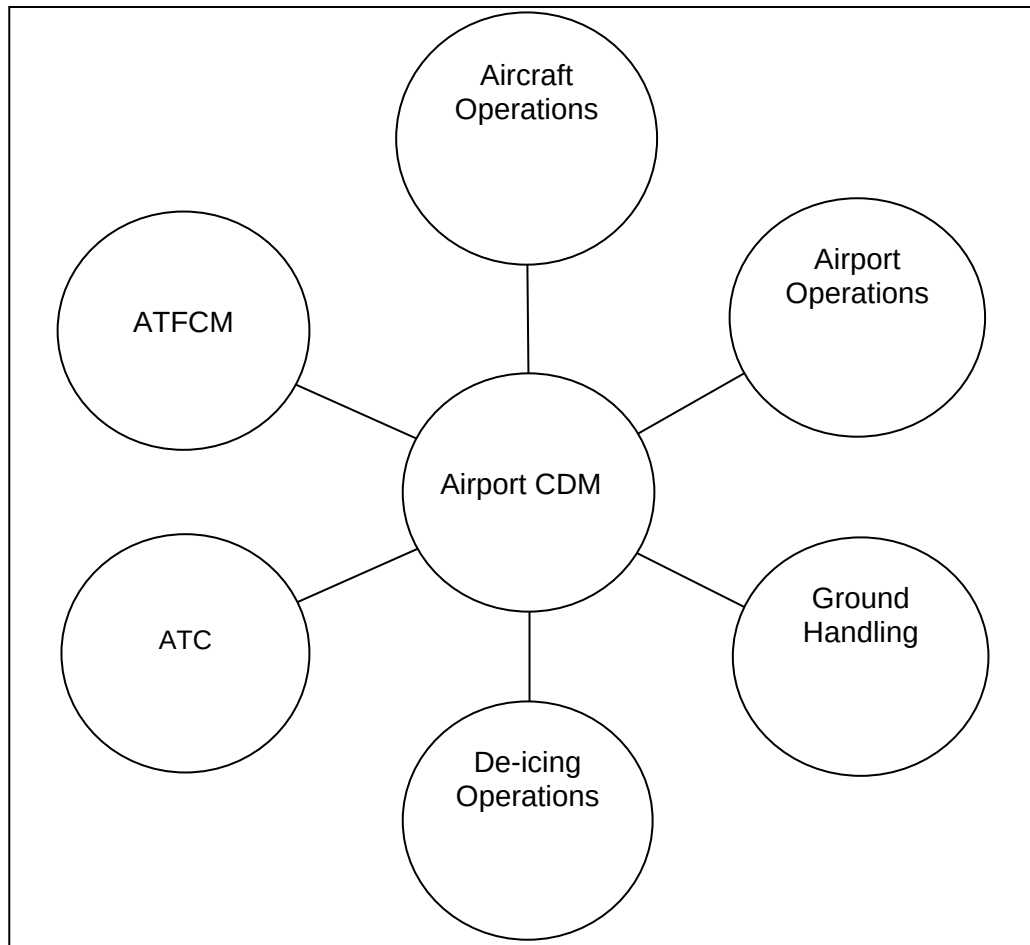


FIGURE 1: THE AIRPORT CDM EXTERNAL LOGICAL ELEMENTS

2.2.2 Logical Data Flows

In order to understand the requirements of an Airport CDM enabling system and provide a modular concept, it is necessary to consider the data flows exchanged with each External Logical Element.

For a description of information exchange, see EUROCONTROL: CFMU Flight Progress Messages V1.5, 31 Jan 2008, Hans Koolen, Ref.: URB/USD/MSG_INTF. *(Note that this document is being updated on a regular basis)*

- [12]** DPI summary document, V1.2, CFMU, June 2006.
- [13]** EUROCONTROL, ATS Data Exchange Presentation (ADEXP), Edition 3.1
- [14]** Safety Assessment of Airport Collaborative Decision Making (Airport-CDM), V1.2, December 2006
- [15]** EUROCONTROL Experimental Centre, Munich AIRPORT CDM, EEC Note No. 03/06, February 2006
- [16]** ICAO DOC7910 - ICAO Location Indicator
- [17]** ICAO DOC8585 - ICAO Designator for Aircraft Operation Agencies and Aeronautical Authorities and Services

ICAO DOC8643 - ICAO Aircraft Type Designator [doc ref. [4]].

The sub-sections below present the main data flows exchanged by each external logical element. Some data can be provided by more than one logical element, but for simplicity only one has been retained in this description. The priority over the most reliable data source (depending on the type of flight and status of flight) will be decided locally at an airport when implementing CDM.

The information to and from external logical elements is depending on the local distribution of responsibilities.

2.2.2.1 Aircraft Operations

Aircraft Operations need:

- Updated CDM situational information such as planned, estimated and actual landing, in-blocks, TSAT and take-off times

Aircraft Operations provide:

- Flight Plan and other data related to the flight, planned, estimated and actual times related to progress of turn-around such as TOBT

2.2.2.2 Airport Operations

Airport Operations need:

- Updated CDM situational information such as planned, estimated and actual landing, in-blocks, TOBT, TSAT and take-off times

Airport Operations provide:

Airport Schedule information, Airport resources allocation

2.2.2.3 Ground Handling

Ground Handling can provide a subset of the data normally delivered by the Aircraft Operator, depending on the agreement between the particular Aircraft Operator and Ground Handler as mentioned above.

Ground Handling need:

- Updated CDM situational information such as planned, estimated and actual landing, in-blocks, TSAT and take-off times

Ground Handling can provide:

- Flight Plan and other data related to the flight, planned, estimated and actual times related to progress of turn-around such as TOBT

2.2.2.4 De-icing Operations

De-icing Operations need:

Updated information about aircraft requesting de-icing and the estimated time ready for de-icing and TSAT

De-icing Operations can provide:

Status of De-icing for the particular aircraft.

2.2.2.5 ATC

ATC needs:

- Updated CDM situational information such as planned, TOBT, Gate/stand number

ATC provides:

- Updated planned, estimated and actual landing, in-blocks, TSAT and take-off times