Network Manager
nominated by
the European Commission

EUROCONTROL

AIRPORT COLLABORATIVE DECISION MAKING (A-CDM) SAFETY CASE GUIDANCE MATERIAL

Edition Number : 2.0
Edition Validity Date : 01/02/2016

DOCUMENT CHARACTERISTICS

Document Title	Document Subtitle (optional)	Edition Number	Edition Validity Date
AIRPORT COLLABORATIVE DECISION MAKING (A-CDM) SAFETY CASE GUIDANCE MATERIAL		2.0	01/02/2016

Abstract

This document presents Safety Case Guidance Material for the Airport CDM (A-CDM) Project. The relevant A-CDM milestones, flight phases and data flows have been systematically analysed. The safety impacts of A-CDM have been identified and documented. Where concerns or new hazards have been found, appropriate risk mitigation has been proposed with the aim of ensuring that the A-CDM project is acceptably safe in principle. Guidance has been provided by EUROCONTROL to assist stakeholders in implementing the A-CDM elements safely and in preparing their own local safety assessments/ cases.

Author(s)

David Booth

Contact Person(s)	Tel/email	Unit
EUROCONTROL Airport CDM Team	airport-cdm@eurocontrol.int	NMD/NOM/APT

STATUS AND ACCESSIBILITY			
Status		**Accessible via**	
Working Draft	☐	Intranet	☐
Draft	☐	Extranet	☐
Proposed Issue	☐	Internet (www.eurocontrol.int)	☒
Released Issue	☒		

TLP STATUS		
Intended for		**Detail**
Red	☐	Highly sensitive, non-disclosable information
Amber	☐	Sensitive information with limited disclosure
Green	☐	Normal business information
White	☒	Public information

©2015 The European Organisation for the Safety of Air Navigation (EUROCONTROL). This document is published by EUROCONTROL for information purposes. It may be copied in whole or in part, provided that EUROCONTROL is mentioned as the source and the extent justified by the non-commercial use (not for sale). The information in this document may not be modified without prior written permission from EUROCONTROL.

DOCUMENT APPROVAL

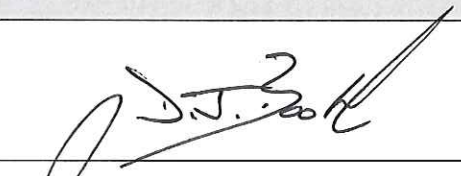
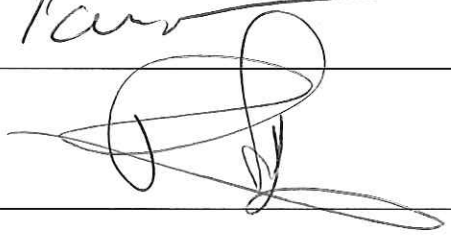
The signature table is optional –a minuted approval meeting may be used instead.

The following table identifies all management authorities who have successively approved the present issue of this document.

This table may be replaced by a format document review and approval meeting, with the meeting details recorded and retained that edition's archive folder.

The approval may also be recorded via electronic workflow, where put in place.

Where document approval is made via a meeting or electronic workflow, the details shall be indicated here in place of the approval table.

AUTHORITY (Name and function)	SIGNATURE	DATE
David Booth A-CDM Implementation Manager		01/02/2016
Paul Adamson Head of Airport Unit		01/02/2016
Joe Sultana Director Network Manager		01/02/2016

Edition History

The following table records the complete history of the successive editions of the present document.

Edition History

Edition No.	Edition Validity Date	Author	Reason
1.2	14/07/2015	Dave Booth	General update
2.0	01/02/2016	Dave Booth	General update of document

Table of Contents

DOCUMENT CHARACTERISTICS I
DOCUMENT APPROVAL III
EDITION HISTORY IV
TABLE OF CONTENTS V
1 EXECUTIVE SUMMARY 1
2 INTRODUCTION 4
2.1 Background to the Safety Case 4
2.2 Objectives of Safety Case Guidance Material 4
2.3 Scope of Safety Case 4
2.4 How to Use this Safety Case GM 4
2.5 Document Structure 5
3 SYSTEM DESCRIPTION 5
3.1 Purpose of the A-CDM Project 5
3.2 A-CDM Concept Elements 6
3.2.1 OVERVIEW 6
3.2.2 AIRPORT CDM INFORMATION SHARING 6
3.2.3 THE A-CDM TURN-ROUND PROCESS (MILESTONE APPROACH) 6
3.2.4 VARIABLE TAXI TIME CALCULATION 7
3.2.5 COLLABORATIVE MANAGEMENT OF FLIGHT UPDATES 7
3.2.6 COLLABORATIVE PRE-DEPARTURE SEQUENCE 7
3.2.7 A-CDM IN ADVERSE CONDITIONS 7
3.2.8 ADVANCED CONCEPT ELEMENTS 7
4 SAFETY ARGUMENT 7
5 SAFETY ASSESSMENT 9
5.1 Overview 9
5.2 Success Case 10
5.3 Failure Case 11
5.4 Trustworthiness of Safety Assessment 11
5.5 Assumptions, Limitations and Caveats 11
6 GUIDANCE FROM EUROCONTROL TO STAKEHOLDERS 12
6.1 Overview 12
6.2 How to Implement the Elements Safely 13
6.3 Safety Case Communication and Guidance 13
7 LOCAL STAKEHOLDER RESPONSIBILITIES 13

7.1 OVERVIEW 13
7.2 LOCAL SAFETY CASES 14
7.3 IMPLEMENTATION OF SAFETY REQUIREMENTS 15
7.4 SAFETY MONITORING 17
8 OUTSTANDING SAFETY ISSUES AND RECOMMENDATIONS 18
9 SUMMARY 18
ANNEX 1 - SAFETY ARGUMENT - GSN 20
A1.1 INTRODUCTION AND METHODOLOGY 20
A1.2 APR GSN 21
10 REFERENCES 26
11 ABBREVIATIONS 28

LIST OF FIGURES IN MAIN DOCUMENT

FIGURE 1 A-CDM ARGUMENT RELEVANT TO SAFETY ASSESSMENT 9
FIGURE 2 ARGUMENT 2 – GUIDANCE FOR STAKEHOLDERS 12
FIGURE 3 ARGUMENT 3 – LOCAL SAFETY ASSESSMENTS/ CASES 14
FIGURE 4 GENERIC AND LOCAL FAILURE CASE ANALYSIS 15
FIGURE 5 ARGUMENT 4 – IMPLEMENTATION OF LOCAL SAFETY REQUIREMENTS 16
FIGURE 6 ARGUMENT 5 – SAFETY MONITORING 17

LIST OF TABLES IN MAIN DOCUMENT

1 EXECUTIVE SUMMARY

Objectives of Safety Case Guidance Material

There are two main objectives of this Safety Case Guidance Material (GM):

1. The primary objective is to satisfy the A-CDM project team and stakeholders that the A-CDM Elements and Functional Groups (FGs) are acceptably safe. This Safety Case GM can only determine if A-CDM is acceptably safe "in principle" as it cannot be known how the elements will be implemented in practice at a local level.

2. The secondary objective is to provide material that can be used by airport stakeholders at a local level in the production of local safety assessments and safety cases.

Structure of Safety Case GM

This Safety Case GM for A-CDM makes use of a methodology known as Goal Structured Notation (GSN). This approach begins with the claim that the 4 EATM Airport Operations Programme (APR) Projects are acceptably safe in principle to implement in ECAC States. This claim is then broken down into 5 main safety arguments.

1. Based on use of safety assessment, Safety Recommendations are specified such that A-CDM is acceptably safe in principle.

2. Guidance is provided to enable safe implementation of system elements for A-CDM.

3. Local Safety Cases/ assessments are written demonstrating the safety of individual elements and combinations of elements and producing local Safety Requirements.

4. Safety Requirements are implemented correctly and consistently by stakeholders for their defined Project.

5. Safety Monitoring will ensure that the on-going operation of the implemented Project is acceptably safe.

Arguments 1 and 2 fall within the control of EUROCONTROL. Arguments 3-5 fall primarily within the control of local stakeholders (although EUROCONTROL also has a high-level monitoring role in terms of looking at ECAC wide trends in incidents etc.). It should be noted that the local stakeholder requirements under Arguments 3-5 are not new requirements introduced by A-CDM. Rather they are already part of ESARR3 and 4, ICAO Annexes 11 and 14 concerning ANSP and aerodrome SMS requirements and regulations from the European Commission and Parliament.

Conclusions of Safety Case

With reference to Argument 1 above, the A-CDM safety assessment [2] identified risk mitigations such that the generic project is acceptably safe in principle. Based on these mitigations it was concluded [2] that A-CDM would have no adverse impact on safety. Furthermore, it should be noted, that whenever potential benefits have been identified, these should not be considered "safety measures" as such.

Concerning Argument 2, sufficient guidance has been provided to assist stakeholders in the safe implementation of A-CDM elements and in the conduct of local safety assessments/ cases.

With respect to Arguments 3-5, a structure for these arguments has been provided in this Safety Case GM which should assist local stakeholders in the development of local Safety Cases.

INTENTIONALLY BLANK PAGE

2 INTRODUCTION

2.1 Background to the Safety Case

Airport CDM is one of the projects maintained by the Network Manager. This document presents the Safety Case Guidance Material for the A-CDM project. It refers extensively to the A-CDM Safety Assessment [2].

2.2 Objectives of Safety Case Guidance Material

1. The primary objective is to satisfy the A-CDM project team and stakeholders that the A-CDM Elements and Functional Groups (FGs) are acceptably safe. This Safety Case GM can only determine if A-CDM is acceptably safe "in principle" as it cannot be known how the elements will be implemented in practice at a local level.

2. The secondary objective is to provide material that can be used by airport stakeholders at a local level in the production of local safety assessments and safety cases.

2.3 Scope of Safety Case

This Safety Case GM (and the supporting safety assessment [2]) covers A-CDM as defined in the Operational Concept Document [3] and the Functional Requirements Document [4].

The GM is based around a structured safety argument presented in Goal Structured Notation (GSN). The GSN is shown in full in Appendix I and shows the responsibilities of EUROCONTROL and local stakeholders.

This document should not be seen as a detailed final safety case. The A-CDM safety assessment [2] produced a set of safety recommendations rather than definitive requirements. The safety argument described in section 3 of this document assumes that these safety recommendations (plus their supporting rationale in the safety assessment) will be used within local safety assessments to produce local safety requirements.

2.4 How to Use this Safety Case GM

Under the ESARRs, ICAO Annexes 11 and 14 and regulations from the European Commission and Parliament, there are requirements that proposed ATM and aerodrome changes are adequately safety assessed and that the changes fall under the overall SMS of the affected stakeholders. This guidance material is intended to assist stakeholders in meeting these requirements by:

- Providing a generic safety assessment of A-CDM (see Ref. [2] and the summary in Section 4 below) and guidance as to how the generic safety assessment can be used locally.

- Highlighting the A-CDM project implementation documentation that has been prepared to assist local stakeholders.
- Providing a safety case structure that could be used in local safety cases. For those stakeholders who do not follow a safety case process, the SMS requirements contained within this safety case GM (e.g. setting responsibilities, monitoring, etc) will still be relevant to the safe implementation of A-CDM.

2.5 Document Structure

This Safety Case GM is structured as follows:

- Section 2 provides a system description of the A-CDM project;
- Section 3 presents the safety argument that forms the framework for the Safety Case;
- Section 4 shows how the outputs of the safety assessment support the safety argument (Argument 1 of 5);
- Section 5 describes what material has been produced by EUROCONTROL to guide and assist stakeholders in the safe implementation of A-CDM (Argument 2 of 5);
- Section 6 summarises the anticipated responsibilities of local stakeholders to ensure safe implementation of A-CDM (Arguments 3, 4 and 5);
- Section 7 summarises outstanding safety issues and recommendations; and
- Section 8 presents the main conclusions of the Safety Case GM.

Appendix 1 provides the full safety argument in GSN format.

3 SYSTEM DESCRIPTION

3.1 Purpose of the A-CDM Project

For readers unfamiliar with the A-CDM project and the A-CDM safety assessment [2], this section summarises key details of the A-CDM project.

Airport Collaborative Decision Making (A-CDM) aims at improving operational efficiency at airports by reducing delays, improving the predictability of events and optimising the utilisation of resources.

Implementation of Airport CDM allows each Airport CDM Partner to optimise their 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 facilitated by the sharing of accurate and timely information and by adapted procedures, mechanisms and tools.

Most airports related operational improvement initiatives launched until now were oriented towards improving performance of an individual partner at an airport. However, optimising the capacity of an airport involves interaction amongst all airport partners working as a team. Individual partners must co-ordinate their decisions and activities by sharing information and resources to attain shared goals.

3.2 A-CDM Concept Elements

3.2.1 Overview

The Airport CDM concept is divided into the following Elements [3]:

- Airport CDM Information Sharing;
- A-CDM Turn-round Process – Milestones Approach;
- Variable Taxi Time Calculation;
- Collaborative Management of Flight Updates;
- Collaborative Pre-departure Sequence;
- A-CDM in Adverse Conditions; and
- Advanced Concept Elements

A phased, bottom-up approach is planned for implementation of each element with each implementation step delivering an incremental benefit, which will become even more significant as the A-CDM Concept Elements mature.

Some of the Airport CDM Elements also serve to create the environment without which other elements cannot work. The Operational Concept therefore assumes that some Elements are implemented before the others are considered, as described in the following sub-sections.

3.2.2 Airport CDM Information Sharing

A-CDM Information Sharing is essential for achieving common situational awareness (CSA) through the exchange and sharing of all pertinent information, including data recording and post-operational analysis. It also forms the foundation upon which all other Elements operate and as such must be implemented first. This element is supported by Functional Group 0, the User Interface (UI)/ Airport CDM Information Sharing Platform (ACISP) and Functional Group 1, Airport CDM Information Sharing (see FRD [4]).

3.2.3 The A-CDM Turn-round Process (Milestone Approach)

Focusing on the turn-round process and linking flight segments with the NMOC, this Element improves inbound and outbound traffic predictability. Together with A-CDM Information Sharing, it provides the foundation of the ground traffic network, essential for system-wide planning improvements. This Element is essential if the full potential of A-CDM Information Sharing is to be realised. It is related to Functional Group 2 [4].

3.2.4 Variable Taxi Time Calculation

Variable Taxi Time Calculation aims at improving the accuracy of calculations associated with the ground movement of aircraft, such as estimated take off times. This Element is a pre-requisite for the implementation of the Collaborative Management of Flight Updates. It is related to Functional Group 3 [4].

3.2.5 Collaborative Management of Flight Updates

This Element ensures that ATFM has the required flexibility to cope with modifications in departure times, due to traffic changes and operators' preferences. It requires the availability of precise taxi times provided by Variable Taxi Time Calculation and the A-CDM Turn-round Process. It is related to Functional Group 4 [4].

3.2.6 Collaborative Pre-departure Sequence

This Element enhances flexibility and helps in optimising airport resources. It is related to Functional Group 5 [4].

3.2.7 A-CDM in Adverse Conditions

This Element facilitates the dissemination of capacity changes and recovery from disruption, ensuring flexibility and optimum use of available resources. It is related to Functional Group 6 [4].

3.2.8 Advanced Concept Elements

These Elements will enhance and extend common situational awareness and increase collaboration between airport partners by utilising advanced technologies and linking with advanced tools, i.e. A-SMGCS, AMAN / DMAN.

The Advanced Concept Elements are still under development and are ex-scope with respect to the current safety assessment. The scope of this safety assessment covers Functional Groups up to FG 6.

4 SAFETY ARGUMENT

This Safety Case GM for A-CDM makes use of a methodology known as Goal Structured Notation (GSN) [5]. This approach begins with the claim that the 4 APR projects are acceptably safe in principle to implement in ECAC States. This claim is then broken down into 5 main safety arguments.

1. Based on use of safety assessment, Safety Recommendations are specified such that A-CDM is acceptably safe in principle.

2. Guidance is provided to enable safe implementation of system elements for A-CDM.

3. Local Safety Cases are written demonstrating the safety of individual system elements and combinations of system elements and producing local Safety Requirements.

4. Safety Requirements are implemented correctly and consistently by stakeholders for their defined Project.

5. Safety Monitoring will ensure that the on-going operation of the implemented Project is acceptably safe.

Arguments 1 and 2 fall within the control of EUROCONTROL. Arguments 3-5 fall primarily within the control of local stakeholders (EUROCONTROL has a high-level monitoring role in terms of looking at ECAC wide trends in incidents etc.).

Argument 1 is addressed fully in Section 4 below. Argument 2 concerning guidance in the context of A-CDM is addressed in Section 5 below.

The full safety argument in GSN format is presented in Appendix I. A key issue to highlight on the first page of the argument concerns the criteria used to define “acceptably safe”. The criteria used in the project are taken from the Safety Plan [6] and are as follows:

• Airport risks are not to be increased (consistent with ESARR4 and ATM 2000+); and

• Airport risks are to be further reduced As Far As Reasonably Practicable.

5 SAFETY ASSESSMENT

5.1 Overview

Figure 5.1 below shows the relevant part of the safety argument which is supported by the A-CDM safety assessment.

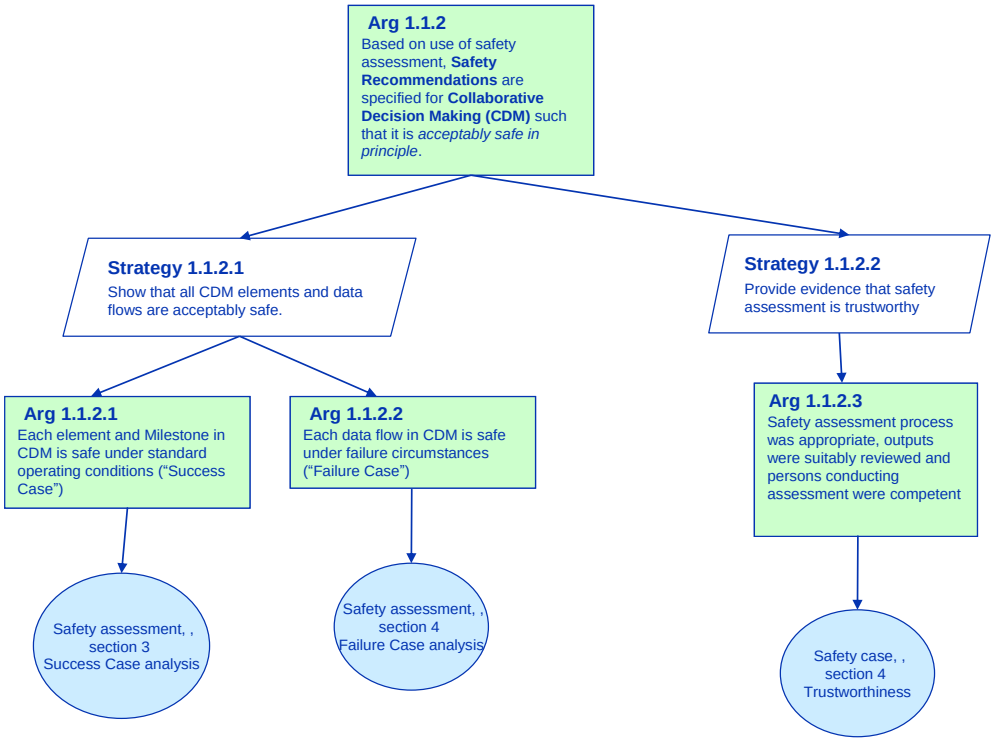


Figure 1 A-CDM Argument Relevant to Safety Assessment

In order to support this part of the argument the A-CDM safety assessment needed to consider each Element and Milestone under standard operating conditions to ensure it was acceptably safe, the so-called "Success Case" (Arg. 1.1.2.1). Then each flow of data under A-CDM was assessed to determine the risk of failures, the "Failure Case" (Arg. 1.1.2.2) to determine if it was also acceptably safe. The sub-sections below describe how these arguments were supported and why the safety assessment evidence is considered trustworthy (Arg. 1.1.2.3).

5.2 Success Case

The A-CDM safety assessment [2] followed a structured approach to analysing the safety impacts by considering each milestone in turn and each airport partner affected. Two workshops were held with relevant experts to undertake this analysis. Some potential safety benefits were identified resulting from the timely and increased provision of information. However, it must be stressed that A-CDM is not a "safety tool" and should not be seen as one. Clearly its prime purpose is to improve efficiency at an airport. Thus, while the potential safety benefits of A-CDM identified were valid outputs from the assessment process, they should not be considered "safety measures" as such.

A limited number of potential issues and concerns were also identified namely:

• Increased potential for Ground Handlers' unauthorised interference with flight plan data.

• Slight workload increases for certain personnel in entering and updating A-CDM information.

These concerns should be adequately addressed by the following two mitigations:

S1 Service Level Agreements (SLAs) and agreed procedures between Aircraft Operators and Ground Handlers on change access to Flight Plan Information are to be formalised.

S2 Update training and resource needs analysis for all partners. These analyses, which are a typical component of a mature Safety Management System, should cover:

- Review of workload and other demands versus human and other resources;
- Ensuring that training and procedures cover input, receipt and correct use of A-CDM information;
- Ensuring appropriate Human Machine Interface for all users of A-CDM; and
- Updated definition of roles and responsibilities.

Overall, with these mitigations in place, it was concluded that A-CDM will not have an adverse impact on safety.

5.3 Failure Case

A systematic evaluation of all the data flows within A-CDM led to the identification of a limited number of failures which could have safety impacts (see Section 4 of Ref. [2]). These are mostly adequately mitigated by practicable procedural recommendations that are described in the safety assessment. In addition, there may be a need for some system equipment requirements (e.g. SWAL) for certain data items and alarms within A-CDM. An initial set of key data items has been identified in the generic safety assessment which local assessments would need to check to determine if system equipment requirements are needed, or whether failure effects are adequately mitigated by other means.

With these recommended mitigations in place, A-CDM will be acceptable safe in principle.

5.4 Trustworthiness of Safety Assessment

The safety assessment processes were designed by EUROCONTROL's APT project team, Safety Department and EUROCONTROL's contracted safety specialist. They were based on EUROCONTROL's Safety Assessment Methodology (SAM) and used techniques documented in the SAM as appropriate for use in ATM [7]. The techniques were combined to ensure that they were adequate to demonstrate that A-CDM was acceptably safe in principle. They were followed using the guidance provided in the SAM and the processes were checked by DAP/SSH review.

The outputs have been reviewed by the APT project teams, and a EUROCONTROL safety specialist. Selected outputs from workshops have also been reviewed and commented on by external stakeholders. Their comments have been fully incorporated in the final documentation.

Safety assessment tasks were conducted by qualified and experienced A-CDM specialists and safety assessment professionals. The multi-disciplinary team of professionals used in the workshop sessions had extensive experience and included persons outside EATM who had first-hand experience of A-CDM (see the safety assessment report [2] for listing of experts).

5.5 Assumptions, Limitations and Caveats

In conducting the analysis of potential system failures in Ref. [2] it was assumed that backwards interference to data sources feeding into ACIS has been guarded against by the design of the data sources.

As noted in section 1.3 this safety case is a high level guidance document. It is assumed that the safety recommendations from [2] (plus their supporting rationale in the safety assessment) will be used within local safety assessments to produce local safety requirements.

It is recognised that the pre-CDM situation could vary significantly between airports and between airport partners. For this study a pre-CDM situation has been defined which lacks the elements and FGs described in the OCD and FRD. Thus the safety impact described in this report may be greater than that experienced by airport partners which already have some parts of A-CDM in operation.

6 GUIDANCE FROM EUROCONTROL TO STAKEHOLDERS

6.1 Overview

Figure 2 presents Argument 2 relating to guidance material for stakeholders provided by EUROCONTROL.

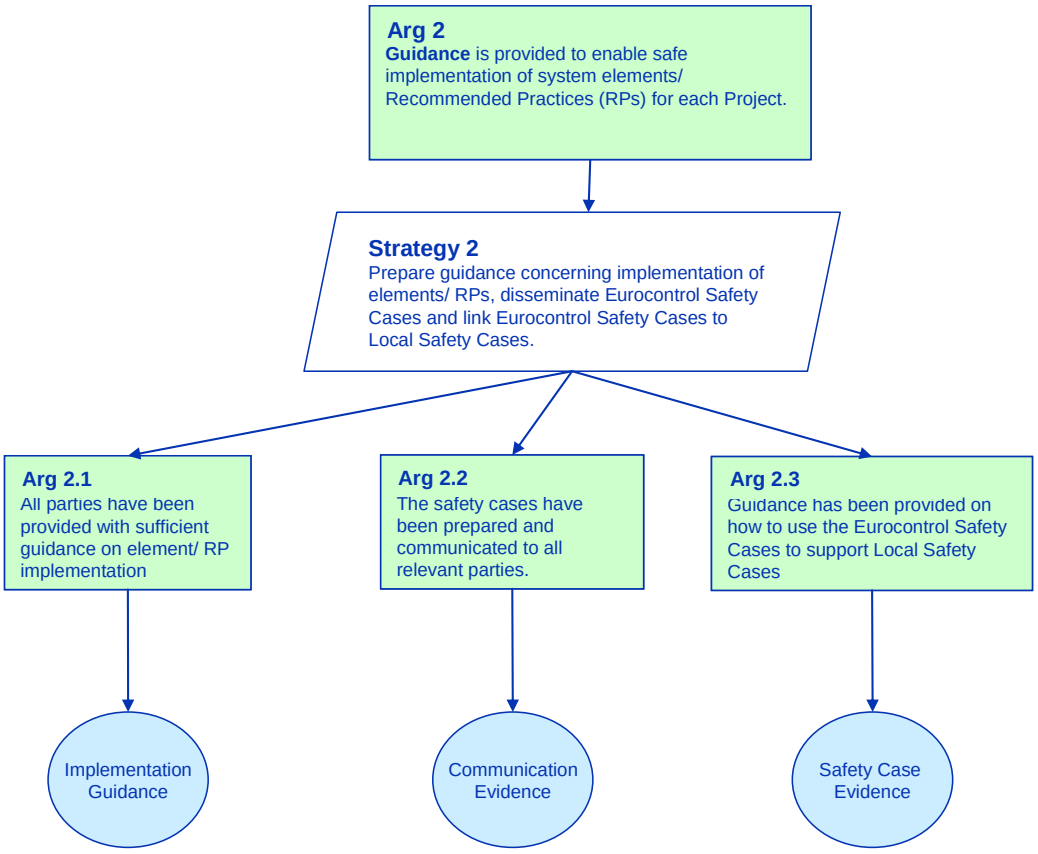


Figure 2 Argument 2 – Guidance for Stakeholders

6.2 How to Implement the Elements Safely

EUROCONTROL has prepared documentation concerning A-CDM implementation (Arg. 2.1), namely:

- "Airport CDM Applications – Guide" [8].
- "Airport CDM Implementation - The Manual" [9].

The main focus of the implementation documentation has been on maximising the efficiency and effectiveness of introducing A-CDM. However, the implementation advice should have a positive effect on the overall management of a local A-CDM project including safety. Safety is noted explicitly in attachment 1 of the Implementation Manual as an important objective. However, given that A-CDM is not expected to have strong safety impacts (see section 4.2 and 4.3 above) the focus of the implementation guidance is appropriate.

6.3 Safety Case Communication and Guidance

This A-CDM Safety Case GM has been prepared (Arg 2.2) based on a formal safety assessment [2]. It will be available via the EUROCONTROL website. Findings from the safety assessment have been presented at the A-CDM Task Force in November 2006.

This safety case document presents a structure that could be transferable to stakeholders for their local safety cases. In addition, the safety assessment on which this Safety Case is built provides guidance in section 5 (see Ref. [2]) on how the generic safety assessment can be used within local safety assessments (Arg 2.3). This is further discussed in Section 7.2 below.

7 LOCAL STAKEHOLDER RESPONSIBILITIES

7.1 Overview

The responsibilities of local stakeholders are set out in Arguments 3-5 of Appendix I. They cover:

- Provision of local Safety Cases
- Implementation of derived safety requirements
- Safety monitoring

These are described in more detail below. It should be noted that the local stakeholder requirements under Arguments 3-5 are not new requirements introduced by A-CDM. Rather they are already part of ESARR3 and 4, ICAO Annexes 11 and 14 concerning ANSP and aerodrome SMS requirements and regulations from the European Commission and Parliament ([10], [11]).

7.2 Local Safety Cases

It is expected that airport stakeholders intending to implement A-CDM elements will conduct local safety assessments/ cases. Such safety studies should be in line with ESARR4 plus ICAO Annexes 11 and 14 guidance, and will generate local safety requirements. Figure 7.1 shows the relevant GSN diagram.

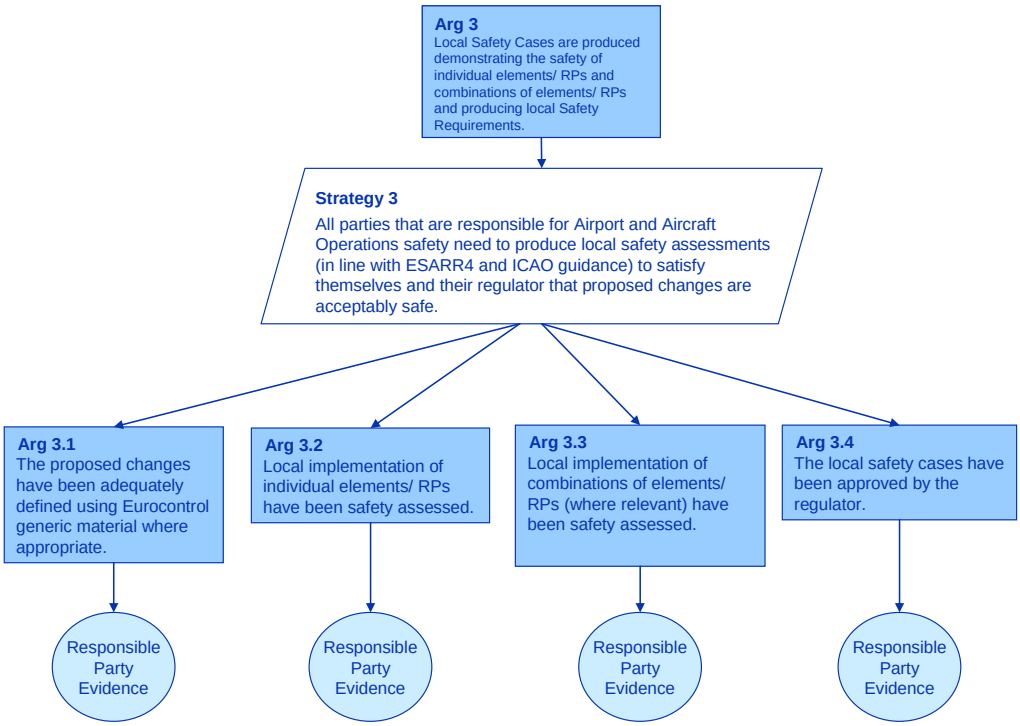


Figure 3 Argument 3 – Local Safety Assessments/ Cases

The four sub-arguments regarding local safety cases in the GSN deal with the following:

- The proposed A-CDM changes at an airport should be clearly defined/ described by the relevant stakeholders. EUROCONTROL's A-CDM project documentation can be used where relevant to assist in this process (Arg. 3.1).
- Implementation of individual A-CDM Elements should be safety assessed (Arg. 3.2) as should combinations of A-CDM Elements (Arg. 3.3). It is anticipated that local A-CDM analysis can make use of the generic safety analysis [2] as shown in Figure 7.2 below. The generic analysis has made an initial identification of those data flows/ items which could have a safety impact if failure occurs. Based on this screening, the worst credible effects of safety related failures have also been identified. It is proposed that local assessments build on this generic work determining local severities and probabilities of effects and thereby deriving safety requirements. Further guidance is provided in Ref. [2], section 5.

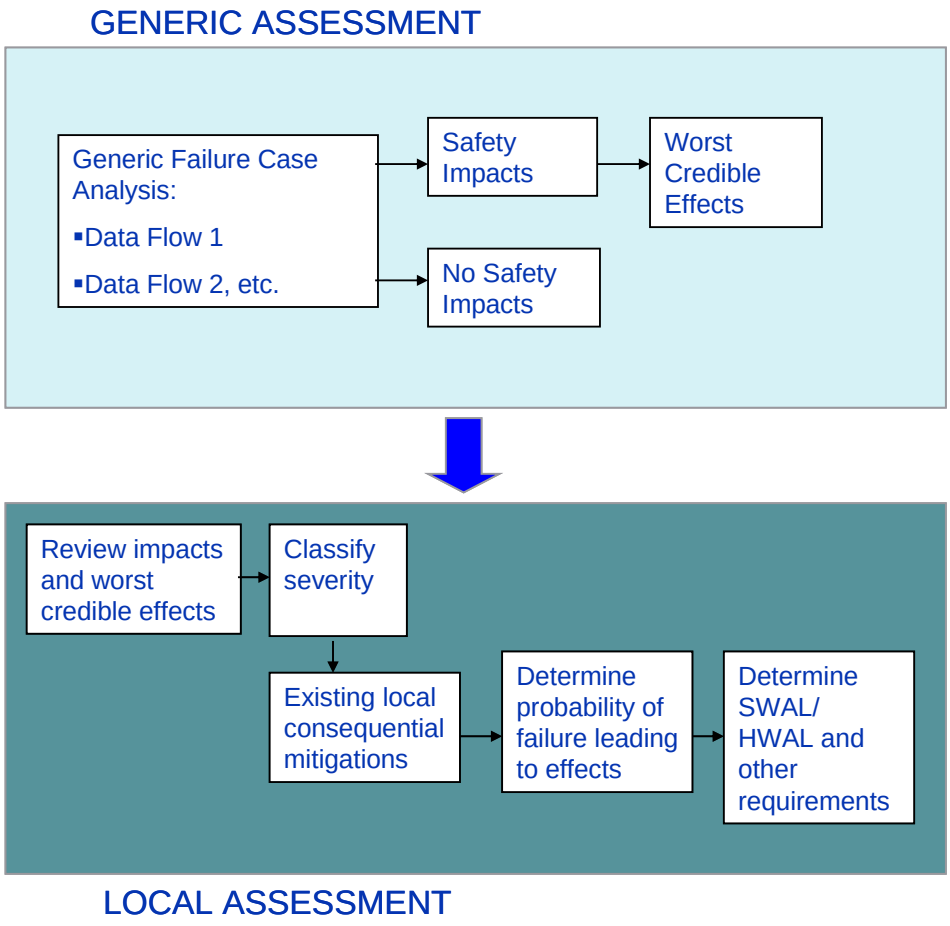


Figure 4 Generic and Local Failure Case Analysis

- While the primary aim of the local safety cases should be to assure the local stakeholders that the proposed changes are acceptably safe, they should also be submitted to and approved by the regulator (Arg. 3.4).

7.3 Implementation of Safety Requirements

The local safety requirements need to be implemented correctly and consistently by stakeholders to ensure the safety of A-CDM Elements.

Figure 7.3 shows the relevant GSN diagram.

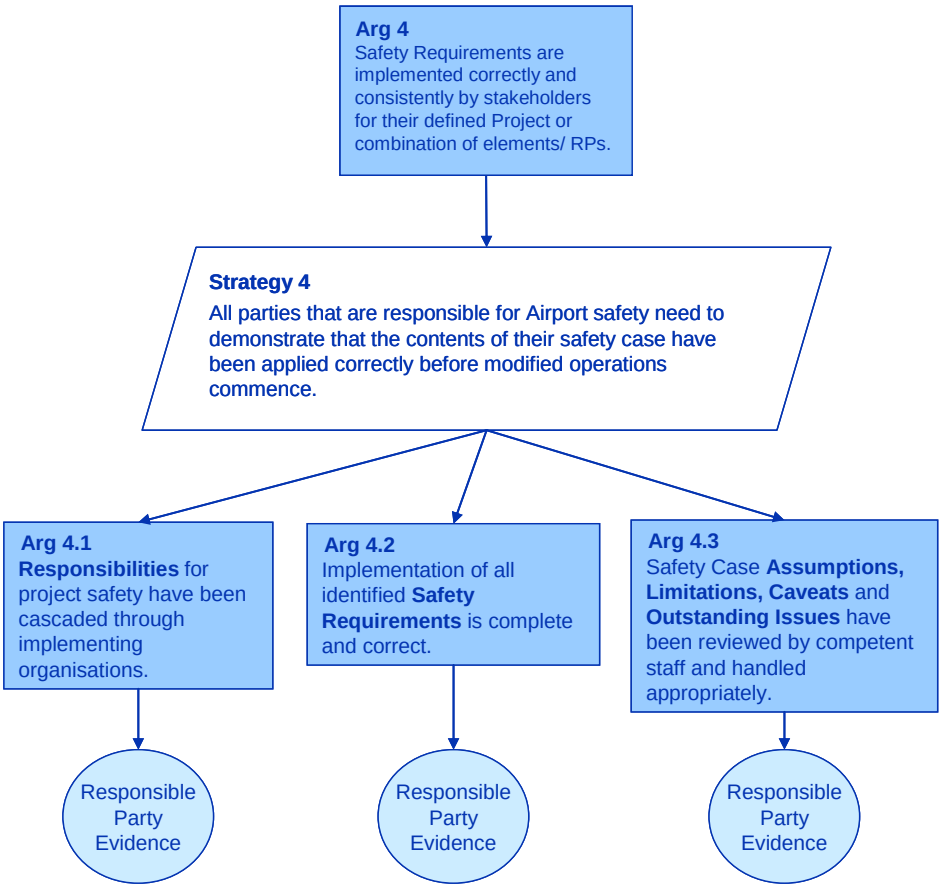


Figure 5 Argument 4 – Implementation of Local Safety Requirements

There are three sub-arguments in Argument 4 of the GSN:

- Responsibilities for A-CDM safety have been cascaded through implementing organisations (Arg. 4.1). This is a normal part of a Safety Management System (SMS) and will need to incorporate the handling of the safety requirements identified in the local safety cases.
- Implementation of all identified Safety Requirements is complete and correct (Arg. 4.2). Evidence will need to be produced, such as a local implementation plan, showing that all the requirements from the safety case have been understood and implemented fully. Any deviations from the requirements will require their own documented safety assessment.
- Safety Case Assumptions, Limitations, Caveats and Outstanding Issues have been reviewed by competent staff and handled appropriately (Arg. 4.3). The main generic issues are shown in section 4.5 above. Even the local Safety Cases will contain Assumptions, Limitations, Caveats and maybe some Outstanding Issues; these will all need to be addressed in a transparent way by the implementation team.

7.4 Safety Monitoring

Having implemented the project Elements, safety monitoring is critical to ensuring the safety of the new system through its operational life. Safety monitoring should be capable of showing incident trends and identifying potentially unsafe operations prior to the occurrence of an accident.

Figure 7.4 shows the relevant GSN diagram.

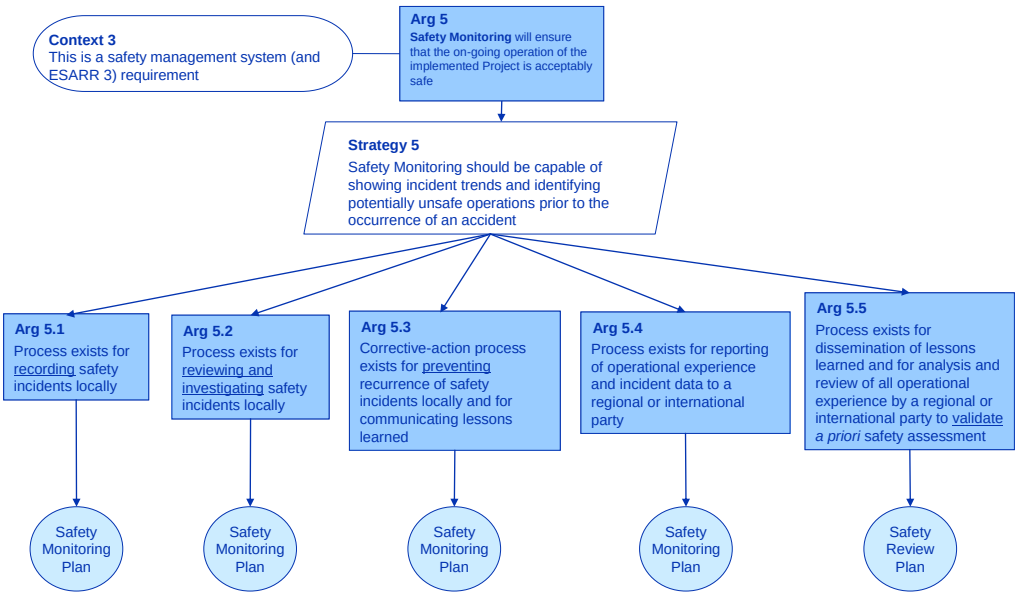


Figure 6 Argument 5 – Safety Monitoring

A safety monitoring and review plan as required by ESARR3 should cover the following:

- A process exists for recording safety incidents locally (Arg. 5.1).
- A process exists for reviewing and investigating safety incidents locally (Arg. 5.2).
- A corrective-action process exists for preventing recurrence of safety incidents locally and for communicating lessons learned (Arg. 5.3).
- A process exists for reporting of operational experience and incident data to a regional or international party (Arg. 5.4).
- A process exists for dissemination of lessons learned and for analysis and review of all operational experience by a regional or international party to validate a priori safety assessment (Arg. 5.5).

8 OUTSTANDING SAFETY ISSUES AND RECOMMENDATIONS

There are no significant outstanding safety issues from this generic A-CDM Safety Case.

The recommendations contained in the safety assessment report (Argument 1) covered the mitigations for a limited number of issues and concerns identified in the Success Case and Failure Case analyses to ensure that A-CDM will be acceptably safe in principle.

9 SUMMARY

Safety Case Guidance Material for A-CDM has been prepared by EUROCONTROL to support the claim that A-CDM will be acceptably safe in principle (i.e. subject to complete and correct implementation).

The main conclusions from the safety assessment (Argument 1) were that A-CDM will not have an adverse impact on safety providing mitigations are in place to address the limited number of issues and concerns. The Success Case issues and concerns would be adequately mitigated by practicable procedural and SMS recommendations which have been proposed. In particular clear definitions of roles and responsibilities are required to ensure that all relevant personnel understand how A-CDM information is to be used. The Failure Case issues are mostly adequately mitigated by practicable procedural recommendations. In addition, there may be a need for some system equipment requirements (e.g. SWAL) for certain data items within A-CDM. An initial set of key data items has been identified in the generic safety assessment [2] which local assessments would need to check to determine if system equipment requirements are needed, or whether failure effects are adequately mitigated by other means.

The Safety Case has further concluded that sufficient guidance (Argument 2) has been provided to assist stakeholders in the safe implementation of A-CDM Elements and in the conduct of local safety assessments/ cases.

With respect to Arguments 3-5, a structure for these arguments has been provided in this Safety Case GM which should assist local stakeholders in the development of local Safety Cases.

INTENTIONALLY BLANK PAGE

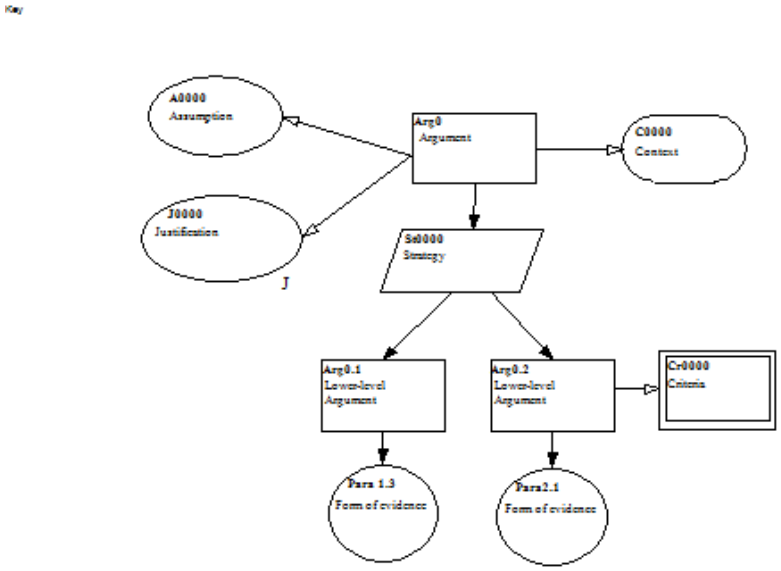
Annex 1 - Safety Argument - GSN

A1.1 Introduction and Methodology

The figures presented below show the safety argument for APR and A-CDM and the evidence structure using Goal Structured Notation (GSN).

A key to the GSN symbology is shown in **Figure 0.**

Figure 0 – GSN Key



An Argument always takes the form of a predicate - i.e. a statement that is either true or false. As the name suggests, GSN provides for the structured decomposition of Arguments into smaller, sub-Arguments; logically, an Argument is true (has been satisfied) if, and only if, all its sub-Arguments are true. For the structure to be considered complete, every branch must be terminated in an item of Evidence that supports the Argument structure to which it is attached.

Other symbology may be used in order to provide supporting information, as follows.

Strategies are a useful means of adding comment to the structure to explain, for example, how the decomposition will develop. They are not predicates and do not form part of the logical decomposition; rather, they are there purely for explanation of the decomposition, and their use is optional.

Contextual symbology - including the Assumptions, Context, Justification and Criteria symbols- is also used to add completeness to the structure.

A1.2 APR GSN

Figure 0 Overall APTS Program Concept

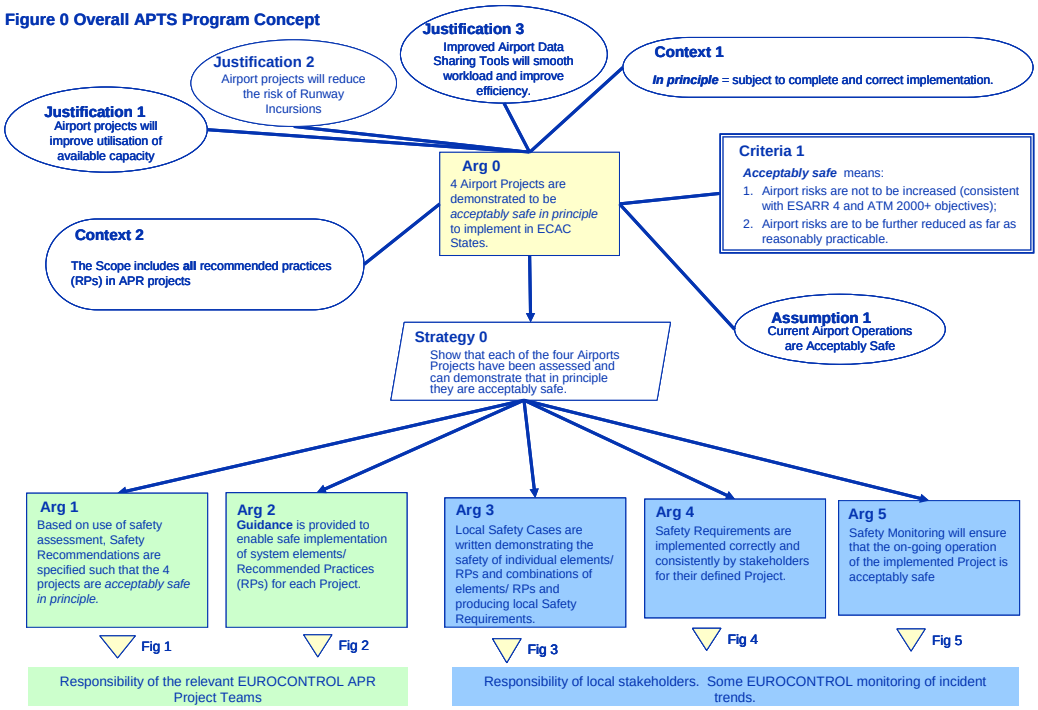


Figure 1 Each Project

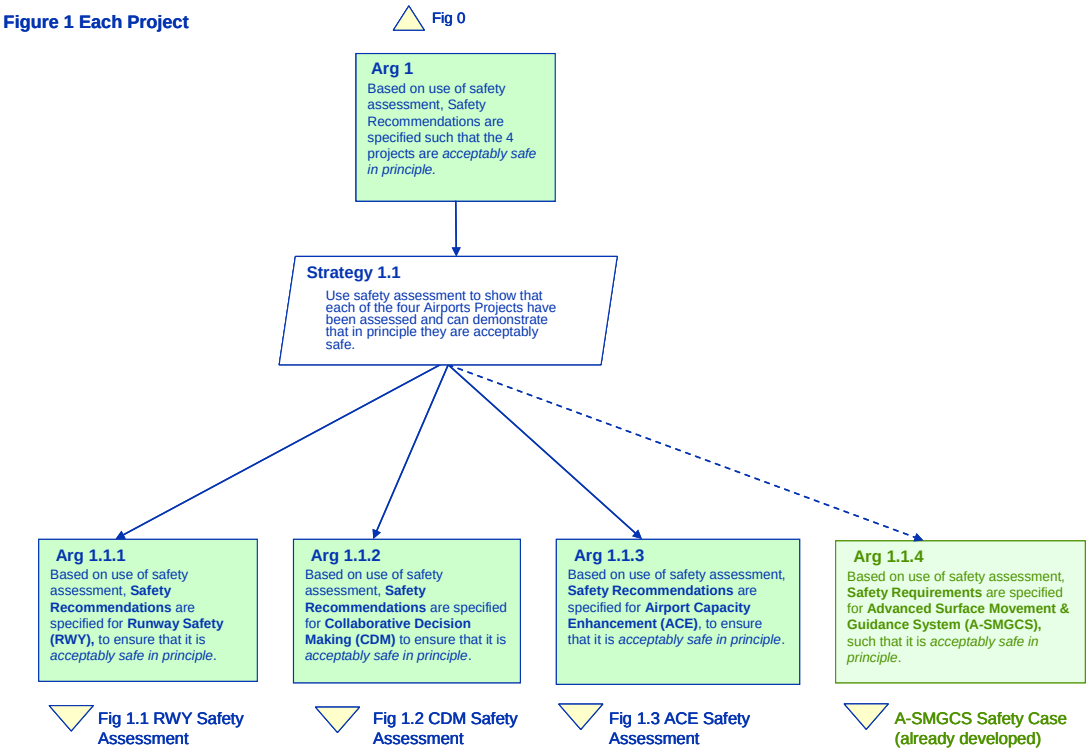


Figure 1.2 CDM Project

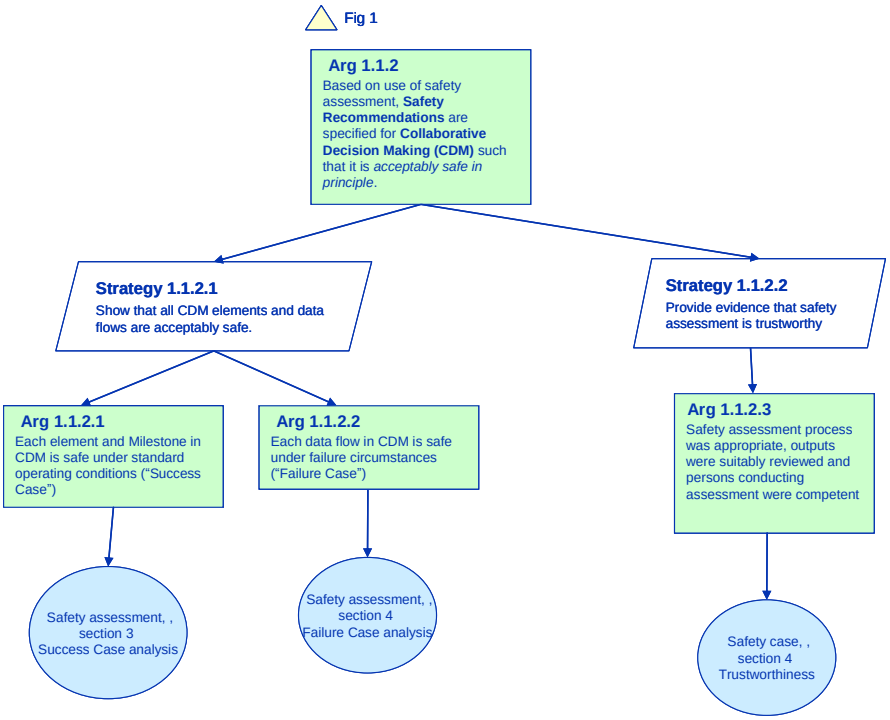


Figure 2 Guidance

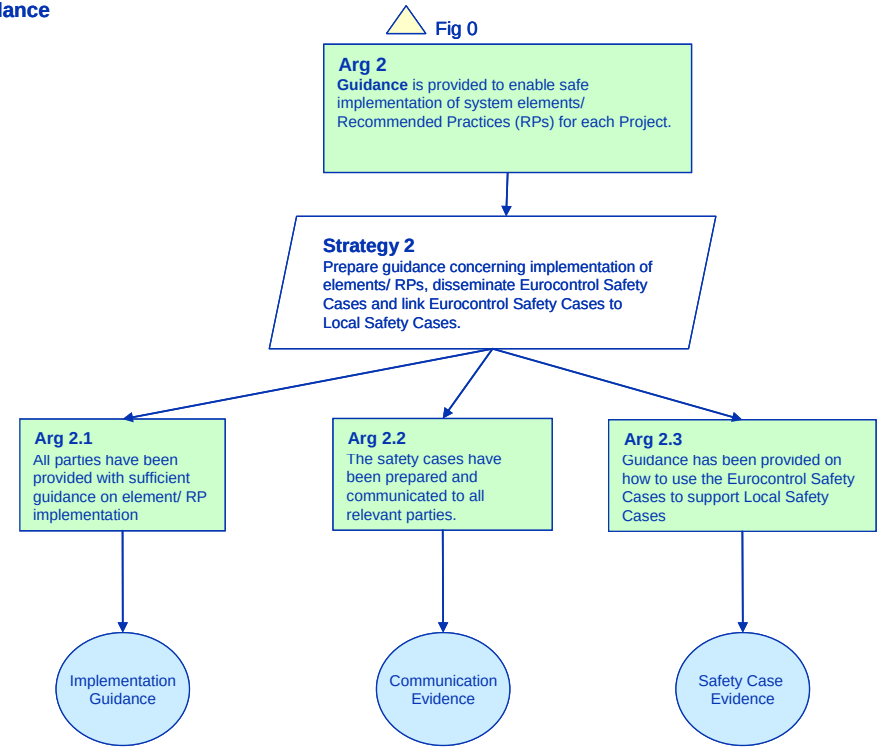


Figure 3 Local Safety Cases

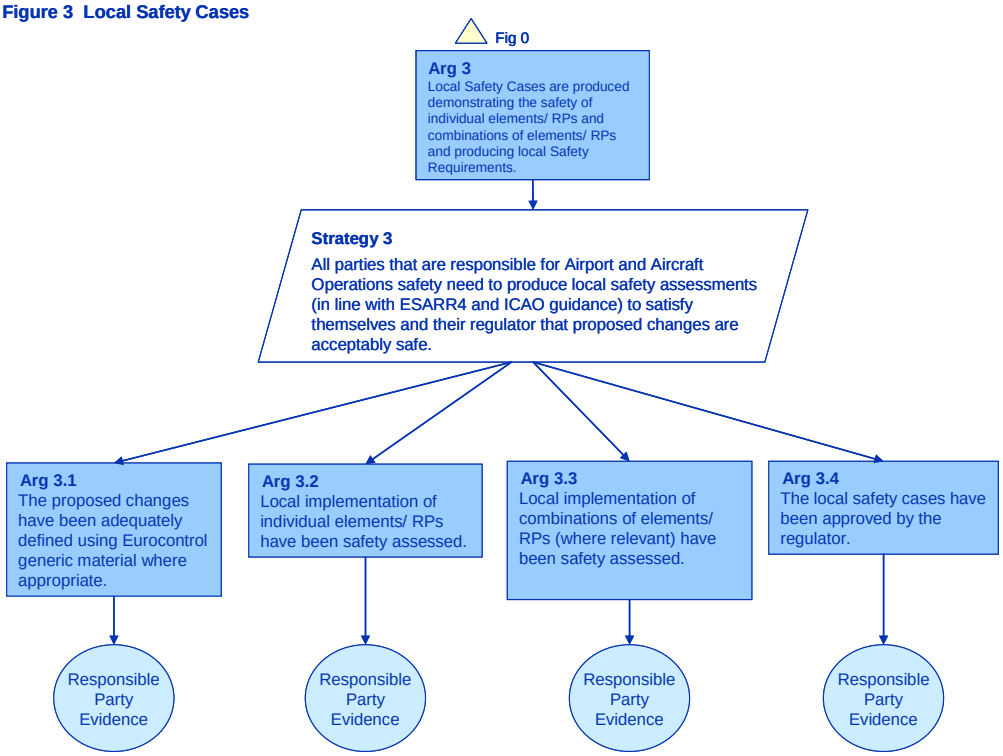


Figure 4 Implementation

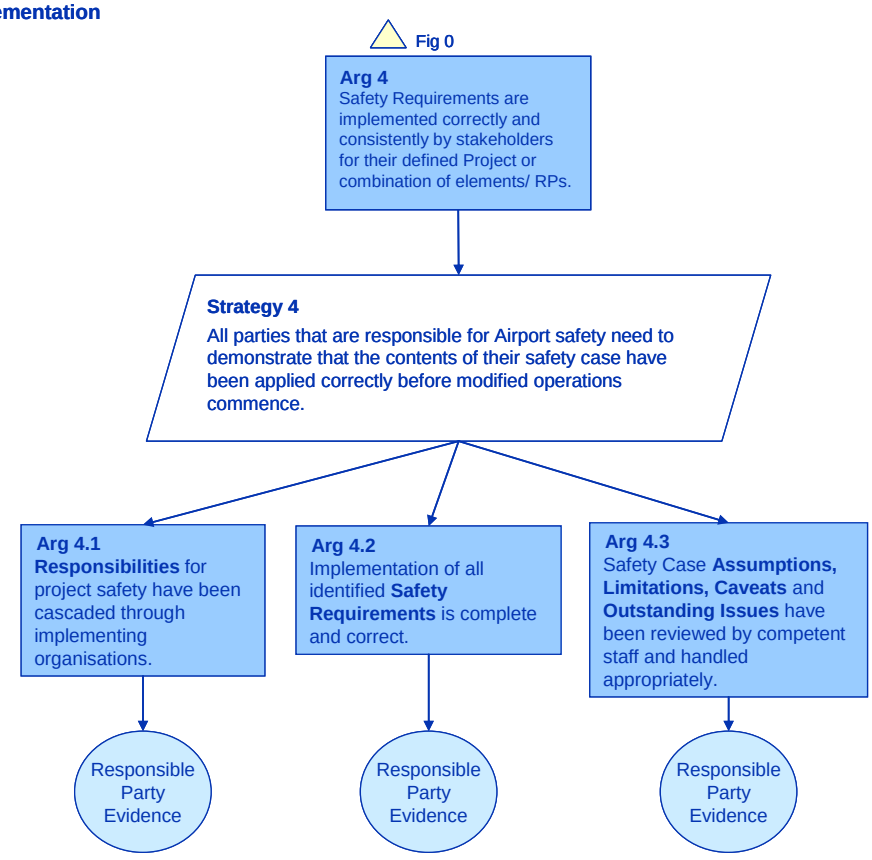
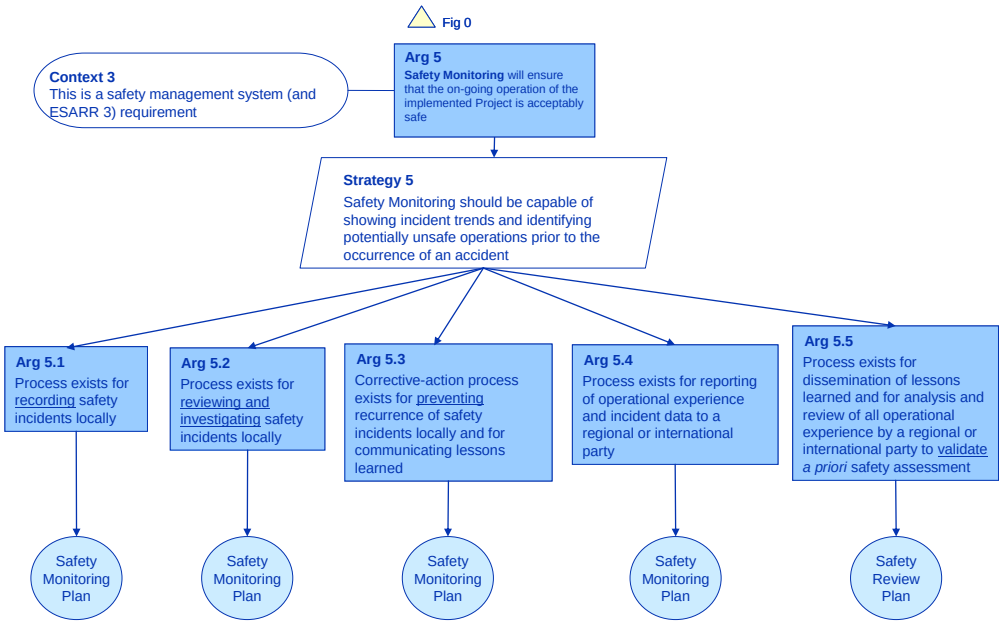


Figure 5 Safety Monitoring



INTENTIONALLY BLANK PAGE

10 REFERENCES

1. EUROCONTROL (2005): “A-SMGCS Levels 1 and 2 Preliminary Safety Case”, Edition 1.4, October 2006

2. EUROCONTROL (2006): “Safety Assessment of Airport Collaborative Decision Making (A-CDM), Edition v1.0, November 2006

3. EUROCONTROL (2005): “Airport CDM Operational Concept Document”, Edition 2.0, October 2005

4. EUROCONTROL (2005): “Airport CDM Functional Requirements Document”, Edition 2.0, October 2005

5. EUROCONTROL (2005): “Safety Case Development Manual”, Edition 2.0, September 2005

6. EUROCONTROL (2006): “Safety Plan for 3 Airports Projects (ACE, A-CDM and RWY SAF)”, Edition 1.0, May 2006

7. EUROCONTROL, 2003: “Review of Techniques to Support the EATMP SAM”, 11 April, 2003

8. EUROCONTROL (2003): “Airport CDM Applications –Guide”, July 2003

9. EUROCONTROL (2003): “Airport CDM Implementation - The Manual”

10. REGULATION (EC) No 550/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 10 March 2004 on the provision of air navigation services in the single European sky, Article 4

11. COMMISSION REGULATION (EC) No 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation services, para 11

INTENTIONALLY BLANK PAGE

11 ABBREVIATIONS

Abbreviations and acronyms used in this document are available in the EUROCONTROL Air Navigation Inter-site Acronym List (AIRIAL) which may be found here:

http://www.eurocontrol.int/airial/definitionListInit.do?skipLogon=true&glossaryUid=AIRIAL

DOCUMENT FINAL PAGE