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SAFETY ASSESSMENT OF AIRPORT COLLABORATIVE DECISION MAKING (A-CDM)

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This document presents a safety assessment of 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.						
Author(s)						
Dave Booth						
Contact Person(s	5)	Tel/email	Unit			
EUROCONTROL A-CDM Te	eam <u>airport</u>	-cdm@eurocontrol.int	NMD/NOM/APT			

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AUTHORITY (Name and function)	SIGNATURE	DATE
David Booth	1 3	
A-CDM Implementation Manager	DJ. Sall	01/02/2016
Paul Adamson		0.1/00/00.10
Head of Airport Unit	Tang	01/02/2016
Joe Sultana		
Director Network Manger	O A	01/02/2016

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1 EXECUTIVE SUMMARY

Objectives and Method

This document presents the safety assessment for the Airport Collaborative Decision Making (A-CDM) project. The objectives of this safety assessment are to:

1. Identify the operational differences between pre and post A-CDM operations for all partners and all flight phases associated with airport operations.

2. Assess the safety impact (positive and negative) of the differences identified for all A-CDM partners under normal operating conditions (Success Case) and failure conditions (Failure Case).

3. For safety concerns and hazards identified in 2), identify mitigations to ensure that A-CDM will maintain or improve safety.

The safety assessment approach consisted of the following steps:

• The A-CDM system was defined based on the Operational Concept Document (OCD) and the Functional Requirements Document (FRD). In particular the Milestones (MST) underpinning the A-CDM concept, the Functional Groups (FG) and the data flows/ items were defined. 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.

• The safety impacts of A-CDM were analysed assuming that the A-CDM system was operating as described in the OCD and FRD. This is termed the "Success Case". For each Milestone and relevant flight phase, A-CDM was compared with the pre-CDM situation from the viewpoint of each airport partner.

• Potential issues and concerns and new hazards associated with failures of the A-CDM system were also analysed (termed the "Failure Case"). For each data item identified in the A-CDM documentation the flow of information between source and recipient was identified. The potential worst credible effects of loss or corruption of this information were then identified.

The outputs of this generic analysis, in terms of safety impacts and mitigations, will be sensitive to local airport conditions. Therefore local safety assessments (as required by ESARR4) will need to review these outputs and update them for their local airport situation. Guidance on conducting such local assessment has been provided in this report.

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Conclusions

This generic safety assessment concludes that A-CDM will lead to no adverse safety impacts with the mitigations identified in this report.

A very limited number of potential safety concerns have been identified. The Success Case issues would be adequately mitigated by practicable procedural and Safety Management System (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. Software Assurance Level) for certain data items within A-CDM. An initial set of key data items has been identified in this generic study 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.

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2 INTRODUCTION

2.1 Background

Airport CDM is one of the projects maintained by the Network Manager. This document presents the safety assessment for the A-CDM project.

2.2 Objectives of Safety Assessment

The objectives of this safety assessment are to:

1. Identify the operational differences between pre and post A-CDM operations for all partners and all flight phases associated with airport operations.

2. Assess the safety impact (positive and negative) of the differences identified for all A-CDM partners under normal operating conditions (Success Case) and failure conditions (Failure Case).

3. For safety concerns and hazards identified in 2), identify mitigations to ensure that A-CDM will maintain or improve safety.

2.3 Overview of Safety Assessment Approach

The Safety Assessment Approach is summarised in Figure 2.1 below:

• The A-CDM system was defined based on the Operational Concept Document [2] and the Functional Requirements Document [3]. In particular the Milestones (MST) underpinning the A-CDM concept, the Functional Groups (FG) and the data flows/ items were defined (Section 2 of this report).

• The safety impacts of A-CDM were analysed assuming that the A-CDM system was operating as described in the OCD and FRD. This is termed the "Success Case". For each Milestone and relevant flight phase, A-CDM was compared with the pre-CDM situation from the viewpoint of each airport partner (ground handler, airport operator, aircraft operator, ATC, NMOC, etc.). Potential safety benefits of A-CDM were identified and documented. Any potential issues and concerns with A-CDM in its normal operating mode were also identified and appropriate mitigations proposed (Section 3 of this report).

• Potential issues and concerns and new hazards associated with failures of the A-CDM system were also analysed (termed the "Failure Case"). For each data item identified in the A-CDM documentation the flow of information between source and recipient was identified. The potential worst credible effects of loss or corruption of this information were then identified. In some cases there were no safety effects. For those cases where there could potentially be safety effects, suitable mitigations have been identified and proposed (Section 4 of this report).

• The outputs of this generic analysis, in terms of the safety benefits and mitigations, will be sensitive to local airport conditions. Therefore local safety

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assessments will need to review these outputs and update them for their local airport situation (see Section 5 of this report).



Figure 1 Overview of A-CDM Assessment Approach

Within the safety assessment the following safety criteria have been used (Safety Plan [4]):

• 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.

2.4 Document Structure and Relation to Other Documents

This safety assessment report is structured as follows:

- Section 2 provides a system description of the A-CDM project;
- Section 3 presents the Success Case analysis described above;
- Section 4 covers the Failure Case analysis described above;

• Section 5 presents a discussion of the results including how this generic analysis can be used at a local airport level;

• Section 6 summarises the validation and verification activities associated with this safety assessment; and

• Section 7 presents the main conclusions and recommendations.

Appendix I provides the full Success Case and Failure Case analysis broken down by relevant Milestones and airport partners. Appendix II contains a specific analysis of failures of the A-CDM alarms.

Safety assessment reports are being prepared for the ACE and RWY SAF projects in parallel with this document. Three safety case documents will also be prepared for RWY SAF, ACE and A-CDM. As noted above a safety case already exists for A-SMGCS.

2.5 **Participants**

EUROCONTROL'S A-CDM Project has received considerable support from EUROCONTROL'S Safety department and external A-CDM stakeholders in the conduct of this safety assessment. Workshops, post-workshop analysis and reviews of documents have been supported by personnel with a mix of disciplines and expertise including A-CDM designers, ATCOs, Air Navigation Service Providers, aircraft operators and safety experts. This assistance is gratefully acknowledged. Further details of participants in the safety assessment are given in Appendix I.

2.6 Definitions

Mitigation	Steps taken from causing acceptable le	to co g ha evel (ontrol or pl rm and re (taken froi	revent a haza educe risk to m ESARR4)	rd [or con a tolerab	cern] le or
System	Understood procedures	to	include	equipment,	people	and

3 SYSTEM DESCRIPTION

3.1 **Purpose 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 airport 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.

The common goals of A-CDM are as summarised in the diagram below:



Figure 2 A-CDM Common Goals

3.2 A-CDM Concept Elements

3.2.1 Overview

The Airport CDM concept is divided into the following Elements [2]:

- Airport CDM Information Sharing;
- A-CDM Turn-round Process Milestones Approach;
- Variable Taxi Time Calculation;
- · Collaborative Management of Flight Updates;
- Collaborative Predeparture 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 Airport 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

Airport 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 [3]).

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 [3].

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 [3].

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 [3].

3.2.6 Collaborative Predeparture Sequence

This Element enhances flexibility and helps in optimising airport resources. It is related to Functional Group 5 [3].

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 [3].

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 exscope with respect to the current safety assessment. The scope of this safety assessment covers Functional Groups up to FG 6.

3.3 System Assumptions

In conducting the analysis of potential system failures in Section 4 it has been assumed that backwards interference to data sources feeding into ACIS has been guarded against by the design of the data sources. More detailed assumptions have been documented in Annex I.

4 SUCCESS CASE ANALYSIS

4.1 Overview

The A-CDM project optimises the information flow, decision making and collaboration of partners within an airport. As part of the safety assessment, the safety impacts of A-CDM under normal operating conditions have been analysed as shown in Figure 2.1 under "Success Case". The analysis process involved two safety workshops with A-CDM partners (see Appendix I for participants) and post workshop analysis.

4.2 Analysis by Milestones, Phases and Airport Partners

The main structure for the Success Case analysis was provided by the A-CDM Milestones from the FRD ([3], Section 3.3.8.1). At the beginning of the first safety workshop three other key phases were added, namely "Flight Update Message (FUM) generated by NMOC", "Landing" and "Taxi-out/Departure". The full list of Milestones/ Phases is shown in Table 4.1 below.

Appendix I presents the complete Success Case Analysis. For each phase, the pre-CDM and A-CDM situation is summarised. Based on this the safety implications for each A-CDM partner are identified and documented. Finally potential safety benefits and any potential concerns are summarised.

These summaries of potential benefits and concerns have been copied into Tables 4.1 and 4.2 below, together with appropriate risk mitigations for the concerns.

4.3 Main Outputs

4.3.1 Potential Safety Benefits

The following potential safety benefits of A-CDM covering all conditions have been identified from Table 4.1:

• The timely and increased provision of key information could both improve the situational awareness of all partners and allow them to plan better. In turn these improvements may enhance reaction to unexpected events and reduce the frequency of rushed operations thereby reducing the occurrence of "error-prone" situations.

• Better planned operations may allow workload peaks and troughs to be smoothed and reduce the probability of overload on any of the partner personnel and the probability of RT frequency overload.

• It could lead to better planning of flows of traffic. This may have a particular safety benefit in the case of inbounds and outbounds within airport cul-de-sacs and enhances the traffic planning for runways in mixed mode operation. It could potentially reduce the number of aircraft moving simultaneously in close proximity.

• Better planned operations may reduce the probability of last minute changes. In particular, ground handlers should have fewer occasions where they have to travel across the airport in a hurry to react to an unexpected event.

• Certain A-CDM alarms help identify inconsistencies or other problems in data flows which otherwise may have gone un-noticed.

Although these potential safety benefits were identified by the experts in the safety workshops, 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 operational efficiency at an airport. Thus, while the potential safety benefits of A-CDM identified above are valid outputs from the assessment process, they should not be considered "safety measures" as such.

4.3.2 Potential Issues and Concerns

The potential issues and concerns in Table 4.2 are:

• 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, under normal operations A-CDM should not have an adverse impact on safety.

Milestones / Flight Phases	Potential Safety Benefits
MST 1 - Flight Plan Submission	 Increased transparency in Flight Plan data A-CDM correlation alarms help to identify inconsistencies in flight plan information
MST 2 – EOBT -2hr	 Reduction of workload for Ground Handlers & Airport Operator due to advance availability of flight information Reduction in ATC workload due to better planning in Stand and Gate management
MST 3 - Take off from outstation	1. Reduction of workload for Ground Handlers, Airport Operator and Aircraft Operator due to advance availability of flight information hence reducing probability of making errors
	 Better co-ordination for airport partners allowing better planning and smoother operations
Flight Update Message (FUM) generated by NMOC	1. Enhanced landing estimates coupled with variable taxi times provide better stand/gate planning for Ground Handlers and Airport Operators, reducing workload and hence reducing likelihood of errors
	2. More accurate information on traffic loading to ATC reducing ATC workload peaks and RT
	3. Better aircraft and crew planning for aircraft operators

Milestones / Flight Phases	Potential Safety Benefits
MST 4 – Local radar update	1. Enhanced availability of flight phase information provide better stand/gate planning for Ground Handlers and Airport Operators, reducing workload hence reducing likelihood of mistakes and incidents
	2. Better aircraft and crew planning for aircraft operators
	3. More accurate indication of traffic loading for ATC
MST 5 - Final Approach, MST 6 – Landing, Taxi-in period & MST 7 – In Block	1. Enhanced availability of flight phase information provide better stand/gate planning for Ground Handlers and Airport Operators, reducing workload hence reducing likelihood of errors
	2. Better aircraft and crew planning for aircraft operators
MST 8 - Ground handling starts	1. Reduction of Ground Handler's workload if Ground Handling start time is automatically obtained
	2. Better estimates on stand/gate vacation leading to potential reduction in errors made by Ground Handler/Airport operator.
MST 9 – TOBT update prior to TSAT issue	1. Reduction of RT loading and workload for ATC
	2. Allows better planning for NMOC
MST 10 – TSAT issue	 Better planning at push-back leading to potential reduction in errors by Ground Handlers and Airport Operator
	2. Improved planning of the taxi flow towards the runways enhances the traffic planning for runways in mixed mode operation

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Milestones / Flight Phases	Potential Safety Benefits
MST 11 - Boarding starts	 Enhanced gate-planning for Airport Operator, potentially reducing errors ATC has advance notice of possible delays enhancing planning
MST 12 - Aircraft ready	 Enhanced gate-planning for Airport Operator, potentially reducing errors Potential reduction in RT loading for ATC
MST 13 - Start up request & MST 14 - Start up approved	1. Better planning of resources and equipment for Ground Handlers, reducing error likelihood
	2. Better stand-gate planning for Airport Operator reducing error likelihood
	3. Reduction of frequency congestion for ATC and pilots
	4. Better planning and flow of taxiing aircraft both inbound and outbound especially in cul- de-sacs
MST 15 - Off Block	1. Better stand-gate planning for Airport Operator reducing error likelihood
Taxi out/Departure & MST 16 - Take off	1. Reduction of en-route sector overloads for ATC
	2. Reduction of en-route sector over- deliveries for NMOC due to increased number of aircraft departing within CTOT tolerance window
Adverse conditions A-CDM	Overall improvement in recovery and management of adverse conditions for all partners, both during and after the event, on a network basis and locally.

Table 1 Analysis of Potential Safety Benefits under Success Case by Milestones/Phases (see Appendix I for more details)

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Milestones/ Flight Phases	lssues and concerns	Mitigation for Concerns	Mitigation Owner
MST 1 - Flight Plan Submission	1. Increased potential for Ground Handlers' unauthorised interference with flight plan data	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.	Ground Handlers and Aircraft Operator
MST 9 – TOBT update prior to TSAT issue	1. Workload increase for Ground Handlers and Aircraft Operator in inputting TOBT data and correcting corrupt data	S2. Update training and resource needs analysis.	All partners
MST 10 – TSAT issue	1. Slight workload increase for ATC if DMAN is not present	S2. Update training and resource needs analysis.	ATC
MST 11 - Boarding starts	 Possible slight increase in workload for Ground Handler to resolve boarding alarms Possible slight increase in workload due to recalculation of TSAT by ATC 	S2. Update training and resource needs analysis.	All partners

Table 2 Analysis of Potential Issues and Concerns under Success Case by Milestones/Phases (see Appendix I for more details)s)

5 FAILURE CASE ANALYSIS

5.1 Overview

In parallel to the analysis of A-CDM during normal operations, an analysis of system failures has also been undertaken as shown in Figure 2.1 "Failure Case". For this generic analysis, the analysis has been focussed on loss and corruption of information flowing around the ACDM system. Clearly other failures could be envisaged, e.g. delay of data, data presented out of sequence etc. However, it is typical in a traditional analysis of system failures that by analysing loss and corruption and considering the worst credible effects of the failures, any potential safety impacts will be identified.

5.2 Outputs of Failure Analysis

Table 5.1 summarises the failures from Appendix I that could have a safety impact together with proposed mitigations that should be considered. It should be noted that there are likely to be local specific measures already in place that will act as mitigations for many of these failures. Thus local safety assessments are required to review these generic safety impacts and worst case credible effects. How these local safety assessments should be conducted is further discussed in Section 6.2.

The mitigations (F1 to F4) are procedural and related to equipment system requirements. In many cases high specification equipment system requirements may be unnecessary due to mitigators already built into the local system or due to the proposed procedural mitigations below. Local safety assessments can be used to determine what Software Assurance Levels (SWALs), etc. are appropriate.

5.3 Alarms Failure Case Results

The Failure Case analysis in Appendix I looked at the A-CDM alarms in terms of safety mitigations for certain failures in dataflows. Thus, if key alarms failed to go off the effect of this was considered. However, A-CDM also consists of other alarms that were not directly included in this initial analysis as they are not key safety mitigators. Thus the remaining alarms were also considered in an extra analysis (see Appendix II). Again the worst credible effects due to spurious operation (corruption) of these alarms were identified and documented. In all cases the worst case effects are minor workload increases for relevant partners shown in Appendix II. Thus, equipment system safety requirements will also need to be developed covering spurious operation of these alarms.

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Table 5.1 Failure Case Analysis

Data Flow / Item	Failure	Worst Credible Effects	Mitigation	Mitigation Owner
Flight Plan Correlation Failure alarm	This alarm mitigates against various potential flight plan data corruption, e.g. incorrect aircraft type. Thus if it fails to alarm when required, errors may be missed.	Misidentification of aircraft type, for example, could lead to inappropriate stand allocation or wake turbulence spacing	F1a: Equipment system requirement	Equipment system designer
ТОВТ	Corrupted TOBT	Start-up based on corrupted TOBT requiring ATC to resolve downstream, workload increase	 F1b: Equipment system requirement F2: Procedure for EOBT/ TOBT originators to review these data and correct if corrupted. 	Equipment system designer Ground Handler / Airport Operator
EXOT	Corruption of EXOT	Departure outside CTOT tolerance, increasing ATC workload	F1c: Equipment system requirement	Equipment system designer
ттот	Corruption of TTOT	Departure outside CTOT tolerance, increasing ATC workload	F1d: Equipment system requirement	Equipment system designer
Default Turn Around Time	Corruption of Default Turn Around Time	Sub-optimum sequencing, increasing ATC workload	F3: Ground handlers to update turn-around time on CDM system if system indicates deviation by more than +/- 15 mins.	Ground Handler

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TSAT L	Loss or corruption of TSAT	Potential for aircraft starting at incorrect times	F4: ATC to cross-check EOBT and CTOT information before issuing startup instructions based on TSAT.	ATC
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6 LOCAL ASSESSMENT

The Failure Case analysis has identified a limited number of data flows/ items which could have a safety impact if failures should occur. Appropriate equipment system requirements and procedures should adequately mitigate their risk. Deciding on what exactly is appropriate will require local safety assessments as described below.

Figure 6.1 summarises how the local A-CDM failure analysis can make use of the generic analysis summarised in Section 5 above



GENERIC ASSESSMENT

Figure 3 Generic and Local Failure Case Analysis

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 way in the following manner:

1. Review whether in the local situation under study, failures of each A-CDM data flow would indeed have safety impacts (see Annex I, sections 1-5, last column, for predicted safety impacts on each airport partner). If failures do have local safety impacts, review whether the worst credible effects from the generic study (Table 5.1) are appropriate.

2. For those failures with local safety impacts classify the severity of the effects. Severity classes and examples of effects corresponding to these classes are given in ESARR4 [5].

3. Identify, analyse and document all the mitigations that will reduce the probability of the failure leading to the worst credible effects (consequential mitigations). These mitigations could include, for example, ATC procedures, other systems for transferring and displaying information, training given to airport partners etc.

4. Taking account of all these mitigations and local airport factors (e.g. traffic density/ complexity) estimate the probability of the failure leading to the identified effects. The EUROCONTROL Safety Assessment Methodology [6] gives guidance about probability estimation in the context of SWAL allocation. The growth of future traffic needs to be considered in this process as the system needs to be safe throughout its intended life.

5. Use EUROCONTROL SAM guidance [6] or equivalent industry guidance to determine suitable equipment system safety requirements. For Software Assurance Levels (SWAL) the SAM shows a matrix of effect severity classes and the probability of a failure generating those effects to identify which SWAL is required.

The 5 step approach above is a simplified description of the Assurance Level allocation process; for a more detailed description EUROCONTROL's SAM [6] should be consulted.

7 VALIDATION AND VERIFICATION

The following verification activities have been conducted during this safety assessment:

• Review of Safety Plan describing safety assessment activities, carried out by EUROCONTROL's APR stakeholders and DAP/SSH (2 review cycles)

• Internal APR Progress meetings at which updates to the method were discussed and agreed with EUROCONTROL's APR stakeholders and DAP/SSH (28th February, 22nd June and 10th August 2006)

• External stakeholder meetings at which the method was presented and feedback received (16th June and 7th September 2006)

• Review of safety assessment document structure and of the draft safety assessment report by EUROCONTROL's APR stakeholders and DAP/SSH.

The following validation has also been carried out:

• Review of safety assessment outputs by internal and external stakeholders at 2 safety workshops, 16th June and 7th September 2006.

• Review by APR stakeholders of the outputs in Appendix I of this report (2 review cycles)

• Review of outputs by DAP/SSH at these workshops and through review of the draft safety assessment.

8 CONCLUSIONS

The three objectives set out in section 2.2 have been met, namely:

1. The operational differences between pre and post A-CDM operations have been defined for all partners and flight phases in Annex I.

2. The safety impacts of the operational differences for the Success Case and Failure Case have been assessed in Annex I and summarised in sections 3 and 4 above respectively.

3. For potential issues and concerns and new hazards, suitable mitigations have been defined in sections 4 and 5.

This generic safety assessment concludes that A-CDM will lead to no adverse safety impacts with the mitigations identified in this report.

A very limited number of potential issues and concerns have been identified. The Success Case issues would be adequately mitigated by practicable procedural and Safety Management System (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

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be a need for some system equipment requirements (e.g. Software Assurance Level) for certain data items within A-CDM. An initial set of key data items has been identified in this generic study 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.

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Annex 1 - A-CDM SUCCESS AND FAILURE CASE RESULTS

The analysis presented in this appendix is based on a series of safety workshops and post-workshop analysis. The participants in this process are detailed in the Table below together with the organisation they were representing. Two main workshops were held with EUROCONTROL and external stakeholders and the participation in each is indicated below.

Name	Role / Organisation	External 1	External 2
Elizabeth Lagios	A-CDM Project Manager, EUROCONTROL	\checkmark	\checkmark
Zarko Sivcev**	CFMU Safety and Quality Manager, EUROCONTROL	✓	✓
Dave Hogg**	Airport CDM Project Expert, EUROCONTROL	✓	✓
Dave Booth*	Airport CDM Project Expert, EUROCONTROL	✓	✓
Marc Matthys**	Capacity, A-CDM and Punctuality, Belgocontrol	✓	✓
Luigi Locoge	ATCO, Belgocontrol	✓	
Albert Coenan	Air Traffic Flow Manager, SN Brussels Airlines	✓	✓
Christopher Machin	DAP/SSH, EUROCONTROL	✓	✓
Edward Smith*	DNV, Facilitator		✓
Roger Lee*	DNV, Recorder / Facilitator	~	\checkmark

* Main post-workshop analysis

** Main reviewers

Table 3 Reviewers of workshop and post-workshop analysis

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The spreadsheet below details the outputs from the workshops and post-workshop analysis. Potential safety benefits of A-CDM are indicated by "+" and potential issues and concerns by "-". The analysis is presented for each of the following partners in turn: Ground Handler (green columns), Airport Operator (light blue columns), Aircraft Operator (orange columns), ATC (purple columns), and NMOC (blue columns). Finally the assessment and proposed mitigations are summarised. It should be noted that the explicit impact on pilots is not included. Clearly many of the impacts will also benefit pilot, e.g. reduced RT at start-up, but these have not been described explicitly for each milestone and flight phase.

1. Ground Handler

	Risk Bearing Data			Operational	
Flight Phases	Items	Without CDM	With CDM	Impact	Safety Impact
MST 1 - Flight	Flight Plan, Aircraft	Flight Plans are submitted	When there is an	All Ground	In standard operations:
Plan	registration and Aircraft	to IFPS from Flight Plan	inconsistency between flight	Handlers now	(+) Increased
Submission	ID, ADEP/ADES, Flight	Filer	plan and airport slot,	have direct	transparency on relevant
	Plan Modification		correlation alarm will be	access to flight	changes (EOBT, Aircraft
	Message, Flight Plan		triggered. Information is fed	plan information	Type, Aircraft Reg) to flight
	Already Correlated		into a centralised platform		plan
	Alarm, Flight Plan		and then displayed to all		(-) Interference from
	Correlation Failure Alarm		partners		handling agent on ATC
					flight plan and hence
					probability of error
					occurrence increased.
					Mitigated by SLAs and
					procedures
MST 2 - ATFM	SAM, Regulation	Slot Allocation information	Slot Allocation is fed into a	All Ground	In standard operations:
Slot Allocation	Cancelled Alarm	is distributed from NMOC	centralised platform and	Handlers get	(+) No need to look for the
		to Flight Plan Filer and	then displayed to all	direct access to	Slot Allocation Message or
		ATC (all concerned	partners.	Slot Allocation	ask other partners for

	Risk Bearing Data			Operational	
Flight Phases	Items	Without CDM	With CDM	Impact	Safety Impact
		ANSPs)		Information	messages. Workload reduction resulting in more time to verify other safety critical activities
MST 3 - Take off from outstation	Movement Messages (MVT), Airborne Alarm, EOBT	ACARS for some airlines, ICAO Movement message protocols	Aircraft Movement Information from ANSP or Ground Handler or Airlines or ACARS. Now information is available to all partners	Movement messages readily available	In standard operations: (+) No need to look for the MVT message or ask other partners for messages. Workload reduction resulting in more time to verify other safety critical activities
Flight Update Message (FUM) generated by NMOC	EET, Capacity Information, Flow Management Attribute, Regulation Cancelled Alarm	Currently procedure does not exist for using FUM	FUM with accurate ETO and ELDT, based on radar data, issued for all inbound flights. Differences of +/- 5 mins incurred en-route will generate new message. Message will be received by one partner on the airport and will be input into the ACIS.	Enhanced landing estimate, coupled with variable taxi times will give more accurate In Block time	In standard operations: (+) Better planning of stand set-up, reduction of probability of aircraft hitting equipment
MST 4 - FIR Entry	Flight Plan Cancellation Alarm	Aircraft FIR entry is co- ordinated between ATCs. Information only available when partners request from ATC	All partners will be informed of FIR entry and more accurate arrival times	Direct access of the FIR Entry information translated into updated ETAs	In standard operations: (+) Better planning of stand set-up, reduction of probability of aircraft hitting equipment
MST 5 - Final Approach	None Identified	Final approach phase is co-ordinated by ATC.	All partners will be informed of start of final approach,	Direct access of the Start	In standard operations: (+) Better planning of

	Risk Bearing Data			Operational	
Flight Phases	Items	Without CDM	With CDM	Impact	Safety Impact
		Information of this phase of flight is not always provided to airport partners	more accurate estimates of next phases of flight	Approach information translated into updated ETAs	stand set-up, reduction of probability of aircraft hitting equipment
MST - Landing	EIBT	ATC record landing time on Flight Progress Strip, all partners might not be disseminated with this information	All partners will have actual landing times	Direct access of the landing time information translated into updated In Block time	In standard operations: (+) Better planning of stand set-up, reduction of probability of aircraft hitting equipment
MST 6 - Taxi-in period	EIBT, Stand/Gate Allocation, Work in Progress	ATC issue taxi-ing instructions, all partners might not be disseminated with this information	All partners will have accurate in bound taxi times and In Block times	Using the variable taxi-times facility in CDM, more accurate In Block time will be available	In standard operations: (+) Better planning of stand set-up, reduction of probability of aircraft hitting equipment
MST 7 - In Block	EIBT	In Block time recorded manually, automated (docking systems), verbally by pilot or by ACARS. Accurate time not always available to all partners.	In Block time disseminated via ACISP to all partners. Long term using ASMGCS data will enhance accuracy and remove manual input	No change	No Change
MST 8 - Ground handling starts	EOBT, Default Turn Around Time, Minimum Turn-around alarm, EOBT Compliance Alarm	Ground Handling event starts and time is recorded by Ground Handler but not generally disseminated to other partners	Actual Start of Ground Handling Time input into ACISP by Ground Handler and this may trigger update of downstream events e.g. automatic update of TOBT	Ground Handler to input AGHT into ACISP. Ground Handler may manually input update of TOBT	In standard operations: (+) If ground handling start is automatic at AIBT then Ground Handler's workload may be reduced. (-) If Ground Handler has

	Risk Bearing Data			Operational	
Flight Phases	Items	Without CDM	With CDM	Impact	Safety Impact
					to input ground handling start time manually workload may increase slightly
MST 9 - Final update of TOBT	TOBT, SRM, SLC, Regulation Cancelled Alarm, Minimum Turn- around alarm, EOBT Compliance Alarm	Submission of TOBT Procedure does not exist currently	Aircraft handlers or aircraft operator send update to all partners	Submit TOBT to all partners	In standard operations: (-) Workload increased In failure circumstances: (-) Should the information displayed be corrupted, Ground Handler would be required to manually correct this on the ACIS system to avoid aircraft startup/takeoff outside CTOT tolerance, increase in workload
MST 10 - ATC issues TSAT	TSAT, ETOT, EOBT Compliance Alarm, Flight Plan Cancellation Alarm, Flight Suspension Alarm, Flight De- Suspended Alarm	Dissemination of TSAT procedure currently does not exist	ATC provides all partners with TSAT information	Visibility of TSAT information	In standard operations: (+) Better planning of resources and equipment reducing the risk of ground incidents
MST 11 - Boarding starts	Minimum Turn-around alarm, Boarding Alarm, EOBT Compliance Alarm	In most cases boarding start time only known by ground handler	Disseminated to all partners by ACISP and any delays in boarding triggers an alarm for action as the TOBT/ TSAT may not be met.	If a boarding alarm is raised the ground handler will be required to resolve the discrepancy	In standard operations: (-) Possible slight increase in workload
	Dick Bearing Data			Operational	
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Flight Phases	Items	Without CDM	With CDM	Impact	Safety Impact
MST 12 - Aircraft ready	Regulation Cancelled Alarm	If aircraft is ready well before CTOT, pilot will advise ATC and request a slot improvement	More automated indication of aircraft readiness via the milestone process and transparency in ACIS	No change	No change
MST 13 - Start up request	SID Allocation, Flight Suspension Alarm, Flight De-Suspended Alarm	Aircraft requests start up approval from ATC	Aircraft requests start up approval from ATC at TSAT	Ground handlers will have access to TSAT and this will enable them to plan their push back resources better	In standard operations: (+) Better planning of resources and equipment reducing the risk of ground incidents
MST 14 - Start up approved	EXOT, Regulation Cancelled Alarm	ATC issues start up approval and records the time on the flight progress strip (paper or electronic)	ATC issues start up approval at TSAT. The Actual Start up Approval Time is input into the ACISP and disseminated to all partners	No Change	No Change
MST 15 - Off Block	Stand/Gate Allocation	Aircraft pushes back from or vacates the parking position. Time recorded by ACARS, automated docking guidance systems, ATC (e.g. ASMGCS) or manually. Time not necessarily disseminated among all partners	Aircraft pushes back from or vacates the parking position. Time recorded by ACARS, automated docking guidance systems, ATC (e.g. ASMGCS) or manually. Time input into ACISP and disseminated among all partners	No Change	No Change
Taxi out/Departure	Runway and Taxiway conditions, RWY to be used for take off,	Aircraft taxis to holding point. Default taxi time available to ATC and	With CDM variable taxi time calculations are used to give a more accurate	No change	No Change

Elight Phases	Risk Bearing Data	Without CDM	With CDM	Operational	Safety Impact
Tilgin Thases	Runway configuration, Aircraft Type, Regulation	NMOC	estimate of take off time	Impact	
	Cancelled Alarm, CTOT Compliance Alarm, Flight Suspension Alarm				
MST 16 - Take off	TTOT, Runway in Use, Regulation Cancelled Alarm	Actual take off from the runway. Time recorded by ATC or by ACARS.	Actual Take Off Time recorded on ACISP either automatically or manually and available to all partners.	No change	No Change
For All Flight Phases in Adverse Conditions	No extra risk relevant items identified	Information on Adverse Conditions is obtained from traditional airport communications mechanisms	Improvement in transparency and timely provision of adverse conditions information	Improved recovery from Adverse conditions. Improved management during and after adverse event on a network basis and locally.	No consensus. Some experts thought that smoother operations during and after adverse event would have potential safety benefits. Others thought that current procedures should already be in place to ensure safety.

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2. Airport Operator

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
MST 1 - Flight	Flight Plan,	Flight Plans are submitted to	When there is an	No Change	No Change
Plan	Aircraft	IFPS from Flight Plan Filer	inconsistency between flight	_	_
Submission	registration and		plan and airport slot,		
	Aircraft ID,		correlation alarm will be		
	ADEP/ADES,		triggered. Information is fed		
	Flight Plan		into a centralised platform		
	Modification		and then displayed to all		
	Message, Flight		partners		
	Plan Already				
	Correlated				
	Alarm, Flight				
	Plan Correlation				
	Failure Alarm				
MST 2 - ATFM	SAM, Regulation	Slot Allocation information is	Slot Allocation is fed into a	Better visibility of slot	In standard
Slot Allocation	Cancelled Alarm	distributed from NMOC to	centralised platform and then	information	operations:
		Flight Plan Filer and ATC	displayed to all partners.		(+) Airport operator
		(all concerned ANSPs)			workload may reduce
					as a result of better
					planning
MST 3 - Take off	Movement	ACARS for some airlines,	Aircraft Movement	Movement messages	In standard
from outstation	Messages	ICAO Movement message	Information from ANSP or	readily available	operations:
	(MVT), Airborne	protocols	Ground Handler or Airlines		(+) No need to look for
	Alarm, EOBT		or ACARS. Now information		the MVT message or
			is available to all partners		ask other partners for
					messages. Workload

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
					reduction resulting in more time to verify other safety critical activities
Flight Update Message (FUM) generated by NMOC	EET, Capacity Information, Flow Management Attribute, Regulation Cancelled Alarm	Currently procedure does not exist for using FUM	FUM with accurate ETO and ELDT, based on radar data, issued for all inbound flights. Differences of +/- 5 mins incurred en-route will generate new message. Message will be received by one partner on the airport and will be input into the ACIS.	Enhanced landing estimate, coupled with variable taxi times will give more accurate In Block time	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 4 - FIR Entry	Flight Plan Cancellation Alarm	Aircraft FIR entry is co- ordinated between ATCs. Information only available when partners request from ATC	All partners will be informed of FIR entry and more accurate arrival times	Direct access of the FIR Entry information translated into updated ETAs	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 5 - Final Approach	None Identified	Final approach phase is co- ordinated by ATC. Information of this phase of flight is not always provided to airport partners	All partners will be informed of start of final approach, more accurate estimates of next phases of flight	Direct access of the Start Approach information translated into updated ETAs	In standard operations: (+) Better planning can result in enhanced stand-gate planning,

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
					reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST - Landing	EIBT	ATC record landing time on Flight Progress Strip, all partners might not be disseminated with this information	All partners will have actual landing times	Direct access of the landing Time information translated into updated In Block time	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 6 - Taxi-in period	EIBT, Stand/Gate Allocation, Work in Progress	ATC issue taxi-ing instructions, all partners might not be disseminated with this information	All partners will have accurate in bound taxi times and In Block times	Using the variable taxi- times facility in CDM, more accurate In Block time will be available	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 7 - In Block	EIBT	In Block time recorded manually, automated (docking systems), verbally by pilot or by ACARS.	In Block time disseminated via ACISP to all partners. Long term using ASMGCS data will enhance accuracy	No Change	No Change

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
		Accurate time not always available to all partners.	and remove manual input		
MST 8 - Ground handling starts	EOBT, Default Turn Around Time, Minimum Turn-around alarm, EOBT Compliance Alarm	Ground Handling event starts and time is recorded by Ground Handler but not generally disseminated to other partners	Actual Start of Ground Handling Time input into ACISP by Ground Handler and this may trigger update of downstream events e.g. automatic update of TOBT	Airport Operator will have direct access to AGHT and any updates to TOBT	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 9 - Final update of TOBT	TOBT, SRM, SLC, Regulation Cancelled Alarm, Minimum Turn- around alarm, EOBT Compliance Alarm	Submission of TOBT Procedure does not exist currently	Aircraft handlers or aircraft operator send update to all partners	Visibility of TOBT information	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 10 - ATC issues TSAT	TSAT, ETOT, EOBT Compliance Alarm, Flight Plan Cancellation Alarm, Flight	Dissemination of TSAT procedure currently does not exist	ATC provides all partners with TSAT information	Visibility of TSAT information	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
	Suspension				stressful situations &
	Alarm, Flight De-				hence reducing
	Suspended				mistakes being made
NOT 44	Alarm	Les estates a la servicia de sete de			
MSI 11 -	Minimum Turn-	In most cases boarding start	Disseminated to all partners	Earlier warning of possible	In standard
Boarding starts	around alarm,	time only known by ground	by ACISP and any delays in	delay to departing flight.	operations:
		nanuei	for action on the TOPT/		(+) Better planning
	Compliance		TSAT may not be mot		stand gate planning
	Alarm		TOAT may not be met.		reduction in late stand
	Латт				changes reduction in
					stressful situations &
					hence reducing
					mistakes being made
MST 12 -	Regulation	If aircraft is ready well	More automated indication of	More automated indication	In standard
Aircraft ready	Cancelled Alarm	before CTOT, pilot will	aircraft readiness via the	of aircraft readiness via the	operations:
_		advise ATC and request a	milestone process and	milestone process and	(+) Stand & Gate
		slot improvement	transparency in ACIS	transparency in ACIS	planning may improve
					as the opportunity to
					tow aircraft off stand or
					utilise remote holding
					facilities increases due
					to advance display of
					aircraft status
MST 13 - Start	SID Allocation,	Aircraft requests start up	Aircraft requests start up	Stand & gate management	In standard
up request	Flight	approval from ATC	approval from ATC at TSAT	will know the precise time	operations:
	Suspension			that an aircraft will leave the	(+) Better planning
	Alarm, Flight De-			stand	can result in enhanced
	Suspended				stand-gate planning,

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
	Alarm				reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
MST 14 - Start up approved	EXOT, Regulation Cancelled Alarm	ATC issues start up approval and records the time on the flight progress strip (paper or electronic)	ATC issues start up approval at TSAT. The Actual Start up Approval Time is input into the ACISP and disseminated to all partners	No Change	No Change
MST 15 - Off Block	Stand/Gate Allocation	Aircraft pushes back from or vacates the parking position. Time recorded by ACARS, automated docking guidance systems, ATC (e.g. ASMGCS) or manually. Time not necessarily disseminated among all partners	Aircraft pushes back from or vacates the parking position. Time recorded by ACARS, automated docking guidance systems, ATC (e.g. ASMGCS) or manually. Time input into ACISP and disseminated among all partners	Stand & gate management will know the precise time that an aircraft has left the stand	In standard operations: (+) Better planning can result in enhanced stand-gate planning, reduction in late stand changes, reduction in stressful situations & hence reducing mistakes being made
Taxi out/Departure	Runway and Taxiway conditions, RWY to be used for take off, Runway configuration, Aircraft Type, Regulation Cancelled Alarm,	Aircraft taxis to holding point. Default taxi time available to ATC and NMOC	With CDM variable taxi time calculations are used to give a more accurate estimate of take off time	No Change	No Change

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
	CTOT Compliance Alarm, Flight Suspension Alarm				
MST 16 - Take off	TTOT, Runway in Use, Regulation Cancelled Alarm	Actual take off from the runway. Time recorded by ATC or by ACARS.	Actual Take Off Time recorded on ACISP either automatically or manually and available to all partners.	No Change	No Change
For All Flight Phases in Adverse Conditions	No extra risk relevant items identified	Information on Adverse Conditions is obtained from traditional airport communications mechanisms	Improvement in transparency and timely provision of adverse conditions information	Improved recovery from Adverse conditions. Improved management during and after adverse event on a network basis and locally.	No consensus. Some experts thought that smoother operations during and after adverse event would have potential safety benefits. Others thought that current procedures should already be in place to ensure safety.

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3. Aircraft Operator

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
MST 1 - Flight Plan Submission	Flight Plan, Aircraft registration and Aircraft ID, ADEP/ADES, Flight Plan Modification Message, Flight Plan Already Correlated Alarm, Flight Plan Correlation Failure Alarm	Flight Plans are submitted to IFPS from Flight Plan Filer	When there is an inconsistency between flight plan and airport slot, correlation alarm will be triggered. Information is fed into a centralised platform and then displayed to all partners	No Change	No Change
MST 2 - ATFM Slot Allocation	SAM, Regulation Cancelled Alarm	Slot Allocation information is distributed from NMOC to Flight Plan Filer and ATC (all concerned ANSPs)	Slot Allocation is fed into a centralised platform and then displayed to all partners.	No Change	No Change
MST 3 - Take off from outstation	Movement Messages (MVT), Airborne Alarm, EOBT	ACARS for some airlines, ICAO Movement message protocols	Aircraft Movement Information from ANSP or Ground Handler or Airlines or ACARS. Now information is available to all partners	Movement messages readily available	In standard operations: (+) No need to look for the MVT message or ask other partners for messages. Workload reduction resulting in more time to verify

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
					other safety critical activities
Flight Update Message (FUM) generated by NMOC	EET, Capacity Information, Flow Management Attribute, Regulation Cancelled Alarm	Currently procedure does not exist for using FUM	FUM with accurate ETO and ELDT, based on radar data, issued for all inbound flights. Differences of +/- 5 mins incurred en-route will generate new message. Message will be received by one partner on the airport and will be input into the ACIS.	Enhanced landing estimate which coupled with variable taxi times will give more accurate In Block time	In standard operations: (+) Better aircraft and crew planning
MST 4 - FIR Entry	Flight Plan Cancellation Alarm	Aircraft FIR entry is co- ordinated between ATCs. Information only available when partners request from ATC	All partners will be informed of FIR entry and more accurate arrival times	Direct access of the FIR Entry information translated into updated ETAs	In standard operations: (+) Better aircraft and crew planning
MST 5 - Final Approach	None Identified	Final approach phase is co- ordinated by ATC. Information of this phase of flight is not always provided to airport partners	All partners will be informed of start of final approach, more accurate estimates of next phases of flight	Direct access of the Start Approach information translated into updated ETAs	In standard operations: (+) Better aircraft and crew planning
MST - Landing	EIBT	ATC record landing time on Flight Progress Strip, all partners might not be disseminated with this information	All partners will have actual landing times	Direct access of the landing Time information translated into updated In Block time	In standard operations: (+) Better aircraft and crew planning
MST 6 - Taxi-in period	EIBT, Stand/Gate Allocation, Work	ATC issue taxi-ing instructions, all partners might	All partners will have accurate in bound taxi times and In	Using the variable taxi-times facility in	In standard operations:

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
	in Progress	not be disseminated with this information	Block times	CDM, more accurate In Block time will be available	(+) Better aircraft and crew planning
MST 7 - In Block	EIBT	In Block time recorded manually, automated (docking systems), verbally by pilot or by ACARS. Accurate time not always available to all partners.	In Block time disseminated via ACISP to all partners. Long term using ASMGCS data will enhance accuracy and remove manual input	Remote AOCs will have access to ACISP	No Change
MST 8 - Ground handling starts	EOBT, Default Turn Around Time, Minimum Turn-around alarm, EOBT Compliance Alarm	Ground Handling event starts and time is recorded by Ground Handler but not generally disseminated to other partners	Actual Start of Ground Handling Time input into ACISP by Ground Handler and this may trigger update of downstream events e.g. automatic update of TOBT	No Change	No Change
MST 9 - Final update of TOBT	TOBT, SRM, SLC, Regulation Cancelled Alarm, Minimum Turn- around alarm, EOBT Compliance Alarm	Submission of TOBT Procedure does not exist currently	Aircraft handlers or aircraft operator send update to all partners	Submit TOBT to all partners	In standard operations: (-) Workload increased In failure circumstances: (-) Should the information displayed be corrupted, Airport Operator would be required to manually correct this on the ACIS system to avoid aircraft startup/takeoff

Flight Phases	Risk Bearing	Without CDM	With CDM	Operational Impact	Safety Impact
					outside CTOT tolerance, increase in workload
MST 10 - ATC issues TSAT	TSAT, ETOT, EOBT Compliance Alarm, Flight Plan Cancellation Alarm, Flight Suspension Alarm, Flight De- Suspended Alarm	Dissemination of TSAT procedure currently does not exist	ATC provides all partners with TSAT information	Visibility of TSAT information	In standard operations: Enhanced information but no foreseeable safety change
MST 11 - Boarding starts	Minimum Turn- around alarm, Boarding Alarm, EOBT Compliance Alarm	In most cases boarding start time only known by ground handler	Disseminated to all partners by ACISP and any delays in boarding triggers an alarm for action as the TOBT/TSAT may not be met.	Earlier warning of possible delay to departing flight.	No Change
MST 12 - Aircraft ready	Regulation Cancelled Alarm	If aircraft is ready well before CTOT, pilot will advise ATC and request a slot improvement	More automated indication of aircraft readiness via the milestone process and transparency in ACIS	More automated indication of aircraft readiness via the milestone process and transparency in ACIS	No Change
MST 13 - Start up request	SID Allocation, Flight Suspension Alarm, Flight De- Suspended Alarm	Aircraft requests start up approval from ATC	Aircraft requests start up approval from ATC at TSAT	No Change	No Change
MST 14 - Start up approved	EXOT, Regulation Cancelled Alarm	ATC issues start up approval and records the time on the	ATC issues start up approval at TSAT. The Actual Start up	No Change	No Change

	Risk Bearing				
Flight Phases	Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
		flight progress strip (paper or	Approval Time is input into the		
		electronic)	ACISP and disseminated to all		
			partners		
MST 15 - Off	Stand/Gate	Aircraft pushes back from or	Aircraft pushes back from or	Earlier notification of	No Change
Block	Allocation	vacates the parking position.	vacates the parking position.	actual push back	
		Time recorded by ACARS,	Time recorded by ACARS,	especially with non	
		automated docking guidance	automated docking guidance	ACARS equipped	
		systems, ATC (e.g. ASMGCS)	systems, ATC (e.g. ASMGCS)	aircraft	
		or manually. I me not	or manually. Time input into		
		necessarily disseminated	ACISP and disseminated		
Taul	Dumunau and	among all partners	among all partners	Fadian indiantian of	Nia Ohianana
I axi	Runway and	Aircraft taxis to holding point.	With CDM variable taxi time	Earlier indication of	No Change
out/Departure		Default taxi time available to	calculations are used to give a	estimated take off time	
	conditions, RVV Y		more accurate estimate of take		
	to be used for		on ume		
	configuration				
	Regulation				
	Cancelled Alarm				
	CTOT				
	Compliance				
	Alarm, Flight				
	Suspension Alarm				
MST 16 - Take off	TTOT, Runway in	Actual take off from the	Actual Take Off Time recorded	No Change	No Change
	Use, Regulation	runway. Time recorded by	on ACISP either automatically		
	Cancelled Alarm	ATC or by ACARS.	or manually and available to all		
			partners.		

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
For All Flight Phases in Adverse Conditions	No extra risk relevant items identified	Information on Adverse Conditions is obtained from traditional airport communications mechanisms	Improvement in transparency and timely provision of adverse conditions information	Improved recovery from Adverse conditions. Improved management during and after adverse event on a network basis and locally.	No consensus. Some experts thought that smoother operations during and after adverse event would have potential safety benefits. Others thought that current procedures should already be in place to ensure safety.

SAFETY ASSESSMENT OF AIRPORT COLLABORATIVE DECISION MAKING (A-CDM)

4. ATC

	Risk Bearing			Operational	
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
MST 1 - Flight	Flight Plan,	Flight Plans are	When there is an	No Change	In failure circumstances:
Plan	Aircraft	submitted to IFPS from	inconsistency between		(+) If credible corruption of flight plan
Submission	registration	Flight Plan Filer	flight plan and airport		modification message occurs, CDM correlation
	and Aircraft ID,		slot, correlation alarm will		alarm will mitigate risk.
	ADEP/ADES,		be triggered. Information		
	Flight Plan		is fed into a centralised		
	Modification		platform and then		
	Message,		displayed to all partners		
	Flight Plan				
	Already				
	Correlated				
	Alarm, Flight				
	Plan				
	Correlation				
NOT	Failure Alarm			Detter initial	
	SAM,	Slot Allocation	Slot Allocation is fed into	Better Visibility	In standard operations:
AIFW SIOT	Regulation	Information is distributed	a centralised platform	OT SIOT	(+) AIC workload may reduce as a result of
Allocation	Cancelled	From NIMOC to Flight	and then displayed to all	Information	better planning in stand and gate management
	Alarm	Plan Filer and ATC (all	partners.		by other partners.
MCT 2 Take	Mayamant		Aircraft Mayomant	No Significant	In standard energiana.
WIST 3 - Take	Mosegee	ACARS IOI Some	Ancrant Movement	No Significant	In Standard Operations:
outstation		Movement message	or Cround Handler or	Change	(+) Beller co-ordination for Airport Partners
Juisialion	Airborne	protocols	Airlines or ACAPS New		
		protocols	information is available to		
			all partners		
Flight Undate	EET Canacity	Currently procedure	FLIM with accurate FTO	No Significant	In standard operations:

	Risk Bearing			Operational	
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
Message (FUM) generated by NMOC	Information, Flow Management Attribute, Regulation Cancelled Alarm	does not exist for using FUM	and ELDT, based on radar data, issued for all inbound flights. Differences of +/- 5 mins incurred en-route will generate new message. Message will be received by one partner on the airport and will be input into the ACIS.	Change	(+) More information on when aircraft is active, reducing workload and RT.
MST 4 - FIR Entry	Flight Plan Cancellation Alarm	Aircraft FIR entry is co- ordinated between ATCs. Information only available when partners request from ATC	All partners will be informed of FIR entry and more accurate arrival times	No Change	No Change
MST 5 - Final Approach	None Identified	Final approach phase is co-ordinated by ATC. Information of this phase of flight is not always provided to airport partners	All partners will be informed of start of final approach, more accurate estimates of next phases of flight	No Change	No Change
MST - Landing	EIBT	ATC record landing time on Flight Progress Strip, all partners might not be disseminated with this information	All partners will have actual landing times	No Change	No Change
MST 6 - Taxi- in period	EIBT, Stand/Gate Allocation,	ATC issue taxi-ing instructions, all partners might not be	All partners will have accurate in bound taxi times and In Block times	No Change	No change as assumed that separate ATC systems already display Stand and Gate Allocation and WIP

	Risk Bearing			Operational	Out the house of
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
	Work in	disseminated with this			
	Progress	information			
MST 7 - In	EIBT	In Block time recorded	In Block time	No Change	No Change
Block		manually, automated	disseminated via ACISP		
		(docking systems),	to all partners. Long term		
		verbally by pilot or by	using ASMGCS data will		
		ACARS. Accurate time	enhance accuracy and		
		not always available to	remove manual input		
		all partners.			
MST 8 -	EOBT, TTOT,	Ground Handling event	Actual Start of Ground	EOBT	In failure circumstances:
Ground	Default Turn	starts and time is	Handling Time input into	information is	(-) Corrupted Default Turn Around Time can
handling	Around Time,	recorded by Ground	ACISP by Ground	displayed in	generate a corrupted EOBT, this is a safe but
starts	Minimum	Handler but not	Handler and this may	ACIS and ATC	sub-optimum sequence which might need ATC
	Turn-around	generally disseminated	trigger update of	displays	to resolve therefore increasing ATC workload.
	alarm, EOBT	to other partners	downstream events e.g.	simultaneously.	
	Compliance		automatic update of		
	Alarm		TOBT and TTOT		
MST 9 - Final	TOBT, TTOT,	Submission of TOBT	Aircraft handlers or	TOBT available	In standard operations:
update of	SRM, SLC,	Procedure does not	aircraft operator send		(+) More information on when aircraft is active,
TOBT	Regulation	exist currently	update to all partners		reducing workload and RT.
	Cancelled				
	Alarm,				In failure circumstances:
	Minimum				(-) If TOBT is credibly corrupted, startup
	Turn-around				clearance could be based on corrupted TOBT
	alarm, EOBT				information, requiring ATC to resolve
	Compliance				downstream, workload increase
	Alarm				
MST 10 - ATC	TSAT, TTOT,	Dissemination of TSAT	ATC provides all partners	No change -	In standard operations:
issues TSAT	ETOT, EOBT	procedure currently	with TSAT information	auto generated	(+) Improved planning of the taxi flow towards

	Risk Bearing			Operational	
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
	Compliance	does not exist			the runways enhances the traffic planning for
	Alarm, Flight				runways in mixed mode operation
	Plan				(-) If DMAN is not present this might be
	Cancellation				performed manually hence more workload
	Alarm, Flight				
	Suspension				In failure circumstances:
	Alarm, Flight				(-) Aircraft could be started at incorrect time if
	De-Suspended				TSAT information is credibly corrupted
	Alarm				(-) If TTOT is credibly corrupted on ACIS, ATC
					might instruct aircraft to takeoff outside CTOT
					tolerance time.
MST 11 -	Minimum	In most cases boarding	Disseminated to all	Earlier warning	In standard operations:
Boarding	Turn-around	start time only known by	partners by ACISP and	of possible	(+) Advance notification of possible delays
starts	alarm,	ground handler	any delays in boarding	delay to	(-) Possible slight increase in workload due to
	Boarding		triggers an alarm for	departing flight	recalculation of TSAT
	Alarm, EOBT		action as the TOBT/	which may	
	Compliance		TSAT may not be met.	result in revised	
	Alarm			TOBI	
MST 12 -	Regulation	If aircraft is ready well	More automated	Using milestone	In standard operations:
Aircraft ready	Cancelled	before CIOI, pilot will	indication of aircraft	process ATC	(+) Potential reduction in R/T as aircraft should
	Alarm	advise ATC and request	readiness via the	have a better	not declare readiness when they are not
		a slot improvement	milestone process and	guarantee of	
			transparency in ACIS	aircraft	
MOT 40 Otont			A in the first state of the sta	readiness	In standard energienes
10151 13 - Start	SID Allocation,	Aircraft requests staft	Aircraft requests start up	Aircraft	In standard operations:
up request	Flight	up approval from ATC	approval from ATC at	requests staft	(+) Decrease in frequency congestion as pilot
	Suspension		ISAI	trom ATC at	Petter planning and flow of toxi ing circreft beth
	Alarm, Flight			TOM ATC at	Better planning and flow of taxi-ing all craft both
	De-Suspended			ISAL	inbound and outbound especially in cul-de-sacs

	Risk Bearing			Operational	
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
	Alarm				
MST 14 - Start	EXOT,	ATC issues start up	ATC issues start up	EXOT, TTOT	In failure circumstances:
up approved	Regulation	approval and records	approval at TSAT. The	times are now	(-) Credibly corrupted EXOT might lead to
	Cancelled	the time on the flight	Actual Start up Approval	available on	credibly corrupted TTOT, causing aircraft to
	Alarm	progress strip (paper or	Time is input into the	ACIS display.	depart outside CTOT. ATC needs to resolve
		electronic)	ACISP and disseminated		this, hence increasing workload
			to all partners		
MST 15 - Off	Stand/Gate	Aircraft pushes back	Aircraft pushes back	No change	No change as assumed that separate ATC
BIOCK	Allocation	from or vacates the	from or vacates the		systems already display Stand and Gate
		parking position. Time	parking position. Time		Allocation
		recorded by ACARS,	recorded by ACARS,		
		(or ASMCCS) or	(o a ASMCCS) or		
		(e.g. ASINGCS) 01	(e.g. ASMGCS) of		
		nanually. Time not	ACISP and disseminated		
		disseminated among all	among all partners		
		nartners			
Тахі	Runway and	Aircraft taxis to holding	With CDM variable taxi	More accurate	In standard operations:
out/Departure	Taxiway	point Default taxi time	time calculations are	estimated take	(+) Better CTOT compliance reduces the risk of
our z opultur o	conditions	available to ATC and	used to give a more	off times give	en route sector overloads
	RWY to be	NMOC	accurate estimate of take	better CTOT	
	used for take		off time	compliance	
	off, Runway				
	configuration,				
	Aircraft Type,				
	Regulation				
	Cancelled				
	Alarm, CTOT				

	Risk Bearing			Operational	
Flight Phases	Data Items	Without CDM	With CDM	Impact	Safety Impact
-	Compliance				
	Alarm, Flight				
	Suspension				
	Alarm				
MST 16 - Take	ATOT,	Actual take off from the	Actual Take Off Time	No change	No change as assumed that separate ATC
off	Runway in	runway. Time recorded	recorded on ACISP		systems already display Runway in Use
	Use,	by ATC or by ACARS.	either automatically or		
	Regulation		manually and available to		
	Cancelled		all partners.		
	Alarm				
For All Flight	No extra risk	Information on Adverse	Improvement in	Improved	No consensus. Some experts thought that
Phases in	relevant items	Conditions is obtained	transparency and timely	recovery from	smoother operations during and after adverse
Adverse	identified	from traditional airport	provision of adverse	Adverse	event would have potential safety benefits.
Conditions		communications	conditions information	conditions.	Others thought that current procedures should
		mechanisms		Improved	already be in place to ensure safety.
				management	
				during and after	
				adverse event	
				on a network	
				basis and	
				locally.	

SAFETY ASSESSMENT OF AIRPORT COLLABORATIVE DECISION MAKING (A-CDM)

5. NMOC

Flight Phases	Risk Bearing Data	Without CDM	With CDM	Operational Impact	Safety Impact
MST 1 - Flight Plan Submission	Flight Plan, Aircraft registration and Aircraft ID, ADEP/ADES, Flight Plan Modification Message, Flight Plan Already Correlated Alarm, Flight Plan Correlation Failure Alarm	Flight Plans are submitted to IFPS from Flight Plan Filer	When there is an inconsistency between flight plan and airport slot, correlation alarm will be triggered. Information is fed into a centralised platform and then displayed to all partners	No Change	No Change
MST 2 - ATFM Slot Allocation	SAM, Regulation Cancelled Alarm	Slot Allocation information is distributed from NMOC to Flight Plan Filer and ATC (all concerned ANSPs)	Slot Allocation is fed into a centralised platform and then displayed to all partners.	No Change	No Change
MST 3 - Take off from outstation	Movement Messages (MVT), Airborne Alarm, EOBT	ACARS for some airlines, ICAO Movement message protocols	Aircraft Movement Information from ANSP or Ground Handler or Airlines or ACARS. Now information is available to all partners	No Change	No Change
Flight Update Message (FUM) generated by NMOC	EET, Capacity Information, Flow Management Attribute, Regulation Cancelled Alarm	Currently procedure does not exist for using FUM	FUM with accurate ETO and ELDT, based on radar data, issued for all inbound flights. Differences of +/- 5 mins incurred en-route will generate new message. Message will be received by one partner on the	No Change in workload. Message will be issued automatically.	No Change

Elight Phases	Risk Bearing Data	Without CDM	With CDM	Operational Impact	Safety Impact
			airport and will be input into the ACIS.		
MST 4 - FIR Entry	Flight Plan Cancellation Alarm	Aircraft FIR entry is co- ordinated between ATCs. Information only available when partners request from ATC	All partners will be informed of FIR entry and more accurate arrival times	No Change	No Change
MST 5 - Final Approach	None Identified	Final approach phase is co- ordinated by ATC. Information of this phase of flight is not always provided to airport partners	All partners will be informed of start of final approach, more accurate estimates of next phases of flight	No Change	No Change
MST - Landing	EIBT	ATC record landing time on Flight Progress Strip, all partners might not be disseminated with this information	All partners will have actual landing times	No Change	No Change
MST 6 - Taxi-in period	EIBT, Stand/Gate Allocation, Work in Progress	ATC issue taxi-ing instructions, all partners might not be disseminated with this information	All partners will have accurate in bound taxi times and In Block times	No Change	No Change
MST 7 - In Block	EIBT	In Block time recorded manually, automated (docking systems), verbally by pilot or by ACARS. Accurate time not always available to all partners.	In Block time disseminated via ACISP to all partners. Long term using ASMGCS data will enhance accuracy and remove manual input	No Change	No Change
MST 8 - Ground handling starts	EOBT, Default Turn Around Time, Minimum Turn-	Ground Handling event starts and time is recorded by Ground Handler but not generally	Actual Start of Ground Handling Time input into ACISP by Ground Handler and this may	No Change	No Change

	Risk Bearing Data				
Flight Phases	Items	Without CDM	With CDM	Operational Impact	Safety Impact
	around alarm, EOBT Compliance Alarm	disseminated to other partners	trigger update of downstream events e.g. automatic update of TOBT		
MST 9 - Final update of TOBT	TOBT, SRM, SLC, Regulation Cancelled Alarm, Minimum Turn- around alarm, EOBT Compliance Alarm	Submission of TOBT Procedure does not exist currently	Aircraft handlers or aircraft operator send update to all partners	NMOC will receive more accurate EOBT	In standard operations: (+) Better planning, more accurate information
MST 10 - ATC issues TSAT	TSAT, ETOT, EOBT Compliance Alarm, Flight Plan Cancellation Alarm, Flight Suspension Alarm, Flight De- Suspended Alarm	Dissemination of TSAT procedure currently does not exist	ATC provides all partners with TSAT information	NMOC gets EOBT AND ETOT update via DPI messages	In standard operations: (+) Better planning, more accurate information
MST 11 - Boarding starts	Minimum Turn- around alarm, Boarding Alarm, EOBT Compliance Alarm	In most cases boarding start time only known by ground handler	Disseminated to all partners by ACISP and any delays in boarding triggers an alarm for action as the TOBT/ TSAT may not be met.	Possible update of EOBT and ETOT via DPI message	No Change
MST 12 - Aircraft ready	Regulation Cancelled Alarm	If aircraft is ready well before CTOT, pilot will advise ATC and request a slot improvement	More automated indication of aircraft readiness via the milestone process and transparency in ACIS	No Change	No Change
MST 13 - Start up request	SID Allocation, Flight Suspension	Aircraft requests start up approval from ATC	Aircraft requests start up approval from ATC at TSAT	No Change	No Change

	Risk Bearing Data				
Flight Phases	Items	Without CDM	With CDM	Operational Impact	Safety Impact
	Alarm, Flight De-				
	Suspended Alarm				
MST 14 - Start up	EXOT, Regulation	ATC issues start up approval	ATC issues start up approval at	No Change	No Change
approved	Cancelled Alarm	and records the time on the	TSAT. The Actual Start up		
		flight progress strip (paper or	Approval Time is input into the		
		electronic)	ACISP and disseminated to all		
			partners		
MST 15 - Off Block	Stand/Gate	Aircraft pushes back from or	Aircraft pushes back from or	No Change	No Change
	Allocation	vacates the parking position.	vacates the parking position.		
		Time recorded by ACARS,	Time recorded by ACARS,		
		automated docking guidance	automated docking guidance		
		systems, ATC (e.g. ASMGCS)	systems, ATC (e.g. ASMGCS)		
		or manually. Time not	or manually. Time input into		
		necessarily disseminated	ACISP and disseminated		
	<u> </u>	among all partners	among all partners		
axi out/Departure	Runway and	Aircraft taxis to holding point.	With CDM variable taxi time	More accurate estimated	In standard
	DW// to be weed for	Default taxi time available to	calculations are used to give a	take off times contribute	operations:
	RVV Y to be used for		more accurate estimate of take	to better monitoring of	(+) Better CIOI
	take off, Runway		on time	the CTOT compliance	compliance reduces the
	Aircroft Turoo			and, il necessary, trigger	nsk of en foule sector
	Ancial Type,				over-deliveries
				CTOT is adhered to	
	CTOT Compliance				
	Alarm Flight				
	Suspension Alarm				
MST 16 - Take off	TTOT Runway in	Actual take off from the runway	Actual Take Off Time recorded	No Change	No Change
	Use, Regulation	Time recorded by ATC or by	on ACISP either automatically		

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Operational Impact	Safety Impact
	Cancelled Alarm	ACARS.	or manually and available to all partners.		
For All Flight Phases in Adverse Conditions	No extra risk relevant items identified	Information on Adverse Conditions is obtained from traditional airport communications mechanisms	Improvement in transparency and timely provision of adverse conditions information	Improved recovery from Adverse conditions. Improved management during and after adverse event on a network basis and locally.	No consensus. Some experts thought that smoother operations during and after adverse event would have potential safety benefits. Others thought that current procedures should already be in place to ensure safety.

SAFETY ASSESSMENT OF AIRPORT COLLABORATIVE DECISION MAKING (A-CDM)

Success Case Safety Assessment Summary and Mitigations identified

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
MST 1 - Flight	Flight Plan,	Flight Plans are	When there is an	Potential safety benefits:	In standard operations:
Plan	Aircraft	submitted to	inconsistency	1. Increased Transparency in Flight Plan data	1. Service Level Agreements
Submission	registration	IFPS from Flight	between flight plan	2. Correlation Alarms help to identify	(SLAs) and agreed
	and Aircraft	Plan Filer	and airport slot,	inconsistencies	procedures with Ground
	ID,		correlation alarm		Handlers on change access
	ADEP/ADES,		will be triggered.	Issues and concerns in Normal Operating	to Flight Plan Information
	Flight Plan		Information is fed	Conditions:	are to be formalised.
	Modification		into a centralised	1. Probability of increase in Ground Handlers'	
	Message,		platform and then	unauthorised interference with flight plan data	In failure circumstances:
	Flight Plan		displayed to all		1. Safety requirements on
	Already		partners		loss and corruption of Flight
	Correlated				Plan Correlation Failure
	Alarm, Flight				alarms to be generated
	Plan				
	Correlation				
	Failure Alarm				
MST 2 -	SAM,	Slot Allocation	Slot Allocation is	Potential safety benefits:	
ATFM Slot	Regulation	information is	fed into a	1. Reduction of workload for Ground Handlers	
Allocation	Cancelled	distributed from	centralised platform	& Airport Operator due to advance availability	
	Alarm	NMOC to Flight	and then displayed	of flight information	
		Plan Filer and	to all partners.	2. Reduction in ATC workload due to better	
		ATC (all		planning in Stand and Gate management	
		concerned			
		ANSPs)			
MST 3 - Take	Movement	ACARS for	Aircraft Movement	Potential safety benefits:	
off from	Messages	some airlines,	Information from	1. Reduction of workload for Ground Handlers,	
outstation	(MVT),	ICAO Movement	ANSP or Ground	Airport Operator and Aircraft Operator due to	

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
	Airborne	message	Handler or Airlines	advance availability of flight information hence	
	Alarm, EOBT	protocols	or ACARS. Now	reducing probability of making errors	
			information is	2. Better co-ordination for ATC with partners	
			available to all	allowing better planning and smoother ops	
			partners		
Flight Update	EET Capacity	Currently	FUM with accurate	Potential safety benefits:	
Message	Information.	procedure does	ETO and ELDT.	1. Enhanced landing estimates coupled with	
(FUM)	Flow	not exist for	based on radar	variable taxi times provide better stand/gate	
generated by	Management	using FUM	data, issued for all	planning for Ground Handlers and Airport	
NMOC	Attribute,	Ū	inbound flights.	Operators, reducing workload and hence	
	Regulation		Differences of +/- 5	reducing likelihood of mistakes and ground	
	Cancelled		mins incurred en-	incidents	
	Alarm		route will generate	2. More accurate information on traffic loading	
			new message.	to ATC reducing ATC workload and RT	
			Message will be	3. Better aircraft and crew planning for aircraft	
			received by one	operators.	
			partner on the		
			airport and will be		
			input into the ACIS.	Detential estate han afite.	
MIST 4 - FIR	Flight Plan		All partners will be	1 Enhanced evolution bility of flight phase	
Entry	Alorm	entry is co-	antry and more	information provide botter stand/gate planning	
	Alaini			for Ground Handlors and Airport Operators	
		Information only	times	reducing workload bance reducing likelihood of	
		available when	unico	mistakes and incidents	
		partners request		2 Better aircraft and crew planning for aircraft	
		from ATC		operators	
				3. More accurate indication of traffic loading for	

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
				ATC	
				No Issues or concerns identified.	
MST 5 - Final	None	Final approach	All partners will be	Potential safety benefits:	
Approach	Identified	phase is co-	informed of start of	 Enhanced availability of flight phase 	
		ordinated by	final approach,	information provide better stand/gate planning	
		ATC.	more accurate	for Ground Handlers and Airport Operators,	
		Information of	estimates of next	reducing workload hence reducing likelihood of	
		this phase of	phases of flight	mistakes and incidents	
		flight is not		2. Better aircraft and crew planning for aircraft	
		always provided		operators	
		to airport			
		partners		No Issues or concerns identified.	
MST -	EIBT	ATC record	All partners will	Potential safety benefits:	
Landing		landing time on	have actual landing	1. Enhanced availability of flight phase	
		Flight Progress	times	information provide better stand/gate planning	
		Strip, all		for Ground Handlers and Airport Operators,	
		partners might		reducing workload hence reducing likelihood of	
		not be		mistakes and incidents	
		disseminated		2. Better aircraft and crew planning for aircraft	
		with this		operators	
		information			
MST 6 - Taxi-	EIBT,	ATC issue taxi-	All partners will	Potential safety benefits:	
in period	Stand/Gate	ing instructions,	have accurate in	1. Enhanced availability of flight phase	
	Allocation,	all partners	bound taxi times	information provide better stand/gate planning	
	Work in	might not be	and In Block times	for Ground Handlers and Airport Operators,	
	Progress	disseminated		reducing workload hence reducing likelihood of	
		with this		mistakes and incidents	
		information		2. Better aircraft and crew planning for aircraft	

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
				operators	
MST 7 - In Block	EIBT	In Block time recorded manually, automated (docking systems), verbally by pilot or by ACARS. Accurate time not always available to all partners.	In Block time disseminated via ACISP to all partners. Long term using ASMGCS data will enhance accuracy and remove manual input	No Potential safety benefits identified.	
MST 8 - Ground handling starts	EOBT, Default Turn Around Time, Minimum Turn-around alarm, EOBT Compliance Alarm	Ground Handling event starts and time is recorded by Ground Handler but not generally disseminated to other partners	Actual Start of Ground Handling Time input into ACISP by Ground Handler and this may trigger update of downstream events e.g. automatic update of TOBT	 Potential safety benefits: 1. Reduction of Ground Handler's workload if Ground Handling start time is automatically obtained 2. Better estimates on stand/gate vacation leading to reduced stress/workload and potential reduction in error made by Ground Handler/Airport operator. Issues and concerns under normal operating conditions: 1. Slight workload increase for Ground handler if need to input Ground Handling time manually 	In standard operations: 1. Update Training and Resource Needs Analysis In failure circumstances: 1. Ground handlers to update turn-around time on CDM system if system indicates deviation by more than +/- 15 mins.

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
				Issues and concerns under failure conditions: 1. Corruption of default turn around time can lead to sub-optimum sequencing, increasing ATC workload.	
MST 9 - Final	TOBT, SRM,	Submission of	Aircraft handlers or	Potential safety benefits:	In standard operations:
update of	SLC,	TOBT	aircraft operator	1. Better estimates on stand/gate vacation	1. Update Training and
TOBT	Regulation	Procedure does	send update to all	leading to reduced stress/workload and	Resource Needs Analysis
	Cancelled	not exist	partners	reduction in error made by Airport operator.	
	Alarm,	currently		2. Reduction of RT loading and workload for	In failure circumstances:
				AIC 2. Allows botton planning for NIMOC	1a. EOBT/TOBT originators
				5. Allows beller planning for NWOC	EOBT/TOBT entry and
	Compliance			Issues and concerns under normal	correct if corrupted
	Alarm			operating conditions:	1b. Loss and Corruption
				1. Slight workload increase for Ground	Systems Requirement for
				Handlers and Airport Operator in inputting	TOBT to be generated
				TOBT data and correcting corrupt data	
				loouse and concerns under feilure	
				conditions:	
				1 If TOBT is credibly corrupted startup	
				clearance could be based on corrupted TOBT	
				information, requiring ATC to resolve	
				downstream, workload increase	
MST 10 - ATC	TSAT, ETOT,	Dissemination of	ATC provides all	Potential safety benefits:	In failure circumstances:
issues TSAT	EOBT	TSAT procedure	partners with TSAT	1. Better planning at push-back reducing	1. ATC to cross-check
	Compliance	currently does	information	stress, workload and errors made by Ground	EOBT and CTOT
	Alarm, Flight	not exist		Handlers and Airport Operator	information before issuing

Elight Phases	Risk Bearing	Without CDM	With CDM	Summany	Mitigation
	Plan Cancellation Alarm, Flight Suspension Alarm, Flight De- Suspended Alarm			 2. Improved planning of the taxi flow towards the runways enhances the traffic planning for runways in mixed mode operation Issues and concerns under normal operating conditions: More workload for ATC if DMAN and AMAN are not present Issues and concerns under failure conditions: Potential increase in ATC RT workload if TSAT is lost and potential for aircraft starting at incorrect times under corruption of TSAT TTOT corruption has the potential to cause aircraft takeoff outside CTOT tolerance, 	startup instructions based on TSAT. 2. Safety requirements for corruption of TTOT shall be generated.
MST 11 - Boarding starts	Minimum Turn-around alarm, Boarding Alarm, EOBT Compliance Alarm	In most cases boarding start time only known by ground handler	Disseminated to all partners by ACISP and any delays in boarding triggers an alarm for action as the TOBT/ TSAT may not be met.	Potential safety benefits: 1. Enhanced gate-planning for Airport Operator, potentially reducing errors 2. ATC has advance notice of possible delays enhancing planning Issues and concerns in normal operating conditions: 1. Possible slight increase workload for Ground Handler to resolve boarding alarms 2. Possible slight increase in workload due to recalculation of TSAT by ATC	In standard operations: 1&2. Update Training and Resource Needs Analysis

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
				No Issues or concerns in failure conditions identified	
MST 12 - Aircraft ready	Regulation Cancelled Alarm	If aircraft is ready well before CTOT, pilot will advise ATC and request a slot improvement	More automated indication of aircraft readiness via the milestone process and transparency in ACIS	Potential safety benefits : 1. Enhanced gate-planning for Airport Operator, potentially reducing errors 2. Potential reduction in RT loading for ATC No issues or concerns identified.	
MST 13 - Start up request	SID Allocation, Flight Suspension Alarm, Flight De- Suspended Alarm	Aircraft requests start up approval from ATC	Aircraft requests start up approval from ATC at TSAT	 Potential safety benefits: 1. Better planning of resources and equipment for Ground Handlers, reducing risks of ground incidents 2. Better stand-gate planning for Airport Operator reducing errors made 3. Reduction of frequency congestion for ATC and pilots 4. Better planning and flow of taxi-ing aircraft both inbound and outbound especially in cul- de-sacs 	
MST 14 - Start up approved	EXOT, Regulation Cancelled Alarm	ATC issues start up approval and records the time on the flight progress strip (paper or electronic)	ATC issues start up approval at TSAT. The Actual Start up Approval Time is input into the ACISP and disseminated to all	No significant safety benefit has been identified Issues and concerns under failure conditions: 1. Corruption of EXOT may lead to aircraft to depart outside CTOT, increasing workload for	In failure circumstances: 1. Safety requirements on loss and corruption of EXOT data

	Risk Bearing				Mitigation
Flight Phases	Data Items	Without CDM	With CDM	Summary	Recommendation
			partners	ATC.	
MST 15 - Off	Stand/Gate	Aircraft pushes	Aircraft pushes	Potential safety benefits :	
Block	Allocation	back from or	back from or	1. Better stand-gate planning for Airport	
		vacates the	vacates the parking	Operator reducing errors made	
		parking position.	position. Time		
		Time recorded	recorded by		
		by ACARS,	ACARS, automated		
		automated	docking guidance		
		docking	systems, ATC (e.g.		
		guidance	ASMGCS) or		
		systems, ATC	manually. Time		
		(e.g. ASMGCS)	input into ACISP		
		or manually.	and disseminated		
		lime not	among all partners		
		necessarily			
		disseminated			
		among all			
Tovi	Dupwov and	Aircraft toxic to		Detential actatu hanafita	
	Runway and	Aircrait taxis to	toxi time	Potential safety benefits: A Deduction of encourte exector everlands for	
ourbeparture	Conditions	Default taxi time			
	PW/V to be	available to ATC		2 Reduction of annuta sector over-deliveries	
	used for take	and NMOC	more accurate	for NMOC	
	off Runway		estimate of take off		
	configuration		time		
	Aircraft Type				
	Regulation				
	Cancelled				
	Alarm, CTOT				

Flight Phases	Risk Bearing Data Items	Without CDM	With CDM	Summary	Mitigation Recommendation
	Compliance Alarm, Flight Suspension Alarm				
MST 16 - Take off	TTOT, Runway in Use, Regulation Cancelled Alarm	Actual take off from the runway. Time recorded by ATC or by ACARS.	Actual Take Off Time recorded on ACISP either automatically or manually and available to all partners.	No significant potential safety benefits identified	
For All Flight Phases in Adverse Conditions	No extra risk relevant items identified	Information on Adverse Conditions is obtained from traditional airport communications mechanisms	Improvement in transparency and timely provision of adverse conditions information	No consensus from experts concerning potential potential safety benefits.	

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Annex 2 - A-CDM ALARMS SAFETY ASSESSMENT

		Worst Credible Effects under failure	Proposed
Alarm	Flight Phase	condition	Mitigation
NMOC Error Alarm	Alarm has been removed from specification		
Flight Plan Correlation Failure Alarm	MST 1 - Flight Plan Submission	Possible minor workload increase for airline operator and ATC under corruption.	System Safety Requirement
Regulation Cancelled Alarm	 MST 2- ATFM Slot Allocation, FUM generated by NMOC MST 9 - Final updates of TOBT MST 12 - Aircraft ready MST 14 - Start-up approved Departure MST-16 Takeoff 	Possible minor workload increase for ground handler, airport operator, airline operator and ATC under corruption.	System Safety Requirement
Airborne Alarm	MST 3 - Takeoff from outstation	Possible minor workload increase for ground handler, airport operator, airline operator and ATC under corruption.	System Safety Requirement
Minimum Turn- around Alarm	 MST 8 – Ground Handling Starts MST 9 – Final Update of TOBT MST 11- Boarding Starts 	Possible minor workload increase for ground handler and airline operator under corruption.	System Safety Requirement
Boarding Alarm	MST 11 - Boarding Starts	Possible minor workload increase for ground handler, airline operator and airport operator under corruption.	System Safety Requirement
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Alarm	Flight Phase	Worst Credible Effects under failure	Proposed Mitigation
EOBT Compliance Alarm	MST 8 – Ground Handling Starts MST 9 – Final Update of TOBT MST 10- ATC Issues TSAT MST 11- Boarding Starts	Possible minor workload increase for ground handler, airline operator, airport operator and ATC under corruption.	System Safety Requirement
missing	manual		
CTOT Compliance Alarm	Departure	Possible minor workload increase for ground handler, airline operator, airport operator and ATC under corruption.	System Safety Requirement
Flight Plan Already Correlated	MST 1 - Flight Plan Submission	Corruption: • Possible minor workload increase for ground handler, airline operator, airport operator and ATC under corruption.	System Safety Requirement
Flight Plan/Schedule Discrepancy Alarm Flight Schedule	MST 1 - Flight Plan Submission Alarm deleted from the	Possible minor workload increase for ground handle and airport operator under corruption.	System Safety Requirement
Cancellation Alarm Flight Plan Cancellation Alarm	• MST 4 – FIR Entry • MST 10 – ATC issues TSAT	Possible minor workload increase for ground handler, airline operator, airport operator and ATC under corruption.	System Safety Requirement
Flight Suspension Alarm	• MST 10 – ATC issues TSAT • MST-13 Start-up Request • Departure	Possible minor workload increase for ground handler, airline operator, airport operator and ATC and NMOC under corruption	System Safety Requirement

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Alarm	Flight Phase	Worst Credible Effects under failure condition	Proposed Mitigation
		Possible minor workload increase for	
	• MST 10 – ATC issues	ground handler, airline	
	• MST-13 Start-up	operator and ATC and	
Flight De-Suspended	Request	NMOC under	System Safety
Alarm	Departure	corruption	Requirement

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10 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&glossaryUi d=AIRIAL

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