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29/08/25

Tenth North American, Central American and Caribbean Working Group Meeting (NACC/WG/10)
Tulum, Mexico, from 8 to 12 September 2025

Agenda Item 5: NACC/WG Collaborative Task Forces Working Session

IATA A-CDM Toolkit

(Presented by IATA)

EXECUTIVE SUMMARY

This working paper presents an A-CDM toolkit elaborated by IATA to support globally harmonized and effective A-CDM implementation. It focuses on addressing the diverse operational challenges, needs, and responsibilities of all involved stakeholders, ensuring a consistent, effective and collaborative approach to airport operations and decision-making

Action:	Suggested actions under item 4 of this working paper
Strategic Objectives:	• Safety • Air Navigation Capacity and Efficiency • Economic Development of Air Transport • Environmental Protection
References:	• ICAO Annex 14 • ICAO Doc. 9830 • ICAO Doc. 9971 • GREPECAS 22 Meeting Report

1. Introduction

1.1 During GREPECAS/22 meeting, A-CDM Implementation (F3) was discussed, and the Secretariat proposed a shift in focus from A-CDM to Surface Movement Guidance Control Systems (SMGCS), addressing safety and efficiency at airports. This proposal was approved through Conclusion GREPECAS 22/13 below.

CONCLUSION GREPECAS/22/13	**MODIFICATIONS APPROVAL TO CAR/SAM F3 PROJECT**		
What: That, to implement Surface Movement Guidance Control System (SMGCS) as part of the F3 Project: a) the States approve the revised version (modifications) of the CAR/SAM F3 Project at **Appendix B** to this report. b) Member States and International Organizations review the proposed modifications to Project F3 and indicate their comments to the Secretariat by than **31 January 2025**, and c) F3 Project Members prepare a detailed action plan, in conjunction with the Secretariat, to carry out such activities, with the identification of priority international aerodromes.		**Expected impact:** ☐ Political / Global ☒ Inter-regional ☒ Economic ☐ Environmental ☒ Operational/Technical	
Why: To date, the F3 project has focused efforts on promoting the A-CDM concept and prepared an implementation guide accepted by the GREPECAS States. However, the Secretariat proposes new approach of the F3 project, based on the implementation of Surface Movement Guidance Control System (SMGCS) reflected in the revised version of the F3 Project.			
When:	1 December 2024	**Status:**	☒ Valid / ☐ Superseded / ☐ Completed
Who:	☒ States ☒ ICAO ☐ Other:		

1.2 Justifications for changing the scope of the project F3 were listed in the appendix B of GREPECAS 22 Report, and they are the following:

a) "A survey presented during GREPECAS/21 revealed the need to re-evaluate the approach to implementing A-CDM in the region.
b) Investigations by the ICAO NACC and SAM Regional Offices concluded that the implementation of A-CDM, according to its original European definition, is not directly applicable to the CAR/SAM region, as it was designed to mitigate the effects of airspace management policies and take-off delays not implemented in our region.
c) A significant lack of apron management and systems to improve situational awareness on the ground at airfields in the region was identified, a prerequisite for more advanced collaborative approaches in selected airports.
d) Although capacity is an issue at some airports in the region, the implementation of A-CDM is not the direct solution to this challenge.
e) It is recognized that the basis for an improvement in airport capacity is the implementation of appropriate platform management services and advanced SMGCS systems.
f) This restructuring aligns with the correct implementation of the provisions contained in sections 9.5 and 9.8 of Annex 14, Volume I, Chapters 1, 7 and 9, Part II of PANS-Aerodromes (Doc 9981), and the guidance provided by Doc 9137, Part8 (Platform Management), Doc 9476 (SMGCS) and Doc 9430 (A-SMGCS)."

1.3 Although GREPECAS has changed the focus of implementing A-CDM to Apron Control and SMGCS, some NACC States has already or are planning to implement A-CDM. In this sense, IATA would like to share the A-CDM toolkit with all States CAAs, ANSPs and Airport Authorities as a contribution for a harmonized and successful A-CDM implementation and operations.

2. SMGCS and Apron Control Implementation

2.1 It is important to note that both Apron Control and SMGCS are ICAO Annex 14 Standards, respectively items 9.5.3 and 9.8.1.

2.2 An upgrade of SMGCS to A-SMGCS shall be based on the corresponding business case that takes into consideration visibility, traffic density, aerodrome layout and other local circumstances (ICAO Doc. 9830 – item 2.1.1).

2.3 Regarding the Apron Control, besides the same aspects mentioned in 2.2, a business case should also consider if the apron management service should be provided by an aerodrome ATS unit, by another aerodrome operating authority, or by a cooperative combination of these. (ICAO Annex 14 – item 9.5.1).

2.4 In NACC Region, it is expected that just a few airports would need an apron control provided by an airdrome operating authority and/or an A-SMGCS due to good visibility operations, low traffic density and/or simple aerodrome layout.

3. A-CDM Implementation

3.1 As global aviation demand continues to grow, the challenge of optimizing turn-around times, minimizing delays and delivering efficient passenger service becomes increasingly complex, particularly at airports where multiple stakeholders, including airlines, airport operators, air navigation service providers, and ground handlers, often operate in silos, each with distinct systems, priorities, and decision-making processes.

3.2 Airport Collaborative Decision Making (A-CDM) process addresses this challenge by promoting real-time information sharing and coordinated operations among all operational partners, thereby enhancing predictability, situational awareness, and overall capacity utilization.

3.3 Implemented at over 40 airports worldwide, A-CDM has delivered significant operational benefits, though its successful implementation requires more than just technological integration. It calls for a cultural shift and a comprehensive procedural transformation, with strong alignment across all participating stakeholders.

3.4 IATA strongly encourages the implementation of A-CDM through a tailored, practical, and effective approach that avoids unnecessary complexity and excessive costs.

3.5 To support globally harmonized and effective A-CDM implementation, IATA has developed a comprehensive A-CDM toolkit that provides step-by-step guidance. This A-CDM toolkit is attached as Appendix A to this working paper. It could also be obtained at IATA ACDM Toolkit.

3.6 It focuses on addressing the diverse operational challenges, needs, and responsibilities of all involved stakeholders, ensuring a consistent, effective and collaborative approach to airport operations and decision-making.

3.7 The IATA A-CDM toolkit is structured around four key areas:

a) A-CDM fundamentals & Systems - Introducing the core principles and enabling technologies that support collaborative decision-making.
b) Sequence-building & A-CDM key Procedures - Defining the operational milestones and processes that drive coordinated airport operations.
c) A-CDM Implementation process - Providing a phased, step-by-step approach for effective implementation.
d) Challenges and Recommendations - Highlighting common obstacles and offering practical guidance for successful implementation.

3.8 Although the toolkit was developed to provide the big picture of A-CDM planning and implementation and it is highly recommended to consider it in total, it is important to call attention for the following even more essential extracts of the Chapter 6 - CRITICAL ELEMENTS AND CHALLENGES:

a) Cultural Change - A-CDM involves creating a commonly owned operational environment based on continuous information sharing. It is necessary to break the traditional silo approach and the traditional culture of blame avoidance.
b) Concept of Operations, AODB, ACISP and PDS Functionalities - The A-CDM ConOps is one of the most important elements of the project. It defines the operational environment and information flows, and it is essential that all stakeholders endorse this new environment. The functionalities of the PDS system regarding the sequence-building process and the capabilities to introduce additional features such as flight swapping, flight prioritization, and slot apportionment should be discussed and agreed upon at this stage.
c) System Specification and Procurement - If the systems are not specified, procured, or validated correctly, the A-CDM operational environment defined in the ConOps will not be successfully implemented.
d) Training Plan - For the implementation of an A-CDM project, a training plan should be approved by the A-CDM WG. All appropriate staff should receive training before performing any duties in the A-CDM environment. The training content should be part of the safety case. If potential mitigations require changes to procedures or systems, the training content should be updated accordingly.
e) Communication Plan - For the implementation of an A-CDM project, a communication plan should be approved by the A-CDM WG. The communication plan should focus on:

- Increasing and maintaining awareness and engagement of staff involved in A-CDM.
- Contributing to the formation of an A-CDM community that includes all stakeholders.
- Motivating and engaging the staff by highlighting the benefits of the project and the progress being made.

f) Transition Phase - The transition from conventional operations to an A-CDM environment is the final milestone of the project and requires intense coordination amongst stakeholders. This transition should be planned by the A-CDM WG. The transition plan can include:

- Planning for the training activities
- Communication activities
- Systems' end-to-end testing if not carried out earlier
- AIP publication timeline if needed
- Timeline for the A-CDM trials.

3.9 It is also important to highlight that A-CDM is not dependent of ATFM implementation. However, if the ATFM is already implemented, a procedure harmonization or, if feasible, operations integration shall be considered.

3.10 For Airports that doesn't have operational requirements to implement A-CDM, it is highly recommended to share information to generate common situational awareness, which will foster improved decision making within aerodromes, by sharing relevant surface operations data among the local stakeholders involved in aerodrome operations. This initiative represents the first collaboration step among stakeholders involved in aerodrome operations.

4. Suggested actions

4.1 The meeting is invited to:

a) Take note of the information provided in this working paper.
b) Urge States, ANSP´s and Airports Authorities to perform the corresponding business case when considering upgrading SMGCS and Apron Control Management Service.
c) Ask States, ANSP´s and Airports Authorities to consider the IATA A-CDM toolkit as a supporting material for implementing A-CDM, mainly the CRITICAL ELEMENTS AND CHALLENGES.

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PREFACE

As aviation demand grows, providing optimal service to the final users (passengers) becomes increasingly challenging. This is particularly evident at airports, the nodes of the aviation network, where traditionally, many interdependent processes are carried out independently by different stakeholders.

Airport Collaborative Decision Making (A-CDM), is an operational concept designed to fill this gap by promoting information sharing amongst all stakeholders and fostering the creation of a joint operational environment that enhances predictability, awareness, and capacity optimization.

A-CDM is currently implemented in more than 40 airports worldwide and is considered an operational success, providing benefits for all parties involved by enhancing the quality of operations.

Achieving A-CDM is not a trivial task, as it is a business transformation project that requires a different cultural approach to operations and a structured methodology to address challenges related to people, system and processes. With this toolkit, IATA has captured the essential A-CDM features around the world and aims to support A-CDM implementation projects globally.

A-CDM implementations aim to support service provision and facilitate airport operations considering the operational constraints of all stakeholders, and specifically catering to the different needs of airlines based on their size, fleet and operational profile.

This toolkit is addressed to all stakeholders involved in A-CDM implementation, recognizing that while each of them has specific and critical responsibilities, the ultimate responsibility for a flight remains to the aircraft operator. They oversee all aspects of flight operations, including regulatory compliance, safety management, financial responsibilities, and customer service. Ultimately, airlines bear the responsibility for operations, services, fleet management costs, and ensuring satisfactory service provision to passengers.

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LIST OF ACRONYMS

Term	Definition
ACC	Area Control Center
A-CDM	Airport Collaborative Decision Making
ACISP	A-CDM Information Sharing Platform
AIBT	Actual In-Block Time
ALDT	Actual Landing Time
AMS	Airport Management System
ATFM	Air Traffic Flow Management
ANSP	Air Navigation Service Provider
AOBT	Actual Off-Block Time
AODB	Airport Operational Data base
ASAT	Actual Start-Up Approval Time
ASBU	Aviation System Block Upgrade
ASMGCS	Advanced Surface Movement Guidance and Control System
ASRT	Actual Start-Up Requested Time
ATOT	Actual Take-Off time
ATCO	Air Traffic Controller
ATFM	Air Traffic Flow Management
AXIT	Actual Taxi-In Time
AXOT	Actual Taxi-Out Time
CDM	Collaborative Decision Making
CTOT	Calculated Take-Off Time
DMAN	Departure Manager
DPI	Departure Planning Information
EG	Expert Group
EIBT	Estimated In-Block Time
ELDT	Estimated Landing Time
EOBT	Estimated Off-Block Time (related to flight plan)

EXIT	**Estimated Taxi-In Time**
EXOT	**Estimated Taxi-Out Time**
FAF	**Final Approach Fix**
FUM	**Flight Update Messages**
LLC	**Low-Cost Carriers**
MTT	**Minimum Turn-Around Time**
MoU	**Memorandum of Understanding**
PDS	**Pre-Departure Sequence**
POBT	**Pre-TOBT or Early TOBT (Predicted Value)**
PoC	**Point of Contact**
RMS	**Resource Management System (Stand Management)**
SC	**Steering Committee**
SSOT	**Single Source of Operational Truth**
SWIM	**System Wide Information Management**
TAM	**Total Airport Management**
TMS	**Turnaround Monitoring System**
TOBT	**Target Off-Block Time**
TSAT	**Target Start-Up Approval Time**
TTOT	**Target Take-Off Time**
TWR	**Control Tower**
TWY	**Taxiway**
VDGS	**Visual Docking and Guidance System**
VTT	**Variable Taxi-Times (EXIT and EXOT)**
WG	**Working Group**
WS	**Work Stream**

1. A-CDM FUNDAMENTALS

1.1 Operational Challenge

1. Airports today face significant operational constraints primarily due to the lack of predictability and insufficient operational information sharing amongst stakeholders.

2. This fragmented approach hinders the overall efficiency of airport operations. Without a unified platform for sharing real-time information, decision-making processes become suboptimal, leading to delays, misallocations of resources, and reduced capacity utilization.

3. The absence of a holistic view prevents stakeholders from anticipating and reacting to potential disruptions in a timely manner, exacerbating existing inefficiencies in the system.

4. Moreover, the lack of a collaborative approach amongst stakeholders hampers airports' ability to optimize their resources effectively. Runways, taxiways, terminals, parking stands, airspace, fleet, and other critical assets are managed based on isolated information, resulting in bottlenecks and congestion.

5. This situation not only affects the punctuality of flights but also has a cascading effect on the entire Air Traffic Management (ATM) network. The inefficiencies are further compounded by the competitive nature of the aviation industry, where each stakeholder prioritizes their individual objectives over collective optimization.

6. To move towards more efficient and streamlined operations, airports need to adopt an integrated approach where real-time data sharing and collaborative decision-making are at the core of their operational strategy. Implementing such a framework would enable stakeholders to make informed, synchronized decisions, thereby significantly enhancing the overall efficiency and capacity of airport operations.

1.2 What Is A-CDM

7. Airport Collaborative Decision Making (A-CDM) is an operational concept that involves re-designing airport airside processes by using timely-shared and more accurate information.

8. A-CDM aims to optimize airport capacity and operations through a collaborative approach where information is shared among all stakeholders, enabling them to carry out their operations consistently, considering all available information.

9. A-CDM originated in the early 2000s in response to growing challenges in airport management, focusing on improving information sharing and decision-making among stakeholders. Initially, piloted at several major European airports, the concept demonstrated significant enhancements in operational efficiency and reduction in delays.

10. Today, A-CDM is widely recognized and implemented across numerous airports worldwide. The collaborative approach ensures that information is shared among all

stakeholders, including airport operators, aircraft operators, ground handling service providers, and air navigation service providers.

11. This unified method enables all stakeholders to make informed decisions, leading to the optimized use of runways, taxiways, terminals, parking stands, airspace, fleet, and other critical resources.

12. By embracing real-time data sharing and collaborative decision-making, airports can better anticipate and respond to potential disruptions, ensuring smoother and more efficient operations.

13. The implementation of A-CDM has significantly improved the overall efficiency of airport operations, reducing delays and enhancing the performance of the Air Traffic Management (ATM) network.

1.3 Stakeholders

14. A-CDM focuses on the importance of the relationships between:
- Airport operator
- Aircraft operators (airlines)
- Ground handling services providers
- Air navigation service provider (ANSP)

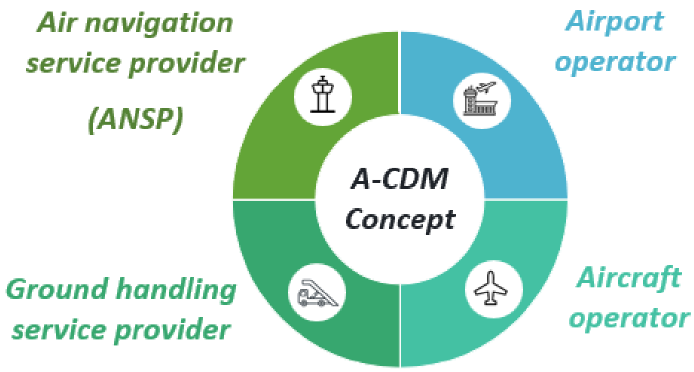

Figure 1. A-CDM Stakeholders

15. By sharing real-time information and collaborating in decision-making, stakeholders can achieve significant improvements in airport operations. This approach reduces delays and enhances ATM network efficiency through the optimized use of runways, taxiways, terminals, parking stands, airspace, fleet, and resources.

1.4 Single Source Of Operational Truth (SSOT)

16. The concept of a Single Source Of Operational Truth (SSOT) is a foundational principle of A-CDM, ensuring that all stakeholders work with the same operational events and associated information.

17. Implementing SSOT as part of the A-CDM project contributes to enhancing the quality of operations for all stakeholders.

18. By ensuring that every entity involved in airport operations works from the same set of accurate, up-to-date information, SSOT fosters a more harmonious and responsive operational environment. This not only contributes to streamlining decision-making processes but also significantly reduces the chances of miscommunication and errors.

19. The seamless integration of data from airport operators, airlines, ground handlers, and air navigation service providers creates a holistic overview of the entire operational landscape. Efficient real-time data sharing allows for more precise actions, whether for managing runway allocations, optimizing taxi times, or sequencing departures.

20. The SSOT is, in essence, about creating a unified and transparent operational environment. It emphasizes the importance of collaboration and real-time data sharing, ensuring that all parties have access to the same information and can work together seamlessly.

21. The SSOT is enabled through:
- An agreed set of data sources.
- An effective system architecture, including system integration, where all relevant operational data is gathered from various sources, processed, and disseminated to the appropriate stakeholders.

22. An important element of the SSOT is the univocal and exhaustive correspondence of flight denomination for the different actors, including airport, TWR, and ground handling agents, i.e. the ICAO/IATA codes for airports or airlines and the information associated with each flight.

1.5 Milestone Approach

23. The milestone approach in A-CDM is designed to ensure that all stakeholders, including airport operators, airlines, ground handlers, and air navigation service providers, are aligned in their operations.

24. By defining and identifying these key milestones throughout the flight's journey, the stakeholders can coordinate their actions more effectively, ensuring a smooth and efficient flow of operations.

25. Each milestone represents a critical operational event or checkpoint that is relevant to all parties involved and has been agreed upon.

26. The use of common milestones contributes to synchronizing activities and solidifies the SSOT for all stakeholders.

27. For each milestone, it is crucial to identify and monitor the specific data sources and touch points to ensure smooth operations and informed decision-making.

28. These data sources could include various systems capable of providing flight schedules, aircraft movement data, passenger information, and should be as automated as possible.

29. A clear understanding of these data sources and touch points ensures that stakeholders have access to accurate and timely information, which is crucial for effective decision-making.

30. One of the key aspects of the milestone approach is the use of standardized timestamps. All stakeholders must use the same timestamps to record and track operational events, ensuring a single source of truth for all parties., This eliminates discrepancies and miscommunications, creating a transparent and cohesive operational environment where everyone works from the same set of facts. This shared understanding is vital for coordinating activities, especially during disruptions or unexpected events.

31. Adopting the milestone approach can foster greater collaboration and trust among stakeholders. Aligning each stakeholder on the same milestones and using the same data sources and timestamps creates a more harmonious and efficient operational environment.

32. This collaborative approach enhances the overall performance of the airport and contributes to a more resilient and adaptive aviation industry. By focusing on common milestones, stakeholders can work together more effectively to achieve their shared goals, ultimately leading to improved service quality and customer satisfaction.

33. The A-CDM milestone format will typically be associated with a 4-letter acronym that has a clear definition and must be agreed upon by all stakeholders.

34. Some A-CDM implementations may be required to adhere to a certain set of pre-selected milestones to ensure a higher level of standardization such as the cases of China and Eurocontrol.

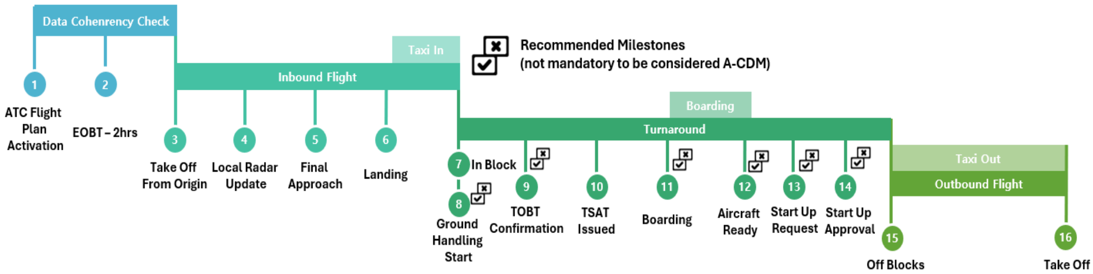

Figure 2. Milestone Approach for Eurocontrol's A-CDM Model

1.6 Variable Taxi-Time (VTT)

35. In the context of A-CDM, variable taxi times (VTT) are crucial for maintaining the efficiency and predictability of airport operations.

36. Taxi times refer to the duration an aircraft spends taxiing, either from the gate to the runway before take-off or from the runway to the gate after landing. These times can fluctuate due to a range of factors such as airport traffic, weather conditions, and operational constraints. By closely monitoring and managing variable taxi times, stakeholders can optimize the flow of aircraft on the ground, reduce delays, and improve overall airport performance.

37. Two important metrics associated with taxi times in A-CDM are the Expected Taxi-In Time (EXIT) and the Expected Taxi-Out Time (EXOT).

- EXIT is the estimated duration from the moment an aircraft lands on the runway until it reaches its designated gate, corresponding to the Estimated In-Block Time (EIBT). This metric helps ground handlers and gate management teams efficiently prepare for the aircraft's arrival, ensuring that all necessary resources, such as ground support equipment, personnel, and gate availability, are in place, facilitating a quick and smooth turnaround process.
- EXOT is the estimated duration from the moment an aircraft starts taxiing from its gate until it reaches the runway for take-off.
- EXOT is used to sequence departures efficiently, helping to minimize congestion and optimize the use of taxiways and runways.

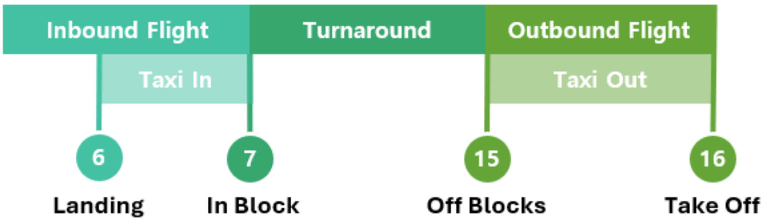

Figure 3. Taxi-In and Taxi-Out

38. The accurate prediction and management of EXIT and EXOT are vital for two main reasons:
- **Enhanced Coordination**: They enable better coordination among the various stakeholders, including air traffic control, ground handlers, and airlines, by providing a clear timeline for aircraft movements. This coordination ensures that all parties are aligned and efficiently manage their respective tasks.
- **Single Source of Operational Truth (SSOT)**: They contribute to the single source of operational truth by ensuring that all parties have access to the same accurate and timely information.

39. This shared understanding enhances decision-making, reduces the risk of miscommunication, and improves the airport's ability to respond to unexpected events.

40. By effectively managing variable taxi times through metrics like EXIT and EXOT, airports can achieve smoother and more efficient operations, leading to increased satisfaction for both passengers and airlines.

1.7 Departure Sequencing

41. A-CDM introduces an optimization for the flow of departures that is carried out considering several elements associated with the immediate and upcoming available capacity, existing demand and the rule setting agreed by all stakeholders.

- **Rate of Departure**: Set by the control tower and associated with the capacity of the runway and airside.
- **Readiness Status and Flight Scheduling**: Provided by the ground handling agents by delegation of airlines and aircraft operators, for departing flights.

- **Functionalities and Constraints**: Agreed upon by all stakeholders, such as Air Traffic Flow Management (ATFM), Calculated Take-Off Times (CTOTs), and airline preferences (e.g., prioritization, flight swapping, etc.).

42. The purpose of the departure sequencing is to establish an automated, transparently built, predictable, and known-to-everyone departure order that will be updated and adjusted according to the latest available information. The sequence will be built to prevent congestion whilst keeping the runway continuously fed.

43. To build the departure sequence, it is necessary to rely on a sequence-generator system (PDS), which can be either under the responsibility of the control tower or the airport.

1.8 Benefits of A-CDM

44. A-CDM introduces a new operational environment in which airside operations are predictable and transparent to all stakeholders.

45. With A-CDM, it is possible to optimize departures flows, reduce unnecessary waiting times, and prevent runway capacity wastage.

46. The agreed A-CDM milestones allow continuous traceability and assessment of the main operational variables.

47. A-CDM brings a more efficient way of operating at the airport that could result in a reduction in operational buffers and an increase in declared capacity.

48. When integrated with an ATFM network, the airport can exchange information in real-time with the network, facilitating a higher level of awareness and continuous airspace optimization based on the latest information.

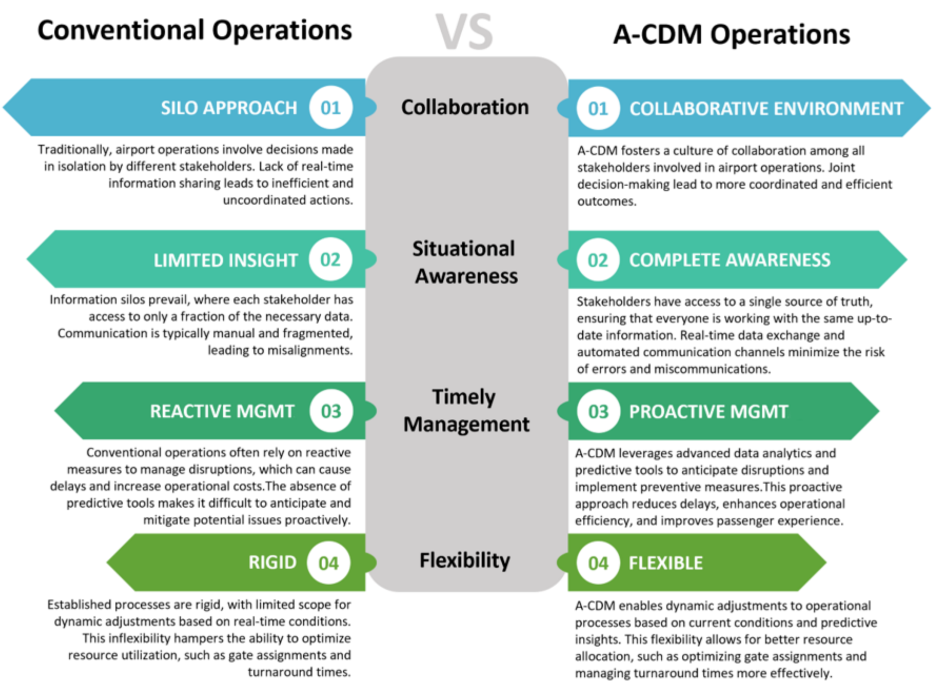

Figure 4. Conventional vs A-CDM Operations

2. A-CDM SYSTEMS

49. The information sharing and processing associated with A-CDM must be supported by integrated systems to enable the seamless exchange of operational data across stakeholders and systems.

50. These systems include, but are not restricted to:

- Airport Operations Database (AODB)
- A-CDM Information Sharing Platform (ACISP)
- Pre-Departure Sequencer (PDS)

2.1 Airport Operational Database (AODB)

51. The AODB is an airport system that processes and registers the information associated with flights operating at the airport, including flight plan information such as plane registration, airline information, scheduled times, assigned stands and other relevant information for the airport. The AODB is typically linked to other systems such as the Fixed Resource Management System (FRMS), Flight Information Display Systems (FIDS) and the Visual Docking Guidance Systems (VDGS).

52. In an A-CDM environment, AODB should have:

- Milestones and operational events aligned with the A-CDM project.
- Ability to dynamically update certain variables of a flight, such as the Estimated Landing Time (ELDT).
- Ability to process different sources and establish prioritization of sources.
- Ability to generate alerts and warnings to be shared with other stakeholders.
- Ability to develop a logic to build additional data in real-time, such as the estimated in-block time.
- Ability to register data for performance and post-operational analysis.

53. To support the A-CDM operational environment, the AODB can be either upgraded or fully substituted depending on existing capabilities and required functionalities.

2.2 A-CDM Information Sharing Platform (ACISP)

54. ACISP serves as a central tool in A-CDM, acting as the enabler of the SSOT. It facilitates the exchange of operational data by both pulling and pushing information from and to stakeholders, along with alerts and potentially other relevant information.

55. To ensure comprehensive and exhaustive alignment of flight-plan information across stakeholders, the ACISP will continuously and automatically reconcile flight-plan data through coherency checks, ensuring information consistency.

56. For this purpose, it is important that the ACISP have a multi-channel structure, including a web-based platform compatible with handheld devices, a system capable of generating alerts and reports, and accessible for all relevant stakeholders.

57. The ACISP should be accessible to all stakeholders, displaying all relevant A-CDM information, including milestones and alerts.

58. It is recommended that the ACISP has certain input capabilities, allowing stakeholders such as ground handlers or airlines to directly enter information when needed.

59. The ACISP should be integrated with other systems at the airports, such as the AODB, VDGS, RMS and the PDS, to enable automated information exchange.

60. The ACISP should be integrated with the control tower to enable automated data exchange.

61. The ACISP could be integrated with ground handling systems, depending on the volume of information to be exchanged and the internal processes.

62. The ACISP could be integrated with airline systems according to the needs of the airlines (e.g., hub carrier vs low-cost carriers). Typically, the greater the number of operations an airline has, the more interested it will be in integrating its operational systems.

63. If the ACISP and the ground handling and/or airlines' systems are not integrated, the immediate consequence is that the exchange of information will not be automated. In this case, the ACISP, in addition to ensuring awareness, can serve as the input channel for certain information or requests, such as TOBT updates and prioritization.

2.3 Pre-Departure Sequencer (PDS)

64. The PDS is a tool that allocates a start-up time to each flight based on:

- Existing demand for departing flights at the airport
- Existing runway capacity set through the "departure rate" value by the TWR
- Hard operational constraints that need to be met:
    - Air Traffic Flow Management (ATFM) measures expressed through CTOT (calculated take-off time)
    - VTT associating each stand of the departing flight with the threshold of the runway in use
- Soft operational constraints that need to be agreed upon by stakeholders and are associated with functionalities that benefit airline operations:
    - Airline prioritization
    - Airline flight swapping
    - Arrival airport curfew prioritization
    - Slot apportionment to distribute waiting times evenly
    - Adverse conditions capabilities to cope with unexpected or non-nominal situations

65. The PDS is typically the most complex tool to be specified, developed, validated, and implemented in the A-CDM project. Its complexity increases based on the functionalities expected and requested from the PDS.

66. In certain cases, some A-CDM implementations rely on a system that is able to sequence departures at the runway threshold, considering variables such as Standard Instrumental Departures (SID) and wake turbulence separations. This system is known as "Departure Manager" (DMAN).

67. Depending on the A-CDM implementation strategy for the airport, and in agreement with all stakeholders, the PDS tool can be complemented or fully substituted by the DMAN.

68. The PDS tool is expected to provide a dynamically optimized departure sequence that is continuously updated based on real-time information provided.

69. The PDS should have a variable parameter associated to the number of aircraft waiting to take-off at the holding point, generally up to three or four aircraft. This waiting time is known as dwell time.

70. The PDS tool should allow manual modification of parameters such as the runway departure rate, dwell time at the runway threshold and taxi-times.

2.4 System Integrations

71. The information exchange is a key pillar of A-CDM and can only be enabled through live, automatic, and dynamic information sharing amongst stakeholders.

72. The exchange of information should be structured around the agreed milestones but should not be limited to them.

73. Additional information to be exchanged may include:

- Alerts
- Performance indicators
- Non-flight related information such as:
  - Departure rate
  - RWY in use
- Weather information

74. The system integration of the A-CDM should include the direct flight information exchange between the PDS system and the ATFM network, if available.

75. It is recommended that the system integration be planned with consideration for potential scalability and additional data sources.

76. The SWIM protocol is currently the most advanced standard for flight-data management and exchange.

77. The airport is likely the stakeholder with the heaviest burden in terms of system integration due to the several external and internal integrations required.

78. As external partners:

- Control tower (obligatory)
- Ground handlers (optional, depending on each case)
- Airlines (optional, depending on each case)

79. As airport internal units:

- Airport management systems (AMS)
- Billing units
- Performance systems

- VDGS
- Turnaround monitoring system
- Stand management system

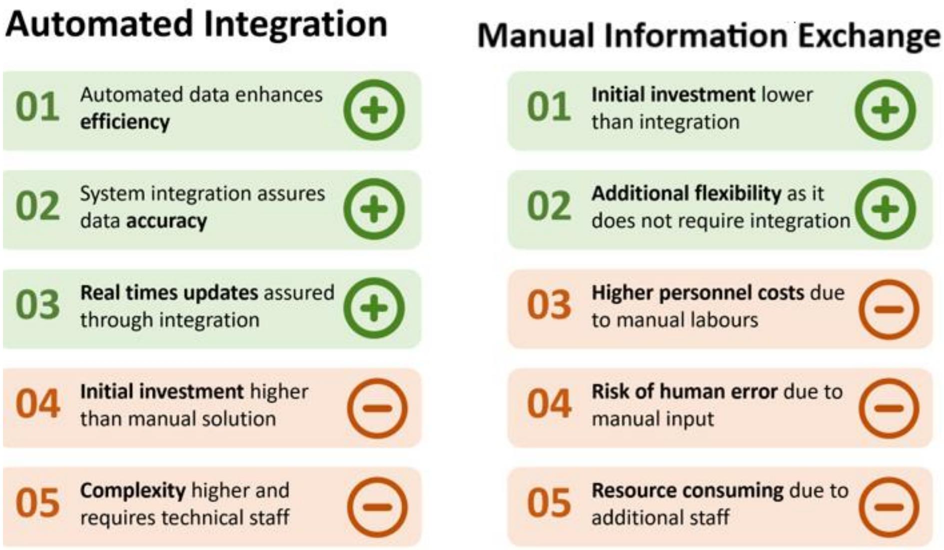

Figure 5. Automated vs Manual Information Exchange Flow

3. SEQUENCE-BUILDING PROCESS

80. One of the main features of A-CDM is the automated generation of an optimized departure sequence through the PDS, based on dynamic demand and a defined departure rate associated with runway capacity.

81. An optimized departure flow means to evolve from a “First arrive, first served” approach to a “Best planned, best served” approach. Airlines and ground handlers provide the readiness status for each flight through the TOBT, and the PDS tool generates a start-up approval sequence using a TSAT value associated to each flight, considering all relevant factors.

3.1 Departure Rate

82. The departure rate is not capacity itself, but rather a measure of how the runway capacity is managed.

83. In an A-CDM environment, the runway departure rate, or simply “departure rate” is a critical value set by TWR that determines how the runway will be used.

84. The departure rate will determine, through the TSAT, the cadence of the flow of aircraft from the stands to the runway.

85. The TTOTs will be allocated based on the departure rate, i.e., a departure rate of 30 departures/hour implies a TTOT spacing of 2 minutes, whilst a departure rate of 20 departures/hour implies a 3-minutes interval between each TTOT.

3.2 TOTT and TSAT Relation

86. To generate the TSAT, the PDS will anticipate a theoretical runway usage based on the departure rate, considering the expected/desired off-block time submitted through the TOBT value and the taxi-time from the current stand to the threshold of the current runway in use.

87. Considering these values, the PDS will generate a theoretical sequence at the runway, associated with a single Target Take-Off Time (TTOT) to each flight based on the earliest availability for take-off.

88. From the TTOT for each flight, the PDS will assign a TSAT by subtracting the taxi-out time: *TSAT=TTOT−EXOT.*

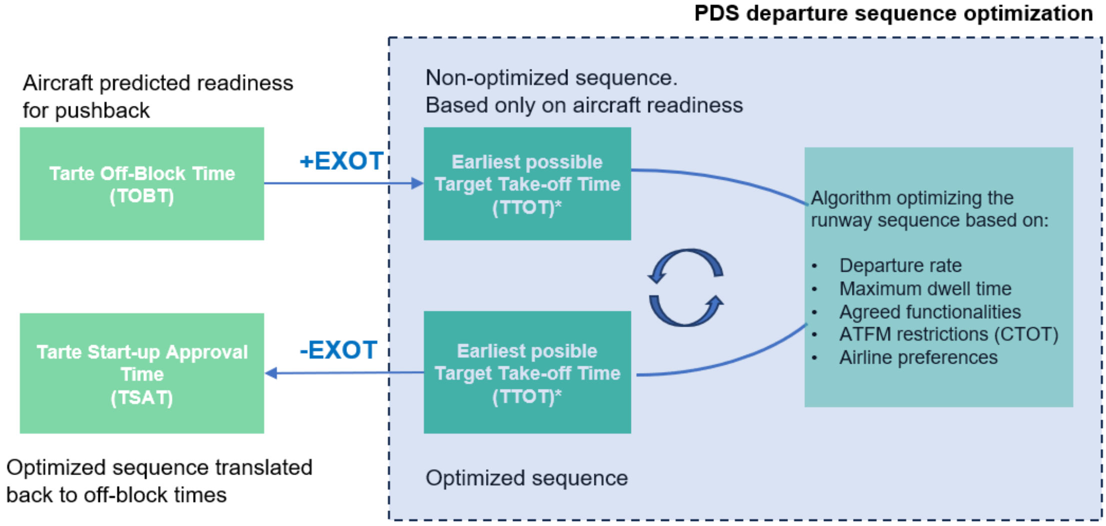

Figure 6. Description of the TOBT-TTOT-TSAT Relation

3.3 Theoretical Sequence vs. Actual Sequence

89. A-CDM departure sequence is generated by the PDS based on a theoretical use of the runway, where each departing flight is assigned a specific and single TTOT. The cadence of the TTOTs is related to the runway departure rate set by the TWR.

90. The theoretical use of the runway with the TTOTs is used to back-calculate the TSAT for each flight according to the EXOT values. In real operations, taxi times can deviate due to slower/faster taxiing, waiting times at the holding points of the runway, unexpected delays, etc.

91. For this reason, the Actual Take-Off Time (ATOT) of a flight is likely to be different from the TTOT.

92. TSAT is a critical value in the A-CDM environment, and the actual off-block time (AOBT) value should be very close to it.

93. TTOT is not a critical value for A-CDM, and the Actual Take-Off Time (ATOT) value can be affected by numerous factors under the exclusive responsibility of ATC, such as taxiway time, dwell time, unexpected situations, flight deck request, etc.

94. Whilst ASAT vs. TSAT is a critical KPI for A-CDM, TTOT vs. ATOT could be considered less critical, though still important.

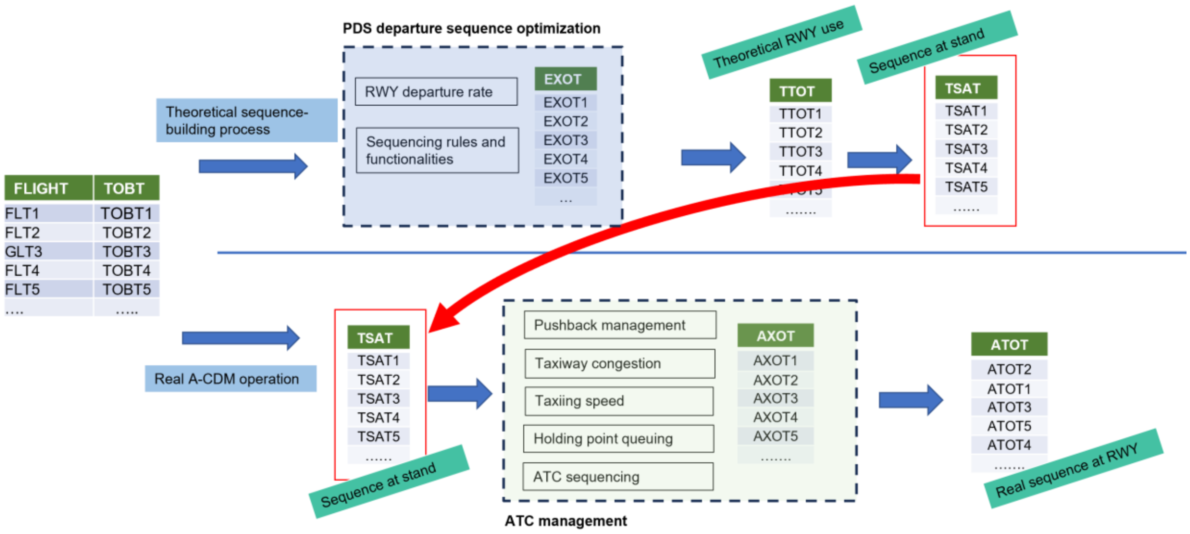

Figure 7. Theoretical vs Actual Sequence Built on TSAT. TTOT vs ATOT.

4. A-CDM KEY PROCEDURES

95. The final goal of A-CDM is to develop a shared operational environment through information exchange amongst stakeholders and supported by their system integration.

96. The shared operational environment is built around common procedures that need to be aligned amongst stakeholders.

97. The procedures that shape the operational environment need to be developed according to the systems and will describe the actions of different stakeholders in various situations.

98. The procedures will be built around milestones, alerts, and information available in the system, and will be clearly defined and complemented.

99. Each A-CDM implementation will result in a set of procedures specific to each airport environment, and considering the specifics of the implementation with factors such as:
- Availability of the information (i.e., ATFM network)
- Level of technology
- Level of system integration with stakeholders
- Number of alerts

100. Typically, there will be at least three common procedures that can be expanded:
- Arrival procedure
- TOBT submission and TSAT generation
- Start-up approval

101. Whilst each A-CDM implementation is unique and requires a specific approach considering stakeholders, systems, and operational needs, some of the A-CDM procedures are common and can be associated with different phases of a flight at an airport.

4.1 Arrival Procedure

102. The owner of this procedure is typically the airport.

103. This procedure shall describe:
- The allocation of a stand to an incoming flight
- The ELDT and EIBT prediction for this flight

EIBT=ELDT+EXIT

104. The key milestones for this procedure are:
- ELDT, ALDT
- EIBT, AIBT

105. The origin of the data is typically:

- ELDT/ALDT: ANSP's TWR
- RWY in use: ANSP's TWR
- Stand allocated: Airport's RMS
- EIBT/AIBT: Airport's VDGS, GH's

106. The ELDT data is of particular importance in environments without ATFM network and can be built from a combination of sources:

- ANSP
- Airlines
- GH
- Non-conventional information sources from external commercial providers, such as ADS-B information services

107. The procedure will include elements such as:

- What information is available
- Hierarchy of sources for the ELDT
- Allocation of stands and updating information in case of last-minute changes
- Alerts in case of absence of arrival information or lack of stands
- Agreed alerts at certain moments of the flight (i.e. FAF, 10NM out)

108. The hierarchy of sources for the ELDT is determined through a quality assessment, comparing ELDT values for flights at different stages with the ALDT.

4.2 TOBT Procedure and TSAT Generation

109. The owner of the TOBT procedure is typically the ground handlers, delegated by the airlines, or the airlines themselves.

110. This procedure covers the submission of the expected readiness time for each flight to create a departure sequence.

111. The key milestones for this procedure are:

- TOBT
- TSAT
- TTOT
- AOBT

112. The origin of the data is typically:

- TOBT: Ground handler or airlines
- TSAT: Obtained from the PDS (TWR/ airport) considering the departure rate and the hard and soft constraints
- TTOT: Obtained from the PDS, associating associates an individualized theoretical runway usage time to each departure
- AOBT: Obtained from airport's VDGS if available, or the ground handlers

113. The TOBT submission is typically the most complex procedure of the A-CDM project because it involves assessing and projecting the flight situation (boarding, fueling, etc.). It is necessary to plan training and coaching activities accordingly.

114. Predictive tools can be integrated to generate an early TOBT value based on late arrivals and minimum turnaround time (MTT).

115. This procedure will cover when, how, and through which mechanisms TOBT values are submitted and how they can be updated.

116. In some A-CDM implementations, TOBT values can initially be predicted through different methodologies, resulting in a preliminary TOBT value, also known as POBT. Any POBT value for a flight is expected to be fully superseded by manual TOBT updates.

117. Manual TOBT updates, whether submitted by ground handlers delegated by the airlines or directly by the airlines, should take priority over any previously generated TOBT.

118. While TOBT manual updates are expected to be provided whenever new information is available, the frequency of TSAT updates should be limited to ensure the stability of the sequence for all the departing flights.

4.3 Start-Up Approval Procedure

119. The owner of this procedure is typically the control tower.

120. The procedure shall be developed in close coordination with airlines/aircraft operators and the airport.

121. This procedure describes the actions associated to the start-up request and approval.

122. The key milestones for this procedure are similar to the previous one:

- TOBT
- TSAT
- TTOT
- ASRT* (Actual Start-up Requested time) – optional milestone
- ASAT* (Actual Start-up Approval time) - optional milestone
- AOBT

123. An important element of this procedure is how the departure sequencing information is conveyed to the departing flight. The recommended method is through the VDGS equipment, as it ensures the awareness of each flight crew and reduces the need for continuous communication exchange between pilots and air traffic controllers at the TWR.

Figure 8. Example of VDGS Information

124. The origin of the data is typically:

- TOBT: Ground handler
- TSAT: Obtained from the PDS (TWR/airport) considering the departure rate and the hard and soft constraints
- TTOT: Obtained from the PDS
- ASRT: Registered by the control tower (Optional milestone)
- ASAT: Registered by the control tower (Optional milestone)
- AOBT: Obtained from airport's VDGS (automatic detection), if available, or the ground handlers

125. Certain flights, such as those operated by military, police, ambulance, and government entities, shall be exempted from all or some of these provisions. The procedure should outline how these exempted flights are to communicate with the Tower (TWR).

4.4 A-CDM Degraded Mode

126. Degraded A-CDM operations at the airport means that A-CDM functionalities will be limited to awareness and predictability when possible.

127. These situations can occur due to unexpected capacity constraints, surges in demand, technical failures, etc.

128. In these situations, while the milestones and the SSOT can be used, the TOBT submission and the sequencing functionalities are not applicable.

5. A-CDM IMPLEMENTATION

129. The implementation of an A-CDM environment requires active involvement from all stakeholders and a structured, step-by-step approach.

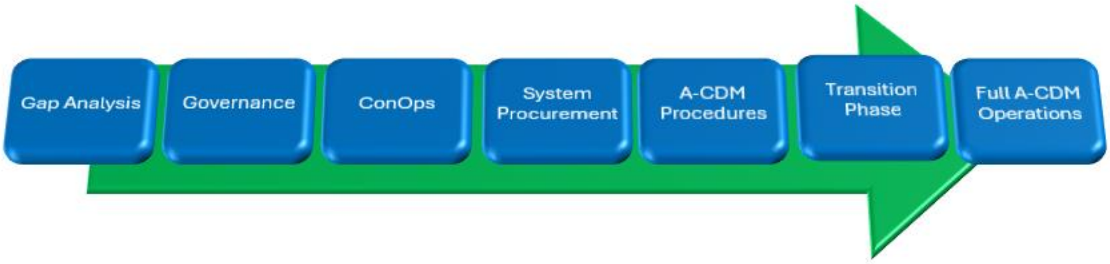

Figure 9. Proposed Step-by-Step Approach for an A-CDM Implementation Project

5.1 Governance Framework

130. The A-CDM operational concept requires a project management structure to support the progress and the achievement of the project's intermediate milestones.

131. The project management structure needs to be built considering all stakeholders of the A-CDM project, ensuring constant validation and agreement from each party. Only with a common alignment among stakeholders will the project be successful.

132. Each stakeholder should have continuous representation, with representatives possessing local operational experience and presence at the airport.

133. It is recommended that the A-CDM implementation project be structured with three distinct layers of governance:

- Steering Committee (SC)
- Working Group (WG) chaired by the project coordinator
- Expert Groups (EGs)

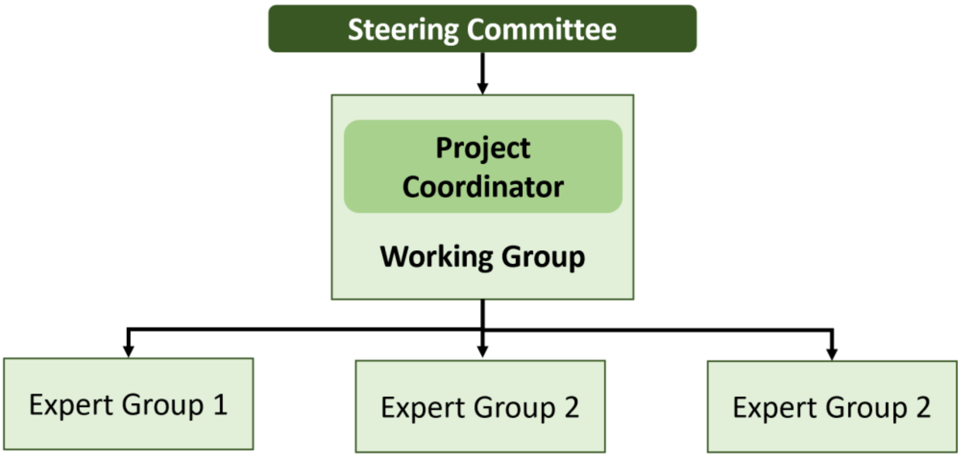

Figure 10. Proposed Governance Structure for an A-CDM Implementation Project

134. **Steering Committee (SC)**

The SC should be formed by these high-level executives or directly appointed representatives with decision-making capacity to prioritize actions and processes.

The SC is responsible for deciding the implementation strategy of the A-CDM Project.

The SC will be supported in its decision-making by the Working Group.

135. **Working Group (WG)**

The WG will consist of representatives and experts from the participating stakeholders.

The WG is chaired by the WG project coordinator, who will act as a point of contact between the WG and the Steering Committee.

The WG, through the project coordinator, will:
- Develop an implementation roadmap.
- Coordinate stakeholders' activities and recommendations.
- Monitor the progress.
- Seek completion and endorsement from the different work streams of the project.

136. **Expert Groups (EGs)**

The Expert Groups (EGs) will consist of representatives from the stakeholders and may also include representatives from various entities such as authorities, suppliers, or organizations.

The EGs have a supporting role in dealing with specific, specialist, technical, functional, and operational subject matters required for the implementation of the A-CDM Project.

The EGs are responsible for analyzing, assessing data elements and solutions, and can propose procedures, workarounds, etc.

Specific areas of the A-CDM implementation, as well as certain working packages, initiatives or activities can be delegated to an EG for further investigation and mitigation.

The establishment and activities of the EGs are decided by the WG. The EGs receive instructions from the WG and reports back to the WG`s project coordinator.

137. The project should begin with a clear endorsement from the future SC formed by CEO-level executives or the highest management. In some cases, this endorsement should also be extended to the regulator or/and civil aviation authority.

138. As a subsequent step, stakeholders should develop a Memorandum of Understanding (MoU) to structure stakeholder participation and define different levels of responsibility and decision-making capacity.

5.2 Baseline Assessment

139. As a first step in the implementation process, stakeholders should assess existing operational elements and agree on the current capabilities. A baseline assessment should focus on what is present rather than what is missing.

140. All procedures, staff preparedness, and existing systems should be reviewed transparently.

141. The output of the baseline assessment should identify mature areas and existing operational challenges where information sharing could be beneficial.

142. Typically, the baseline assessment is conducted with external support, alongside a gap analysis, as a preliminary step to the project's implementation actions.

5.3 Gap Analysis

143. After assessing the existing operational environment, it is necessary to identify the missing elements, which will logically lead to the A-CDM implementation roadmap.

144. The gap analysis is particularly important as it will compare the existing elements from the baseline assessment against a basic target scenario agreed by all stakeholders.

145. The target scenario will introduce a preliminary approach to the A-CDM environment, expected to align with the Concept of Operations, ConOps, to be developed at a later stage.

146. The definition of this target scenario is typically carried out considering available literature on A-CDM, the best practices and potential benchmarks from airports with similar characteristics.

147. The gap analysis is expected to identify specific missing elements at technical, procedural, and human levels for each stakeholder, considering the target scenario.

148. The gap analysis is a critical component of the A-CDM project, as it:

- Defines the operational approach to the project.
- Determines the implementation actions and the roadmap itself.
- Directly influences and shapes the ConOps.

149. External support can be very valuable at this stage, as it:

- Uses previous experiences to avoid mistakes.
- Avoids any risk of a biased approach among stakeholders.
- Ensures a transparent and accountable approach.
- Builds confidence among stakeholders and reduces resistance to project deployment.

150. The output of the gap analysis should transparently define the set of missing elements for each stakeholder.

5.4 Project Roadmap and Stakeholder Alignment

151. As a result of the A-CDM gap analysis, it will be possible to structure a project implementation plan and a roadmap that will exhaustively and comprehensively cover the missing elements for all stakeholders.

152. Different actions, activities, and developments can be grouped in work streams (WS) where stakeholders collaborate. For example, data integration activities will involve the IT areas of various stakeholders.

153. The roadmap should include various elements of the project and allocate sufficient and realistic timelines for each of them:
- ConOps
- System procurement
- Procedure development
- Training activities
- Transition phase to A-CDM operations

5.5 Concept of Operations (ConOps)

154. The ConOps is a critical element of the A-CDM project, as it defines the operational environment and specifies the areas of responsibility for each stakeholder.

155. The following elements are expected to be included in the ConOps:
- Milestones to be considered
- Sources and logic for the milestones, including the hierarchy of sources
- System architecture and information flows (milestones, alerts, KPIs, etc.)
- Adverse condition plan
- Sequence-building capabilities and functionalities
- Set of alerts including their origin, display, and associated actions with ownership
- Anticipation of shared procedures and responsibilities

156. The ConOps needs to be customized to the specific operational realities of the airport, addressing the needs and objectives of its stakeholders.

157. The ConOps needs to be endorsed by each stakeholder through the highest body of the A-CDM project, the Steering Committee.

158. The ConOps should include the initial set of alerts that will be part of the A-CDM operational environment.

5.6 System Enhancement

159. System procurement and upgrading activities should only begin once the ConOps has been endorsed.

160. System enhancement should start with the specification of the systems. The operational specifications and capabilities should align with those outlined in the ConOps.

161. The most complex system to be upgraded or procured is the Pre-Departure Sequencer (PDS) due to the departure capabilities required by airports and airlines.

162. System integrations should also be planned and executed in accordance with the ConOps and the previously approved roadmap.

163. The validation of the systems should be carried out in coordination with all stakeholders.

5.7 A-CDM Procedures

164. The A-CDM procedures could be drafted during the system enhancement phase and should be aligned with both the ConOps and the actual systems.

165. The procedures are specific to the systems that have been procured and need to be actionable and clear.

166. The validation and acceptance of the systems should be conducted in coordination with all stakeholders.

167. The system integration validation should include end-to-end testing and assessment of the accuracy and latency of the information exchanged.

168. Each stakeholder should individually cover system upgrades and procurement costs unless agreed otherwise at the beginning of the project.

169. The system integration costs should be shared among stakeholders unless agreed otherwise at the beginning of the project.

5.8 Performance Framework

170. In a shared operational environment, it is necessary to align the criteria for all stakeholders to jointly assess the outcome.

171. An A-CDM operational environment, through the milestone approach and the SSOT, will provide a higher data granularity and enable analytical assessment of operations.

172. Stakeholders need to agree on a set of parameters that will use the available data to assess operational performance through KPIs.

173. A set of KPIs should be selected and obtained automatically from the AODB or ACISP platforms.

174. Depending on the nature and the consideration given to the different KPIs, it may be desirable to display them in real-time on the ACISP (i.e., TOBT vs TSAT, OTP, etc.) or report them to the appropriate individuals (EXIT vs AXIT, TSAT vs AOBT, etc.).

175. The number and nature of the KPIs should be limited in the initial phases of the project.

When A-CDM is implemented and the operational environment is more mature, new KPIs can be introduced and will then enable identifying and analyzing bottlenecks, leading to actions for improvement.

5.9 Alerting Functionalities

176. The stakeholders should jointly define a set of alerts associated with normal operations.

177. The generation of alerts should be fully automated from the AODB and ACISP systems.

178. Alerts should be linked, when possible, to actions with clear ownership and be part of the A-CDM procedures. Alerts not associated with specific procedures may lead to confusion, uncertainty, and unnecessary workload.

179. It is recommended to limit, at least initially, the number of alerts to those that are essential and that have clear operational consequences and actions.

5.10 Training and Communication

180. Implementing a shared operational environment requires general and specific upskilling of the workforce and a clear awareness of expectations for all staff and management.

181. Training should be coordinated and developed consistently with all stakeholders.

182. Training provisions should align with the A-CDM project implementation roadmap and include all general and specific A-CDM operational features.

183. A communication plan is highly recommended to increase overall awareness and incentivize engagement and participation.

184. Communication activities need to be coordinated and planned according to the A-CDM implementation plan.

5.11 Transition Phase to A-CDM

185. The A-CDM operational concept can only be considered as implemented when all stakeholders conduct their normal activities within a shared operational environment.

186. Evolving from conventional to A-CDM operations is the culmination of the A-CDM project and requires careful planning.

187. The transition should be reflected in a transition plan agreed by the WG and endorsed by the SC.

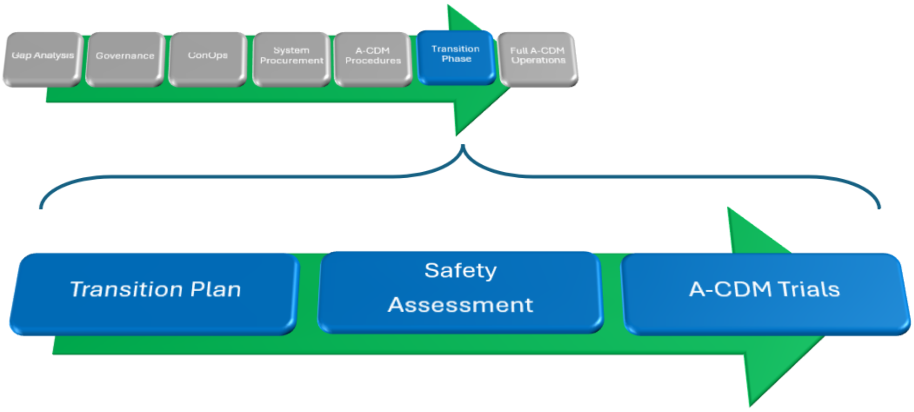

Figure 11. Stages of the Transition Phase

Transition plan

188. To effectively achieve this operational environment, it is necessary to design and agree on a transition roadmap that covers all necessary actions to ensure a successful new operational environment.

189. The transition timeline should be initiated in a coordinated manner and fully agreed upon by all stakeholders.

190. The transition phase should avoid peak seasons or environments with potential operational pressure (e.g., high-demand events, meteorology, peak times).

191. It will begin with limited periods during hours of lower-than-normal than normal demand and sufficient spare capacity. These periods will be progressively expanded.

192. All stakeholders will conduct daily follow-ups of the transition phase to identify potential improvements or needs.

193. The transition phase to the A-CDM environment will be covered in a specific document: the A-CDM Transition Plan.

194. The A-CDM Transition Plan will include:

- Timeline for the phases
- Success criteria
- Potential mitigations (capacity capping, fallback mechanisms, etc.)
- AIP publishing timeline (for the start-up approval procedure, if needed)

Safety assessment

195. Although A-CDM poses no operational risk, it is recommended to conduct a safety assessment involving the regulator and seek explicit approval before initiating the transition phase.

196. The safety assessment should include a multi-stakeholder risk-identification session and should examine:

- The A-CDM ConOps agreed by all stakeholders
- Applicable A-CDM procedures and proposed AIP publication

- A-CDM training plan that has been followed/is being followed
- A-CDM transition plan

197. As a result of the safety case, there could be potential mitigations such as capacity reductions, procedures modifications, or other measures that should be completed before initiating the transition phase.

198. AIP updates should be planned according to AIRAC cycles, with submission for publishing to take place after the safety assessment.

A-CDM trials

199. Only once that the safety case has been completed and the identified mitigations have been implemented, can the effective transition to A-CDM be initiated through A-CDM trials.

200. The transition should be implemented gradually during periods of considerable spare capacity to avoid any impact on operations. These periods would progressively increase until all operations are conducted in an A-CDM environment.

201. The transition phase requires continuous monitoring by the A-CDM WG examining:
    - Objective elements: KPIs, impact on operations
    - Subjective elements: Surveys completed by involved operators, specifically TWR and ground handling staff

202. Depending on the monitoring outcomes, the A-CDM WG can make the following decisions:
    - If successful, expand the periods under A-CDM conditions.
    - If not successful and depending on the severity:
        - If more familiarization time is needed, extend the trials.
        - If judged to be a failure, revert to conventional operations and find an appropriate solution to re-initiate the process.

203. Only when all stakeholders are confident, the A-CDM WG will elevate the proposal to the A-CDM SC to fully and formally migrate to an A-CDM environment, subject to A-CDM SC endorsement.

5.12 A-CDM and ATFM Integration of the Airport in the Network

204. Both ATFM and A-CDM are collaborative processes built on information exchange, aimed at improving operational efficiency by optimizing the use of resource capacities at airports and in airspace.

205. Integrating ATFM and A-CDM allows for automated integration of airport information into the ATFM network, improving and optimizing network capacity use in the most efficient way. Conversely, integrating ATFM network information into the A-CDM process enhances accurate planning and utilization of airport resources during the aircraft turnaround phase.

206. The integration of ATFM and A-CDM is centered on continuous, automated, and seamless exchange of operational information between the two systems, focusing particularly on the dynamically exchange of updated times associated with the arrival (ELDT) and departure (TTOT) milestones.

207. Recommended information to be exchanged from the ATFM system to the A-CDM environment includes:

- ELDT for arriving flights, providing accurate, dynamic predictions of landing times and potentially including arriving flight status information (i.e., departure from outstation)
- CTOT (Calculated Take-Off Time) allocated by the ATFM unit to departing flights as part of the ATFM measure imposed upon them

208. Recommended information to be exchanged from the A-CDM environment to the ATFM system includes:

- Departure planning information
- ATOT: Updated airborne information
- Existing departure rate at the airport environment

209. The departure planning information to be shared from the airport environment to the ATFM can include:

- TOBT/TTOT information
- AOBT

This exchange of information can be done through discrete messaging, such as the DPI messages in Europe, or as a data feed shared with the ATFM network.

210. As mentioned earlier, an early departure sequence based on EOBT and POBT can be very valuable for planning ATFM measures in congested airspace (i.e. re-routing, level capping, regulations, etc.).

211. Shared information fosters common situational awareness, which is essential for effective decision-making and traffic management.

212. The integrated information flow, supported by collaborative procedures, provides real benefits such as:

- Better management of the network, thanks to the common situational picture enabling better understanding and enhanced CDM among the stakeholders.
- Improved traffic prediction and more accurate resource capacity declaration, thanks to expanded information sharing.
- Ability of the ATFM system to consider A-CDM airport constraints impacting relevant flights when making demand-capacity balancing decisions.
- Access for the airports to more accurate flight updates from the ATFM system, enabling a more optimized aircraft turnaround process upon arrival.
- Access for all stakeholders to comprehensive information and better situational awareness, enabling more effective contributions to both the ATFM and A-CDM processes.

213. Regional ATFM networks that include cross-border environments are part of ICAO's Global Air Navigation Plan (GANP) and should be implemented worldwide to promote efficiency across the airspace.

214. There are ongoing initiatives to integrate A-CDM and airport departure information in regional ATFM networks such as in Europe (Eurocontrol), Asia Pacific, (Bobcat), Latin-America (Cadena), etc.

215. The ANSP, as ATFM and TWR operator, is required to choose an appropriate message exchange infrastructure, such as through SWIM-based technologies, to facilitate information exchange in a multiple airport A-CDM environment (i.e. Europe uses FUM -Flight Update Messages- compatible with SWIM protocol).

6. CRITICAL ELEMENTS AND CHALLENGES

216. Adopting an A-CDM operational environment implies re-designing all processes, which entails a significant change.

217. A-CDM implementation projects can face significant challenges at different stages of development, as they need to consider technological, procedural, and human changes in terms of change management.

218. Each A-CDM implementation has its own characteristics, including different constraints from existing stakeholders (technical, procedural, etc.).

219. A specific approach tailored to the operational needs of each airport is required.

6.1 Cultural Change

220. A-CDM involves creating a commonly owned operational environment based on continuous information sharing. It is necessary to break the traditional silo approach and the traditional culture of blame avoidance.

221. Continuous communication and training with all stakeholders are necessary to build an environment that fosters collaboration amongst.

222. It is highly recommended to establish a cross-stakeholder A-CDM community where all stakeholders are committed and can collaborate effectively.

6.2 Concept of Operations, AODB, ACISP and PDS Functionalities

223. The A-CDM ConOps is one of the most important elements of the project. It defines the operational environment and information flows, and it is essential that all stakeholders endorse this new environment.

224. The ConOps should be exhaustive and comprehensive to prevent potential misunderstandings or incorrect assumptions that could lead to suboptimal system procurement or flawed procedural designs.

225. For A-CDM to be successful, the system architecture and information flows must be meticulously designed and agreed upon by all stakeholders. This collaborative approach ensures that each system integrates seamlessly with others, providing a robust and reliable information-sharing network. As example, AODB and ACISP systems should be fully integrated to ensure consistency and timely updates.

226. The functionalities of the PDS system regarding the sequence-building process and the capabilities to introduce additional features such as flight swapping, flight prioritization, and slot apportionment should be discussed and agreed upon at this stage.

6.3 System Specification and Procurement

227. Poor system specification can lead to gaps in functionality, while improper procurement might result in incompatible systems. Furthermore, inadequate validation can cause discrepancies in data accuracy and reliability.

228. If the systems are not specified, procured, or validated correctly, the A-CDM operational environment defined in the ConOps will not be successfully implemented.

229. System integrations need to be planned earlier and should consider potential enhancements in the system ecosystem, i.e., new system integrations with ground handlers or airlines, or with new systems such as a Turnaround Monitoring System (TMS).

6.4 Training Plan

230. For the implementation of an A-CDM project, a training plan should be approved by the A-CDM WG.

231. The training plan should focus on:
- Upskilling the staff to perform their duties in accordance with the new A-CDM environment.
- Ensuring full understanding and readiness for the project.
- Coordinating efforts amongst all stakeholders.

232. The training content should be aligned with the systems and procedures in use.

233. The training activities should be coordinated among all stakeholders to ensure unified approach. However, each stakeholder should also consider developing specific content tailored to their needs to effectively operate in the new operational environment.

234. All appropriate staff should receive training before performing any duties in the A-CDM environment.

235. The training content should be part of the safety case. If potential mitigations require changes to procedures or systems, the training content should be updated accordingly.

6.5 Communication Plan

236. For the implementation of an A-CDM project, a communication plan should be approved by the A-CDM WG.

237. The communication plan should focus on:
- Increasing and maintaining awareness and engagement of staff involved in A-CDM.
- Contributing to the formation of an A-CDM community that includes all stakeholders.
- Motivating and engaging the staff by highlighting the benefits of the project and the progress being made.

238. The communication activities need to be planned and coordinated in a timely manner according to the A-CDM implementation roadmap.

6.6 Transition Phase

239. The transition from conventional operations to an A-CDM environment is the final milestone of the project and requires intense coordination amongst stakeholders. This transition should be planned by the A-CDM WG.

240. The transition plan can include:

- Planning for the training activities
- Communication activities
- Systems' end-to-end testing if not carried out earlier
- AIP publication timeline if needed
- Timeline for the A-CDM trials.

241. Depending on the regulation, a safety assessment may be recommended or mandatory before initiating the A-CDM trials.

7. RECOMMENDATIONS FOR A-CDM IMPLEMENTATION

7.1 People

242. A-CDM involves stakeholders with diverse specializations and cultural backgrounds. A non-negligible degree of patience and soft skills are required to make progress in the implementation project.

243. Cultural change is a critical element to break the traditional silo-approach and should never be underestimated.

244. Intense communication and specific training are essential to upskill the workforce and successfully implement and operate an A-CDM airport.

245. It is highly recommended to coordinate continuous and periodic meetings to facilitate cultural change, align stakeholders, and foster engagement and commitment to the A-CDM project.

246. Developing a common A-CDM community that includes all stakeholders requires a soft approach and a common understanding of the project.

247. High-level endorsement and explicit support to the A-CDM project are critical to ensure stakeholders' alignment.

248. An appropriate governance structure that ensures coordination and agility is essential for the project's progress. It is recommended that, once there is a high-level endorsement for the project, working group representatives dedicate full or near-full time to the project, considering the number of tasks involved.

249. Training should be conducted through e-learning platforms to ensure consistency of content for all stakeholders. It is recommended that training be structured in two parts:

- General A-CDM training: Common to all stakeholders, covering general A-CDM concepts and specifics of the airport (systems and procedures).
- Specific A-CDM procedure training: Targeting the staff involved in new procedures, including:
    - Ground handlers: TOBT submission and updates
    - ANSP: New start-up procedure

250. Communication activities are a powerful means of raising awareness and fostering engagement amongst stakeholders and their staff. At the beginning of the project, it is recommended to focus the communication activities on team-building and raising awareness of the project. In later stages, these activities should focus on informing stakeholders about the project's progress and expected benefits.

7.2 Systems

251. The specification of the systems should begin once there is a clear agreement on the A-CDM functionalities, and these have been explicitly outlined in the agreed ConOps.

252. ACISP specifications should include robust data-reconciliation checks, the generation of corresponding alerts, and the resolution of identified discrepancies to ensure data accuracy.

253. Stakeholders should coordinate the system integration activities and standardize them as much as possible to facilitate future evolutions, such as incorporating additional milestones and integrating with other systems.

254. System validation and integration should include end-to-end testing and a thorough examination of the compatibility of the systems with the operational environment and the functionalities described in the ConOps.

255. The most complex A-CDM system is typically the PDS. It is recommended that all stakeholders, particularly the airlines, are aware of it and define the capabilities accordingly.

Capabilities such as flight swapping, slot apportionment, and flight prioritization need to be specifically developed for the airport and may require more time and effort for their specification, procurement and validation.

7.3 Processes

256. Airports considering future A-CDM implementation will benefit from a solid operational strategy that integrates A-CDM into the Airport Operations Centre functionalities and associated processes.

257. It is highly recommended to align with international best practices and standardize A-CDM procedures so that the ground handling agents, flight dispatchers, and flight crews can operate at different airports with minimal changes.

258. It is recommended that the milestone denominations and the A-CDM acronyms in general follow a standard format aligned with ICAO's denominations.

259. Whilst the set of milestones is specific for each airport, it is highly recommended to evolve towards standardization across the industry and different regions, such as the case in Europe (Eurocontrol), China (CAAC) and South-East Asia (BOBCAT).

260. The A-CDM operational procedures need to be developed according to the technical environment and tailored to the systems in place.

261. Each procedure needs to clearly define the areas of responsibility of each stakeholder, the actions expected in each situation, and always specify the levels of accountability and responsibility.

262. Each alert should ideally be associated with actions. The alerts in the A-CDM project should be defined and agreed upon together with the A-CDM procedures and should be an integral part of them.

263. The alerts should be automatically generated based on the real-time status of the flight. The most important alerts which require immediate action are those related to the flight-plan reconciliation (data-coherency check) and potential issues in stand management (e.g., stand in use, stand not expected to be cleared).

264. It is recommended that the number of alerts not be increased unnecessarily with warnings that are not linked to procedures or do not represent any operational value.

7.4 Continuous Improvement

265. A-CDM operations provide a vast amount of operational information linked to the milestone approach, enabling stakeholders to conduct exhaustive and objective performance and quality assessments.

266. Stakeholders should align on a set of KPIs and variables to monitor and track their evolution through a structured approach.

267. All identified KPIs should be continuously assessed in an automated manner.

268. Performance indicators should be shared and commonly discussed to identify potential improvements and develop a common approach towards operational excellence.

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