



# AIRPORT COLLABORATIVE DECISION-MAKING: OPTIMISATION THROUGH COLLABORATION

An Introductory Guide for Air  
Navigation Service Providers

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<b>Acknowledgements</b>	page 2
<b>Executive Summary</b>	page 4
<b>Introduction</b>	page 5
<b>1 The Silo Effect – Slowing Down Operational Efficiency at Airports</b>	page 7
1.1 Primary Sources of Silos between Airport Stakeholders	page 7
1.2 Addressing Airport Challenges Collaboratively	page 8
<b>2 Principles of Collaborative Decision-Making</b>	page 10
2.1 From the Concept of CDM to the Process of Airport-CDM	page 10
2.2 Airside Airport-CDM	page 11
<b>3 Airport-CDM: A Philosophy of Open Communication Exchange</b>	page 12
3.1 Transparency	page 12
3.2 Sharing Information	page 13
3.2.1 Examples of Shared Information	page 13
3.2.2 Ways of Sharing Information	page 13
<b>4 Airside Airport-CDM Stakeholders</b>	page 14
4.1 Stakeholders	page 14
4.1.1 Air Navigation Service Provider / Air Traffic Flow Management	page 14
4.1.2 Airport Operator	page 14
4.1.3 Apron Control	page 15
4.1.4 Ground Handling	page 15
4.1.5 Airline	page 15
4.2 Secondary Stakeholders	page 15
<b>5 Airport-CDM Collaboration Levels</b>	page 16
<b>6 Steps to Success</b>	page 17
<b>7 Main Benefits of an Airport-CDM initiative</b>	page 19
7.1 Cost Reductions	page 19
7.2 Environmental Benefits	page 20
7.3 Capacity Optimisation	page 20
7.4 Improving Efficiency	page 21
<b>8 Conclusions and Recommendations</b>	page 22
8.1 Conclusions	page 22
8.2 Recommendations	page 22
<b>References</b>	page 23
<b>Annex: Case Studies</b>	page 24
1. Charles de Gaulle Airport, Paris, France	page 25
2. Chhatrapati Shivaji International Airport, Mumbai, India	page 27
3. Gatwick Airport, United Kingdom	page 30
4. John F. Kennedy International Airport, New York, USA	page 32
5. Rome Fiumicino Airport, Italy	page 34
6. Oslo Airport, Norway	page 37
7. Phoenix Sky Harbor International Airport, USA	page 39
8. Singapore Changi Airport, Singapore	page 41
9. Vienna International Airport, Austria	page 45
<b>Acronyms</b>	page 47

## **Executive Summary**

Committed to constantly provide the safest and most efficient service to their customers, air navigation service providers (ANSP) must remain at the forefront of air traffic management (ATM) innovation to maintain a high level of safety, support economical and efficient operations as well as future growth planned by airlines and airports.

To this end, the concept of airport collaborative decision-making (A-CDM) began more than a decade ago with A-CDM in Europe and its equivalent, Surface-CDM in the United States of America (USA), as a new path to optimise operations at airports through more efficient collaboration between all stakeholders.

This new approach, based on transparency and sharing information, is now a well-documented and strongly supported concept which is accepted worldwide based on concrete results at numerous airports.

Stakeholders implement A-CDM step-by-step based on their working and cultural environment, relationships, and operational objectives; and by collaborating at different levels ranging from exchanging basic information to common decisions and further extension of the collaborative decision-making (CDM) scope.

Progressive implementation brings tangible benefits both in daily and non-routine situations to all stakeholders in terms of mutual comprehension, optimising capacity, predictability, efficiency and recovery from irregular operations.

Judging from results obtained around the world by airports that have implemented A-CDM, and from the great potential of this concept to bring further safety and cost related benefits to the ATM world, the Civil Air Navigation Services Organisation (CANSO) and its Members regard implementation as a high priority.

CANSO has developed this Guide to assist in implementing the A-CDM concept and processes. The objective of this document, based on the experience of CANSO Members, is to support ANSPs to improve the efficiency of global air transport by outlining topics for consideration such as the involvement of relevant stakeholders when implementing A-CDM. Additionally, CANSO supports regional and local development and implementation initiatives by providing practical information and support in regional seminars and workshops.

This Guide is a high-level document mainly dedicated to ANSP managers, and by extension, to the managers of airports and airlines. It purposely considers A-CDM through a non-technical prism to bring the concept to a broad audience and focuses mainly on the ANSP's perspective in accordance with the primary mission of CANSO.

This Guide provides several case studies from around the globe to bring useful examples of concrete and effective A-CDM implementation.

## Introduction

Vision 2020 is the strategic framework of the Civil Air Navigation Services Organisation (CANSO) to transform global air traffic management (ATM) performance and deliver seamless airspace globally. A key element is to improve the performance of the airports that often represent a bottleneck in the air transport system.

Airport collaborative decision-making (A-CDM) is a process that provides a concrete response to the problem of congested airports. In recent years, it has become a key process supported by CANSO, the International Civil Aviation Organization (ICAO), Airports Council International (ACI), and the International Air Transport Association (IATA).

There are currently manuals on A-CDM and the associated standards, including Single European Sky ATM Research (SESAR), Next Generation Air Transportation System (NextGen) in the USA, and Collaborative Actions for Renovation of Air Traffic Systems (CARATS) in Japan, which incorporate variants of CDM. Each of these organisations and projects developed a vision according to their specific needs and context.

A-CDM is a change of mind-set and working methods involving the main stakeholders of an airport. This includes, at a minimum, the ANSP, airport operator, ground handlers, and the airlines. The objective is to improve the performance of airport operations and provide overall better predictability, by enabling the stakeholders to work together as a team for mutual benefit.

This process is based on transparency and sharing information between the main stakeholders that starts with the establishment of collaborative working methods and practices.

*Airport-CDM Optimisation through Collaboration: An Introductory Guide for ANSPs* presents the basic elements of A-CDM, including

the process, principles and expected benefits. It aspires to be useful, easy to understand and relevant to every ANSP across all continents and is aimed at managers and operational staff. This document focuses on the strategies rather than the technicalities, and provides guidance on the following topics:

- **The Silo Effect – Slowing Down Operational Efficiency at Airports** describes common information stovepipes at airports where information traverses through levels of a hierarchy efficiently but does not disperse widely, and why airport stakeholders should minimise these to progress in addressing their current and future operational and organisational challenges
- **Principles of Collaborative Decision-Making** introduces the broad scope of CDM and outlines its three main elements: en-route, airside and landside. As airside CDM is the element to which ANSPs most contribute, it focuses on the main principles, applicable situations and expected benefits of this airside collaborative approach.
- **Airport-CDM: A Philosophy of Open Communication Exchange** stresses that successful A-CDM implementation requires a working philosophy, which incorporates transparency and sharing information as the main pillars.
- **Airport-CDM Stakeholders** describes the primary and secondary stakeholders involved in an airport collaborative decision-making approach.
- **Airport-CDM Collaboration Levels** defines five levels of cooperation, from basic information and sharing data to connecting en route and landside into

A-CDM protocols and processes.

- **Steps to Success** describes five important steps of the continuous process when implementing an A-CDM initiative.
- **Main Benefits Derived from an Airport-CDM initiative** provides examples of realised benefits from implementation, including better understanding between partners, optimising existing capacities, predictability and improving efficiency.
- **Conclusions and Recommendations** outlines why ANSPs might want to further expand the implementation of A-CDM worldwide, and the CANSO activities to assist Members in this expansion.
- **Case Studies** have been gathered from CANSO Members around the world to provide practical examples of A-CDM

initiatives. These case studies provide an overview of the airport, and present the main reasons, objectives, phases, and results of the collaborative approach.

This CANSO Guide is a first step to help CANSO Members understand A-CDM. To expand the implementation of A-CDM, CANSO recommends that Members consider including this topic in the agenda of their CANSO and ICAO regional meetings and conferences to discuss initiatives and share experiences. In addition to these high-level and large-scale meetings, development workshops involving various stakeholders are often an effective means to further disseminate the principles among managers and operational staff and thus take a step forward in the implementation process.



Figure 1 - Elements to put in motion the A-CDM implementation process

## 1

## The Silo Effect – Slowing Down Operational Efficiency at Airports

Air navigation service providers, airlines and airport operators know that challenges in the aviation industry are highly demanding and simply maintaining and sustaining day-to-day activities is becoming increasingly more difficult due to increasing traffic volume, heightened security concerns, and emerging technologies.

Under financial and environmental constraints, there is a need to maximise assets within current budgets and with existing infrastructure. Stakeholders are tasked to attain maximum performance and service from their assets, while simultaneously delivering improved capacity and cost efficiencies.

Nevertheless, airport stakeholders often operate independent systems in isolation, focusing on their own outcomes and without a shared situational awareness across the wider airport community. This limited perspective on the operation as a whole can result in widespread inefficiencies.

Phil Ensor, a corporate director of Goodyear Tire, described in *The Functional Silo Syndrome* (1988), the organisational structure where lines of business are divided and isolated from one another leading to dysfunction. He coined the now famous phrase 'the Functional Silo Syndrome' to describe Goodyear's organisational difficulties due to employees working in lack of communication. "... communication is heavily top-down – on the vertical axis. Little is shared on the horizontal axis, partly because each function develops its own special language and set of buzzwords".<sup>1</sup>

### 1.1 Primary Sources of Silos between Airport Stakeholders

**Lack of Common Vocabulary and Definitions** – Groups with limited interaction often develop their own semantic references; this includes airport stakeholders as they may use different terminologies to cover the same reality. This lack of common definition and understanding of terms and processes across the stakeholder community can exacerbate misunderstanding and contribute to the lack of common situational awareness.

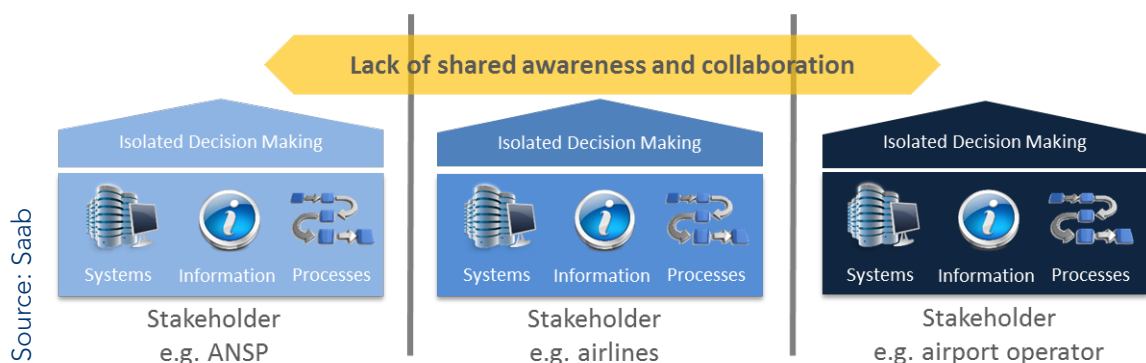


Figure 2 - Stakeholders operating in isolation

<sup>1</sup> <http://www.ame.org/sites/default/files/documents/88q1a3.pdf>

As example, “arrival time” to an air traffic controller (ATCO) or an airline could mean at the point of touchdown, whereas for ground handling agencies “arrival time” may be understood as the time when an aircraft is at the gate. This disparity in a common definition of terms leads to a lack of shared awareness and clarity of the operational picture, which can lead to confusion and result in increased inefficiencies.

**Lack of Information Exchange and Communication** - Another major factor that causes inefficiencies and misunderstanding among stakeholders is a lack of clear and concise communication and information exchange processes. There are many instances where departments and organisations work independently of each other and do not share information, data and concerns, which leads to decisions and actions being reactive rather than proactive, and are based on incomplete or faulty information.

Often, there are no recognised processes or agreements bringing all stakeholders together regularly. This denies stakeholders an opportunity to share their difficulties and successes with other members of the airport community. In addition, a lack of process makes it difficult to ensure that relevant information is shared with concerned stakeholders in a timely manner.

A common theme when looking at challenges faced by an airport community is that stakeholders are simply not aware of the needs, constraints, and goals of others, and how decisions and actions impact the other stakeholders and the operation of the system as a whole, often in an escalating fashion. The data and information required to enhance efficiency exists, and it must be shared within the network in real-time to facilitate better decision-making across the stakeholder community. This allows business partners to act more predictably - even during unusual situations, which is essential for a smooth overall process.

**Disconnected Strategies and Working in Isolation** - In an effort to improve their own performance, stakeholders may work independently to deliver increased efficiencies in their area without realising the impact on other stakeholders and thus, the overall operation, including their own. These disconnected or fragmented procedures, strategies, and systems often lead to decreased efficiency and performance across the entire operation.

For example, slippery runway conditions caused by snow may reduce runway capacity and create other constraints, such as aircraft departures being delayed. These delays may mean that more passengers are accommodated inside the terminal increasing pressure on existing check-in and security areas. In addition, if aircraft do not clear their gates in a timely manner, ground handling and other resources within the terminal are effected, potentially causing delays to inbound aircraft.

The entire airport community feels the impacts of delays. Without shared situational awareness across all stakeholders, and the ability to appropriately plan, both tactically and strategically, the delays can compound and escalate, further deteriorating the situation and leading to a blaming culture among stakeholders.

## 1.2 Addressing Airport Challenges Collaboratively

According to Phil Ensor, one functional consequence of information silos is that the organisation is unable to learn from its errors. Rather, it simply detects and corrects them without addressing the underlying symptoms, causing the same difficulties to occur repeatedly. To overcome this syndrome, the organisation has to learn how to engage in planned and vision-led change through better horizontal communication.

By establishing collaborative processes involving all stakeholders across landside and airside areas of an airport and the ANSPs, all



stakeholders can benefit from efficiencies within the system. Collaboration provides stakeholders with greater operational awareness, but realises its true benefits when information and data sharing lead to better and more informed strategic and tactical decisions.

A collaborative approach moves stakeholders from considering only their own requirements, and ensures that they become an active participant in achieving the common goal of improved safety and efficiency across the network of stakeholders.

Furthermore, when considering future investment proposals, it is important to consider the needs and requirements of the stakeholder community as a whole. To work in isolation without this consideration of the larger community, could result in a poor return on investment for both individual organisations as well as the stakeholder community.



Source: Saab

Figure 3 - Collaborative processes and information exchange

## 2

### Principles of Collaborative Decision-Making

#### 2.1 From the Concept of CDM to the Process of Airport-CDM

Air traffic management is a complex system that involves many stakeholders and processes. Stakeholders actively and passively participate in this system and are affected by the outcome of these processes. Rita McGrath (2011) advised that “Today’s decision makers face environments in which things that were isolated from one another just 30 years ago are bumping up against each other, often with unexpected results.”<sup>2</sup> When stakeholders and processes act independently, without collaboration and information sharing, predictability is limited and inefficiencies multiply. This lack of collaboration can lead to higher overall and individual operational costs.

The principle of CDM is to put in place agreed cross-collaborative processes including communication protocols, training, procedures, tools, regular meetings and information sharing, which moves ATM operations from stovepipe decision-making into a collaborative management process that improves overall system performance and benefits the individual stakeholders.

There are clearly defined Airport-CDM concepts and activities such as A-CDM in Europe, Surface-CDM in the USA, and CARATS in Japan. While there are clearly defined and shared Airport-CDM concepts and activities at the global level, the approach to the concepts and its implementation

may vary at the regional level such as A-CDM in Europe, or at the ANSP level, such as Surface CDM in the USA or CARATS in Japan. However, in each case they share common objectives and strategies.

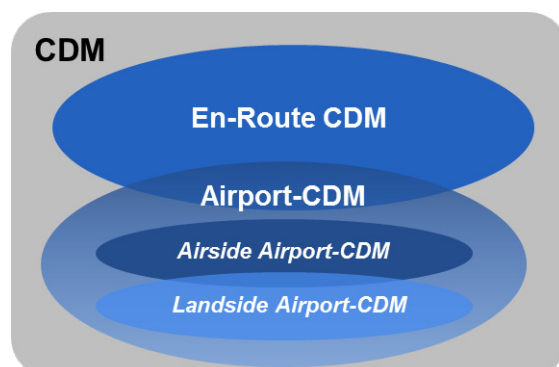
This document aligns CDM into the following categories and their respective area of focus:

- En-route CDM – focuses on routing and air traffic flow management operations
- Airport-CDM
  - Airside A-CDM – focuses on turnaround and surface management operations
  - Landside A-CDM – focuses on operations inside the terminal

Airport-CDM is a process that applies to all airports irrespective of size that supports landside, airside, and en route air traffic flow management (ATFM) operations, while enhancing forward planning and tactical decision-making. ICAO has included A-CDM as one of the Aviation System Block Upgrades (ASBU) Block 0 Modules to improve airport operations. The related key performance areas (KPA) are capacity, cost, efficiency and environment<sup>3</sup>.

IATA regards A-CDM as an “...effective management of existing airport capacity” and mandates its Airport Working Group to “implement operational improvements at airports, such as Airport-Collaborative Decision Making (A-CDM)”<sup>4</sup>.

Figure 4 - Various Elements of CDM in Air Traffic Management



<sup>2</sup> [https://hbr.org/2011/08/the-world-really-is-more-compl&cm\\_sp=Article\\_-\\_Links\\_-\\_Top%20of%20Page%20Recirculation](https://hbr.org/2011/08/the-world-really-is-more-compl&cm_sp=Article_-_Links_-_Top%20of%20Page%20Recirculation)

<sup>3</sup> <http://www.icao.int/sustainability/Documents/ASBU.en.Mar.%202013.pdf>

<sup>4</sup> [http://www.iata.org/whatwedo/workgroups/Pages/airport\\_atc.aspx](http://www.iata.org/whatwedo/workgroups/Pages/airport_atc.aspx)

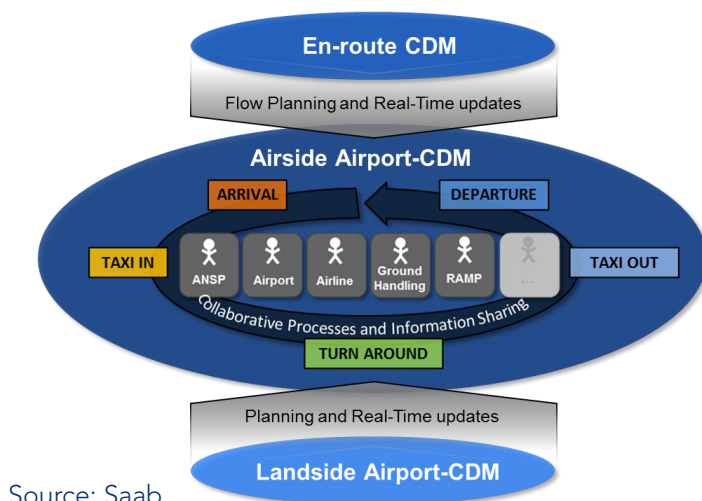


Figure 5 - Scope of Airside Airport-CDM

Source: Saab

Olivier Jankovec, Director General of ACI Europe, stated in 2014 that “There is little doubt that A-CDM is the way forward and that it is a win-win-win-win for airports, airlines, ANSPs and the travelling public”<sup>5</sup>.

We recommend that ANSPs be involved in CDM initiatives that focus on the en-route and airside operations as they play a key role in the processes and performance outcomes. This Guide focuses on the airside operations of A-CDM, as this is the most prominent scope of ANSPs’ operations in the frame of A-CDM.

## 2.2 Airside Airport-CDM

Sharing operationally relevant information among all stakeholders involved in airside processes, from the approach, to the turnaround and the take-off, is fundamental in achieving common situational awareness and a collaborative decision-making processes involving multiple stakeholders. By exchanging real-time pertinent information, stakeholders will share a common view that is based on the same and best information available, which will have a positive impact on predictability, punctuality, fuel burn, and environment as well as the utilisation of resources. While A-CDM delivers many benefits on its own, to further enhance the benefits, sharing information between en-route and landside is essential.

Examples of airside Airport-CDM processes:

**Sharing essential time information** – An aircraft has an estimated take-off time at 12:00 UTC and to achieve an on-time departure, the estimated arrival time of the in-bound leg, the aircraft ready time, and the taxi-time are needed. Even in this simple

example, to have a punctual departure, collaboration and sharing information is needed between en-route, landside and airside operations.

**Minimising taxi queues when having high departure demand** – When departure demand is greater than capacity, long departure queues can result, with aircraft burning fuel unnecessarily while waiting to depart. In this scenario, proactive A-CDM processes and sharing information can improve the situation by sharing information such as scheduled and estimated off-block and take-off times as well as estimated taxi-out times. Processes can be put in place that enable the ANSP, airlines, and ground handlers to predict when to start up and push back from gate to minimise queuing at the runway.

**Malfunction causing delayed departure** – If boarding of a flight will commence 15 minutes later than planned due to a malfunctioning computer at the gate, this information will be available simultaneously to the ramp agent, gate planning, tow truck dispatcher, en route and terminal ATCO, and possibly to entities at the affected flight’s destination airport.

**Runway closure due to snow removal** – Through A-CDM the closure of a runway due to snow removal will be known to involved stakeholders. This will allow new optimal start-up sequences to be calculated that take into account arriving aircraft, individual taxi times, de-icing requests and capacity restrictions of the surrounding airspace. This will also allow the optimisation of available resources and allow aircraft to reach the runway holding points as soon as snow removal is complete and be able to depart without additional and unnecessary delay.

<sup>5</sup> <https://www.canso.org/sites/default/files/Article%20-%20Airspace%20Q4%202014%20-%20Airport%20collaboration.pdf>

**3****Airport-CDM: A Philosophy of  
Open Communication Exchange**

Transparency and sharing information are fundamental principles of A-CDM. In this context they are symbiotic, one cannot exist without the other. For a strong and effective collaborative process, stakeholders should understand and become comfortable with the central principle of transparency. As soon as the decision is made to implement A-CDM, agreed principles, processes, and data quality standards for a multi-directional information exchange should be agreed. The groundwork of agreeing to the principles and methods of sharing information and transparency is essential.

**3.1 Transparency**

Transparency obligates operating in such a way that it is easy for others to see what actions are, or will be performed, and to understand the rationale behind the actions. If all stakeholders are aware of the tactical and strategic plans for airport operations, they can proactively mitigate developing issues and revise their individual and collective plans accordingly.

It is essential to understand and promote that each stakeholder does not operate in isolation, and that each action has positive or negative consequences for the others, and for the system as a whole. To manage the airport as a connected system, rather than as isolated components, it is important to agree on collective airport objectives. With clearly agreed objectives, stakeholders understand their role in the system and how their actions can support or undermine agreed objectives, and they can begin to work together to improve operations overall.

Transparency allows stakeholders to make decisions based on a common situational awareness and take collaborative action that would be beyond the ability of any one stakeholder with incomplete

and fragmented information. It is not always an easy concept for a stakeholder to accept, and initially there can be concerns that one's own "control" is being given up. However, as seen in the case studies in Annex A, this transparency provides benefits to everyone involved. By establishing a culture where all stakeholders work collaboratively and everybody acts collectively in an agreed process, the perceived loss of control is rapidly overcome.

Optimising the safety and efficiency of the entire airport operation should be a shared target. A mature level of transparency embedded into the A-CDM agreement allows operational bottlenecks, constraints, and weaknesses to be identified and empowers stakeholders to develop and deploy agreed solutions as a unified team. When stakeholders are aware of an on-going or developing problem they are able to adapt their operations proactively rather than reactively.

Creating an environment where the organisational philosophy is an open exchange of dialogue and data is perhaps the most difficult part of a new A-CDM process, and can take time before full implementation is achieved and benefits are realised. There must be commitment and agreement from stakeholders' top management to share information that may impact airport operations. Establishing agreed communication protocols, such as routine conference calls or meetings, to share relevant operational issues that may impact the system and other airport partners, facilitates building trust and the shaping of common and agreed operational strategies.

Successful implementation requires more than introducing processes and tools that help optimise the aircraft turnaround process. It is a continuing process that requires agreed definitions;

implementation activities, such as training and data sharing protocols; procedures and principles during both regular and irregular operations; and a review and critique process to improve future outcomes. It is a process in which each stakeholder should actively participate.

### 3.2 Sharing Information

It is a fundamental principle that quality data and timely information that can improve the safety and efficiency of the aircraft flight should be shared with concerned stakeholders. However, it is not critical that stakeholders share all their data with all stakeholders; it should be agreed that data and information be shared when there is a need and benefit to having that information. For example, in the case of an emergency, the ANSP needs to know how many people are on board, but not their names or passport numbers.

In order to make appropriate decisions, stakeholders need timely and accurate information and a shared view of current and expected constraints. Sharing information not only within one's own organisation, but among all stakeholders is the backbone of A-CDM, and it is a great challenge to implement effectively. Stakeholders may be reluctant to share information or data due to reasons of organisational security or economics. This is the first obstacle that needs to be resolved by any group looking to bring A-CDM to its operation. Stakeholders must jointly identify what data is available and what benefits can be achieved as a result of the shared awareness. Stakeholders can then identify and understand the sensitivities of the data and agree processes to ensure that it is suitably processed, made anonymous and safeguarded to protect the individual stakeholders.

#### 3.2.1 Examples of Shared Information

Each stakeholder has pertinent information that should be shared to improve the overall operation:

- ANSP:
  - Terminal ATC – Departure/arrival runways, departure/arrival capacity, estimated landing times.
  - En route ATC – Weather constraints, systems status such as outages, and en route demand and capacity (when limited)
- Airlines: Time at which the aircraft will be ready to leave the stand, aircraft type
- Airport: In/off block times, parking positions
- Meteorological Offices: Weather including winds, visibility, convective activity, and volcanic ash dispersion

#### 3.2.2 Ways of Sharing Information

There are several ways to share information, depending on the trust, needs and maturity of the processes of the stakeholders. Sharing information can range from a simple meeting to sophisticated automated solutions. The parameters to establish full, timely and correct information flow among partners are largely based on the quality, security and availability of the data exchanged.

It is advisable for stakeholders to establish an agreement, such as a memorandum of understanding (MoU) to establish the information sharing parameters and processes in advance. This MoU should clearly specify the type, quality, frequency, timeliness, and scope of the information that will be shared and with whom. The MoU should take into account the commercial sensitivity of data, and clearly state the limitations of how the data will be distributed and used; setting clear protocols and expectations of how and to whom information will be shared helps to ensure organisations' data are not compromised. By doing this at the outset, procedures and expectations of the stakeholders are clarified and misunderstandings can be avoided.

## 4

### Airside Airport-CDM Stakeholders

The primary stakeholders of an A-CDM process and their roles must be considered and identified, as organisations can differ from one airport to another. In some cases, it may be that some of the stakeholders are the same, for example, some airports and airlines also provide ground handling.

#### 4.1 Stakeholders

##### 4.1.1 Air Navigation Service Provider / Air Traffic Flow Management

Often, the ANSP and the airport do not share information or the information shared is sparse. The time an aircraft spends in the terminal environment is often a mystery to all but aerodrome ATCOs, who at least have some of the data; even for them, anything that happens between on-block and off-block is not particularly or uniformly visible.

Through A-CDM, ANSPs can understand when an aircraft at the airport will be ready to begin its next journey, long before the actual start-up request of its pilot. This shared information allows for improved runway, airport and airspace demand, capacity and resource planning.

ANSPs are able to provide information on:

- Estimated arrival times
- Estimated departure times based on planning data provided by handling agent
- Runway in use and runway capacity

Network operations can optimise the use of airspace by relying on a more accurate departure time provided by the airport.

##### 4.1.2 Airport Operator

Airport operators are becoming more capacity constrained both on landside and airside operations<sup>6</sup>, while experiencing greater pressure



Figure 6 - Primary Stakeholders of A-CDM Airside

to be more efficient and financially competitive. In parallel, the overall process of turning aircraft around is becoming more complex as there are many interrelated tasks and inter-dependent activities by a multitude of organisations. These efforts need to come together at the right time and place, many times throughout the day, to ensure that airport resources are used efficiently and aircraft throughput is maximised. Improving the physical infrastructure of an airport, such as terminals, taxiways and runways, is costly, which incentivises airport operators to maximise existing resources. Having reliable real-time information allows airport operators to plan and allocate airport resources more efficiently. More effective airport processes will also positively impact the overall experience of the end customer – the passenger.

Airport operators, in cooperation with the ANSP, are generally the main actors and drivers of A-CDM. The airport operators should provide information on:

- Stand and gate allocation
- Environmental information
- Special events such as air shows, major sport events
- Reduction in airport capacity
- Runway availability
- Aircraft movement data

<sup>6</sup> [http://www.icao.int/SAM/Documents/2015-ACDM/12\\_2A-CDM%20Generic%202015%20V2.pdf](http://www.icao.int/SAM/Documents/2015-ACDM/12_2A-CDM%20Generic%202015%20V2.pdf)



#### 4.1.3 Apron Control

Apron control is responsible for all aircraft movements on the ramp; aircraft positioning is an important factor to ensure a smooth and safe flow of aircraft to and from various positions at the airport. Apron control may be operated by the ANSP, the airport or the airlines, respectively.

In the context of airside A-CDM, the apron control is a partner that is responsible for acting on information related to arrival and departure information, such as landing times, in-block times, off-block times, and start-up approval times as well as take-off time while sharing the information with the ANSP, the airlines and the airport operator.

#### 4.1.4 Ground Handling

Ground handling operators perform most of the task associated with the aircraft turnaround and are vital stakeholder in the airside A-CDM process. Like other stakeholders, a primary concern is having the right resources available at the right time and in the right place. Driven by service-level agreements with the airlines, they are pressured to deliver services efficiently and at the least cost to the airline. Ground handling operators are able to provide information on:

- Changes in turn-round times
- Target off-block time (TOBT) updates
- Planning data
- Information concerning de-icing

#### 4.1.5 Airline

The aviation business ultimately aims to deliver people or goods safely, economically and efficiently to their destinations. The physical aircraft is only benefiting the business when it is in the air – ground time is costly lost time.

At many airports, it is not uncommon to see a number of aircraft waiting in line, engines idling, and burning fuel without getting any closer to their destinations. By receiving information on

aircraft handling, push-back, expected taxi time, de-icing, and when the departure clearance can be expected, operators can plan their own processes. Instead of starting aircraft engines at a pre-planned time only to encounter unexpected taxi delays, long lines at the de-icing stands, or runway holding positions, bottlenecks are factored into the entire airside turnaround process at the airport. This provision of timely information allows for a stable departure process, ideally one that runs seamlessly and interruption-free, from doors-closed to wheels-off; a process with clear target times and very little uncertainty along the way.

Having up-to-date information available on the overall flight and related processes will allow airlines to deliver a better service to the end customer. Information to be provided by airlines

- Priority of flights
- Flight plans
- Aircraft registration
- Aircraft type

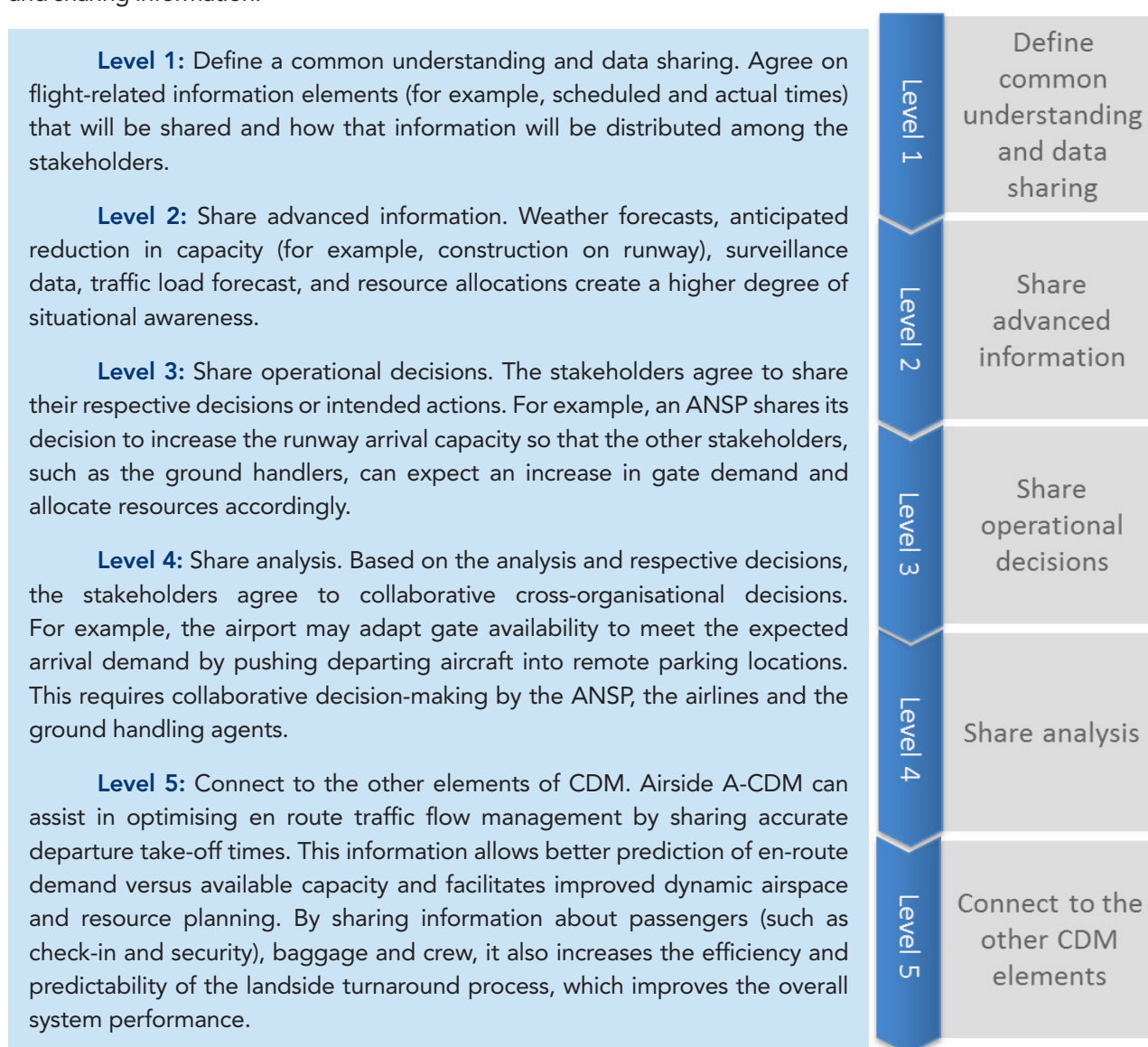
#### 4.2 Secondary Stakeholders

Various secondary stakeholders including regulators, military, local traffic providers, and local tourism agencies may need to be involved from the beginning or during an on-going A-CDM initiative depending on the objectives of the project, feedback received, or a change in the stakeholders' strategy during the project.

## 5

### Airport CDM Collaboration Levels

There is no 'one-size-fits-all' A-CDM process or tool set that can be bought off-the-shelf and implemented ready-to-use. ANSPs, airports and airlines differ in terms of size, strategy, status, constraints, and business models, and each of these differences may require a different form or level of airside A-CDM. Implementation is shaped by the benefits sought by the stakeholders and involves various levels of collaboration and sharing information.



The implementation of A-CDM does not require that stakeholders achieve all collaboration levels to bring benefits. Stakeholders can start from, or stop at, any collaboration level or even bypass levels depending on the current and expected future issues to be addressed and the benefits sought.



## 6

### Steps to Success

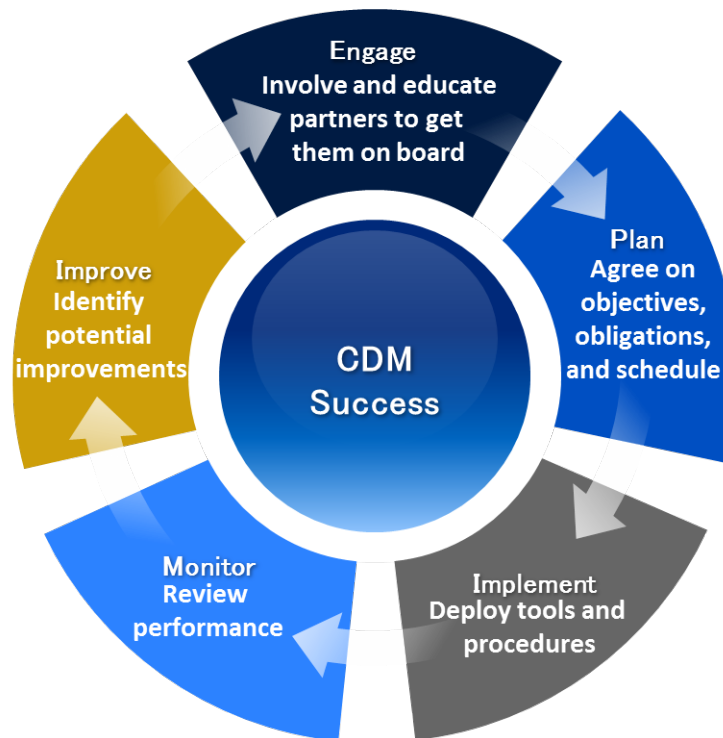


Figure 7 - Airport-CDM Success Steps

A successful A-CDM initiative requires the involvement of the stakeholder at every level of its organisation. It must be recognised that it is a continuing process; it does not stop after implementation of the processes and supporting tools. Figure 7 highlights five important steps that need to be considered to achieve success, and which should be part of the on-going A-CDM ecosystem.

**Step 1 – Engage:** Whether operating at full capacity or not, by bringing all stakeholders together from the start, a detailed and joint review can identify weaknesses in the system. Collectively, members of the group can educate themselves and agree goals, not as individual organisations, but as part of the overall system. Each stakeholder needs to understand and convey how its involvement contributes to the

overall system performance and that its contribution matters; this understanding facilitates engagement.

**Step 2 - Plan:** Just as engagement is a very important step to get every stakeholder involved, the planning step is equally important to reach consensus on objectives and expectations. During the planning step, the strategic objectives and key performance indicators (KPIs) are defined and agreed, along with individual and group obligations, and the schedule for implementation. Valuable KPIs related to these KPAs can be found in the *CANSO Recommended Key Performance Indicators for Measuring ANSP Operational Performance* (2015).

Early consideration of A-CDM in any investment planning cycle can help all stakeholders

jointly develop requirements to focus expenditure in a careful and coordinated manner; it is often inadvisable to invest in new systems, infrastructure or technology until the common issues and processes are identified.

- Definition and agreement of objectives and KPIs
- Definition and agreement of individual and group obligations
- Determination of the schedule for implementation
- Definition and communication of strategic objectives to all stakeholders

plan of action is put in place to do so. The action plan must identify the improvement areas, responsible party or parties, and when the action must be completed.

**Step 3 – Implement:** This step is about putting in place the processes, supporting tools (if any are agreed), testing, and the training of operational staff across involved organisations. The success of this step is reliant on how well steps 1 and 2 are executed.

- Procurement of supporting tools (if agreed during Step 2)
- Alignment of testing strategy and testing execution
- Training of operational staff
- Implementation of agreed processes

**Step 4 – Monitor:** The monitoring step is on-going and an essential component in understanding the success and weakness of the processes, and whether they are providing expected results that meet strategic objectives. All stakeholders should contribute to the monitoring process and the outcomes and assessment shared within the stakeholder group.

- Monitoring of adherence to processes, data quality and collection, and analysis of data as a basis for improving processes

**Step 5 – Improve:** A focused assessment and refinement of the implemented processes developed and agreed in Step 2. If the agreed processes do not meet the expected results and objectives, then the procedures and processes need to be reviewed and improved. During this step it is important to ensure that shortcomings are identified and adjusted and a

## 7

### **Main Benefits of an Airport CDM initiative**

As A-CDM, by definition, is a joint undertaking of various stakeholders, it is important to emphasise that this act of collaboration in itself brings major benefits.

Before and during implementation, airlines, airport operators, ANSPs, and other involved stakeholders must come together to consider their role in the wider airport environment and how they operate in that environment. Through collaboration, all stakeholders achieve a better understanding of the needs, challenges and problems of their partners' processes, both in tactical and strategic planning.

Successful collaboration only becomes a reality when all stakeholders start to think and act as a single community. This change of mind-set is not only necessary, but is almost unavoidable when implementing the communication, coordination, collaboration, and follow up critiquing processes of A-CDM, and it creates the foundation for all benefits derived thereafter.

As one of many results, organisations and individuals will start to consider the requirements of, and consequences to, the other stakeholders when deliberating their internal planning strategies and processes. Instead of each partner operating in individual silos with the goal of optimising its own area of responsibility, through communication and collaboration it becomes apparent that accepting small initial individual inefficiencies may actually achieve a more stable and efficient overall result. One of the major benefits in collaborating is the predictability of partners' actions under given circumstances, which can be more valuable than an exclusive focus on one's own efficiency. This collaborative approach widely influences the decision-making process and delivers benefits for all of the community stakeholders.

A-CDM leads to a variety of improvements among the stakeholders. These improvements are grouped into four main areas:

- Reduction in costs by avoiding unnecessary fuel burn and reducing delays at critical locations such as runway holding points
- Environmental benefits by lowering CO2 emissions and noise
- Better assessment of airport system capacity through identifying bottlenecks and improving options for mitigating constraints, and less loss of capacity during irregular operations
- Improved efficiency by better planning of duties for all stakeholders due to more predictable demand

A well implemented and executed process results in tangible benefits. For example, Munich Airport, home of the first A-CDM implementation worldwide, has changed the way passengers see and experience airport operations. Instead of seeing large queues of aircraft waiting for departure at runway holding positions, which was a common result of traffic demand before the implementation of A-CDM, they now see coordinated effort and experience fewer taxi-out delays. While the number of airport operations has not changed significantly before or after A-CDM implementation, the very short queues visible today are a sign of a working process that is increasing efficiencies across the whole airport.

With A-CDM implemented at 17 airports within Europe as of 2015, Eurocontrol completed its first continent-wide assessment and published the findings in *A-CDM Impact Assessment: Final Report* (2016). Among other benefits, it shows that even less constrained airports can realize significant local ground delay savings through Airport-CDM<sup>7</sup>.

#### **7.1 Cost Reductions**

As the financial margin of many airlines is

<sup>7</sup> <https://www.eurocontrol.int/sites/default/files/publication/files/a-cdm-impact-assessment-2016.pdf>

usually very limited, sustainable activities demand reliable services at airports, especially during high-demand, irregular or disruptive operations that can destabilise a flight schedule, which can reverberate throughout the system further exacerbating the situation.

A-CDM enables a smooth flow of traffic and efficient handling of traffic at an airport, reducing idle times of aircraft to a minimum and avoiding costly waiting periods with running engines. This allows more stable flight schedules and therefore lowers the need for tactical adjustments. Overall efficiency gains can result in fewer or delayed acquisition needs, such as push-back trucks or de-icing vehicles.

## 7.2 Environmental Benefits

Less delay for outbound aircraft between engine start and take-off translates into reduced fuel consumption and therefore fewer emissions. Also, waiting periods for inbound flights can be reduced by feeding the latest available data on flights into the gate and position planning process, assuring that unexpected early arrivals or late departures do not result in planned parking positions being unavailable and a flight having to wait with engines idling.

## 7.3 Capacity Optimisation

A-CDM provides a shared awareness of the constraints and expected mitigation tactics among all relevant stakeholders. Everyone has an equal opportunity and expectation to contribute their subject expertise, including known and expected constraints that should be taken into account by the other stakeholders.

Each stakeholder might not be able to achieve its maximum capacity every day due to technical failures, staff shortage, labour disruption, etc., but A-CDM helps each stakeholder to reach, as often as possible, the maximum capacity under given conditions. The process of collaboration,

communication, and coordination, along with common data and a robust shared decision-making process, helps to maximise capacity, identify weaknesses, focus on operationally essential matters, and to allocate resources appropriately while minimising negative impact on each partner.

Sharing information allows all stakeholders to appropriately plan and to minimise the disruptive effects of irregular operations or unusual situations, not only on their organisations, but on all airport partners by agreeing a joint solution and defining an agreed recovery process that helps bring stability to the operation.

Unexpected bottlenecks due to poor weather conditions, technical breakdowns, work on airport infrastructure, or special events such as air shows, large sporting events, very important person (VIP) movement, or industrial action, may occur at any airport irrespective of size. As money and time are often key issues, A-CDM is a valuable tool in helping deliver solutions that provide continuous, seamless, cost effective and timely daily operations. While the above bottlenecks may require tactical actions, for other circumstances, such as major renovation work, A-CDM processes can facilitate a coordinated approach to optimise strategic planning and mitigate disruption to the operation.

This can be expanded to include discussion and investment decisions on the need to expand capacity, or whether all partners, through collaboration, can improve the efficiency of existing infrastructure without resorting to expensive and disruptive expansion projects. At Paris Charles de Gaulle Airport (CDG) for instance, the ambitious CDG2020 Master Plan to improve airport operations, increase capacity and safety, was defined from an A-CDM perspective by the stakeholders and is managed by joint teams<sup>8</sup>. Also, Munich Airport, within its Total Airport Management project, is planning to strongly expand on A-CDM ideas by including landside parts

<sup>8</sup> <http://www.developpement-durable.gouv.fr/CDG2020-a-major-collaborative.html>

of its operation and expanding the timescale of collaborative processes.

of 10 to 20 percent, by removing the need for 'overflow' buffers in capacity constrained EU airspace"<sup>9</sup>

#### 7.4 Improving Efficiency

Through its capacity optimisation, A-CDM helps in solving issues by bringing more predictability and efficiency. Predictability is improved by sharing general and constraint-related information in a timely manner. The stakeholders have a better and similar understanding of the situation and current and forecasted capacity issues. It allows stakeholders to individually and collectively plan scenarios and to develop new processes, procedures, and solutions, not only as a response to a crisis but proactively before it even occurs.

A-CDM facilitates the stakeholders' understanding of operational constraints, and likely actions of the other partners. As a cohesive team, the stakeholders can recognise the weakest part of the system and plan the best strategies to minimise impact from adverse conditions and achieve maximum efficiency across the airport system; the partners are far more effective and efficient operating as a team rather than acting on their own.

An A-CDM process that is integrated with a network management, or ATFM system, will provide more accurate estimated departure times that will help to minimise loss of airspace slots in congested or otherwise constrained airspace. An obvious, easily realised and tangible benefit of this more accurate and timely information, is a better understanding and calculation of the balance between the en route demand and the en route capacity which will facilitate more efficient distribution of available airspace, and implementation of the least restrictive flow control initiatives. Mr Ad Rutten, President of ACI EUROPE and COO of Schiphol Group, highlighted this benefit when he said "Next to local efficiencies at all our airports, this improved information sharing is beginning to provide substantial network benefits

<sup>9</sup> [http://www.euro-cdm.org/library/cdm\\_brochure.pdf](http://www.euro-cdm.org/library/cdm_brochure.pdf)

## **8**

### **Conclusions and Recommendations**

#### **8.1 Conclusions**

Sharing information and collaboration among stakeholders enables them to make better informed decisions, to use the available resources more efficiently, agree to the most efficient and effective actions, and to make those actions predictable and known to the other stakeholders

The basis of A-CDM is sharing information, such as available runway capacity, stand and gate resources, landing times, intended take-off times, and forecast weather. This shared information enables shared awareness and facilitates collaborative decision-making to increase the overall efficiency of the system instead of focusing on optimising individual processes. Quite often A-CDM is connected to other external stakeholders and systems, like ATFM units, which provides even greater system benefit.

From an ANSP point of view, the increased predictability of traffic demand allows for better planning of ATC operations. All airside processes are more visible, including their effects on air traffic services. Recovery from irregular operations will be more easily accomplished in a coordinated effort, and investment decisions can be optimised to target those areas where they will bring the largest benefit to the overall airport operation.

#### **8.2 Recommendations**

More and more airports all over the world intend to implement some form of A-CDM.

As an important stakeholder in the processes at an airport, ANSPs are very likely to be asked to participate in the implementation projects or may even initiate a project themselves. Involvement of ATC staff, from top managers to frontline operators, is essential to maximise the benefits for ANSPs, airlines, airports, and customers. In

addition, ANSPs which actively participate in the process will also be able to realise operational and strategic advantages for themselves.

CANSO recognises the proven benefits of implementing A-CDM and therefore strongly encourages its Members to develop and participate in these initiatives from the early stages on.

To expand the implementation of A-CDM, CANSO recommends that Members consider including A-CDM in the agenda of their CANSO and ICAO regional meetings and conferences to discuss initiatives and share experiences. In addition to these high-level and large-scale meetings, development workshops involving various A-CDM stakeholders can be an effective means to disseminate the principles and make a step forward in the implementation process.

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## **Annex**

### **Case Studies**

1. Charles de Gaulle Airport, Paris, France
2. Chhatrapati Shivaji International Airport, Mumbai, India
3. Gatwick Airport, United Kingdom
4. John F. Kennedy International Airport, New York, USA
5. Rome Fiumicino Airport, Italy
6. Oslo Airport, Norway
7. Phoenix Sky Harbor International Airport, USA
8. Singapore Changi Airport, Singapore
9. Vienna International Airport, Austria



## CASE STUDY 1

### A-CDM Implementation at Paris-CDG

General overview of the airport

ICAO Code	LFPG
IATA Code	CDG
ANSP	DSNA
Airport Operator	Paris Aéroport
No. of Runways	4

Paris-Charles De Gaulle (CDG), one of the largest European hubs, is the busiest French airport, serving mainly international destinations and the major domestic airports. In 2015 the three terminals handled 65.8 million passengers and over 469,000 aircraft movements.

The traffic has a hub structure with six peak hours a day. The connection rate is about 30 percent and the main airlines operating at the Paris-CDG airport are Air France, EasyJet and Lufthansa.

Paris-CDG airport has two sets of parallel runways allowing it to operate independent departures and arrivals (under certain conditions).

- Programming capacity in 2015: 118 movements (arrivals/departures) per hour
- Projected capacity for 2015-2020: 120 movements per hour.

The airport has more than 300 aircraft parking stands including about 130 in contact with terminals.

In January 2003 Paris-CDG airport faced heavy snowfalls which lead to several days of disrupted operations. This led CDG to identify CDM as a solution to reduce the operational consequences of such an event and to improve the recovery time.

In 2008, the CDM objectives at Paris-CDG were defined as followed:

- To manage efficiently the departing flights (based on the Central Flow Management Unit (CFMU) regulation and integrating local constraints)
- To make ATC decisions and traffic forecast available in real time for the key stakeholders
- To share a common situational awareness and operational picture among the key airport stakeholders
- To involve ATC in a collaborative approach and trust-based relationship.

All the stakeholders (Air France, FedEx, DSNA, Paris Aéroport) were interested in implementing a CDM approach at Paris-CDG to optimise the operations: they were involved in all the meetings (workshops, steering meetings) and provided human resources accordingly to make this common project a success.

#### Key Success Factors:

- Strong will demonstrated by the stakeholder's highest level of management.
- Ambitious vision of the CDM concept
- Pragmatic operating solutions found to reach set goals
- Continuous improvement process

We have achieved many successes but we still keep going to remain innovative and improve our CDM. Several options are available:

- Extending the CDM scope to landside operations
- Extending the CDM scope to the full Paris terminal area (TMA) to optimise the airspace capacity
- Refining pre-departure sequence (PDS)

algorithm and improve input data: target off block time (TOBT), actual off-block time (AOBT) to gain on calculated take-off times (CTOT) and target take-off times (TTOT) adherence figures

- Creating dynamic taxi-time table
- Using dynamic data through ground radar to adjust PDS based on live traffic.

A-CDM has definitely been a success and no stakeholders would like to revert to non-CDM operations. We monitor our performance on a daily basis through KPIs.

CDM operations are a dramatic change for all stakeholders at every operating level. Therefore it needs time for all partners to adapt their organisation. All changes are to be thoroughly explained and be consistent between each other.

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### Implementation Process of A-CDM at Paris CDG Airport

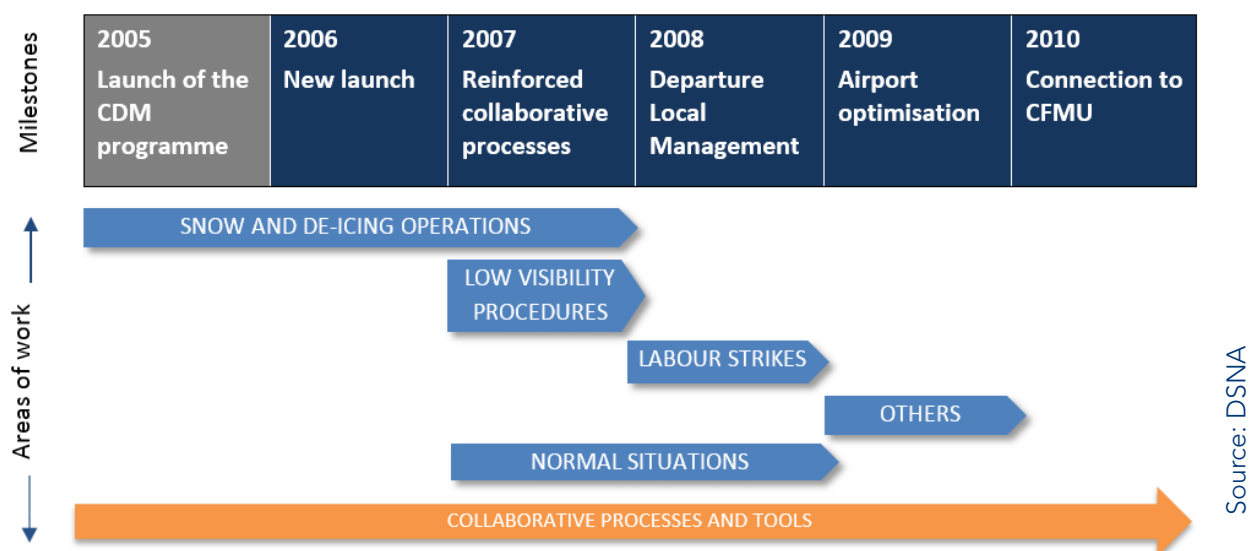


Figure 8 - Steps of the A-CDM implementation process and the specific work areas of optimisation (de-icing operations, low visibility procedures, regular operations, labour strikes).

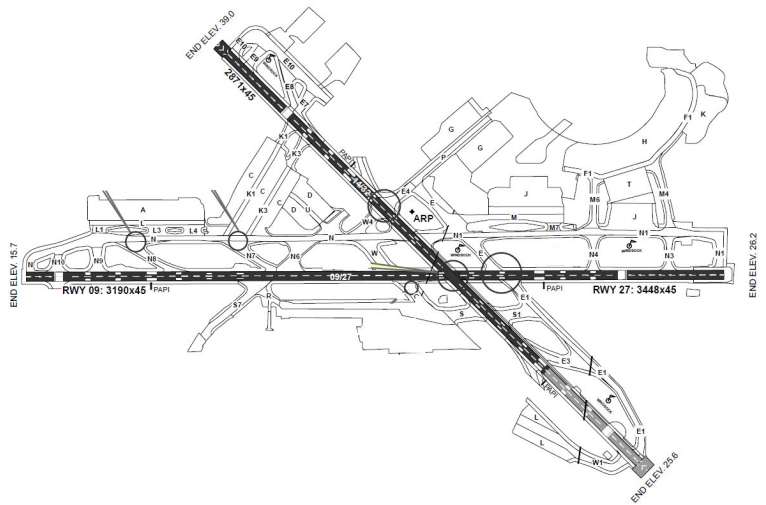
## CASE STUDY 2

### Use of Airport-CDM in Optimising Departure

#### Flow at Chhatrapati Shivaji International Airport,

#### Mumbai

ICAO Code	VABB
ANSP	Airports Authority of India
Operator	Mumbai International Airport (Pvt) Ltd.
No. of Runways	2 (crossing)
No. of movements	~320,000 per annum
No. of Passengers	~35 Million per annum
C.S.I. Airport, Mumbai is the second busiest airport in India in terms of air traffic movements. On a typical day close to 900 flights and more than 95,000 passengers arrive and depart.	



#### Project Background

Mumbai Airport is one of the busiest single runway airports. Commercially attractive slots are hard to find, and a fast growing economy and aviation demands a greater number of slots. The operations are constrained by limited land availability.

Between 0000 UTC and 1630 UTC, barring 2-3 hours, there was congestion short of the runway due to departures queuing up. This congestion was taking a toll on predictability and airlines' optimum utilisation of resources. As the Airport-CDM concept could provide a possible solution, Airports Authority of India (the ANSP) decided to proceed with the process. A team of three ATCOs were assigned the task of the project's design, development and implementation as they had software skills in addition to domain knowledge.

A steering committee involving representatives from ATM, DGCA (the regulator),

communications, navigation, and surveillance (CNS), meteorology, airlines, air force, airport operator and ground handling agencies were formed to decide on the modalities and guidance to the project team.

#### The System

The Airport-CDM system works on the concept of calculating target start-up approval time (TSAT). Departures starting up at TSAT, will reach holding position in optimised timings so as to depart without causing congestion at the holding position. This system calculates TSAT automatically through a complex algorithm, which takes into account the runway handling capacity, arrival congestion, runway closures, dynamic TOBT and variable taxi times.

#### System Inputs:

- Aeronautical fixed telecommunication network (AFTN) flight plan messages
- Parking bay and registration marking from airport operations database (AODB)

- Flight movement data from automation system
- TOBT revisions from airline operators

#### System's Output:

- Capable of processing and updating data every three seconds
- Maintains record of relevant flight movement information
- Relevant information to airline operators/ airport operator is displayed through a specifically developed interactive human-machine interface (HMI)
  - For departures: colour coded TSAT, TOBT, AOBT, ATOT, and air defence clearance, alerts etc. are displayed
  - For arrivals: estimated landing time (ELDT), estimated in-block time (EIBT), actual landing time (ALDT), arrivals on final, bay alert etc. are displayed
- Processed data is displayed to ATC using specifically designed HMI, which has control features like runway handling capacity, runway-in-use, runway closure, and slot control in addition to flights display
- All aviation stakeholders are provided with processed data through a dedicated website. The web interface provides TSAT, air defence clearance, movement charts, current NOTAMs, TOBT and bay alerts, automatic terminal information services (ATIS) for 46 stations and updated arrival information

#### The Work Involved

- Deciding the rules, unanimously acceptable to all the stakeholders, on which the functionality of the Airport-CDM system will depend
- Technical:
  - Sharing of required live data streams and feed monitoring

- Integrating the data received from multiple live feed
- Database design and database server management
- System design and software coding
- Application and web servers' design and security
- Network design, setup and security
- Regular awareness and coordination meetings with a committee of nodal officers from stakeholders
- Internal trials for testing software integrity
- Live trials with all stakeholders
- Training of stakeholders' executive staff

#### The Challenges

- Convincing the stakeholders to accept the system and its rules; some of the operators have shown displeasure on holding them until TSAT, as on-time performance (OTP) is based on chocks-off time
- Apprehension of the airline operators, as to whether the system will be transparent
- Apprehension of the airline operators on sharing commercial information
- Apprehension of the ATCOs on correctness of input data
- Educating stakeholders' personnel, especially pilots
- Airport-CDM display is independent from air traffic services (ATS) automation display and therefore increases ATCO workload

#### The Solution

- Regular interaction with and training for Airport-CDM in stakeholders' organisation
- System is made transparent by allowing all stakeholders viewing rights on entire flight data

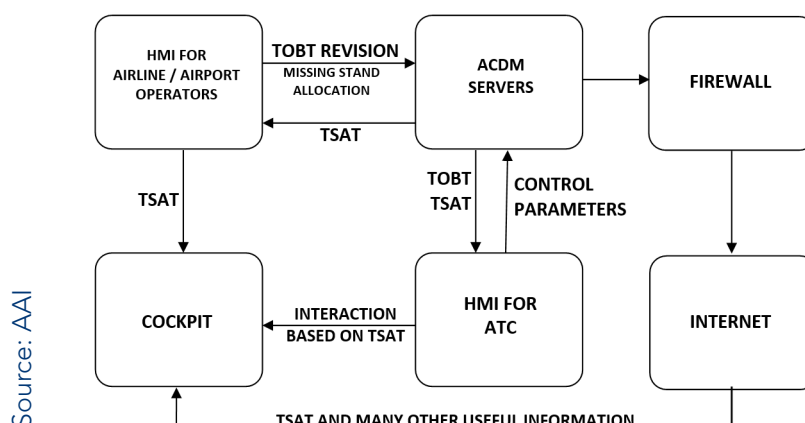


Figure 9 - Schematic Diagram for the stakeholder interaction

- Information displayed is to the satisfaction of all stakeholders. Sensitive commercial information is not displayed
- Authorisation to input data to the ACDM system is provided to trained personnel only
- Aeronautical information publication (AIP) supplement, with details on the subject and system, has been issued and educational material has been circulated for pilots
- Attempt are being made to integrate ATC specific Airport-CDM display in the electronic flight plan processing system (EFPS)
- Approximately 250 departures are handled during the 12 hours of the Airport-CDM operation period, with an average fuel saving observed to be approximately 1.5 minutes, which amounts to significant fuel saving and reduction in CO<sub>2</sub> emissions. The fuel savings and reduction in carbon foot-print will improve with better understanding and an increased operational period
- Increased safety due to reduced number of simultaneous aircraft movements on manoeuvring area and reduction in radio-communication congestion
- Optimisation of resource utilisation by stakeholders due to enhanced predictability
- Sharing of information is leading to better management of terminal activities
- In subsequent phases, the Airport-CDM team at Mumbai Airport plans to extend the benefits of the system for city side (landside) activities also and develop a module for immigration and security agencies

#### Lessons Learned

- The design, development and implementation by experienced ATC persons, onsite, has helped prepare a user-friendly system and increased the platform's acceptability
- Frequent interaction among stakeholders for better participation is very important

#### Benefits of Implementation

The Airport-CDM system was implemented at Mumbai Airport on 10 December 2015. It is being run for 12 hours daily. The hours of Airport-CDM operations may be increased as the stakeholders are asking to increase the period to 14 hours.

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### CASE STUDY 3

#### Airport Collaborative Decision-Making (A-CDM)

##### at Gatwick

ICAO Code	EGKK
IATA Code	LGW
ANSP	NATS / ANS
Airport Operator	Global Infrastructure Partners
No. of Runways	1

##### Overview

London Gatwick Airport (EGKK, LGW) is the world's busiest single runway airport and the UK's second largest airport. Being a leading connected point-to-point airport in Europe, Gatwick welcomed more than 40 million passengers in 2015. Currently 45 airlines as well as four ground handling agents are based at Gatwick Airport.

In 2012 Gatwick Airport and NATS, the UK's air navigation service provider, initiated its ACDM55 project as a deployment of an airport collaborative decision-making solution in line with Eurocontrol's A-CDM processes and an A-CDM platform. The deployment took two years and has proven to deliver operational benefits. With the A-CDM solution in place, Gatwick managed to handle 55 flights per hour with an estimated increase of 2 million additional passengers per year.

##### Pre-CDM Situation

Prior to the full implementation of A-CDM55, the key airport stakeholders (airlines, ground handlers, fuel personnel, cleaners, de-icers) did not have the same level of situational awareness and operational transparency as they have today. This lack of common situational awareness resulted in capacity constraints on the runway and availability at the gates and stands, ultimately leading to lower on time performance of the airport system.

**The objectives of the A-CDM55 implementation** were to (1) increase and maintain runway capacity of 55 movements per hour on a sustainable

basis during peak operations; (2) achieve an improvement in on time performance; (3) improve the environmental footprint through reduced cost/noise/carbon in ground operations and noise respite capability; and (4) obtain connection to the European network for improved slots during busy periods.

##### Participation

From its inception, the A-CDM project was a joint undertaking of all airport stakeholders. It was clear to all parties that to successfully implement the project would require a leadership and project management team that consisted of committed and equal partners from the outset.

During the course of the implementation, Gatwick's AODB was updated to enable easy implementation of the core A-CDM elements. An enterprise service bus was implemented to handle messaging between A-CDM subsystems and between the AODB and Eurocontrol. It was agreed that Gatwick Airport would procure the departure manager (DMAN) with NATS, providing air traffic control services in the tower, as the primary user of the system. Additionally, the DMAN was installed in the Airfield Flow Centre, where it is used to provide common situational awareness of critical A-CDM milestones such as TSAT, TOBT and TTOT. The Central Airfield Flow Centre was created to bring representatives of the airport operator, airlines, ground handlers and the meteorological office together to facilitate easier collaboration, communication, to deliver a highly optimised operation.

##### Benefits Achieved

Clear defined goals such as an increase in capacity and on-time performance as well as a better environmental footprint were set with the implementation of CDM at Gatwick Airport and the project did deliver the related benefits to all stakeholders involved.

Overall, Gatwick's A-CDM implementation has enabled better decision-making that has

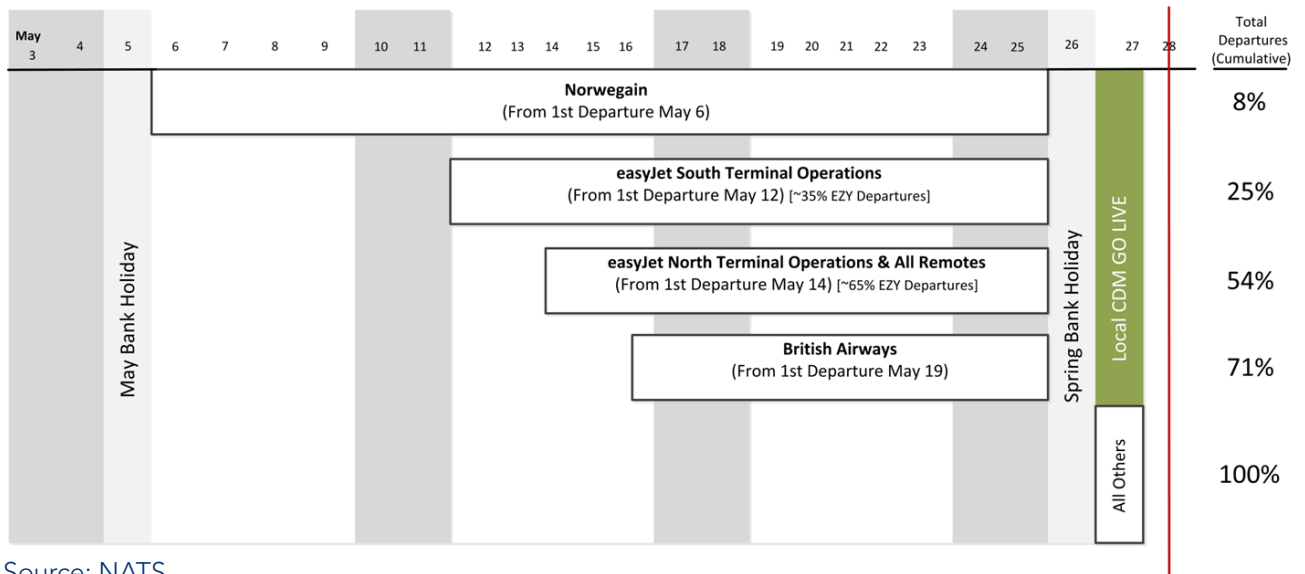


Figure 10 - Depicts process of implementation

contributed to smoother and more efficient operations at the airport and has boosted runway capacities on a sustainable basis. Common situational awareness has enabled more efficient resource planning across all airport stakeholders which has resulted in an improvement in service level agreement compliance and better overall on-time performance. Ultimately, the A-CDM project has delivered an improved service experience for everyone: airlines and passengers, handling agents and airlines, airport and its customers.

The DMAN directly contributed to the increase in runway capacity and more predictable departure flows at the airport but delivering more precise TSATs, TOBTs and TTOTs to all participants involved in the efficient movement of aircraft into and out of Gatwick.

Higher quality information (TOBTs, TSATs, TTOTs) coupled with common situational awareness of the turnaround process resulted in an improved on time departure score, thus decreasing delays at the airport.

The deployment of the DMAN also enabled Gatwick Airport to improve its environmental footprint by reducing runway queues and taxi time leading to decreased fuel burn (cost savings) and reduced NOx emissions (environmental foot print).

The Arrival Manager, operated by Swanwick ATCOs for optimising and sequencing aircraft flow into the Gatwick Terminal movement Area, coupled with the use of the DMAN at the airport

for optimising departure flows, enabled Gatwick to achieve a new world record for aircraft movements on a single runway in August 2015 – 934 flights per day.

### Lessons Learned and Way ahead

Implementing CDM requires commitment from all stakeholders across all levels. In particular, the change process involved for every individual should not be underestimated and the project therefore needs to be staffed with open-minded team members.

Following the initial implementation phase, it became clear that not all scenarios found in the daily operation can be sufficiently simulated during the implementation phase. This applies specifically to regulations provided by the network manager which in the course of 2015 have increased by 100 percent.

Furthermore, CDM is a living and involving processes. Employees at the relevant stakeholders change regularly. Therefore defined processes need to be documented and a recurring training plan should be implemented.

### Conclusion

The CDM implementation at Gatwick Airport has delivered benefits to all stakeholders involved with improving the overall passenger experience. Furthermore it has facilitated an atmosphere of trust between all stakeholders involved.

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CASE STUDY 4

Collaborative Decision-Making in the Context  
of Departure Metering at John F. Kennedy  
International Airport

Facts about John F. Kennedy International Airport

ICAO Code	KJFK
Owner	City of New York
Operator	Port Authority of New York
No. of Runways	4
No. of movements	~422.000
No. of Passengers	~53.2 Million
Over seventy airlines operate out of John F. Kennedy International (JFK), with direct flights to destinations in all six inhabited continents. The airport features six passenger terminals, four runways and serves as a hub for American Airlines and Delta Air Lines. It is also the primary operating base for JetBlue Airways.	

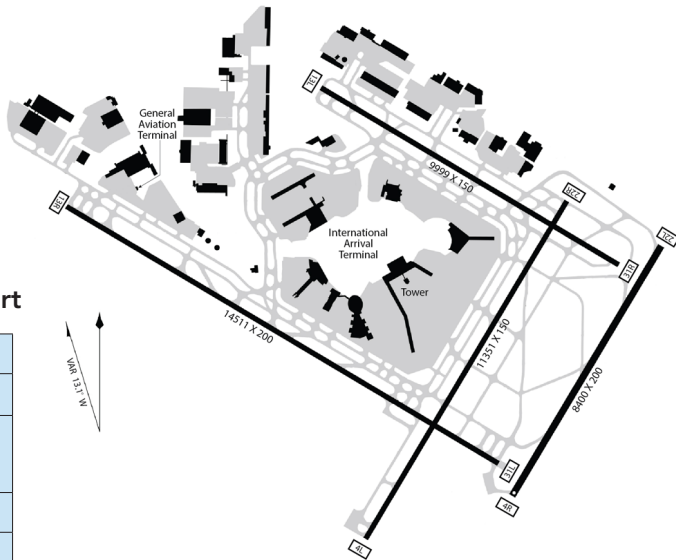
The Challenge and the Solution

In 2011, JFK decided to implement a Ground Management Program with the objective of reducing departure taxi times and delays. The program introduced a collaborative decision-making approach using a departure management process and supporting system, referred to as a Departure Manager (DMAN).

The Departure Management Process

The whole process begins with the input of the planned runway configuration, expected throughput on each runway, and the target departure queue lengths. Flight schedules and estimates are also integrated. Flight schedules and their associated updates are used to determine the demand and carrier priority when rationing departure opportunities in periods where demand exceeds capacity. During these periods, the Departure Manager determines how many departures can be accommodated in each “time slice” going forward.

Based on the input parameters, all departure opportunities are filled by assigning flights in the original schedule order. All departing flights are issued a Target Movement Area Time (TMAT).<sup>10</sup>



To truly enable collaboration, the process and system allows for flight operators to directly manage their own flight priorities. This means that flight operators can simply “drag and drop” their flights within the system’s Graphical User Interface to meet their needs.

Lessons Learned

**Independent Operations** - At JFK and many other airports in the U.S., each terminal at the airport operates independently. They are owned by different entities, serve different carriers, and have varying concepts of operation for everything from ramp traffic flow and parking to deicing procedures. An early lesson learned was that the process and tool must allow for maximum flexibility and minimally constrain procedures while still providing enough guidance and direction to attain the goal of limiting the departure queue without starving the runway.

**Garnering the Cooperation of Competing Airlines** - Asking any airline to voluntarily delay its departures for the good of the overall airport is a daunting task. At JFK, the program team did just that and asked all the airlines to cooperate in this way. Developing sufficient trust among the carriers and terminal operators so that they would accept the plan required diplomacy, patience, and exhaustive negotiations and explanations. In the end, however, all the major airlines and terminals decided to go forward to cooperatively benefit by using the procedures and technology. Through a combination

<sup>10</sup> In e.g. Europe this corresponds to the Target Start-up and Approval Time (TSAT) due to the fact that the concept of operation is slightly different.



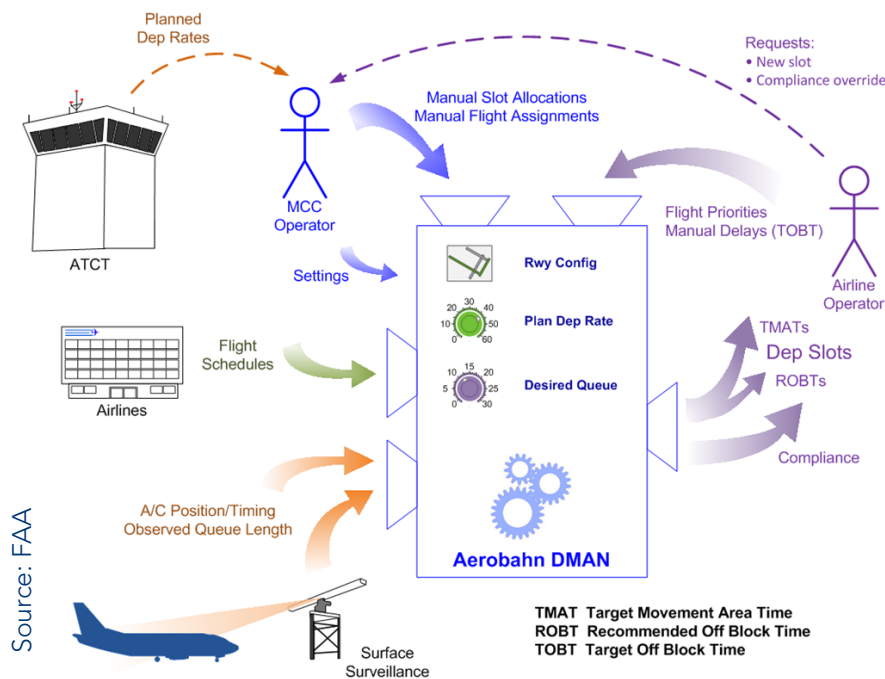


Figure 11 - Departure management process

of voluntary cooperation and inter-stakeholder accountability, they together dramatically reduced taxi times and surface congestion.

The inter-stakeholder accountability is especially interesting as it has changed the mindset of the stakeholders and truly created a collaborative environment by using transparent compliance reporting and regularly occurring meetings whereby stakeholders who are not achieving the agreed performance targets are held mutually accountable. Another success factor of the program was the establishment of monthly stakeholder "focus group" meetings that are continuing today.

#### Training a Diversity of Roles and Needs

- Because of the diverse, complex nature of the operational environment, the program had to build a particularly flexible and wide-ranging training package.

The user training was multi-faceted and included instruction on using the system itself: navigating the workspace, understanding the toolsets, and subsequently familiarizing users with the more advanced features. Next, the users had to be taught the principles behind departure metering and how to use the process effectively in a collaborative environment. Finally, training included a more subtle component aimed at showing users the value of departure metering and viewing themselves as part of the airport community rather than independent operators.

**Shared Situational Awareness - Bringing together operations so varied and geographically**

dispersed required a common platform for all users to interact with the departure metering process. This common platform provides shared situational awareness to everybody. Operators representing the various stakeholders see the same flights on the map, the same flight information updates (including metered departure times) and the same alerts and event notifications, if desired. At the same time, individuals can customize the display according to their own operational needs and priorities.

#### Benefits from the Ground Management Program

Based on independent analysis and evaluation in "Assessing the Impacts of the JFK Ground Management Program"<sup>11</sup> it has been shown that the JFK Departure Management program has provided great benefits for the stakeholders. The following data indicates the significant savings that were achieved immediately after program implementation.

Improvement Type	2011	2012
Taxi-Out Time reduced	1,700 hours	2,100 hours
Fuel saved	0.8 million kg	1.0 million kg
Fuel cost savings	\$0.8 million	\$1.0 million
CO <sub>2</sub> emissions reduced	2,600 metric tons	3,200 metric tons
Take-Off Delay reduced	1,800 hours	2,400 hours

Table 1. Savings at JFK airport compared to 2009 (values shown are the aggregate improvement per month during summer)

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<sup>11</sup> <http://www.mit.edu/~hamsa/pubs/StroineyLevyKhadiIkarBalakrishnanDASC2013.pdf>

## CASE STUDY 5

### A-CDM Implementation at Rome Fiumicino

#### Airport

ICAO Code	LIRF
IATA Code	FCO
ANSP	ENAV S.p.A.
Airport Operator	Aeroporti di Roma (ADR)
No. of Runways	3

#### Introduction

Rome Fiumicino (LIRF/FCO) is Europe's eighth busiest airport by movements<sup>12</sup>, generating 312,000 IFR movements and processing over 38 million passengers.

Fiumicino has three main runways:

- 25/07 mainly used for departures
- 16L/34R used for departures and arrivals (only during arrival peak)
- 16R/34L used for arrivals.



Figure 12  
- Fiumicino  
Airport

Source: ENAV

ATC services are provided by ENAV S.p.A. and the airport is operated by the Aeroporti Di Roma Group (ADR).

Fiumicino has been a full A-CDM airport since March 2014 and is the 10th A-CDM airport in Europe. The A-CDM kick-off meeting took place in July 2011 with ENAV and ADR signing a memorandum of understanding. A local A-CDM trial started in October 2013.

Following a gap analysis conducted by Eurocontrol, the main airport stakeholders (ENAV and ADR), decided to implement A-CDM aiming to put in place all the actions necessary to manage the airport in a more collaborative, efficient and sustainable way. After the initial stage, Alitalia joined the A-CDM Steering Committee as the main airline carrier in Fiumicino.

#### Project Organisation and infrastructure

There was a clear distinction in the role of each partner:

- The airport operator (ADR) was in charge of developing the A-CDM platform to manage information sharing with ground handlers, aircraft operators and ENAV. ADR provided training to ground handlers on the processes and on the platform usage. A dedicated protocol for data exchange with ENAV and the A-CDM platform was established.
- In the first milestone of the process, ADR checks the coherence of flight plan with SOBT, then exchanges all relevant information on turnaround process with handlers and airlines and communicates the actual readiness of the flight and an accurate TOBT to ENAV.
- Air navigation service provider (ENAV) was in charge of developing an A-CDM platform to manage information sharing with the Network Manager

<sup>12</sup> Year 2014

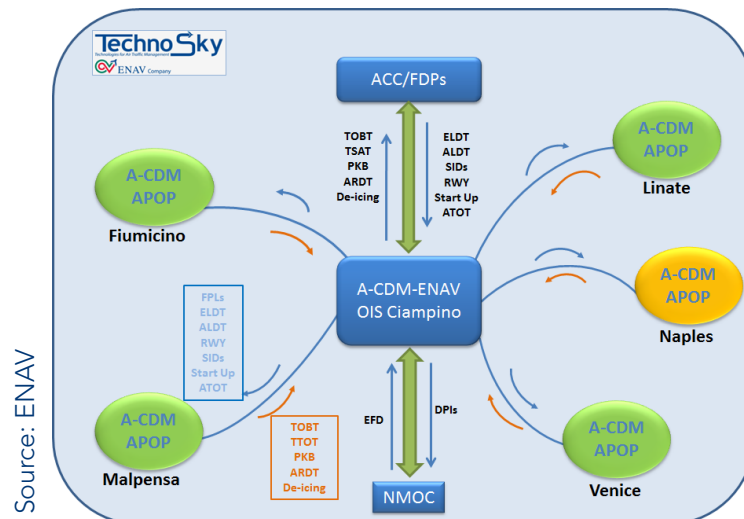


Figure 13 - ENAV A-CDM System Architecture

Operations Center (NMOC) and the airport operator. The ENAV platform provides relevant information to the airport on arriving and departing flights, in particular, an accurate estimation of landing times as well as relevant information on departing flights.

- The ENAV platform, taking into account TOBTs received by ADR and additional airport constraints, generates the pre-departure sequence that allocates a TSAT to each flight.
- Moreover, the platform provides all different departures planning information (DPI) types to NMOC that uses this information for ATFM purposes.

ENAV adopted a system-centralised architecture (provided by TechnoSky): all data are managed at the central level by an A-CDM platform that provides/receives data to/from the airport and feeds the NMOC platform with DPI messages. A pre-departure sequencer tool is embedded in the platform. This approach made the implementation of A-CDM at other airports (Milano Malpensa, Milano Linate, Venezia Tesserà), quite easy once airport operators agreed a common data exchange protocol and limited local adaption to the general A-CDM procedure.

### Problems and lessons learned

The main problems encountered during the implementation phase were:

- Fiumicino is a complex airport with many interactions between arrival and departure flows, so the tuning of the pre-departure sequencer was quite difficult
- In the first stage A-CDM data were not integrated in the ATC operational system
- Work in progress on Runway 25 during the first A-CDM trials resulted in a large difference between TOBT and TSAT, which resulted in delay to the airlines

### Key success factors were:

- The strong commitment from top management: the risk is to stop implementation at first sign of a problem if top management is not committed
- Involvement of all airport stakeholders via frequent and transparent meetings to collaboratively identify problems and find shared and balanced solutions
- An incremental approach: it is not possible to have a “perfect” system or procedures at the beginning, they need to be tuned, based on operational experience rather than with pure theoretical analysis.

### Benefits

Analysing the benefits for a sufficiently long period since A-CDM implementation was not easy for Fiumicino as the airport has been subject to extensive works, an increase of traffic due to the

arrival of a new major airline customer and, during 2015, severe operational disruptions due to fires - both on and off the airfield. Nevertheless, the first benefits derived from implementing A-CDM can be summarised as:

- Taxi-out time has been reduced especially when operating at a high level of departure rate. Despite significant traffic increases in 2014 and disruptive taxiway construction, taxi-times at Fiumicino remained stable in 2014
- ATC workload has been reduced during busy periods through sequencing support and improved situational awareness of runway apron and runway demand.
- The accuracy of take-off time estimates sent to NMOC has improved significantly – by as much as 60 percent during normal operations and 85 percent during periods of adverse conditions.
- Estimated landing time updates are providing improved arrival time predictability that is supporting the ground handlers in the allocation of resources. This is particularly important at Fiumicino where the aircraft must be ready with a tow in place before they can be released to ATC for clearance and push.

During the implementation, the A-CDM team faced and overcame a lot of issues due to the integration of the new operational procedure in the airport environment. This included a cultural change for airport stakeholders to work in a more transparent and cooperative way. From the ATC perspective, the change was from a “first come, first served” principle to a “best planned, best served” one.

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## CASE STUDY 6

### A-CDM Implementation in Oslo

ICAO Code	ENGM
IATA Code	OSL
ANSP	AVINOR
Airport Operator	AVINOR
No. of Runways	2

#### Introduction

Oslo Gardermoen (ENGM/OSL) is currently Europe's 13th busiest airport by movements, with 247,700 movements in 2014, a 2.8 percent increase on the previous year, handling over 24 million passengers. The airport is operated by AVINOR and is an operational hub for both Scandinavian Airlines and Norwegian Air Shuttle. The top 10 airport destinations are within Scandinavia or Northern Europe, with increasing numbers of services to further afield destinations including North America and the Middle East.

Operational characteristics of OSL include the following:

- Two parallel runways mainly operated in mixed mode During winter operations, this changes to segregated parallel operations
- For stand proximity domestic arrivals mainly use 01L / 19R and international arrivals mainly use 01R/19L
- Type mix is primarily narrow body jets, however there is an increasing number of wide body aircraft serving long haul routes
- Widerøe operates a fleet of Dash 8 turbo-prop aircraft from OSL
- The Royal Norwegian Air Force operates logistical and personnel transport flights from OSL
- No VFR schooling flights (local patterns) are permitted to operate from OSL
- OSL is terminal constrained in the

Source: Oslo Airport



Figure 14 - Oslo Airport

morning (06-09) and afternoon (15-18) peak

- OSL's capacity is currently 69 movements / hour. Runway capacity is constrained during times of severe weather only
- OSL provides remote de-icing on pads close to the runway threshold of Runways 19L and 01L

#### A-CDM Implementation: Why and How

AVINOR committed to implement A-CDM through Local Single Sky Implementation (LSSIP), as they expected it to become mandatory at some point and the gap analysis conducted by Eurocontrol showed several potential benefits of implementing A-CDM at OSL. The A-CDM project

at OSL was initiated in November 2011 and OSL became the 9th certified A-CDM airport in January 2014. The airport worked closely with the key stakeholders ahead of the decision to implement A-CDM, to make sure that we had their support and contribution.

From the start, the CDM project at OSL focused on involving the stakeholders ("What's in it for me") throughout the project and they followed an incremental approach, implementing small bits of CDM at a time. The project team had a pragmatic approach to CDM; they wanted to really understand the meaning behind the CDM concept and implement CDM in a way that would work locally at their airport, as opposed to just implement the manual from cover to cover. The core project team consisted of stakeholders from different areas of the airport (ATC, airside operations, information technology) that had the correct experience, expertise and commitment to the project. A former pilot represented the "customer voice" in the project. The team meet regularly and had many intense discussions on how CDM should work at OSL. The suggestions from the core project team were discussed and agreed by all main stakeholders before implementation. The team strongly believe that this approach was key to the success of implementing CDM at OSL.

The OSL CDM project is on-going to continuously improve the A-CDM system and the connected processes. For instance, OSL recently improved the A-CDM system with a feature to stop TSAT allocation to aircraft parked in certain parts of the airport when snow removal is taking place on the taxiways behind them. In addition, the project team have visited and given presentations to the operational personnel of all the handlers and major airlines to improve the operational processes related to CDM.

## Benefits

The CDM team at OSL consider the project to have been a success. Oslo airport has seen several positive effects after implementing CDM, both qualitative and quantitative. For instance: better estimated in-block times due to the integration between CDM and arrival manager (AMAN); better off-block and take-off predictability; better and easier slot allocation; less late gate changes and better utilisation of stands and runways. Nevertheless, we do realise that there is still an untapped potential for CDM at OSL. We monitor TOBT quality at several points in the CDM process on a weekly and per handler basis, and it is quite clear that we still have some work to do in regards to our handlers and airlines to make sure TOBT is updated as early as possible.

## Lessons learned

The project team realised that A-CDM is more a cultural change than it is a new IT-system before the project started. Hence, they devoted considerable effort to change the culture (ATC, airlines, handlers, airport) during the project, but there is always the potential to do even better. Another crucial lesson they have also learned is that A-CDM never stops. The system needs to be developed continuously to make it even more useful for all the stakeholders and keep the momentum on the change in culture and processes to ensure OSL exploits the full potential of A-CDM.

## Contact

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## CASE STUDY 7

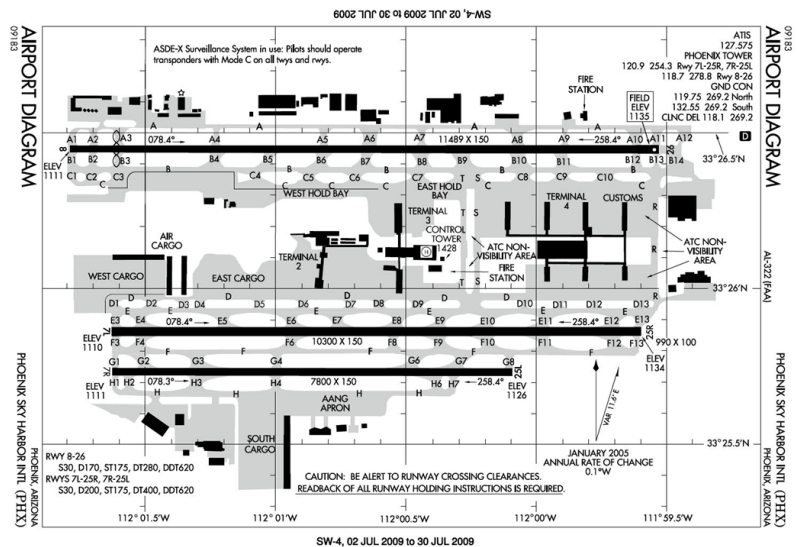
### Optimising Arrival Flows at Phoenix Sky Harbor

#### International Airport using Collaborative

#### Decision-Making

#### Facts about Phoenix Sky Harbor International Airport

ICAO Code	KPHX
Owner	City of Phoenix
Operator	Phoenix Airport System
No. of Runways	3
No. of movements	~430,000
No. of Passengers	~42.1 Million
Phoenix Sky Harbor International Airport is one of the ten busiest airports in the U.S. for passenger traffic with a \$79 million daily economic impact. On a typical day more than 1,200 aircraft and more than 100,000 passengers arrive and depart. In addition more than 800 tons of air cargo is handled.	



#### The Challenge

As one of the top 10 connection hubs in the United States, Phoenix Sky Harbor International Airport (KPHX) manages through periods of heavy arrival and departure demand during the morning and afternoon peak. Although the traveling public benefits from the flexibility and choice of connection, the peak schedule frequently results in periods of heavy traffic on the airport surface when departing and arriving flights must be carefully coordinated to avoid excess delays or gridlock. During heavy arrival periods, air traffic control will assign arriving aircraft to holding areas (or "Penalty Box") while departing flights vacate gates and alleys. This coordination of flight movements requires a substantial amount of radio communication between the air traffic control tower, ground control and the flight deck.

For each flight in the hold area, a significant number of radio transmissions are required to answer key questions about gate and alleyway availability. The high number of radio transmissions results in high frequency occupancy and increases the opportunity for miscommunication. An example of these exchanges is summarized below. According to local studies, peak period arrivals require at least 10 radio transmissions between the air traffic controller and the pilot. Compounding the issue, for each transmission between the air traffic control tower and the flight deck, there is an equal number between the ramp control. When considered in total, the process results in inefficient coordination, unnecessary radio communication as well as on-ground delays, adverse taxi times and increased fuel burn.



Source: FAA

What Gate?  
Gate Status?  
Hold in Penalty  
Box!  
Proceed to Spot!



What Gate?  
Gate Status?  
Ramp Ready?  
Gate is now available!

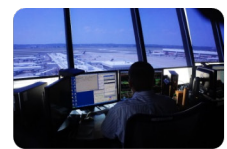


Figure 15 - Frequency congestion at KPHX

Source: FAA

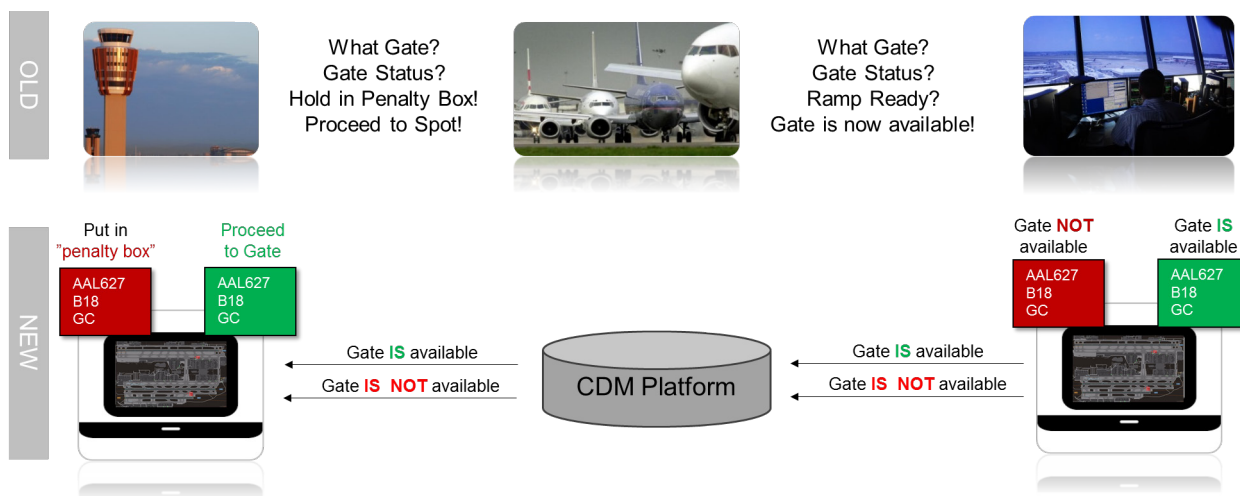


Figure 16 - Highlights the old process versus the new collaborative process

### The Solution

Thanks to an initiative by the CDM Stakeholder Group, the airlines (American Airlines as the pioneer) and ramp control at KPHX, a new collaborative process has been developed to address the issues and improve the process. Leveraging the collaborative platform in place at KPHX, the community established a new procedure for communicating gate occupancy, alleyway conflict and directions for arriving aircraft. The Collaborative Decision-Making tool, which is available to each of the three stakeholders, provides users with a simple-to-use interface, including a map and surveillance targets for situational awareness, and a label associated with each flight. This label provides the critical information required by the user to "give" or "not give" a flight clearance to taxi-to-gate. Each label contains information about the flight identification, the gate and its planned taxi route. Using color differentiation to communicate instructions or status of the flight, the label color is modified as follows:

- A flight with green-label in the CDM tool indicates to the user that the flight is be cleared to proceed to its assigned gate by the air traffic controller
- A flight with a red-label in the CDM tool indicates that the flight is required to proceed to the hold area and or remain holding until further instruction. When

the gate and alleyway become available, the ramp controller then turns the label green to indicate to the ATCT, and other stakeholder that the flight is cleared to proceed to the gate.

### Benefits Achieved

The new process and CDM tool has achieved significant benefits for the stakeholders at Phoenix Sky Harbor Airport:

- Taxi times during major banks is reduced by ~ 5 Min/aircraft.
- Taxi times overall are down about 30 seconds per aircraft.
- Reduction of about 50% in the number of communications between pilot and ground.
- Transmission counts decreased by over 252 transmissions a day (59percent).
- Transmissions decreased by 5.13 calls per aircraft per day (49.5 percent).
- Controller time decreased by 9.25 minutes per day (17 percent).
- Aircraft counts on controller decreased by 7.5 flights per day (18 percent).
- Both the Federal Aviation Administration tower and the ramp tower gained additional insight into airfield conditions, resulting in improved traffic flow.

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## CASE STUDY 8

### Implementation of A-CDM at Singapore Changi Airport

ICAO Code	WSSS
IATA Code	SIN
ANSP	Civil Aviation Authority of Singapore (CAAS)
Airport Operator	Changi Airport Group (CAG)
No. of Runways	2
Changi Airport is the world's seventh busiest airport for international traffic. It served a record 55.4 million passengers from around the globe in 2015. With over 100 airlines providing connectivity to 320 cities worldwide, Changi Airport handles about 6,800 flights every week, or about one every 90 seconds.	



Civil Aviation Authority of Singapore (CAAS) in partnership with Changi Airport Group (CAG) had embarked on the Airport-CDM programme back in 2013, as part of a capacity enhancement initiative to optimise airport capacity utilisation and operational efficiency.

Airport-CDM operational trials at Changi Airport commenced on 22 February 2016 and are currently conducted in progressive phases involving all airport partners. Implementation is expected to be in the third quarter of 2016.

#### Why A-CDM?

Today at Changi Airport, operations management is often reactive in nature – comprising of actions to solve operational issues as and when they occur. Often, operational data, required for decision-making, resides in each individual's area of responsibility and are not openly shared. For example, with the current non-CDM operating procedures, ATC will only be made aware of an aircraft's pushback and start-up status when an ATC clearance is sought. The airlines or ground handling agents would already be aware of this aircraft's readiness in advance.

The 'silo mentality' thus creates a challenge to smooth day-to-day operations. This lack of information sharing created difficulty for ATC in optimising the pre-departure sequence for efficient runway utilisation. Aircraft queuing times at the runway holding point were increasing over the years due to an approximate 31 percent increase in traffic movements from 263,000 in 2010 to 346,000 in 2015. The airport operator is also facing challenges in stand planning due to increasing traffic movements and capacity limitation. As the status of departing flight is not always shared by airlines and ground handling agents, airport operator had to use the scheduled departure time for the parking stand allocation, which may not be optimal. Very often, delay in the stand due to turnaround activities or ATC constraints were not made known in advance to the airport operator, leading to stand conflicts resulting in arrivals waiting on the taxiway for their stand or last minute gate change for the flights.

#### Objectives of Changi A-CDM

- Optimise pre-departure sequencing
- Improve fuel savings by reducing taxiway congestions and runway queuing time
- Improve gate management and

- allocation of airport resources
- Improve on-time performance with a better turnaround process.

Changi A-CDM aims to establish procedures and systems to co-ordinate the sharing and usage of operational data among airport partners to achieve the above objectives. With transparent information sharing, it will enhance the overall airport situational awareness, which helps improve the decision-making process for all airport partners. In addition, it will also allow a timely response to the dynamic changes in the operating environment, enabling safer, more efficient operations, and better passenger experience at Singapore Changi Airport.

### Process of Implementation

**Collaboration is the Key** - Changi A-CDM is a process-driven initiative with both CAAS and CAG taking an inclusive approach, with the 'C' from 'Collaborative'. The team is constantly working closely with the airport community to ensure their needs are met and the project is rolled out in a timely and harmonised way to maximise operational efficiency.

Understanding that collaboration is essential for the success of the A-CDM initiative, the team invited

all local hub carriers and ground handling agents to be partners from the beginning of the project. The partners' active participation in the working groups throughout the years had contributed significantly to the progress of the project. Practical solutions for procedures and systems needed for implementing A-CDM were developed based on their operational inputs and experience.

**Challenges** - From the start, the A-CDM team knew that the greatest challenge for A-CDM implementation entails a mind-set shift towards the open and timely sharing of operational information. Some airlines and ground handling agents see this as unnecessary workload and there was also the fear of blame when predicted information for sharing like TOBT may not be always accurate. Fortunately, we managed to get the buy-in and support of our key stakeholders through the collaborative approach taken and constant engagements to help them understand the concept and benefits of A-CDM.

**A-CDM systems** -To enable real-time operational information sharing amongst airport partners in different locations of the airport, four A-CDM systems were introduced.

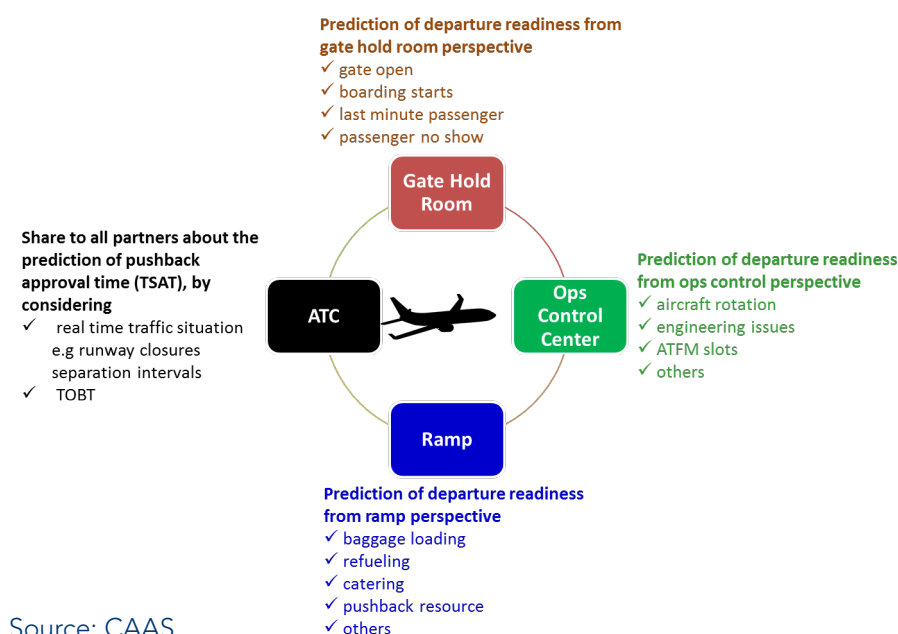
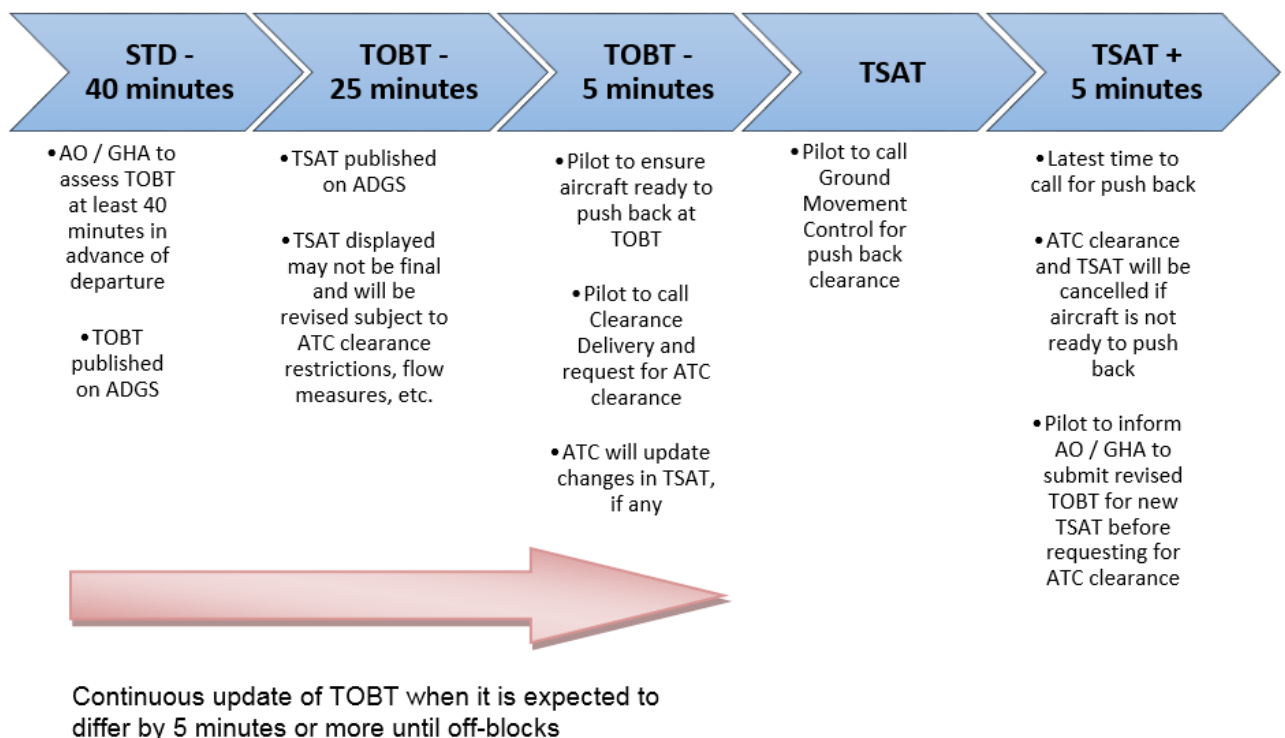


Figure 17 - Real-time information sharing

- Airport operations centre system (AOCS)
    - Web-based common situational awareness portal developed to allow airlines and ground handling agents to view and update A-CDM information at operation control centres. The significant milestones of A-CDM, which involves tracking flight progress, linking arrival and departure flights, are also shared under this portal.
  - Gate message input device (GMID) – Existing device at boarding rooms used for gate opening, boarding and gate closing messages, upgraded to enable view and update of A-CDM information (TOBT and TSAT)
  - Aircraft docking guidance system (ADGS) – Existing device at apron used for guiding inbound aircraft for parking into stand, upgraded to enable display of A-CDM information (TOBT and TSAT)
- to ramp staff and pilots
- Pre-departure sequencer (PDS) system
    - Located at the control tower allowing ATC to view A-CDM information and at the same time, update current traffic situation through parameters like runway availability and capacity for accurate TSAT output.

### A-CDM Procedures

With A-CDM systems linking all relevant airport partners at appropriate locations, information gaps are bridged and common situational awareness is enabled, providing more predictability for better decision-making process. However, the systems only enable the real-time sharing of A-CDM information. Airport partners (pilots, airlines, ground handlers and ATC) are still required to follow a set of procedures to ensure the accuracy of data shared and allow the A-CDM processes to operate efficiently.



Source: CAAS

Figure 18 - Procedures required to ensure accurate exchange of data

**A-CDM Operational Trials** - The on-going A-CDM operational trials will allow CAAS and CAG to review the procedures and systems planned for A-CDM operations before actual implementation. It is also an opportunity for airlines and ground handling agents to validate their internal TOBT update workflow planned for A-CDM operations.

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[Roger\\_lau@caas.gov.sg](mailto:Roger_lau@caas.gov.sg)**Next Steps**

1. Reviewing the procedures and improving the systems
  - The pre-defined A-CDM procedures will not be able to cover all possible operational scenarios. The team will need to review and refine it using findings from the operational trial and also engagements with key stakeholders before actual implementation. In addition, systems will also need to be improved after feedback from operators or upgraded to support any new procedures.
2. Measuring the performance of A-CDM operations
  - One of the most important principles of the A-CDM concept is collaboration in a transparent and open manner. This principle must also extend to the measurement of performance and results.
  - Although A-CDM is already a proven concept with positive cost benefit analysis done by Eurocontrol, airport partners will be expecting to see measureable improvements with A-CDM operations at Changi Airport since resources were put into it.
  - The A-CDM team will be constantly tracking and reporting quantitative benefits like OTP and reduction in taxi time, which are our primary objectives.

## **CASE STUDY 9**

### **Airport Collaborative Decision-Making (A-CDM)**

#### **VIENNA – LOWW - VIE**

ICAO Code	LOWW
IATA Code	VIE
ANSP	Austrocontrol
Airport Operator	Flughafen Wien AG
No. of Runways	2

#### **Overview**

A-CDM has been introduced at Vienna Airport by Austro Control as the country's air navigation service provider together with Vienna Airport and Austrian Airlines.

Vienna (LOWW, VIE) is Austria's biggest airport with some 23 million passengers per year. It currently has two runways (with a third pending government approval) and is an important gateway for the country and the nation's capital, Vienna.

#### **Pre-CDM situation**

The main reason for implementing CDM was to increase transparency and predictability during 'bad' weather situations.

Airlines and the airport already had a clear picture about capacities at Vienna Airport and where the bottlenecks are. Neither delays in start up approvals nor arrival (ARR) slots for destination LOWW came as a surprise.

Predictability started to become an issue when the airport is affected by any kind of irregularities like runway closures, thunderstorms, and foggy weather and so on. Not to forget aircraft de-icing.

After starting to disseminate TSATs the situation has significantly improved. Even though the implementation of CDM did not increase capacity the capacity of the entire ground handling can now be better used.

As one significant result it can be underlined that Austrian reported a drop of around 50 percent in lost connections.

#### **Participation**

CDM has been started as a joint undertaking right from the beginning. It has been obvious to all stakeholders that there would be no other reasonable approach than to form a team of equal partners from the very start.

The AODB is now operated under the responsibility of the airport itself as an extension to the previously existing gate allocation and ground handling software.

DMAN on the other side is operated by Austro Control at the ATC tower where responsibility of runway assignment, start up and pushback approval is located. This solution has mainly been chosen because of the tight integration of DMAN into ATCT e-strips and a very user friendly HMI. This has turned out to be one of the key success factors for Vienna.

#### **Process of implementation**

We have decided to assign equal resources to both software and procedure design as well as to human factors.

The implementation of CDM requires a change in the mind-set of all partners. Therefore, this topic has been taken very serious to avoid any complication based on resistance, uncertainty or just lack of knowledge and understanding.

There has been involvement in the DMAN HMI design, which is completely user designed and customised. Cooperation of the company providing the software has been helpful.

Ample time has been given to briefings and training so as that questions could be answered well before the actual start of operation. In addition, it was made clear that this project did not have any kind of trial status but that full operation would be the end goal.

This balance of maximum user participation in the design phase together with a clearly defined goal contributed to successful implementation.

### **Lessons learned**

Implementation of CDM is a long process. It requires significant commitment of all levels from all stakeholders. The management team needed to develop one voice and think beyond company borders. Without identifying open-minded players who are ready to take and communicate decisions any implementation will be much harder and even put it at risk.

Again it has turned out that the final proof of solutions can only be found in day-to-day operation. Many things cannot be simulated. Airport operations are too complex. A general framework can and must be designed before but fine-tuning but it can only be done with hands-on experience.

### **The way ahead**

Vienna has only partially integrated the remote de-icing process. All taxi time predictions are available and used (validated by Advanced Surface Movement Guidance Control System (ASMGCS) recordings), de-icing duration predictions have been validated by historical data and are used.

The only value missing for covering the entire aircraft de-icing process is the exact planning of de-icing capabilities per position and for which time span.

This gap will be closed in the next months, safeguarding a stable CDM process independent from weather situations.

### **Conclusion**

There is no such thing as 100 percent predictability without jeopardising capacity. There will always be a balance necessary in order to achieve predictability as far as possible while maintaining flexibility.

### **Contact**

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## Acronyms

A-CDM	Airport collaborative decision making
Airport-CDM	Airport collaborative decision-making
ACI	Airports Council International
ADGS	Aircraft docking guidance system
ADR	Aeroporti di Roma
AFTN	Aeronautical fixed telecommunications network
AIP	Aeronautical information publication
ALDT	Actual landing time
AMAN	Arrival manager
ANSP	Air navigation service provider
AOBT	Actual off-block time
AOCS	Airport operations center system
AODB	Airport operations database
ARR	Arrival
ASBU	Aviation System Block Upgrades
ASMGCS	Advanced surface movement guidance control system
ATC	Air traffic control
ATCO	Air traffic control officer
ATCT	Air traffic control tower
ATFM	Air traffic flow management
ATIS	Automatic terminal information service
ATM	Air traffic management
ATOT	Actual take-off time
ATS	Air traffic service
CAAS	Civil Aviation Authority of Singapore
CAG	Changi Airport Group
CANSO	Civil Air Navigation Services Organisation
CARATS	Collaborative Actions for Renovation of Air Traffic Systems
CDM	Collaborative decision-making
CFMU	Central Flow Management Unit
CNS	Communication, navigation and surveillance
CTOT	Calculated take-off time
DGCA	Directorate General of Civil Aviation
DMAN	Departure manager
DSNA	Direction des Services de la Navigation Aérienne (French ANSP)
DPI	Departures planning information
EIBT	Estimated in-block time



EFPS	Electronic flight plan processing system
EGKK / LGW	London Gatwick Airport
ELDT	Estimated landing time
ENAV	Ente Nazionale di Assistenza al Volo (Italian ANSP)
ENGM / OSL	Oslo Gardermoen Airport
EOBT	Estimated off block time
EU	European Union
FAA	Federal Aviation Administration (US ANSP)
GMID	Gate message input device
HMI	Human machine interface
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
KJFK / JFK	John F. Kennedy International Airport
KPA	Key performance area
KPI	Key performance indicator
KPHX / PHX	Phoenix Sky Harbor International Airport
LFPG / CDG	Paris-Charles de Gaulle Airport
LIRF / FCO	Leonardo da Vinci – Fiumicino Airport
LOWW / VIE	Vienna Airport
LSSIP	Local single sky implementation
LVP	Low visibility procedures
MIN	Minutes
MoU	Memorandum of understanding
NATS	(UK air navigation service provider)
NextGen	Next Generation Air Transportation System
NOTAM	Notice to Air Men
NMOC	Network Manager Operations Center
OTP	On time performance
PDS	Pre departure sequence
SESAR	Single European Sky ATM Research
SOBT	Scheduled off-block time
TMA	Terminal area
TMAT	Target movement area time
TOBT	Target off block time
TSAT	Target start-up approval time
TT	Taxi time
TTOT	Target take-off time
UK	United Kingdom
U.S.	United States
UTC	Coordinated universal time
VABB / BOM	Mumbai Airport
VIP	Very important person
VFR	Visual flight rules
WSSS / SIN	Singapore Airport



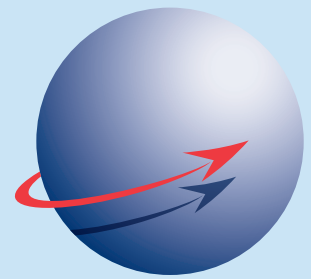




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