A-CDM
CONCEPT OF OPERATIONS

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Reviewers

Name	Organisation	Job Function
Roel Hellemons	BAC	General Manager, Strategic Planning & Development
Ken Allcott	SACL	Airfield Planning Manager
Sarah Renner	APAM	Head of Operations
Kerr Forbes	APAM	Airfield Manager & AOCC
Anthony Green	PAPL	Manager Operational Development
Craig Charker	Airservices	Airservices Australia
Gary Cox	Airservices	A-CDM Program Manager
Adrian Bannister	BAC	Terminal Facilitation Manager
Edward de Kruijf	BAC	Aeronautical Capacity Manager

Paul Chisholm	Airservices	ICT Architect

Distribution List

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EXECUTIVE SUMMARY

Airport CDM (A-CDM) is a concept which aims at improving operational efficiency at airports by reducing delays, improving the predictability of events during the progress of a flight and optimising the utilisation of resources and infrastructure.

Implementation of A-CDM allows each airport CDM Partner to optimise their decisions in collaboration with the other A-CDM partners, knowing their preferences and constraints, and the actual and predicted situation. The decision making by the A-CDM partners is facilitated by the sharing of accurate and timely information, and by adapted procedures, mechanisms and tools.

Airservices Australia (Airservices) established the CDM Program in 2010 as a continuation of the previous work conducted by the InDeX Project. The Airservices CDM Program is an integral part of the OneSky concept which seeks to establish an overall CDM capability for the Australian ATM Network which includes three key capabilities: Air Traffic Flow Management (ATFM), Airport Collaborative Decision Making (A-CDM) and Integrated Arrival & Departure Management (A/DMAN).

This operational concept describes how A-CDM can be adapted to the specific needs at Australian Airports. It also details the way in which it will improve the current operational shortcomings and lists the main changes and impacts on airport partners including Airports (BNE/SYD/MEL/PER), Airservices, and Airlines.

Improvements

By using A-CDM the life-cycle of each flight can be divided into 16 stages, showing the progress of each aircraft as it comes in to land, throughout its turnaround and subsequent departure. This means operational staff at the airport can calculate more realistic timings for each flight, reducing the duration of taxi times and potentially reducing delays. Alerts are generated automatically if an aircraft looks likely to miss its slot, so airport staff can react swiftly.

Increased efficiency means that the number of minutes aircraft spend taxiing on the airfield is reduced, cutting the amount of fuel burn. As well as sharing data across Airports, A-CDM will also share information with airports across the Australian network. This will help to improve network predictability and reduce delays.

Among the other objectives of Airport CDM is the requirement for improvement of the following operational processes: transfer planning, aircraft and crew planning, start-up planning, gate planning, runway and capacity planning, ground handling and turnaround planning, management of large disruptions of airport operations.

Changes

A-CDM requires changes for each airport partner in terms of information sharing and adaptation of internal procedures to a collaborative way of working.

BNE / SYD / MEL / PER / Airport Operators	Facilitate information sharing, sharing of (expected) planning data and improve the use of airport resources and infrastructure.
Airservices	Introduce collaborative departure, surface and arrival planning and sharing of (expected) planning data.
Airlines/GHAs	Adapt the turnaround, pushback and connection planning using the improved CDM information, adapt network planning and sharing of (expected) planning data.

Conclusions

The concept of A-CDM elements are expected to bring significant improvements to the efficiency of processes and the overall airport operation at Australian Airports. The advantages of this capability include:

- Reduced active taxi-out delay for departures from Brisbane, Sydney, Melbourne and Perth;
- More accurate time estimates to facilitate the optimisation and enhanced use of stands, gates and terminals at Brisbane, Sydney, Melbourne and Perth;
- Reduced taxi–in delays associated with congestion of gates and aprons;
- Optimisation and enhanced use of Airline and Ground Handler resources by positioning their resources more efficiently using their precise knowledge of schedule and flight order;
- Improved predictability and subsequent reduction in airborne delay for arrivals into Brisbane, Sydney, Melbourne and Perth through closer compliance with Calculated Take Off Times (CTOT);
- More accurate runway sequence planning at Brisbane, Sydney, Melbourne and Perth airports.

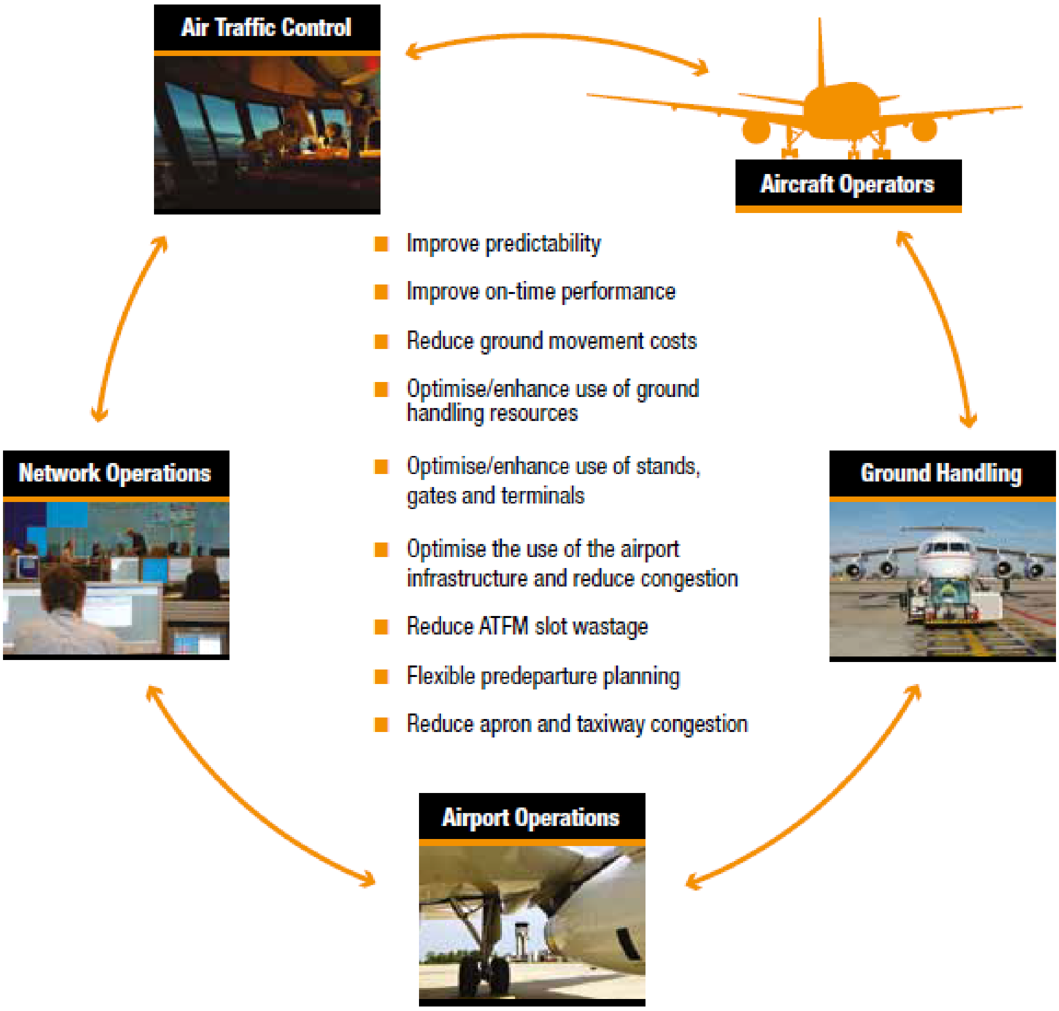
NO.1 INTRODUCTION

1.1 Background

Airport-CDM is the concept which aims to improve operational efficiency at airports by reducing delays, improving the predictability of events during the progress of a flight and optimising the utilisation of resources. With A-CDM the network is served with more accurate take-off information to derive better en-route capacity planning. When more airports implement A-CDM, the network will be able to utilise available slots more efficiently and reduce buffer periods to increase capacity. The decision making by the A-CDM Partners is facilitated by the sharing of accurate and timely information and by adapted operational procedures, automatic processes and user friendly tools.

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

FIGURE 1
AIRPORT PARTNERS AND CDM OBJECTIVES



A-CDM is about partners working together more efficiently and transparently in how they work and share data. Improved decisions based on more accurate and timely information can be taken with A-CDM implementation, resulting in all airport partners having the same shared operational picture, with the same meaning to all involved. It allows each A-CDM Partner to optimise their decisions in collaboration with other A-CDM Partners, knowing their preferences and constraints with the actual and predicted situation.

For the Airport Operator, improved use of stands / gates will increase capacity. More stable traffic flows and reduced taxi times will lead to fewer queues at the runway or congestion on the apron or taxiways. The Air Navigation Service Provider (ANSP) will benefit from improved runway and capacity planning, resulting in less congestion on aprons and taxiways. More accurate take off time predictions will lead to more accurate calculations of the network demand. This enhanced flow and capacity management will result in better ATFM compliance and a reduced number of missed ATFM landing opportunities, and more correlation and compliance with local airport slot schemes. The Ground Handler will benefit from more accurate arrival and departure times, which allows for more accurate planning with more efficient use of resources, including utilisation of pushback trucks. Aircraft Operators (AO) will have an improved awareness of the status and location of their aircraft. Together with sequence information and better arrival times, more accurate fleet predictions will be the result. Fuel burn due to queues at the threshold will be reduced, which has both economic and environmental benefits. Passengers will benefit from reduction in delays, and fewer missed connections. After disruptions recovery will be faster. Also for arrivals more accurate information can be delivered to public flight information display systems (FIDS) service desks and other airport communication channels.

In the absence of A-CDM, joint operational decisions may often be incorrect, or not get made at all. Partners may make conflicting decisions as a result of lack of information or the receipt of information that has diverging meaning to different partners. Addressing these shortcomings individually will bring improvements, however A-CDM can only succeed when the entire set of complex issues are addressed.

This Operational Concept describes how A-CDM is built of elements, addressing specific functionalities that enable realisation of these benefits and solve a significant part of today's operational shortcomings at Australian Airports.

1.2 Purpose of the document

The purpose of the A-CDM Concept of Operations is to:

- Build upon the Schiphol A-CDM Concept of Operations document as a basis for understanding and generating the desired operational benefits for all CDM partners in the Australian airport context;
- Enable understanding of the added value of A-CDM for Australian Airports operation;
- Enable insight into and understanding of the required changes to systems and procedures for each airport partner;
- Enable management decision making on the CDM concept in the Australian context.

1.3 Scope of the document

The A-CDM Concept of Operations includes:

- A description of A-CDM operational concepts based on the European CDM Concept as described by Eurocontrol
- Operational concepts inline with Australian airport CDM objectives

1.4 Organization of the document

Chapter 1 (this chapter) provides an overview, the scope and background of the concept together with the organization of the document.

Chapter 2 provides an analysis of the operational problems and their root causes that CDM will solve.

Chapter 3 provides an introduction to the CDM concept elements and links them to the root causes.

Chapter 4 contains a description of the CDM concept elements.

Chapter 5 provides the proposed solutions based on the concept elements.

Chapter 6 concludes with the recommended solutions and transitions.

1.5 Reference documents

	Document Title	**Version and date**
1	Eurocontrol CDM Operations Concept Document	v1.4, Sep 2006
2	Eurocontrol CDM Implementation Manual	v4.0, Mar 2012
3	Schiphol CDM Operational Concept	v1.5, Feb 2012
4	Schiphol CDM Operations Manual	v0.92, May 2013
5	Airservices Improved Airprot Operations through Departure, Surface and Arrival Management Concept of Operations, C-REF0256	v1.0, December 2013
6	SWIM Concept, ICAO ATMRPP	V0.9 (draft), November 2013

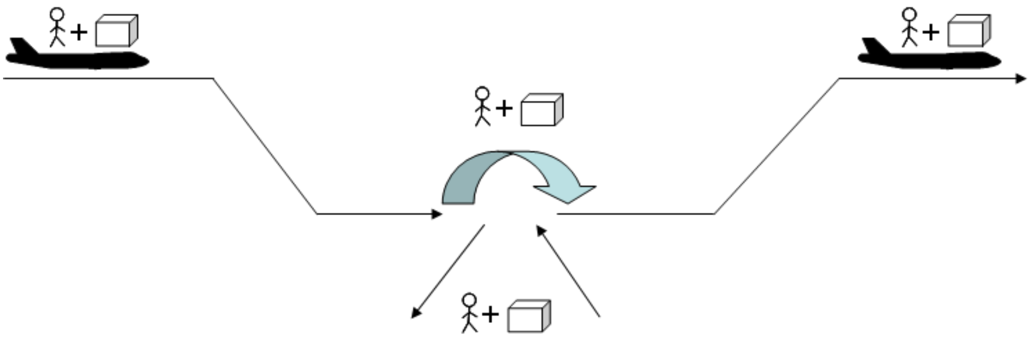
NO.2 PROBLEM ANALYSIS

2.1 Current shortcomings

2.1.1. Current high level process Inbound – Turnaround – Outbound

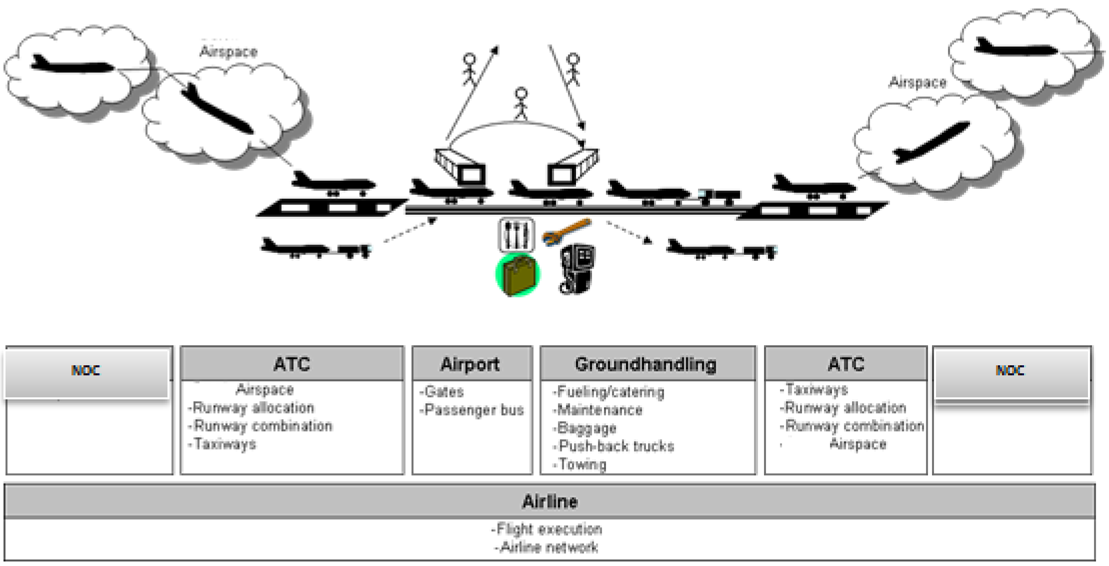
A-CDM aims for a more efficient aircraft arrival, turn-round and departure process at the airport by making best use of the available resources in the daily operation. This facilitates an efficient flow of passengers and cargo.

FIGURE 2
THE AVIATION PRODUCT: PASSENGER AND CARGO TRANSPORT



The flights are handled by a chain of interdependent resources that are managed by several parties. The following figure indicates the involved resources and parties:

FIGURE 3
RESOURCES AND PARTIES INVOLVED IN THE TURN-AROUND PROCESS



The flight schedules and their allocated aircraft link the inbound and outbound flights during the turnaround process. The aircraft will be allocated to the flights in the schedule. Also, many flights are inter-connected due to transfers of passenger and cargo, the core of the hub system.

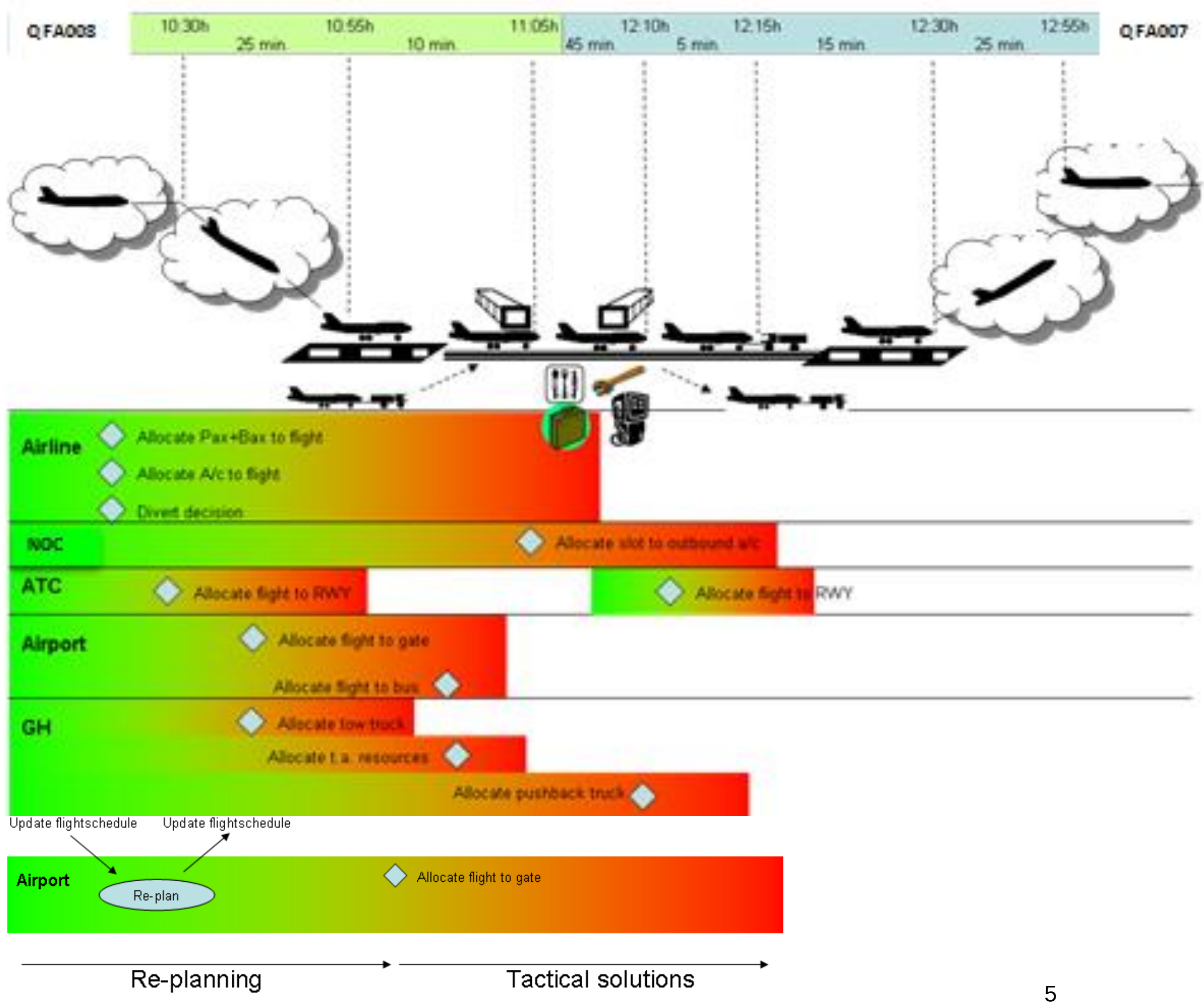
To ensure the on-time handling of the original schedule, each resource should be prepared to handle the scheduled demand of inter-connected flights.

FIGURE 4
AIRCRAFT TO FLIGHT ALLOCATION

Flight schedules ~~will~~ may become disrupted if one (or more) of the resources are unable to handle the flight on-time. These disturbances and their consequential effects require re-planning of the downstream resources. Therefore, each party has set-up processes to manage these resources. However, if the disruption is not shared with the down- & upstream chain, no preventive actions can be taken.

Based on the (updated) flight schedule, the resources can be (re-)allocated to the flights. Initially this will only be in the planning phase, but at a certain time tactical execution of the flight begins. Late decision making and last minute changes will have negative effects due to required reaction times for re planning of flights and their associated resources.

FIGURE 5
PRIMARY DECISION POINTS AND PROCESSES IN RELATION TO TURNAROUND PROCESS



2.1.2. Description of current shortcomings

TABLE 1
CURRENT OPERATIONAL SHORTCOMINGS

Current Shortcoming	Operational Consequences & Knock-on effects	Collaborative (Airport) problem
Aircraft departs outside ATFM calculated off block time tolerance	• Delays at destination airport • Extra workload due arranging with ATC for slot extensions • Airborne holding due to departing non-compliant with ATFM business rules	Reduced punctuality, actual landing times (ALDT) vary to ATFM calculated landing times (CLDT) leading to gate plan changes
Inbound aircraft has to wait for occupied gate	• Congestion of taxiways and aprons, increased workload, blocking of other arrivals and departures • Missed connections (pax/bags/crew/aircraft) or delayed departures • Fuel waste, higher ops costs • Waste of resources	Reduced arrival and departure punctuality, loss of turnaround capacity
Inbound aircraft has to wait for docking / parking guidance	• Congestion of taxiways and piers, increased workload, blocking of other arrivals and departures • Missed connections (pax/bags/crew/aircraft) or delayed departures • Fuel waste, higher ops costs • Waste of handling resources	Reduced arrival punctuality and loss of turnaround capacity
Last minute gate change for inbound flight	• Increased workload in case of gate-change during taxiing • Delayed (bags / aircraft) • Waste of resources, repositioning of GHA equipment and resources (takes approx 20min)	Negative airport image/ passenger perception: Delayed arrival of bags at pickup belt, missed bags during transfer
Runway (combination) changes do not match actual traffic demand	• Additional start-up delay or extra inflight delay • Reprogramming of aircraft board computers and rebriefing of flight crew • Late ready for push/taxi or take-off due to recalculation of take-off performance •	Mismatch of capacity and demand leading to extra startup delays or arrival (inflight) delays. Reduced arrival and departure punctuality
Prioritisation of the departure sequencing is not possible	• Loss of connections • Extra delays and flight cancellations due to crew out of working hours	Unforeseen additional delay for high priority flights (start-up and line-up delay)
Late detection of stand/gate conflicts	• Sub optimal use of stands and gates, waste of stand/gate capacity • Airservices: congestion on taxiways and cul-de-sacs • Last-minute arrival delays resulting in loss of connections • Last minute delays for outbound flights waiting for connections • Extra aircraft towings resulting in more congestion	Reduced punctuality

Passenger buses too early or too late for boarding or disembarkation	• Sub optimal use of passenger transportation (buses), higher costs • Loss of connections, extra delays • Late start of handling • Possible delay for other aircraft, planning problems	Pax perception / airport image Reduced punctuality (if late)
Unexpected long towing time leading to late aircraft on position for start of ground handling	• Late start of handling	Reduced departure punctuality Pax perception / airport image
Last minute resource planning for ground handling	• Late start of handling • Waiting inbound aircraft	Reduced punctuality Pax perception / airport image
Unexpected diversions	• Shifting and out-dated arrival times • Airline unable to advise crew on best diversion option • Handler unable to prepare or check available handling at diversion airport • Late start of handling due to unplanned nature of flight	Reduced punctuality, Pax perception / airport image
Limited predictability of aircraft ready	• Limited options to optimize planning • No or last minute communication on handling delays	Unreliable departure times
No indication of expected pushback time (except in case of CTOT/slot)	• Limited options to optimize planning • No accurate expected take-off time • Airline no indication for arrival time at outstation	Unreliable departure times
Sub-optimal use of pushback capacity	• Waiting push-back trucks • Unreliable push-back times	Unreliable departure times
Last minute decision making of connecting pax/bags/crew and aircraft and resource planning	• Last minute delays • Limited resource planning of tail-to-tail baggage due to late decision making on connections	Reduced punctuality, Pax perception / airport image
Lack of Overall Airport/Network Capacity Management under Adverse Conditions	• “Filling-Up” of the airport under conditions with reduced outbound capacity • Ad-hoc diversion decisions under reduced inbound capacity • Too much or too little rescheduling and cancelling of flights	Chaotic situations during adverse conditions, very poor info for passengers Loss of planning capability; everybody waiting for somebody else.
Taxi-out delay	• Departure queues cause congestion • Lack of traffic predictability	Reduced departure punctuality, Negative airport / airline image / passenger perception
Taxi-in delay	• Taxiway congestion • Lack of traffic predictability • Gate can become unavailable	Reduced arrival punctuality, Negative airport / airline image / passenger perception

2.2 Objectives

2.2.1. High level CDM objectives

The implementation of A-CDM at Australian Airports has the following strategic high level objectives:

- Efficient overall airport operation and sustainable growth for airline operators.
- Reduction of operational and non-performance / service recovery costs in flight and airport operations.
- Maximise traffic throughput by effective use of Airport infrastructure and resources.
- Reduction of delays in flight and handling processes at Airport.
- Minimise effects of major disruptions and temporary reductions in capacity.
- Effective allocation of people and equipment for operational decision making and flight handling.
- Increased reliability of transfer flows, for passengers, baggage, cargo and crew.
- Reduction of aircraft fuel burn

The introduction of A-CDM at Australian airports may deliver benefits to the following operational processes:

- Transfer of passengers and baggage.
- Aircraft and crew planning by Airlines and their (contracted) Ground Handlers.
- Start-up planning by ATC.
- Gate planning by the Airport.
- Runway and Network capacity planning.
- Ground handling and turnaround planning.
- Overall decision making during large disruptions of airport operations.

The CDM procedures and information sharing should be developed in such a way that they guarantee a reliable and flexible operation that is capable of dealing with both normal as well as exceptional conditions and events.

2.2.2 Objectives in terms of safety, efficiency and environment

2.2.2.1 Safety

A primary objective is that there is no impact on the safety level as a consequence of implementing CDM. As a pre-condition for safety to maintain at least an equal level, the risk per handled flight of an incident or accident shall not increase.

Note that this is the program safety objective; the final safety effect as a consequence of efficiency improvements is not known yet and must be studied in a later phase before operational changes, using the regular procedures and methods of the internal and sector-wide safety management systems.

2.2.2.2 Efficiency

The key driver for A-CDM is an improvement of the efficiency of airport operations. This implies improvements in:

- Capacity: better use of stands, gates and terminals; better use of ground handling resources (ground handlers positioning their resources more efficiently, using their precise knowledge of the order and time flights will require resources)
- Punctuality: improve predictability and subsequently reduce airborne delay for arrivals through closer compliance with ATFM departure times, slot adherence robustness, optimal fallback / recovery after disruptions
- Sustainability: fallback / recovery after disruptions minimal impact of delays slot-adherence

2.2.2.3 Environment

The objective is for a positive effect on the environmental impact as a consequence of the efficiency improvements associated with reduced taxi-in and taxi-out delays and airborne delays.

2.3 Root Cause Analysis

2.3.1. Root Causes

An operational problem or disturbance is normally the result of a sequence of events. Finding the root cause identifies the main origin of the problem. As will be demonstrated, these root causes often originate from a lack of collaboration between the airport partners. With the introduction of A-CDM the root causes should be solved and current operational shortcomings should be significantly reduced.

These root causes can be grouped in and summarized by the following root cause categories:

1. Lack of timely and accurate flight information
2. Lack of timely and accurate airport information
3. Lack of collaborative procedures

The following specific root causes were identified for the shortcomings stated in chapter 2.1.2

TABLE 2
SHORTCOMINGS AND THEIR ROOT CAUSES

Current Shortcoming	Root cause	Root Cause Category
Aircraft departs outside calculated off-block time tolerance (or calculated take-off time)	Lack of accurate expected take-off time Lack of automated update to determine if 2nd and subsequent wave flights will be capable of achieving allocated times Lack of planning procedure to take account of handling delays and/or longer departure and taxi process	1 & 3
Inbound aircraft has to wait for occupied gate	Lack of accurate expected in-blocks and off-blocks time Lack of timely re planning and alerting procedure	1, 2& 3
Inbound aircraft has to wait for docking guidance	Lack of accurate expected in-blocks time	1
Last minute gate change for inbound flight	Lack of accurate expected in-blocks and off-blocks time Lack of timely re planning and alerting procedure	1,2& 3
Runway (combination) changes do not match actual traffic demand	Lack of accurate traffic demand (expected landing and take-off times)	1
Prioritisation of the departure sequencing is not possible	Lack of accurate expected ready Lack of collaborative off-blocks planning procedure Lack of accurate expected in-blocks time for destination	1 & 3
Late detection of stand/gate conflicts	Lack of accurate expected in-blocks and off-blocks time Lack of timely re planning and alerting procedure	1, 2 & 3
Passenger buses too late for boarding or disembarkation	Lack of accurate expected off-blocks time and in-blocks time for destination	1
Unexpected long towing time leading to late aircraft on position for start of ground handling	Lack of accurate expected in-blocks, lack of collaborative towing-planning procedure	1 & 3
Last minute resource planning for ground handling	Lack of accurate expected in-blocks and off-blocks time	1

Unexpected diversions to another airport	Lack of timely re planning and alerting procedure	1 & 3
Unexpected arrival delay	Lack of information of additional flight time	1 & 3
Limited predictability of aircraft ready	Lack of accurate expected in-blocks and handling progress	1 & 3
No indication of expected pushback time (except in case of CTOT/slot)	No departure planning (TOBT/TSAT)	3
Sub-optimal use of pushback capacity	No departure planning (TOBT/TSAT)	3
Last minute decision making of connecting pax/bags/crew and aircraft and resource planning	Lack of accurate expected in-blocks and off-blocks time	1
Lack of Overall Airport/Network Capacity Management under Adverse Conditions	Lack of accurate airport status info and traffic & capacity info	2 & 3
Taxi-in / out delay	Lack of collaborative EXIT and EXOT times	1 & 3

2.3.2 High level requirements/needs

Based on the root causes from chapter 2.3.1 the high level needs can be summarised by:

- Timely and accurate flight information
- Timely and accurate airport information
- Collaborative procedures
- Appropriate airport partners involved
- Overall airport coordination for adverse conditions

NO.3 MAPPING OF CONCEPT ELEMENTS TO ROOT CAUSES

3.1 CDM Concept Elements

3.1.1 A-CDM Information Sharing

CDM Information Sharing is essential for achieving common situational awareness through the exchange and sharing of all pertinent information, collaboratively supplied by all CDM partners, including data recording and post-operational analysis of key KPAs/KPIs. It also forms the foundation upon which all other Elements operate and as such must be implemented first.

3.1.2 The CDM Turnaround Process (Milestone Approach)

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

3.1.3 Variable Taxi Time Calculation

Variable Taxi Time Calculation aims at improving the accuracy of calculations associated with the ground movement of aircraft, such as estimated take off times and in-block times. This Element is a pre-requisite for the implementation of the Collaborative Management of Flight Updates. The aim is to improve traffic predictability.

3.1.4 Collaborative Management of Flight Updates

This Element ensures the required operational flexibility of ATFM to cope with modifications in departure times, due to traffic changes and operators' preferences. It requires the availability of precise taxi times provided by Variable Taxi Time Calculation (VTTC) and the CDM Turn-round Process.

3.1.5 Collaborative Pre-departure Sequence

This Element enhances flexibility and planning in departures and helps in optimising all airport resources including airside and take-off capacity.

3.1.6 CDM in Adverse Conditions

This Element facilitates the dissemination of capacity changes and recovery from disruption, ensuring flexibility and optimum use of available resources.

3.2 Mapping to root causes

The following table shows which CDM concept element addresses (part of) the identified root causes of the current operational shortcomings. TABLE 3
MAPPING OF CONCEPT ELEMENTS TO ROOT CAUSES

Root Cause Category **CDM Concept Element**	**Lack of accurate flight information**	**Lack of accurate airport information**	**Lack of collaborative procedures**
A-CDM Information Sharing	✓	✓	
CDM Turn-round process (Milestone Approach)	✓		✓
Variable Taxi Time Calculation	✓		
Collaborative Management of flight updates	✓		
Collaborative Pre-departure Sequence	✓		✓
CDM in adverse conditions		✓	✓

NO.4 A-CDM CONCEPT ELEMENTS

4.1 A-CDM Information Sharing

The Information Sharing Element defines the sharing of accurate and timely information between the A-CDM Partners in order to achieve common situational awareness and to improve traffic event predictability.

The A-CDM Information Sharing Platform (ACISP), together with defined procedures agreed by the partners, is the means used to achieve these goals.

Information Sharing is the core A-CDM Element and the foundation for the other A-CDM Elements. It needs to be implemented before any other Concept Element.

4.1.1 Current Shortcomings

The following shortcomings will be addressed by the A-CDM Information Sharing concept element:

- The exchange of timely and accurate information between Airservices, Airlines / Ground Handlers and Airports locally requires improvement.
- Effective collaborative decision making is not possible due to lack of timely and accurate flight information and the lack of an accurate shared overview of Airport critical information.

Both lead to sub-optimal decisions with regard to the management of flights and airport resources such as runways, taxiways, stands, gates and buses.

4.1.2 Objectives

A-CDM Information sharing aims at facilitating the information exchange between the various partners with a view to creating common situational awareness of actual and expected airport situation.

It will improve the decision making process and hence improve the efficiency of operations by making best use of available information through timely and more accurate information sharing between Aircraft Operators, Ground Handlers, Airservices, Airport Operator, and the Meteorological Provider.

A-CDM Information Sharing shall not only lead to improvements by itself, but also enable the implementation of CDM procedures amongst the various partners in the airport. The enhancements will not be restricted to one airport but will have a positive effect on the entire ATM network.

It also forms the information management foundation upon which all other A-CDM Concept Elements are based.

4.1.3 General Description

A-CDM Information Sharing, while providing the basis for common situational awareness (CSA) is also the primary enabler for all other A-CDM Concept Elements. Effective collaborative decision making is not possible without timely and accurate flight and airport information. A common view of the airport operation will facilitate decision support for both the CDM Cell (see 4.6.6) and individual decision making.

The general principle is the sharing of data, at no costs, between key A-CDM Partners. The A-CDM Information Sharing Platform (ACISP) is a logical data repository, collecting and distributing data from and to the participating partners. The Airport Schedule as well as known airport operational configuration information will be used as the data repository foundation. Incoming and outgoing flights as well as aircraft registrations will be related to the airport schedule.

The arriving flight, the turnaround process and the departing flight of a particular airframe is seen as one continuous operation, where the successful completion of a task, or the lack of on time completion, has an impact on the downstream operations.

Each participating Australian Airport will need to modify their AODB/FIDS System to include all flight information required for CDM Information Sharing.

4.1.5 Data sources and destinations

The A-CDM Information Sharing Platform (ACISP) will consider as a data source or data destination any organisation or system that generates and/or uses information concerning the management of flights and airport resources. It should be considered as [the foundation for] the local System Wide Information Management (SWIM) system (see ATMRPP SWIM Concept), as described in the ATM Masterplan.

All CDM required flight information shall be provided to ACISP as agreed / to be agreed in the Milestone Approach procedures.

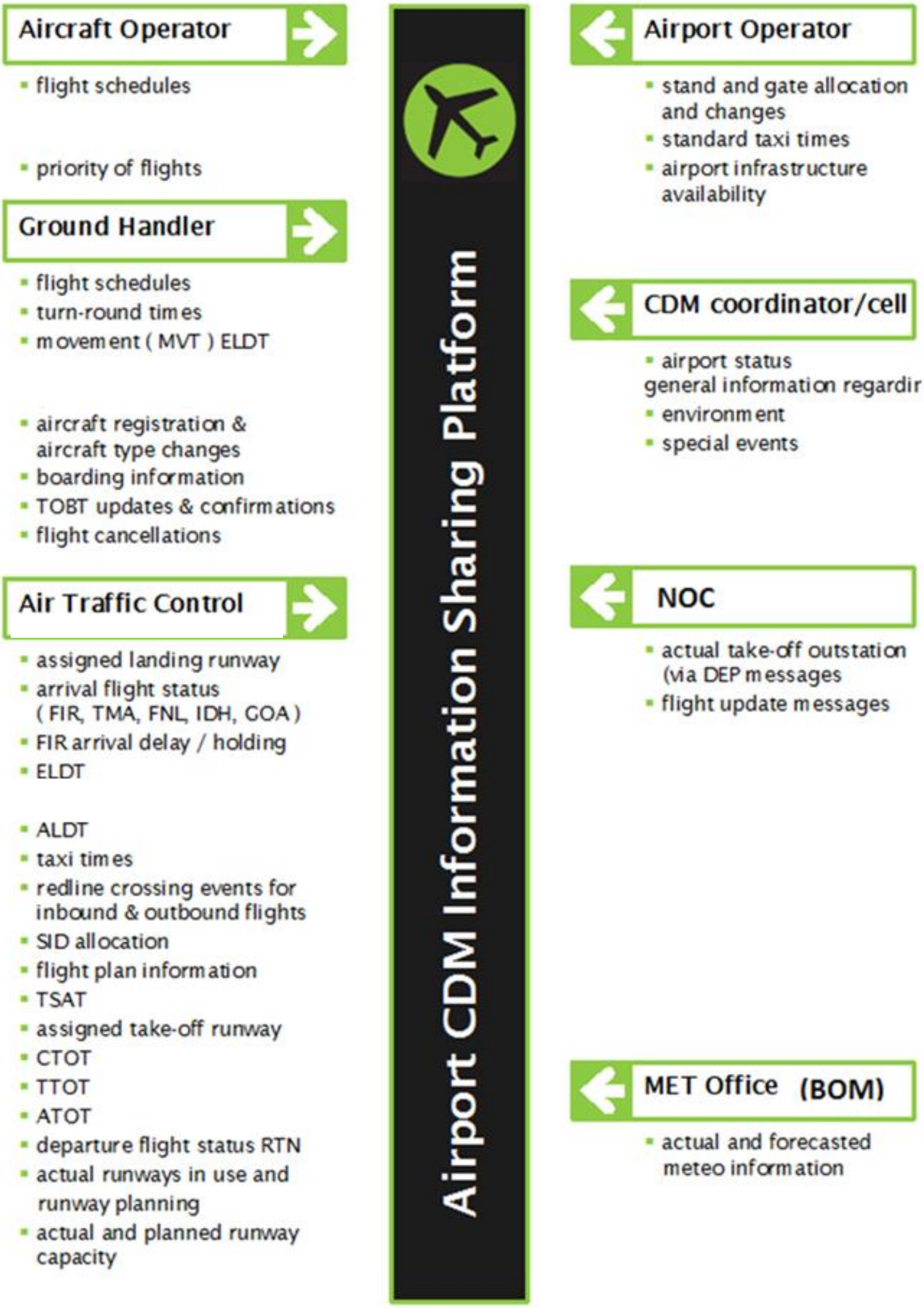
The A-CDM Information Sharing Platform (ACISP) is a generic term used to describe the means at a CDM Airport of providing Information Sharing between the A-CDM Partners.

The ACISP can comprise of systems, databases, and user interfaces.

4.1.5.1 ACISP - Information collecting

FIGURE 6

AIRPORT PARTNERS AND THEIR CONTRIBUTION TO CDM INFORMATION SHARING



4.1.9 Technology

To facilitate data exchange, systems design will align with Service Oriented Architecture (SOA) principles. An A-CDM Data Exchange will be used to facilitate back-end services between external Partners and Airservices. The A-CDM data exchange will also facilitate security, messaging, data provisioning and access management for the services identified in this Concept of Operations.

External partners will access services and request products using a web-enabled interface or portal. Access to services will be restricted to only those that need to use that service and if required have proven they will be competent in its use.

Support, Integration and Technical services will have one or more applications to access services and perform their required business activities including processing system event messages.

A-CDM participants applications will communicate and access services and information via the A-CDM Data Exchange.

4.2 The CDM Turn-Round Process (The Milestones Approach)

4.2.1 Current Shortcomings

In the existing environment, there is often no visible link established between the airborne and ground segments of flights, known and shared by all partners. This results in changes in one segment not being communicated to all the partners and hence they are unable to anticipate the impact and take appropriate measures to re-plan resources and necessary activities. This results in poor data quality and predictability especially for departing flights.

4.2.2 Objectives

4.2.2.1 General Objectives

The objective of this Concept Element is to define Milestones compared to which flight progress is monitored and which enable at the same time the estimation of the impact on the future progress of the flight. The information will be shared by all involved partners.

The Milestone Approach will allow more accurate predictability of the flight progress and timely information and will support collaborative procedures. As a result, it can also help each party involved in CDM to optimise their own internal processes.

The information updating procedures need to match the required information accuracy; e.g. updates of estimated times should take place if there is a need for more accurate information at that moment in time.

4.2.2.2 Specific Objectives

The main objective of the Milestone Approach is to further improve the common situational awareness of all partners when the flight is inbound and in the turnaround flight phases. More specifically, the objectives are to:

- Determine significant events in order to track the progress of flights and the distribution of these key events as Milestones
- Define information updates and triggers: new parameters, downstream estimates updates, alert messages, notifications, etc.
- Specify data quality in terms of accuracy, timeliness, reliability, stability and predictability based on a moving time window
- Ensure linkage between arriving and departing flights
- Enable early decision making when there are disruptions to an event
- Improve quality of information

4.2.3 General Description

A milestone is a significant event during the planning or progress of a flight. A successfully completed milestone will trigger the decision making processes for downstream events and influence both the further progress of the flight and the accuracy with which the progress can be predicted.

The CDM Turn-round process (Milestones Approach) is a CDM Element supporting the goal of achieving common situational awareness. A set of Milestones in the aircraft turn-round process have been established. The Milestones help in identifying potential deviations from planning trigger re-planning and allow collaborative decisions to be made.

Milestones that are passed shall lead to an update of downstream milestones/time elements following agreed procedures. Some milestones are Airport specific; other milestones serve the destination airport of the flight as well. The most important time elements that are linked and updated at the passing of a Milestone are: the Estimated Landing Time (ELDT), the Estimated In-Block Time (EIBT), the Target Off-Block Time (TOBT), the Target Start-Up Approval Time (TSAT), and the Target take-off time (TTOT).

4.2.4 A-CDM Milestones

A-CDM requires the provision of accurate and timely information from partners at milestones in the flight lifecycle. Milestones are organised into 3 groups: Inbound, turn-round and outbound.

TABLE 5 : A-CDM MILESTONES AS PROPOSED BY AIRSERVICES AUSTRALIA

No.	Milestone	Time Reference	Data Elements	Accuracy
1	Initial CTOT allocation for a flight departing A-CDM airport to a GDP airport.	12-18 hours before EOBT	CTOT ETA	-5 to +15 minutes -5 to +15 minutes (98% of arrivals)
2	Flight plan submission for flight departing A-CDM airport	To be determined	FPL	NA
3	Take off from outstation	ATOT from outstation	ATOT ETA	+/- 1 minute -10 to +30 minutes within 3 hr -20 to + 60 minutes greater than 3 hr
4	Expected Landing Time	ETA – 70 min	ELDT EIBT	+/- 5 minutes (98% of arrivals) +/- 10 minutes(98% of arrivals)
5	Final approach	ELDT – 10 minutes	ELDT EIBT	+/- 1 minute +/- 5 minutes
6	Landed	ALDT	ALDT EIBT	+/- 30 seconds +/- 1 minute
7	In-block	AIBT	AIBT	+/- 1 minute

8	Ground handling starts (optional)	ACGT	ACGT	+/- 1 minutes
9	TOBT update prior to TSAT	TOBT -30 minutes	TOBT	+/- 2 minutes
10	TSAT issue	TOBT – 25 minutes	TSAT	+/- 2 minutes
11	Boarding starts (optional)	Varies according to airport	ASBT	+/- 2 minutes
12	Aircraft ready	ARDT	ARDT	+/- 2 minutes
13	Start-up request	ASRT	ARDT	
14	Start-up approved	ASAT	ASAT	
15	Off-block	AOBT	AOBT	+/- 30 seconds
16	Take off	ATOT	ATOT	+/- 30 seconds

The primary interaction with the A-CDM modules at each milestone in the Australian context is depicted below.

FIGURE 7

PROPOSED AUSTRALIAN A-CDM MILESTONES AND APPLICATIONS

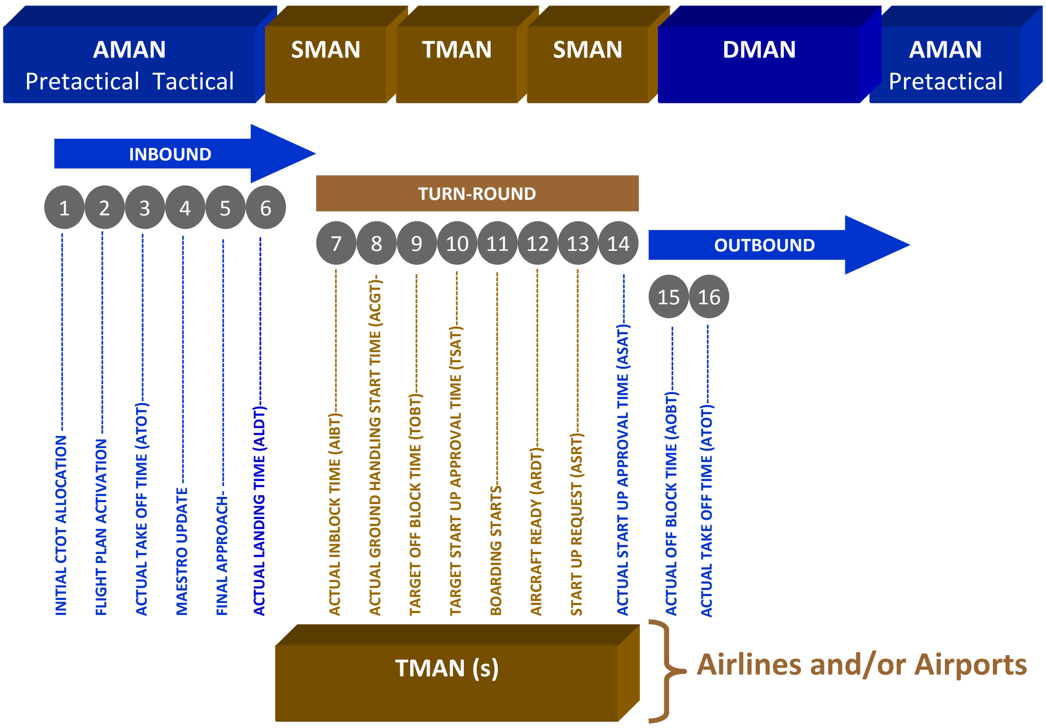


Figure 10 summarises the milestones and the exchange of information showing the exchange of milestone information between the various A-CDM partner systems.

FIGURE 8
AUSTRALIAN A-CDM EXCHANGE

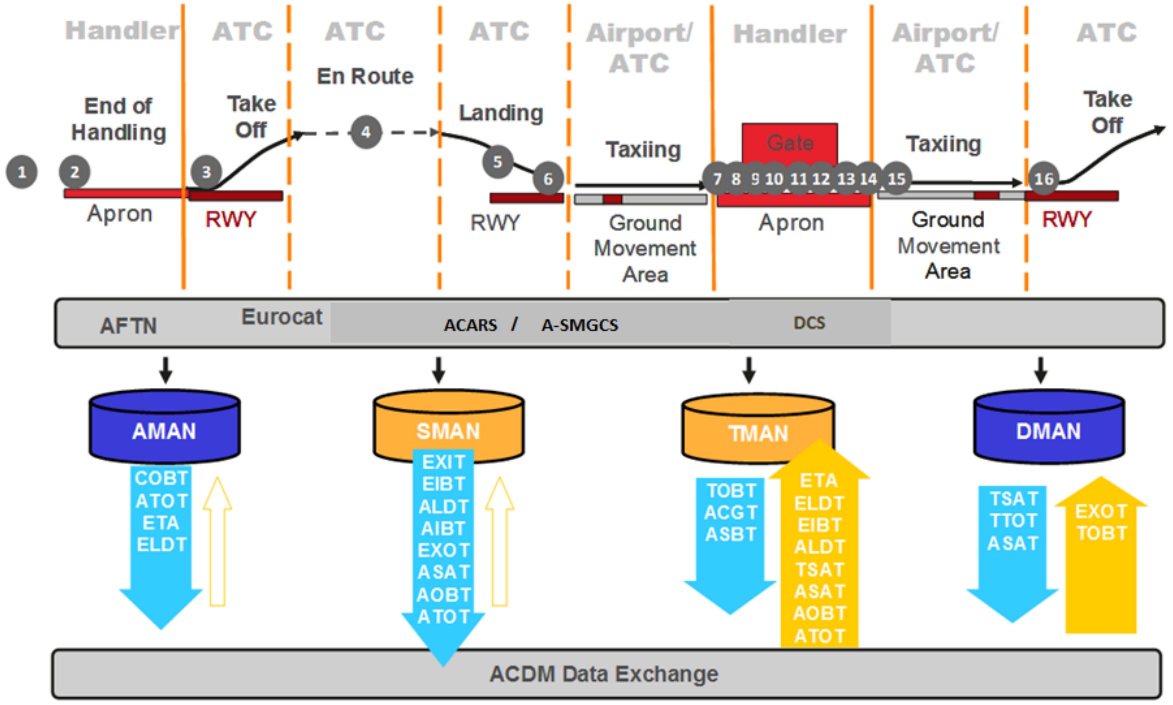
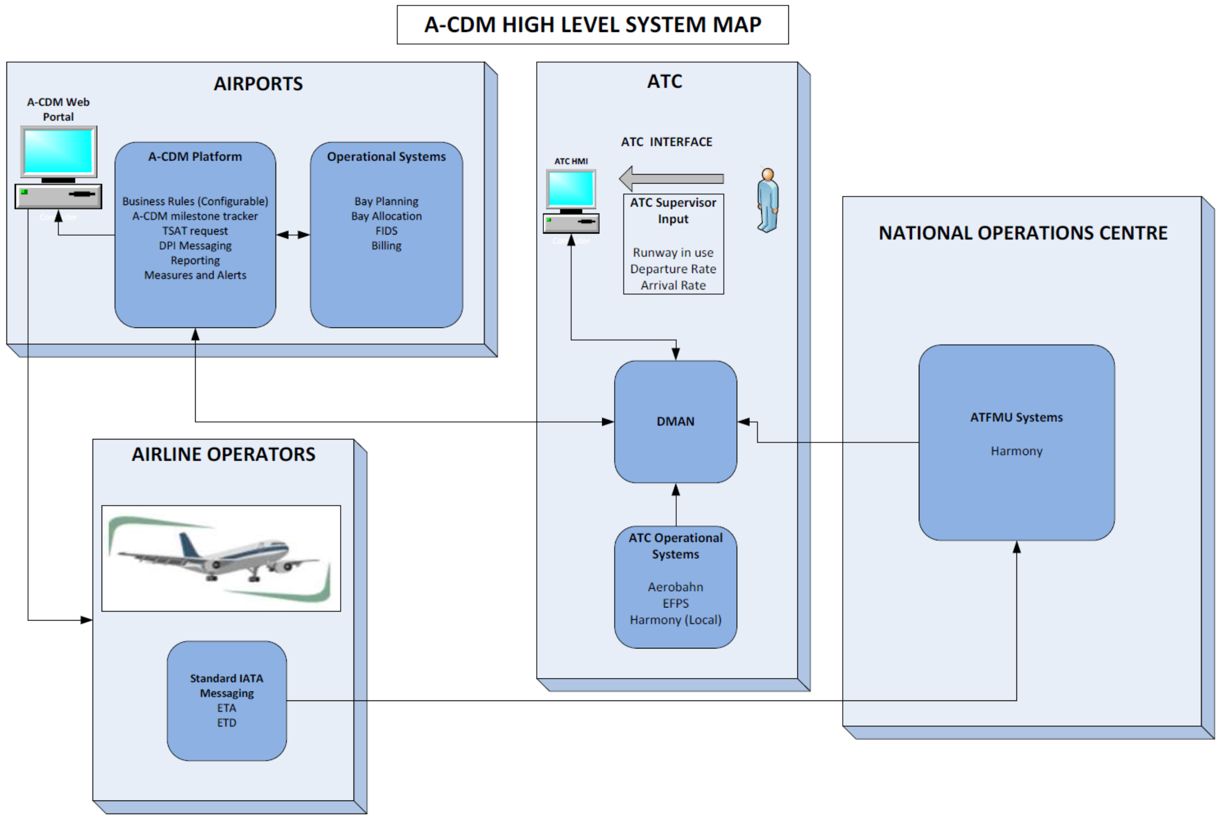


FIGURE 9

HIGH-LEVEL DATA FLOW BETWEEN A-CDM PARTNERS



4.3 The Variable Taxi Time Calculation

The Variable Taxi Time Calculation Element consists of calculating and distributing to the A-CDM Partners accurate estimates of taxi-in and taxi-out

Comment [MPW5]: Question – will variable taxi times ever make it back into Metron.

Comment [c6]: The aerobahn DMANs variable taxi time will be subtracted from the Metron CTOT to give a TSAT which will be the equivalent of the Metron COBT.

times to improve the estimates of in-block and take off times. The complexity of the calculation may vary according to the needs and constraints at the Airport.

4.3.1 Current Shortcomings

Taxi times can vary significantly due to the aerodrome layout (varying distances between different aprons and runways) and the traffic situation. Current processes in calculating taxi times use look-up tables based on historical values. Therefore, the use of default values introduces inaccuracies in estimated in-blocks times and makes adherence to the CTOT difficult. Hence, there is a need to introduce variable taxi times.

Currently there is no shared reliable indication of taxi time for flights at Australian Airports. This results in sub-optimal local (hub) operations.

4.3.2 Objectives

The objective of this Element is to provide an accurate and semi-automatic taxi time calculation for each flight, resulting in an enhanced predictability of in block and take off times. Semi-automatic means that the controllers still have the possibility to adjust the taxi times as provided by the automated calculation part.

4.3.3 General Description

Taxi Time is the duration of time that an aircraft spends taxiing between its parking stand and the runway or vice versa. It includes some time spent on the runway when lining up and vacating.

For A-CDM purposes, taxi time is considered to be:

- For arriving flights: the taxi-in time is the period between the Landing Time and the In Block Time.
- For departing flights: the taxi-out time is the period between the Off Block Time and the Take Off Time.

For planning purposes within the CDM operation, taxi times will be referred to as estimated taxi-in (EXIT) and estimated taxi-out (EXOT).

For planning purposes and for tactical management of time estimates, each movement must be considered individually. This is the reason why the taxi time is called variable. It is no longer a fixed default value for all flights. The notion 'variable' is used as opposed to the default fixed taxi times, which are currently applied

4.3.6 Static and dynamic variable taxi times

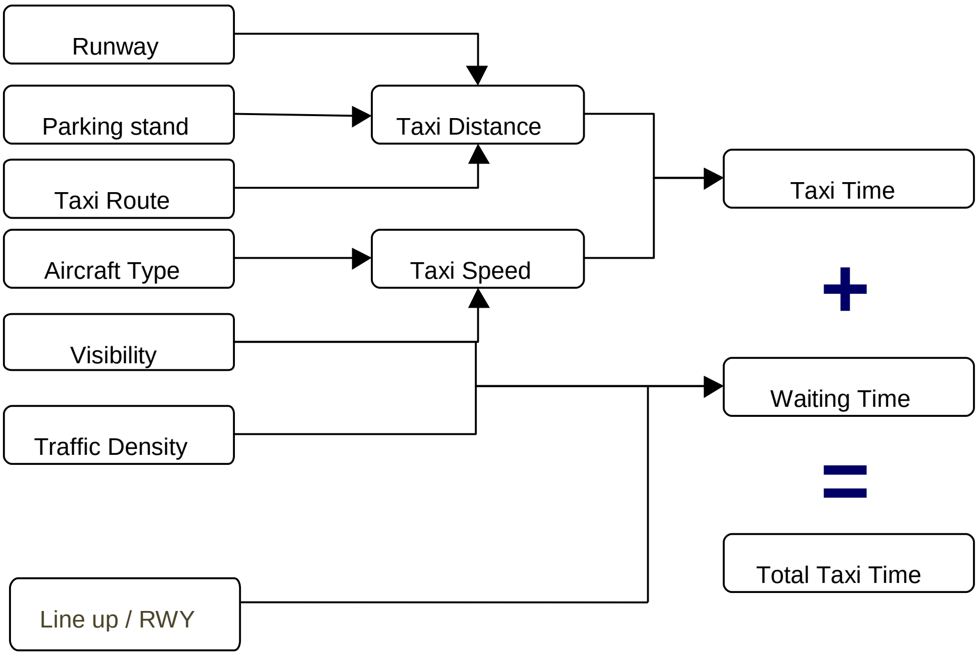
VARIABLE TAXI TIMES: STATIC

Average taxi times for each stand-runway combination are collected in a look-up taxi table. Some more diversification can be introduced in case of more than one taxi route for certain stand-runway combinations. The averages can be based on e.g. last year, and might be updated e.g. each season or each month. Operational conditions such as low visibility or traffic congestion might require a significant longer taxi time for one, some or all flights. In this case it might be required to increase the static taxi times in order to achieve the required accuracy for estimated in-block times and the TSAT's and estimated take-off times. This taxi time increment could be initiated manually and/or applied automatically for a specific flight, for flights to/from a specific runway or specific time of the day (traffic peaks). The necessity of such a function depends on the accuracy of the static taxi times and the required accuracy for in-blocks and collaborative departure planning.

VARIABLE TAXI TIMES: DYNAMIC

The calculation method mentioned in the previous paragraph is still primarily based on an almost static table. Variable taxi time calculation can become more dynamic when the times are automatically updated for short term factors or influences in the pre-tactic or the tactic phase. Taxi times are called dynamic taxi times if they take account of all these factors.

FIGURE 10
MAIN ITEMS INFLUENCING TAXI TIME



4.4 Collaborative Management of Flight Updates

4.4.1 Current Shortcomings

The ATFM network, although physically existing, is not yet considered as an entity where successive flights depend on each other and where ground processes and en route traffic are considered as equivalent parts of a time-dependent chain. Too many processes are considered in an independent way and are not evaluated for any impact downstream.

All involved partners look at their area of responsibility for each flight and each aircraft but the importance of the supply of information to other partners is underestimated.

Ground processes and the en route segment of flights are considered within their respective areas without sufficient early notification to the next partner(s) in the chain.

A flight en route is considered from its aerodrome of departure to its destination. On the ground the responsibilities change. Aspects linking the flight to its turn-round process, to connecting flights and to successive flight legs are not considered early enough and the focus is mainly on local aspects only.

Aircraft operators try to overcome this lack of information flow within the current air traffic network by using fleet management systems. These systems aim to achieve the best possible overview concerning one particular fleet. One AO reflects only a fraction of the entire network and its fleet management systems lack information from important partners in the network, e.g. ATC, Stand & Gate management at out stations or even occasionally at their own hub. Fleet management systems give the best possible overview of a fleet network using a reduced set of information. The achieved picture of an AO's network (daily operations) is only a part of the entire network.

Currently, this portion of the entire network is not communicated to other partners and most other partners do not believe that this information could be of interest to them.

Unlike airlines, Airservices tries to obtain a view of the complete ATM network in order to identify bottlenecks and to calculate the resulting, necessary regulations. Airservices bases the ATFM slot allocation on predicted air traffic based on filed flight plans and updates from airborne traffic. The efficiency of the slot allocation process depends largely on the quality of the traffic prediction, which in turn is highly influenced by the quality of the flight plan data. An FPL gives only a raw picture of a flight, because the Estimated Off-Block Time (EOBT) and route can only be considered as provisional when the flight plan is filed. The inaccuracy of ETOTs (derived from EOBT + standard taxi time) is a major source for uncertainty in the overall traffic prediction and this lack of predictability leads to inefficient use of capacity where actual landing times do not align to ATFM Metron Traffic Flow (MTF) Slots. The procedures associated with ATFM allow aircraft to operate from -5 to +15 of allocated COBT.

Of all the involved partners, Airservices has the most holistic picture of the network but there is still need for improvement. In particular, the integration of ground activities linked to the flights will improve the data quality used for ATFM, especially by providing a reliable ETOT, and facilitate the early intervention of a flight that will be unable to meet COBT, and the reduction of tolerances associated with the ground delay process.

Eurocontrol has established a series of messages to address the limitations of legacy systems. Individual flight progress is monitored tactically to trigger Departure Planning Information (DPI) messages in order to inform the network concerning time predictions and their updates. These messages to the network are essential to the European environment as they update network predictions, and hence have a direct impact on the allocated times from the TMI (CLDT and CTOT), and an indirect impact on other scheduled departure flights in the network.

4.4.2 Objectives

The objective of this Element is to bring further improvements to the flexibility of aircraft and airport operations by improving co-operation with the ground delay program. It will introduce the concept of a CDM Airport (CDM-A), designating airports meeting all requirements for close co-operation with the NOC.

Collaborative Management of Flight Updates will be sent and received via the A-CDM Information Sharing Platform.

4.5 The Collaborative Pre-departure Sequence Planning (CPDSP)

This concept foresees the creation of an off-blocks planning based on the TOBT's from Aircraft Operators & Ground Handlers and the available airport & airspace capacity. The initial off-blocks planning will be created by ATC and shared amongst the CDM partners. It is expected that this shared planning will enable an improved traffic, resource and capacity management for all partners involved.

4.5.1 Current shortcomings

TRAFFIC AND CAPACITY MANAGEMENT

As a general rule, ATC applies the "first come first served" principle in pre-departure sequencing. Fights are pushed back in an order that is best suited for the current ATC situation. However, it does not take into account the aircraft operator preferences.

In addition, ATC has only limited knowledge about the flights that will become ready for departure. The only indication they have at present, is a list of EOBT that have been used in the flight plan filing by the AO. These EOBTs will only be updated when new estimates differ more than 30 minutes from the ones filed in the FPL. As a consequence, ATC is not able to create a reliable plan for the start-up sequence. Such a plan would allow AO and GH to plan their resources and take actions based on this plan. Since the planning is not present currently, this is not possible.

In addition, it is impossible to make a good estimation for the upcoming demand. Adaptation of the current runway configuration to accommodate a change in demand is therefore based on information that does not reflect the actual operational situation. This might result in a sub-optimal runway planning.

STAND AND GATE MANAGEMENT

Stand and Gate management has information on estimated in-block as well as estimated off-block times. However, the accuracy of this information is not always enough to avoid gate conflicts. With Collaborative Predeparture Sequence Planning (CPDSP) the off-blocks planning that is made by ATC and shared with the other sector partners, will give more accurate planning data on the outbound part.

Together with the improved information on the in-block times through the Milestone Approach, this will allow timely detection of possible gate conflicts that can then be resolved.

GENERAL

New technology and tactical planning based on CDM procedures will create planning that better reflects the operational situation. This will allow improved planning of resources by AO/GH, improved Stand and Gate Management by the Airport authorities, as well as improved runway configuration planning by ATC at Australian Airports.

4.5.2 Objectives

Collaborative pre-departure sequence planning, Airports intend to : Enhance flexibility – Aircraft operators and ground handlers can use the TOBT to indicate their preferences. The TSAT information that is fed back to them by ATC provides feedback on how their preferences are reflected in the planning. Swapping of TSAT (within limits to be discussed and agreed between the airport partners) will be possible similar to processes used for slot swapping in MTF.

- Increase punctuality – The aircraft operators, ground handlers and ATC can work together to optimise the start-up order
- Provide all partners with greater transparency of the operational situation regarding the status of departing flights
- Enable ground handlers to position their resources more efficiently, using their precise knowledge of the order and time flights will require them
- Enable more efficient stand and gate management
- Enable demand versus runway configuration and capacity balancing that better reflects the operational situation
- Reduce taxi-out times, as expected delays can be absorbed on the gate (where feasible)

4.5.3 General Description

Collaborative Pre-Departure Sequencing Planning uses the provided Target Off Block Times (TOBT; provided by AO and GH) to create initially an optimum take off sequence (TTOT; Target Take Off Times) based on the operational situation at the airport and on the available runway and airspace capacity. The VTTC concept element will be used in this process to have an accurate estimation of the required taxi-out time (EXOT). The resulting list of sequenced TTOTs will create the Target Start-Up Approval Time (TSAT) order that will be provided to the CDM partners together with the TTOTs. This way flights can leave their stands in the optimum order.

Efficient pre-departure sequence planning is possible only if all the other CDM concept elements, except CDM in Adverse Conditions, have been implemented.

From a CDM perspective, the departure phase of a flight at an airport contains two significant, distinct events:

- leaving the stand/parking position
- departure from the runway (take-off)

In the context of this concept element, the pre-departure sequence refers only to the organisation of flights from the stand/parking position, i.e. it is an off-blocks planning. However, this off-blocks planning is based on a take-off optimisation of the available runway capacity with the active runway combination. In order to optimally use the available runway capacity, SID's and WTC of flights need to be taken into account in the take-off planning process. The related off-blocks times, that are calculated using the variable taxi times (via VTTC), will therefore also be dependent on these.

4.6 CDM in Adverse Conditions

4.6.1 Current shortcomings

Airport operations is a finely co-ordinated and tuned set of actions, carried out by a large number of partners, all aiming for maximum efficiency in their particular activity. Under normal conditions this is usually achieved for the common good of the users of the airport. Problems can quickly arise though when normal conditions are disturbed by events that require different procedures and co-operation.

Adverse conditions are a part of the life of any airport. The problem is, not all such methods are equally effective and many are applied inconsistently and/or without coordination with the other partners. Although every individual airport partner does their utmost to keep their operations as close to normal as possible this does not result in the best overall airport performance. In fact, continuing with normal operations can lead to extra disruptions and delays under adverse conditions. An example is the “filling up” of the airport under conditions with a reduced outbound capacity (e.g. fog); or an Airline check-in / booking system outage which causes passenger confusion and flight delays.

All this results in situations where adverse conditions, whether they could be anticipated or not, result in available capacity not being used fully and the time needed to return to normal operations is longer than necessary. The optimum use of available capacity and resources under these conditions requires swift communication between the A-CDM Partners and central coordination.

4.6.2 Objectives

The objective of CDM in Adverse Conditions is to safely and collaboratively manage periods of disrupted operations as a result of predicted or unpredicted reduction of the overall airport capacity. In particular, transitions from normal to reduced capacity and vice versa need to be well managed to ensure minimal impact on passengers and overall airport operations.

The most important objectives of CDM in adverse conditions are:

- Enable the anticipation of adverse conditions and the subsequent loss of capacity
- Provide central coordination and communication to optimise the overall airport operation
- Keep airport operations as efficient as possible through prompt decision making, flexibility and adaptability of the A-CDM Partners
- Facilitate return to normal operations in the shortest possible time

4.6.3 General Description

Adverse conditions are generated by external or internal events that significantly reduce the overall airport capacity and affect and disrupt the operational processes.

Operation of CDM in Adverse Conditions requires that other CDM concept elements, in particular CDM Information Sharing, Turn-Round Process and Predeparture Sequence, are available at the airport concerned.

Adverse conditions may be predictable or unpredictable. Predictable adverse conditions include forecast bad weather, industrial action, scheduled maintenance or repair works, etc. Unpredictable adverse conditions are, for example, unforeseen deteriorations in the weather, undeclared strikes, terrorist alerts, incidents etc.

CDM in Adverse Conditions requires appropriate agreements and procedures to be put in place to be activated in case of adverse conditions. These include detection of the expected or actual arrival of such conditions, effective communication and exchange of appropriate information to all A-CDM Partners. Exchanging timely and reliable information is essential to ensure the fastest possible return to normal operations, this being one of the most important objectives of CDM in Adverse Conditions.

The special procedures under adverse conditions should diverge from those used under normal conditions only to the extent absolutely essential, to limit the workload, training needs and changes to partners’ working habits. Where collaborative procedures for the management of adverse conditions already exist, it is proposed to adapt and use these if possible, rather than develop completely new procedures.

The CDM coordinator and CDM Cell, along with the airport status indication, are the core functions of this concept element. These are described in the following sections.

4.6.4 Adverse conditions

It is important to constantly estimate and monitor the actual impact of reduced capacity on the operation of flights and adjust the procedures accordingly. The facts and effects of these adverse conditions need to be made available to all airport partners so they can have a common understanding of the actual and expected airport operation. Here the CDM coordinator and CDM Cell play a central role in establishing and communicating the impact and information on the adverse conditions and the collaborative planning to deal with their effects.

WEATHER AND RUNWAY CAPACITY – ATC will use the weather forecasts and other information to determine in advance the configuration and capacity of runways. The resulting information will be shared with all A-CDM Partners via the CDM Portal.

PLANNING OF WORKS – Information on planned maintenance or repair works that may affect air side or land side capacity will be provided by the airport. The resulting relevant information will be shared with all the A-CDM Partners via the CDM Portal.

MANAGEMENT OF TECHNICAL RESOURCES – Availability of the technical resources used for airport operations will be reviewed by the airport. When availability falls below a pre-defined level, this will be communicated to all airport partners via the CDM Portal.

INDUSTRIAL DISRUPTIONS – Each A-CDM Partner will provide advance information in the event of predicted industrial disruption in its services. The resulting information will be shared with all A-CDM Partners via the CDM Portal.

UNPREDICTABLE EVENTS – By definition, unpredictable adverse conditions cannot be anticipated. If the regular procedures cannot be applied then organised improvisation is required. However, even in such cases, certain basic steps and procedures can be prearranged. Information will be shared via the CDM Portal.

EMERGENCIES & ACCIDENTS – standard emergency procedures will apply which will overrule any CDM process.

NO.5 MODIFIED OPERATIONAL SOLUTIONS

5.1 Evaluation of Concept Solution

The proposed basic CDM concept and the proposed incremental enhancements have been evaluated and checked against the current operational shortcomings to be improved by CDM.

The following table gives an indication of the expected improvements for each of these shortcomings if compared to the current situation.

TABLE 6
EVALUATION OF CONCEPT SOLUTION

Current Shortcoming	Basic CDM	With further Enhancements	Contribution/Description of CDM
Aircraft departs outside ATFM slot	Some Improvement	Significant Improvement	Due to increased accuracy of estimated ready (TOBT), estimated off-blocks (TSAT) and taxi times leading to accurate take-off times. Flights are much less likely to depart outside slot window.
Inbound aircraft has to wait for occupied gate	Some Improvement	Significant Improvement	Due to early and reliable detection of stand conflict (resulting from timely and accurate EIBT and TSAT) it will be possible to timely re-plan inbound flight or have outbound flight towed for remote holding.
Inbound aircraft has to wait for parking guidance	Significant Improvement	Significant Improvement	Ground handler or marshaller will arrive in time at stand due to reliable estimated in-block time (EIBT).
Last minute gate change for inbound flight	Some Improvement	Significant Improvement	Timely and accurate EIBT and TSAT enable early and reliable detection of stand conflicts: it will be possible to timely re-plan inbound flight or have outbound flight pushed for remote holding.
Runway (combination) changes do not match actual traffic demand	Some Improvement	Significant Improvement	Build-up of start-up delay can be seen from TOBT's and TSAT's in the departure sequence. This could trigger re-evaluation of runway planning.
Unable to prevent additional delays for prior flights in the departure sequence	Some Improvement	Significant Improvement	Basic: Shorten turnaround and have earlier TOBT by putting more handling resources on a specific flight. Enhancements: Airline can exchange (swap) TSAT of 2 flights, thereby giving one flight an earlier TSAT and the other one a later TSAT.
Late detection of	Some	Significant	Timely and accurate EIBT and TSAT enable early and reliable detection of

stand/gate conflicts	Improvement	Improvement	stand conflicts: it will be possible to timely re-plan inbound flight or have outbound flight pushed for remote holding.
Passenger buses too early or too late for boarding or disembarkation	Some Improvement	Significant Improvement	Buses will depart and arrive in time at stand due to reliable estimated in-block time (EIBT) and target off-block time (TOBT). With advanced CDM the EIBT and TOBT will be even more accurate.
Unexpected long towing time leading to late aircraft on position for start of ground handling	Some Improvement	Significant Improvement	Better towing coordination of aircraft towing by the Airport due to shared required aircraft on position information provided by GH. Further enhancements from tracking the progress of the towing process itself.
Last minute resource planning for ground handling	Significant Improvement	Significant Improvement	Inbound improvement due to accurate EIBT and less late stand & gate changes. Outbound improvement due to better prediction of handling ready with TOBT and TSAT.
Unexpected diversions	Some Improvement	Significant Improvement	Due indication of holding time and indefinite holding indication the ground handler and airline operator can prepare for a diversion.
Limited predictability of aircraft readiness to depart	Some Improvement	Significant Improvement	Introduction of TOBT provides increased awareness and shared information on the estimated all doors closed event. TSAT provides latest time aircraft ready with availability of pushback truck. Initially a better TOBT then current ETD. Further enhancements from further improvement of TOBT & TSAT accuracy.
No indication of expected pushback / off-blocks time (except in case of CTOT/slot)	Significant Improvement	Significant Improvement	Introduction of TSAT provides indication of estimated off-blocks time.
Sub-optimal use of pushback capacity	Significant Improvement	Significant Improvement	Introduction of TSAT provides timely and accurate indication for pushback coordination to plan and re-plan pushback trucks.
Last minute decision making of connecting pax/baggage/crew and aircraft and resource	Significant Improvement	Significant Improvement	Introduction of EIBT, TOBT and TSAT provides timely and accurate indication of available transfer time.

planning			
Lack of Overall Airport/Network Capacity Management under Adverse Conditions	Some Improvement	Significant Improvement	Initially basic improvement of coordination due to CDM coordinator and improved info sharing. Further enhancements will come from CDM Cell and combined traffic demand and cap information enable significant improvement.

NO.6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Based on the described CDM elements, the analysis of the current shortcomings and the proposed concept solution the following can be concluded:

- The implementation & operational use of CDM at Australian Airports will bring substantial improvements to the identified current operational shortcomings. Information Sharing will result in more accurate and effective planning information.
- Collaborative procedures will result in more flexible and efficient execution of planning.
- The European framework for A-CDM can be applied within the Australian context of operation.

6.2 Recommendations

Based on the proposed concept solution and conclusions it is recommended to implement A-CDM in the following order:

1. Phased implementation of CDM
2. Make it work locally and validate the initial elements.
3. Link Australian Airports to the Australian network via DPI messaging, first on a “trial” basis.
4. Continue with enhancing the CDM operation by implementing the additional CDM steps.

6.2.1 CDM Planning Horizon

The concept for CDM aims at a collaborative operational horizon of up to 3 hours into the future. This means that the intention is to always have the best possible overview of the expected flight and airport situation for the next 3 hours. In order to achieve this some processes need to extend their current planning horizon. The most important ones are:

- Flight-Runway allocation. Earlier planning of flights to and from a runway by ATC is required to determine a timely and accurate in-blocks time and TSAT.
- Connection management. Airlines, in particular the local carriers, need to make earlier decisions on crew or aircraft changes and connections of passengers and cargo. This is required to identify rotational and connection delays in an earlier stage.
- Turnaround monitoring. Ground Handlers need to communicate earlier about disruption or delay during the turnaround process. This is required for a timely and accurate TOBT.
- Gate management. The airport needs to react earlier to stand and gate conflicts since this determines the start or reallocation of the turnaround process and the accuracy of the in-block time for the inbound flight.

The above four processes are dependent upon each other; one cannot succeed without the other. The A-CDM implementation plan will contain phased extension of the planning horizon for these processes.

The information sharing horizon is not restricted to these 3 hours since most of the information sharing is based on the milestone approach, which starts when the inbound flight is still at its departure airport.

6.2.2 Post Implementation; Monitoring & Evaluation

After the implementation of the initial CDM elements a collaborative monitoring and evaluation process should be in place. This process is required to validate at least the following aspects of the CDM operation:

- ✓ Familiarization and understanding of CDM concepts.
- ✓ Knowledge of own-work related CDM procedures.
- ✓ Timeliness and accuracy of flight arrival information (estimated landing and in-block times).

- ✓ Timeliness and accuracy of turnaround planning (early TOBT consistency).
- ✓ TOBT and TSAT compliance (comparison with start-up request and actual off-blocks).
- ✓ Satisfaction and/or reported problems of airport partners with the A-CDM process.

These items should be evaluated on a regular basis and be determined in a consistent manner, e.g. using performance indicators or surveys. Collaborative quality and consistency criteria should be established. A review and evaluation body should be in place. Appropriate actions should be taken if performance indicators drop below the agreed target levels. Specific attention with swift response times is required in case of problem reporting by a specific airport partner.

6.2.3 Considerations

When A-CDM is introduced on an airport, the partners have to come together and discuss the impact and organisation of such a project. Moreover, they need to prepare their own organisations for the work ahead, and how the cooperation with partners will be organised.

Two main topics can cause difficulties in and between each organisation:

- New procedures, the consequence of more information sharing and use of automation.
- Culture change, the impact of A-CDM on people and organisations.

As A-CDM includes a whole set of new procedures and processes, a training phase to understand these new features will be needed for personnel and management. For the purpose of knowledge exchange between operational experts from different working areas, it is of great importance that training is conducted with partners with the relevant expertise. This joint approach into new working procedures will then provide multiple perspectives of activities by individual persons and organisations, and assess both the individual and collective impact of new procedures on the working floors.

Where it comes to the integration of existing technology, or development of new automation applications, engineers are needed in discussions to understand the operational problems and to be able to extrapolate the technical impact on individuals and their organisations.

To get the optimal results on the day of operations, further improvements in demand and capacity management at Australian airports have to be made in the strategic (seasonal slot scheduling), the (pre-) tactical and the operational phases. A-CDM helps to make improvements in the (pre-) tactical and operational phases.

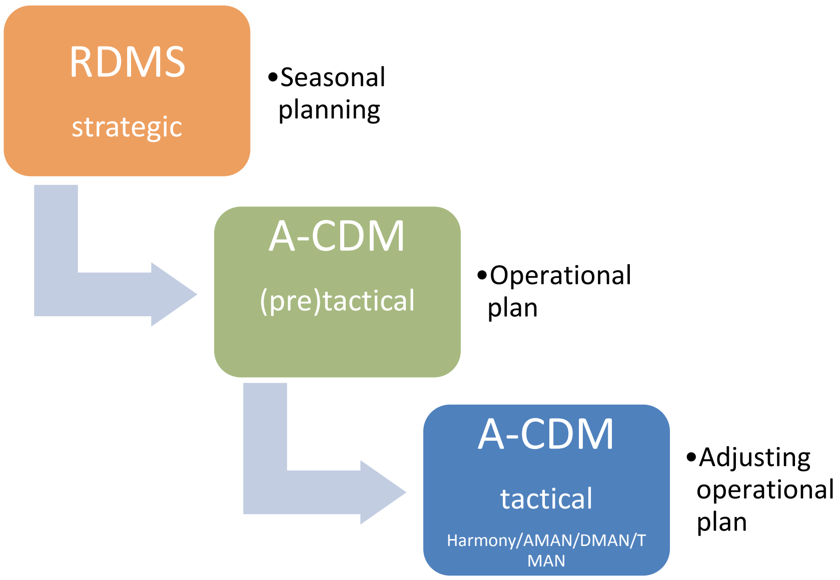


Figure 11: Optimal capacity and demand tools used in improved decision making.

APPENDIX 1 – ACRONYMS

Acronym	Definition
Airservices	Airservices Australia
A-CDM	Airport Collaborative Decision Making
ACGT	Actual Commence of Ground Handling Time
ACISP	A-CDM Information Sharing Platform
A/DMAN	Arrival & Departure Management
AEGT	Actual End of Ground Handling Time
AFTM	Air Traffic Flow Management
AGHT	Actual Ground Handling Time
AIBT	Actual In-Block Time
ALDT	Actual Landing Time
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
AOBT	Actual Off-Block Time
AODB	Airport Operational Database
APAM	Australia Pacific Airports (Melbourne) Pty Ltd
ARDT	Actual Ready Time
ASAT	Actual Start-up Approval Time
ASBT	Actual Start Boarding Time
A-SMGCS	Advance Surface Movement Guidance and Control System
ASRT	Actual Start-Up Request Time
ATC	Air Traffic Control/Air Traffic Controllers
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMRPP	Air Traffic Management Requirements and Performance Panel

ATOT	Actual Take Off Time (equivalent to ATC ATD or ACARS OFF)
ATS	Air Traffic Service(s)
ATTT	Actual Turn-Round Time (AOBT-AIBT)
AXIT	Actual Taxi-In Time (AIBT-ALDT)
BAC	Brisbane Airport Corporation Pty Limited
BNE	Brisbane Airport
BOM	Bureau of Meteorology
CDM	Collaborative Decision Making
CDM-A	CDM Airport
CDTI	Cockpit Display of Traffic Information
CIBT	Calculated In Block Time
CLDT	Calculated Landing Time
COBT	Calculated Off Block Time
ConOps	Concept of Operations
COTS	Commercial Off The Shelf
CPDSP	Collaborative Predeparture Sequence Planning
CSA	Common situational awareness
CTOT	Calculated Take Off Time
DCS	Departure Control System
DMAN	Departure Manager
EET	Estimate Elapsed Time
EIBT	Estimated In Block Time
ELDT	Estimated Landing Time
EOBT	Estimated Off Block Time
ETA	Estimated Time of Arrival
ETOT	Estimated Take Off Time
Eurocat (TAAATS)	The Australian Advanced Air Traffic System
EXIT	Estimated Taxi-In Time
EXOT	Estimated Taxi-Out Time

FIDS	Flight Information Display System
FIR	Flight Information Region
FIS	Flight Information Service
FIXM	Flight Information Exchange Model
FMS	Flight Management System
GHA	Ground Handling Agent
IATA	International Air Transport Association
IBT	In Block Time
ICAO	International Civil Aviation Organization
IT	Information Technology
KPA	Key Performance Area
KPI	Key Performance Indicator
LoA	Letters of Agreement
MEL	Melbourne Airport
MET	Meteorological (weather information)
MTF	Metron Traffic Flow
NOC	National Operations Centre
Pax	Passengers
PAPL	Perth Airport Proprietary Ltd
PER	Perth Airport
RWY	Runway
RDMS	Runway Demand Management System
SACL	Sydney Airport Corporation Ltd
SYD	Sydney Airport
TMAN	Turnaround Manager
TMA	Terminal Manoeuvring Area
VTTC	Variable Taxi Time Calculation