International Civil Aviation Organization

FOURTH MEETING OF ASIA/PACIFIC METEOROLOGICAL REQUIREMENTS TASK FORCE (MET/R TF/4)

Tokyo, Japan, 2 – 3 July 2015

Agenda Item 4: MET required to support end user system (CDM, AT/ATFM)

COLLABORATIVE DECISION MAKING

(Presented by Name of Australia)

SUMMARY

This paper presents an overview of options under consideration for Collaborative Decision Making in support of Air Traffic Flow Management (ATFM) at major capital city aerodromes in Australia

1. Introduction

1.1 The Bureau has participated in four Collaborative Decision Making (CDM) trials for meteorological briefing (MET) that examined products and processes for MET CDM at Brisbane and Sydney airports managed through Airservices Australia (Airservices) National Operations Centre (NOC). The latest trial has proved that the MET CDM capability would benefit Air Traffic Flow Management (ATFM) around these major airports.

1.2 Several issues have been identified during the trials that could be resolved through an alternative approach to the one that has previously been trialed at these aerodromes. These issues include:

- The forecaster for the aerodrome in question has a priority to amend and update regulated products such as Trend, TAF and Aerodrome warnings before any update or creation of MET products for ATFM.
- The TAF is not a suitable product for ATFM purposes and was designed for safe flight planning and in flight decisions.
- There were times during the trials where forecasters covering Brisbane and Sydney airports were too busy to provide a MET CDM product for ATFM purposes.
- The inherent mismatch between ICAO products designed for safe flight planning and Met products designed to optimise ATFM.
- During the trial, the Bureau's briefing service to Airservices imbedded in NOC (NOCMET) and the airline meteorological briefing service (AVMET) were provided with the appropriate briefs. It was noted through the trials that the AVMET opinions and ideas for improved ATFM MET CDM were not always effectively included in the process.

- The trials revealed that meteorologists involved in this process needed detailed knowledge of the meteorological parameters affecting ATFM. This was resolved in part by the development of Reference Cards, see attachment for an example of an airport reference card. However the process to educate Bureau aviation forecasters in ATFM processes had proved difficult.

2. Discussion

2.1 A future MET CDM concept will examine whether a more centralised model, where the NOCMET would become responsible for the delivery of all MET CDM ATFM products, could deliver the required products and services for improved ATFM. The NOCMET currently provides briefing service and presently does not produce ICAO regulated products. It has been proposed that NOCMET would gather information from a variety of sources, including consultation with the applicable Meteorological Watch Office (MWO), prior to issuing the product. The MET CDM ATFM product would then be discussed and continuously updated through a MET CDM process with Airservices, MWOs and AVMET units.

2.2 The MET CDM product would be significantly different to the current matrix type products previously trialed but would incorporate the information gathered from Airservices documentation and air traffic managers in the development of the CDM Reference Cards, see attachment. The NOCMET would initially manage four products for Sydney, Brisbane, Melbourne and Perth (YSSY, YBBN, YMML, and YPPH) but would also be tasked with the ongoing development of these products and the future development of ATFM products for the terminal maneuvering area (TMA) and other areas of airspace deemed important.

2.3 NOCMET would continue to liaise with all applicable personnel across the Bureau and other industry stakeholders. The concept of operation would include the following elements:

- NOCMET would monitor forecast products TAF, Trend, Aerodrome Briefing, Warnings etc.
- NOCMET would discuss any underlying issues with the forecasters for the major airports.
- NOCMET would generate an acceptance rates matrix within Airservices system based on the forecast and using the rates tables in the MET CDM Reference Cards. Matrix would be hour/weather phenomena of importance/acceptance rate to whatever the forecast timeline required.
- NOCMET would convene a MET CDM conference with AVMET units and modify rates accordingly while noting key points in discussion and making final decisions.
- MET CDM rates table passed to Airservices Traffic Manager for discussion and final decision on acceptance rates by Airservices Traffic Manager.
- NOCMET liaises with Airservices and AVMET units regarding changes to forecasts that may impact on the MET CDM rates. Conducts further MET CDM discussions as appropriate.

2.4 The current acceptance rate for thunderstorm (TS) at YBBN is (18-22). If the rates table was less prescriptive the MET CDM process could decide which rate within the bracket would be applied to any TS on the TAF. If the MET CDM process were given broader brackets (say 16-23) a higher hedged rate could be achieved and the MET CDM process could consider TS in the TMA if it were significant.

Example: PROB30 TEMPO 0207 3000 TSRA BKN010

TIME (UTC)	00	01	02	03	04	05	06	07	08
WEATHER	Nil	Nil	TS	TS	TS	TS	TS	TS	Nil
MET CDM RATE	26	26	22	19	18	19	22	22	26

2.5 The MET CDM rate then goes to the traffic managers who can then apply a plus or minus X factor and Airservices would set the applied rate and have the final decision.

2.6 The roles and responsibilities for the Bureau aerodrome forecaster would include no change with status quo except be involved with any proposed discussions with NOCMET, including:

- Provide the TAF and Aerodrome Weather Briefing.
- Discuss the forecast and any underlying issues with NOCMET. This should convey confidence and issues not conveyed in the TAF. Discuss parameters that may not have change groups in the TAF.

2.7 The roles and responsibilities for the NOCMET Meteorologist will require 24/7 coverage to implement MET CDM properly, including those described in section 2.3.

2.8 The roles and responsibilities for the AVMET Meteorologist would include:

- Generating estimates of rates taking into consideration meteorological conditions, the forecast, information on airport reference cards and factors relating to airline commercial risk.
- Contributes to the weather forecast and rates discussion through the MET CDM conference call.

2.9 The roles and responsibilities for Airservices would include:

- Develop rates tables within which the MET CDM process should operate in.
- Develop the rates tables such that the rates need not reference the TAF though the phenomena should be aligned.
- Together with the Bureau develop a process to monitor and incorporate lessons learned.
- Manage the rates tables and the mandatory processes that the meteorologists should be following.
- Manage rules surrounding changes to the tables, MET CDM Reference Cards and MET CDM process.

3. Conclusion

3.1 The advantages of the proposed MET CDM option includes:

- The MET CDM process would develop into an organised discussion on forecast risk and commercial risk interpreted through a rates table.
- The process is managed through NOCMET and Airservices Traffic Managers.
- The MWO forecaster would not need to be involved in the MET CDM rates discussion.
- Airservices Traffic Managers would have the final say on the rates and can apply an X factor if required.

3.2 There are some issues that need to be addressed before this new system of MET CDM can be implemented. This would include:

- Overcoming resistances by Airservices Managers to meteorologists setting a MET CDM rate. However Airservices Managers would have controls over the rules (tables) that meteorologists apply, with Airservices still setting the applied rates.
- We might need another trial October to November. Positives: This is no additional resource for the Bureau. This could be continued as BAU from a Bureau perspective. We could probably immediately apply the process to the other airports with only minor changes in NOCMET staffing.
- The AVMET Units and the NOCMET should have a face to face meeting once or twice a year to address any ongoing issues; they are effectively the collaborative decision makers. This is a minor cost for the service.

4. Action by the Meeting

3.1 The meeting is invited to note the information contained in this paper

– – – – – – – – – – – – – –

Attachment

Sydney (YSSY) Airport Reference Card

Australian Government
Bureau of Meteorology

YSSY Air Traffic Operations

Sydney is the busiest international airport in Australia consisting of twin moderately spaced parallel runways in the direction of 16/34 magnetic, and a single cross runway of 07/25 magnetic.

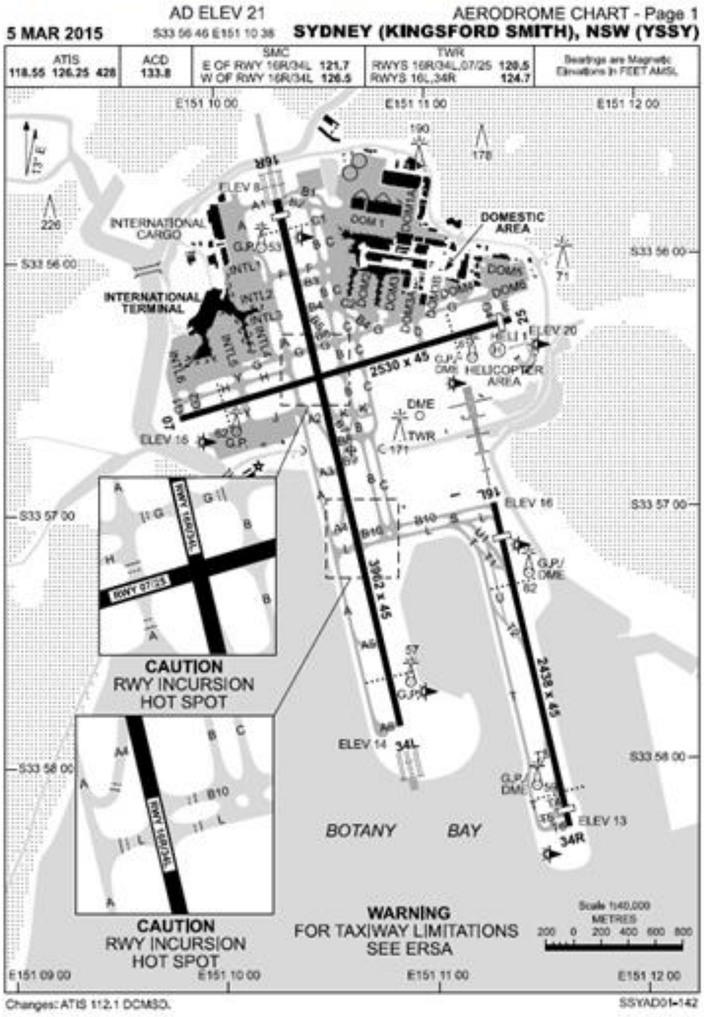

Figure 1 Sydney Airport Aerodrome Chart (Source: Airservices Australia)

Curfew

A curfew at Sydney airport prevents aircraft from taking off or landing between the hours of 11pm and 6am. A limited number of scheduled and approved take-offs and landings are permitted in the "shoulder periods" of 11pm to midnight and 5am to 6am, by Section 12 of the *Sydney Airport Curfew Act 1995*.

Terminal Area (TMA)

The TMA is a designated area of controlled airspace surrounding a major airport where there is a high volume of traffic. The TMA is a 45nm radial area surrounding Sydney Airport.

The TMA is divided into segments called corridors for arriving and departing aircraft. For Sydney airport the main airport arrival corridors are to the N and SW.

Australian Government
Bureau of Meteorology

Airport Acceptance Rates (AAR)

Sydney airport has a legislated capacity of 80 aircraft movements per hour which cannot be exceeded. For arrivals only, Sydney Airport has the capacity to take a rate of 46 or 50 on the parallel runways and 24 on the cross runway.

METRON – Ground Delay Program

Airservices Australia run a Ground Delay Program (GDP) at Sydney airport. The new application called Harmony (produced by Metron Aviation) is an advanced Air Traffic Flow Management (ATFM) application capable of simultaneously managing traffic flows at multiple airports.

Essentially, when delays are foreseen to occur because of capacity and demand imbalances, delays are assigned to the aircraft at their location of departure rather than in the air.

An aircraft that departs significantly before their assigned Calculated Off-Blocks Time (COBT) will be given enroute delays to meet their programmed time of landing. Aircraft that complied with their assigned COBT will be given priority. The maximum benefit of the system will only occur if all users comply.

The Harmony application is run at the Airservices National Operations Centre (NOC) and is based on the 18Z TAF to plan rates for the subsequent day. The Bureau's NOCMET staff are co-located at the NOC and supply additional information critical to decisions surrounding the running of the GDP.

The ground delay program can be revised at any time.

Runway Direction

It is important to remember that although runway direction is annotated in magnetic co-ordinates, wind direction is reported in degrees true. The conversion for Sydney Airport is as follows:

Table 1 Sydney Runway Direction Conversion Table

Magnetic	True
160	168
340	348
070	074
250	254

*Please note that you refer to a runway direction as it is being travelled on. Using RWY16 means landing and departing towards the SSE. As opposed to how meteorologists report wind direction.

Nomination Of Runways

The nomination of runway is determined by Air Traffic Control (ATC) using a preferred landing or take-off direction. ATC shall not nominate a particular runway for use if an alternative runway is available, when:

Table 2 Runway Wind Thresholds

	Dry	Wet
Crosswind	>20kts	>20kts
Downwind	>5kts	>0kts

*Please note that thresholds relate to sustained wind gusts as well as mean wind speeds.

If possible, aircraft will take off and land with a head wind. A tail wind on landing is acceptable up to 5 knots, or not at all when the runway is wet. When departing with a tail wind, the Take-off Distance increases so the runway length is important.

An alternative landing runway will be planned when crosswinds exceed 20kts. It is important to note that departures and arrivals do not have to occur on the same runway.

One other thing to keep in mind is the length of the runway. Landing and take-off distances are dependent on aircraft-type, weight, atmospheric pressure and temperature; the active runway will have to be able to accommodate the majority of traffic.

Forecasting at Sydney Airport

Forecasters at Sydney Airport Meteorological Unit (SAMU) are co-located with Airservices Australia in Sydney. Forecasters are in direct contact with both the flow manager and Air Traffic Line Manager.

The flow manager is responsible for allocating an arrival slot and runway to aircraft inbound to Sydney Airport. The Air Traffic Line Manager is responsible for the arrivals, departures and flow of Air Traffic within the TMA.

It is essential that forecasters can provide meaningful information to air traffic controllers regarding Sydney Airport when requested.

Peak Times

Generally peak demand for traffic movements at Sydney airport occur between 7-9am and 5-7pm Monday to Friday. Additional loads occur on both a Monday morning and a Friday afternoon.

The forecasting of holding near or during these hours must be considered carefully. The removal or movement of holding that affects these periods should prompt a call to NOCMET prior to the TAF amendment.

Australian Government
Bureau of Meteorology

Wind Forecasts

Forecasters are routinely providing information about wind speed and directional changes to ATC for informed decisions about runway changes.

Accurately forecasting a strong cross wind on the parallel runways is critical in planning reduced movements and the allocation of less landing and takeoff slots.

Instances can occur where a strong cross wind is forecast on both runway directions. ATC has a process of dealing with this issue.

Thunderstorms at YSSY

Thunderstorm cells within 5-10nm of Sydney airport affect the ability of aircraft to land; as well as the provision of services to aircraft once on the ground. The movements of aircraft into and out of bays may be affected due to ramp closures and the removal of ground staff from the tarmac.

Airline WHS regulations require the removal of ground staff from the tarmac when a thunderstorm is within 5nm, with an 'on-alert' status for a thunderstorm within 10nm. This decision is an important part of the duties of the Virgin and Qantas meteorologists.

Prolonged thunderstorm events can lead to a pile-up of aircraft waiting on the ground to be handled. By accurately forecasting thunderstorms on a TAF the planned acceptance rate at Sydney is dropped thereby mitigating airport congestion.

Additionally the ability of forecasters to predict or recognise wind outflow from nearby thunderstorms is important in the management of tactical runway changes.

Thunderstorms in the TMA (45nm)

Thunderstorms within the TMA also affect operations. Specifically thunderstorms in the entry corridors to the north and southwest of Sydney airport have major impacts on traffic flow. Accurately forecasting thunderstorms in these areas can permit Airservices the capability to open additional corridors and re-route aircraft to minimize delays.

Fog

Fog can occur at any time of the year at Sydney airport. SAMU have developed the Sydney Airport Fog Aid (SAFA) which provides forecasters with a systematic approach to forecasting fog at Sydney Airport. During the Fog Season (25 March through to the 14 September inclusive) this systematic approach is followed every day.

The SAFA system routinely allows the forecaster to evaluate the development of fog in a post-rain and no rain environment.

The inclusion of a PROB for fog onto the Sydney TAF does not trigger a revision of the arrival rates into Sydney Airport. However a forecast of fog in the main body of the TAF decreases the planned rate to 24 (or as negotiated).

The occurrence of fog at Sydney Airport will result in a revised AAR of 15. Rate planning for a fog and fog clearance is provided in Figure 2.

Time Commence	Time End	Rate
0600 or fog formation	+ two hours after first light rounded to the nearest Harmony 15 min block	15
Two hours after first light	+ one hour or until the fog is forecast to clear	24
Previous end time	+ one hour	34
Then		Normal rates

Figure 2 Planned AAR for fog cessation

Instrument Approaches

Low cloud and/or reduced visibility on approach will necessitate the use of an instrument approach when a visual reference with the runway is not available. Any instrument approach has a specified Decision Height (DH) at which a 'missed approach' must be initiated if the required visual reference to continue the approach still has not been established.

This decision height (DH) primarily dependent upon the navigational equipment available on the runway. The Category 1 Instrument Landing System (ILS) at Sydney airport has a DH of 200ft with 550RVR. Sydney has a category 2 ILS available on runway 34L/16R (108ft, 350RVR).

Visibility and cloud are less critical during take-off, with most commercial jet aircraft allowed to depart with visibility over 550m.

Cloud/Visibility

Cloud and visibility have a large effect on AAR at Sydney Airport. Scattered or more cloud below 4000ft can effect operations, as seen in the Table 4. Cloud at and below 3000ft/2500ft (runway dependent) ensure the use of the ILS and are likely to trigger the PRM system described below.

Similarly, visibility below 5000m also will trigger the use of the ILS and PRM system.

Australian Government
Bureau of Meteorology

Special Procedures

PRM

The Precision Runway Monitor (PRM) is a highly accurate air traffic surveillance system designed to maximize air traffic flow to parallel runways during periods of inclement weather. PRM allows qualified pilots to accept reductions in lateral separation standards during ILS approaches to parallel runways separated by less than 1,525 meters.

The specialized controller interfaces will alert ATC to any tendency an aircraft may have to deviate towards the adjacent center-line. A 'No Transgression Zone' (NTZ) with a width of 610 meters is established between the parallel approach paths to provide for a suitable safety buffer between aircraft on adjacent ILS approaches.

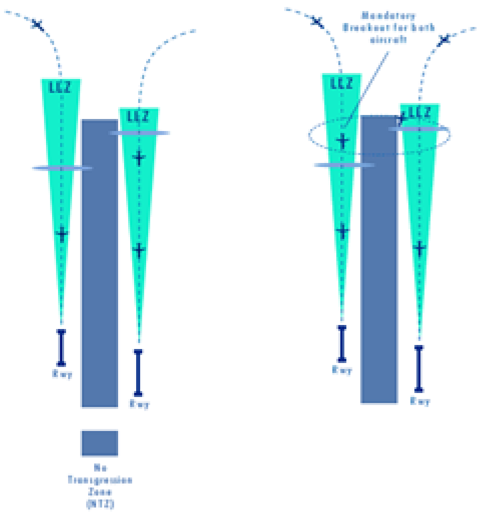

Figure 3 Illustration of Sydney Airport PRM (Source: Airservices Australia)

Forecast conditions at Sydney which may result in the practice of PRM the following morning result in additional certified staff being rostered in the Sydney Terminal Control Unit (TCU).

Meteorological conditions that affect the decision of PRM procedures include cloud amounts of scattered or more at or below 2500ft or visibility below 5000m.

SODPROPS

During times of low traffic demand and with certain meteorological conditions it is a requirement of air traffic management to undertake noise abatement procedures. Simultaneous opposite direction parallel runway operations or (SODPROPS) is only one of the many methods at their disposal. SODPROPS involves the arrival of aircraft on one runway with the departure of aircraft on the other.

Figure 4 Illustration of SODPROPS at Sydney Airport
(Source: http://www.airliners.net/search/photo.search?regsearch=VH-VBH)

Australian Government
Bureau of Meteorology

Summary

For simplicity, the meteorological conditions which cause a revision in the airport acceptance rate (AAR) for Sydney airport have been summarised in Table 3.

Table 3 Summary of Decision Point Triggers

Phenomena	Criteria	Potential Effect
Cloud	≤4000ft	Reduced arrival rate
	≤3000ft/ 2500ft	Reduced arrival rate, PRM
Visibility	≤5000m	Reduced arrival rate, PRM
X-Wind	>20kts	Change of runway
Downwind	>5kts/0kts (dry/wet)	Change of runway
Headwind	>25kts	Reduced arrival rate

The effect of weather on the availability of runway modes at Sydney Airport is summarised in Table 4.

Table 4 Weather effects on Runway Rates at YSSY

RWY Configuration	Cloud Base/VIS	Rate
16 IVA	> 4001 FT and > 5000 m	46
16 DVA	3001 FT – 4000 FT and > 5000 m	42
16 ILS	2001 FT – 3000 FT and > 5000 m	38
16 ILS	≤ 2000 FT	36
16 ILS	≤ 1500 FT and/or ≤ 5000 m	34
16 PRM	-	42
34 IVA	> 3501 FT and > 5000 m	50
34 DVA	2501 FT – 3500 FT and > 5000 m	44
34 ILS	2001 FT – 2500 FT and > 5000 m	40
34 ILS	≤ 2000 FT	36
34 ILS	≤ 1500 FT and/or ≤ 5000 m	34
34 PRM	-	46
TS Forecast	-	38
Headwind > 25 kt (not applicable during PRM)	< 3000 FT and/ or 5000 m	RWY 16// ≤ 38 RWY 34// ≤ 40

(Source: Airservices Australia

Australian Government
Bureau of Meteorology

This is a reference card intended to educate users on the phenomena that affect Air Traffic Flow Management (ATFM) and is based on information obtained from Airservices Australia. The card was accurate on 08/04/2015– Version 4.0, but may be subject to short term changes that are not reflected in this document. There may also be other factors beyond the meteorological conditions affecting ATFM on any particular day. Airservices Australia should be contacted for all day of operations information related to arrival/departure rates and runway configurations. Please email any feedback, corrections or comments to SRAT@bom.gov.au.

www.bom.gov.au