ATM Network Performance Report

July 2018

Table of contents

Summary

Overview

This report focusses on the performance of the Air Traffic Network in July 2018. There were a large number of significant weather events during July, including strong winds and fog. As a result, July contained the highest number of delay events for 2018 so far, with fourteen days where the 75th percentile airborne delay into one of the major airports exceeded 7 minutes (compared to twelve events during March and June). Sydney and Brisbane had fewer delay events than in June, while Melbourne and Perth experienced more events.

The combined 75th percentile performance during July for airborne delay across the four major airports (Sydney, Melbourne, Brisbane and Perth) was **3.5** minutes, and the median was **0.6** minutes. This was a slight increase (0.1 minutes for both metrics) compared to the same period last year and were above the KPI target of 3.4 minutes for the 75th percentile and 0.6 minutes for the median. July performance was slightly improved on June performance.

There were a total 28 notable events during July, six more than in June. Details of these events are contained in the report and are summarised in **Table 1.** Fourteen of these notable events resulted in a prolonged and moderately elevated airborne delay for the entire day (i.e. 75th percentile greater than 7 minutes across the entire day) - these events are shown in **Figure 1**. Fourteen events resulted in a shorter and more intense period of elevated airborne delay (i.e. 2 or more consecutive hours where the 75th percentile was over 10 minutes).

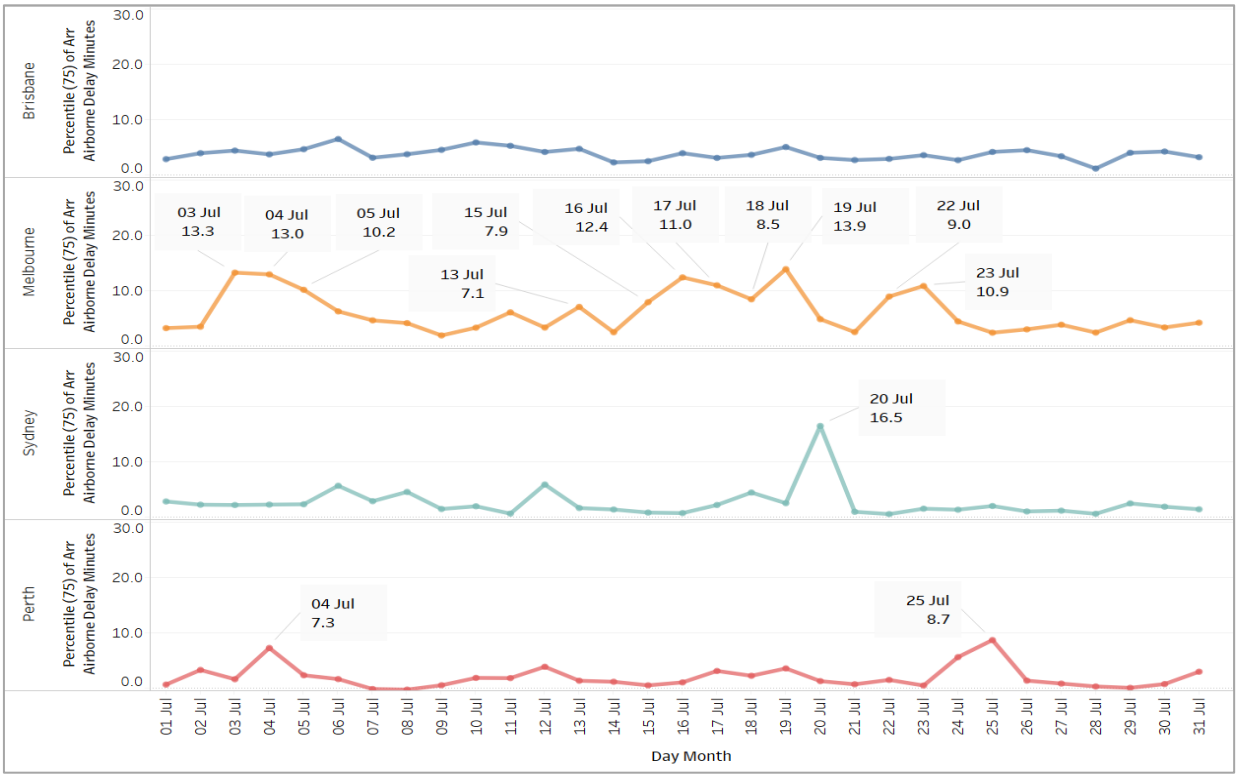

Figure 1: Notable delay impact events during June 2018.

Numbers underneath the dates indicate the extent of the 75th percentile of airborne delay in minutes.

Location	Day	Local Time	Delay (minutes – 75th percentile)	Event Descriptions (*Contributing causes to increased delays*)
Sydney	06 July	15-16	5.7	Un-forecast change to single runway operations required a Level 2 GDP Revision with rates reduced. Decreased capacity led to increased airborne delay.
	07 July	15-16	2.9	Early change to single runway operations required a Level 2 GDP Revision with rates reduced. Decreased capacity led to increased airborne delay.
	12 July	17-18 & 20-21	5.9	Thunderstorms impacted operations throughout the afternoon leading to a Level 3 GDP Revision at 1730 local.
	20 July*	13-21	16.5	Planned single runway operations with a full program. Late-departing domestic flights, off-schedule international flights, and MEDEVAC flights led to gradually increasing airborne holding, which prompted a Level 2 GDP revision at 1815 local.
Melbourne	03 July	07-11	13.3	Planned single runway with reduced rates due to possible severe turbulence and wind shear. Concentrated demand due to 19 heavy aircraft in first 3 hours of the arrival sequence, several off-schedule internationals, and late non-compliant aircraft.
	04 July	08-10 & 15-16 & 19-22	13.0	Exempt, early and late non-compliant aircraft concentrated demand combined with low rates that persisted for the entire day. Showers, gusty wind and turbulence impacted operations throughout the day.
	05 July	08-09 & 19-21	10.2	Fog disruptions for departures from Sydney led to late departing aircraft concentrating demand. Tactical rates increased in the morning. A Level-1 GDP revision occurred at 1230 local.
	06 July	08-09	6.3	Increase in tactical rates. Exempt, early and late non-compliant aircraft concentrated demand leading into a peak period.
	13 July	16-18	7.1	Exempt and late non-compliant aircraft concentrated demand leading into a peak period.
	15 July	18-21	7.9	
	16 July	08-12 & 17-19	12.4	
	17 July	08-10 & 19-20	11.0	
	18 July	08-09 & 11-12	8.5	

	19 July	08-10 & 18-20	13.9	Exempt, early and late non-compliant aircraft concentrated demand leading into a peak period. Un-forecast thunderstorms required a Level-2 GDP Revision with rates reduced. Decreased capacity led to increased airborne delay.
	22 July	18-20	9.0	Exempt, early and late non-compliant aircraft concentrated demand leading into a peak period.
	23 July	08-12	10.9	
	31 July	17-18	4.2	
Brisbane	02 July	18-20	3.9	Exempt, early and late non-compliant aircraft concentrated demand leading into a peak period.
	06 July	18-20	6.5	
	08 July	18-19	3.7	
	09 July	19-20	4.5	
	11 July	18-19	5.3	
	19 July	20-21	5.1	
	25 July	18-19	4.2	Increase in tactical rate in first hour and decrease in second hour (with runway 14 no longer available for arrivals). Exempt, early and late non-compliant aircraft concentrated demand leading into a peak period.
Perth	04 July	10-11	7.3	Decrease in tactical rates. Uncertainty around weather conditions – thunderstorms, showers and winds aloft (x-factors applied to reduce rates).
	19 July	18-19	3.6	Exempt and late non-compliant aircraft concentrated demand leading into a peak period. Runway inspection required after low wheel pressure warning.
	24 July	10-11	5.6	Exempt and late non-compliant aircraft concentrated demand leading into a peak period. Weather reduced rates.
	25 July	17-19	8.7	Decrease in tactical rate in last hour. Exempt and late non-compliant aircraft concentrated demand leading into a peak period. Thunderstorms, showers and gusty winds.

Table 1: Notable event descriptions.

Asterisk symbols in the labels (*) indicate that a Post Operational Performance Review (POPR) is available for that event. The reviews are included in Appendix A.

Network Wide Performance

Airborne delay

The combined median and 75th percentile airborne delay at the four major airports is indicated in **Figure 2**. The 24-month trend is statistically flat and close to the target levels. The target for the 75th percentile decreased by 0.1 minutes (to 3.4 minutes) from July 2018 in line with the Airservices Corporate Plan.

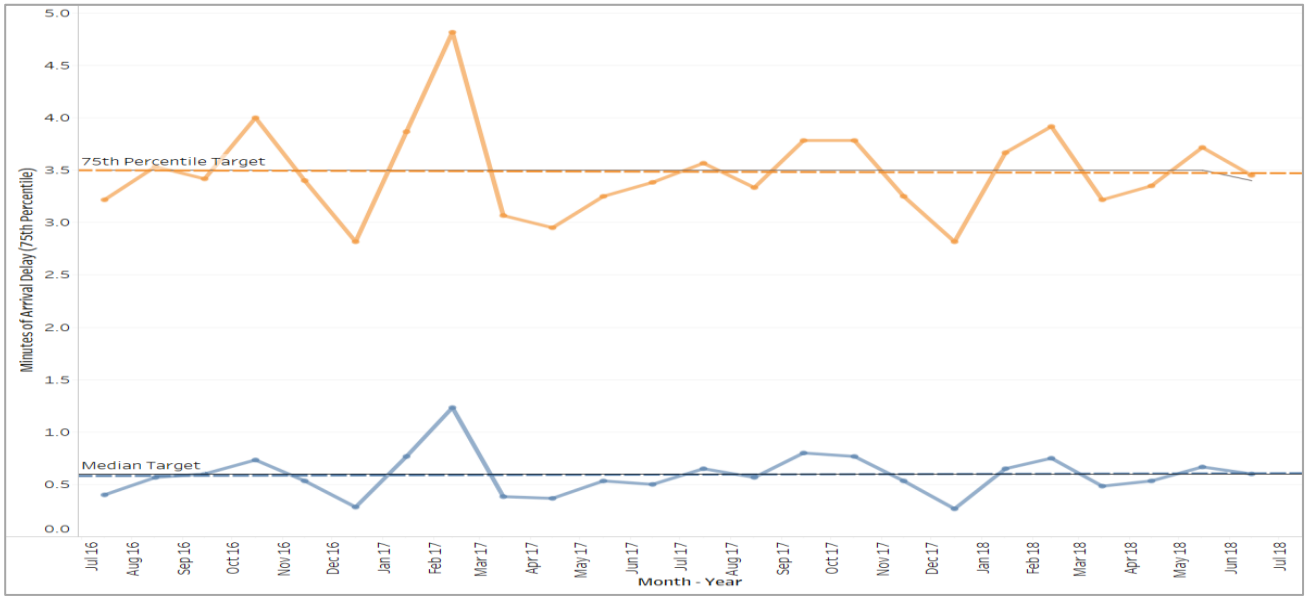

Figure 2: 24-month trend for Airborne delay

The 48-month trends of the 75th percentile airborne delay for each of the four major airports are depicted in **Figure 3**. The long-term trends for Sydney and Melbourne are upwards. More detailed analysis for each airport is presented later in this report.

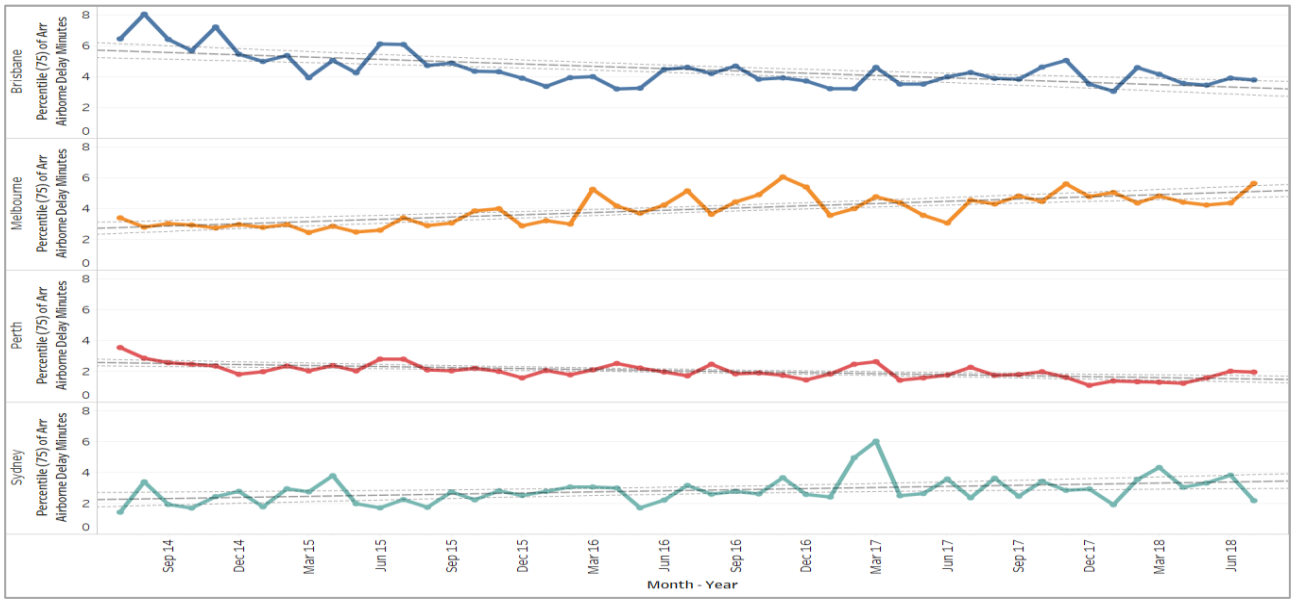

Figure 3: Long-term airborne delay (75th percentile) by airport

The monthly total minutes of arrival airborne delay for Sydney, Melbourne, Brisbane and Perth combined is depicted in **Figure 4**. Figures are adjusted for the number of days in the month. July was the fifth lowest month of adjusted total delay in the August 2017 to July 2018 period. There is no significant trend.

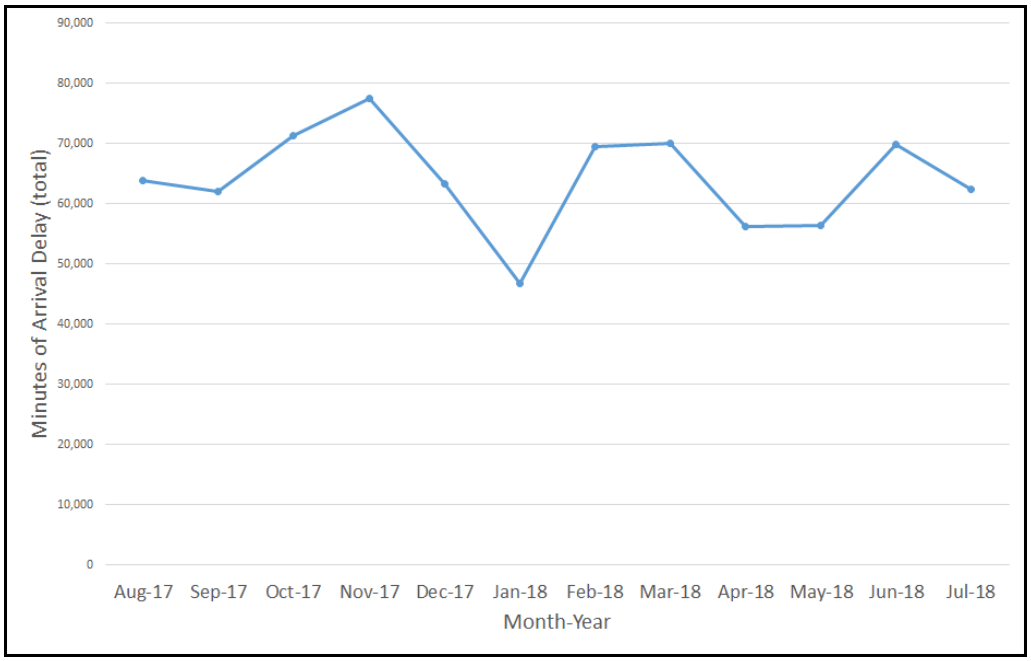

Figure 4: Total amount of arrival airborne delay by month for Sydney, Melbourne, Brisbane and Perth Airports.

Network Delay Ratio: July 2018

There are three components of network delay that impact flights. These are Airborne Delay, Ground Delay and Taxi Delay. Work to routinely produce taxi delay figures is currently underway. The table below shows the ratio of Airborne Delay to Ground Delay taken for flights arriving at the major airports. Only flights subject to the ATFM program have been included.

Airport	Flights included	Airborne delay (minutes)	Ground Delay taken(minutes)	Total Delay (minutes)	Airborne Delay %	Ground Delay %
Sydney	9,848	16,787	33,991	50,778	33	67
Melbourne	7,629	31,499	33,121	64,620	49	51
Brisbane	6,375	17,056	12,874	29,930	57	43
Perth	2,175	5,917	5,458	11,375	52	48

Sydney

Airborne delay

The 75th percentile performance figures for airborne delay at Sydney are indicated in **Figure 5.** July performance met the target for median and 75th percentile of airborne delay (-0.2 and 2.2 minutes, respectively). Compared to the same month last year there was no change in the median airborne delay and a decrease in the 75th percentile (from 2.4 minutes). The long-term trend for airborne delay at Sydney is upwards. However, the 24-month trend is flat.

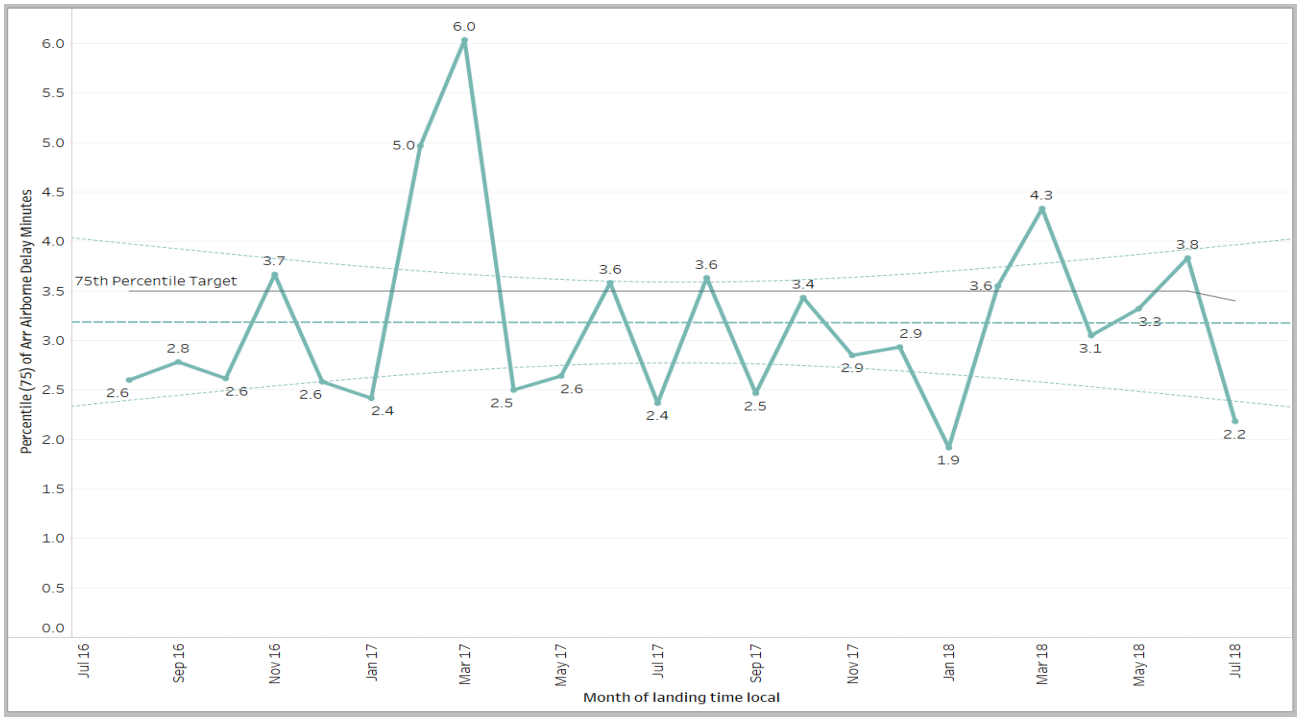

Figure 5: Sydney airborne delay 75th percentile (last 24 months)

Notable events

The following commentary describes the notable airborne delay events during July in Sydney:

- 06 July (1500-1600 Local) – Delay 5.7 minutes
  - Un-forecast change to single runway operations
  - When forecasts were updated with a prediction of wind direction change, which indicated a change from parallel runways to single runway operations there was a degree of uncertainty around the timing of this change
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Level 2 GDP revision at 1445

- 07 July (1500-1600 Local) – Delay 2.9 minutes
  - An early change (one hour early, from 1400 instead of 1500) from parallel runways to single runway operations
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Winds strengthening with moderate to severe turbulence from 1500
  - Level 1 GDP revision at 1130
- 12 July (1700-1800 and 2000-2100 Local) – Delay 5.9 minutes
  - Weather diversions from 1400 due to thunderstorms
  - No successful approaches from 1710 to 1738 due thunderstorms
  - Change from 34 parallel to 16 parallel operations (from 1738) due to southerly outflow
  - Level 3 GDP revision at 1730
  - Rates were lowered from 1800 to 34 (rather than parallel runway rates, 46 and higher) due to staff breaks from running all consoles leading up to revision
- 20 July (1300-2100 Local) – Delay 16.5 minutes
  - Planned change to single runway operations from 1200
  - Three missed approaches due wind shear and unstable approach
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Level 2 GDP revision at 1815
  - Issues with flights missing from Harmony following the level 2 GDP revision

Other events

The following commentary describes events during July where the airborne delay was not excessive and are not included in Notable Events, but the event is likely to have caused some disruption:

- 17 July (1022-1030 Local)
  - Runway 34L temporarily not available due to an aircraft emergency
  - An aircraft had fire indications and Runway 34L was not available for a short period to facilitate unimpeded ARFFS vehicle access to the aircraft
  - One aircraft diverted to Bankstown

Melbourne

Airborne delay

The 75th percentile performance figures for airborne delay at Melbourne are indicated in **Figure 6.**

July performance (1.9 minutes median and 5.6 minutes 75th percentile) did not meet the targets and delay increased when compared to the same period last year (1.2 minutes median and 4.5 minutes 75th percentile). The long-term trend for airborne delay at Melbourne is upwards, the trend for the last 24 months shows no significant change.

Melbourne experienced eleven days exceeding 7 minutes, the highest in 2018, and there were two additional days which experienced two consecutive hours exceeding 10 minutes of delay.

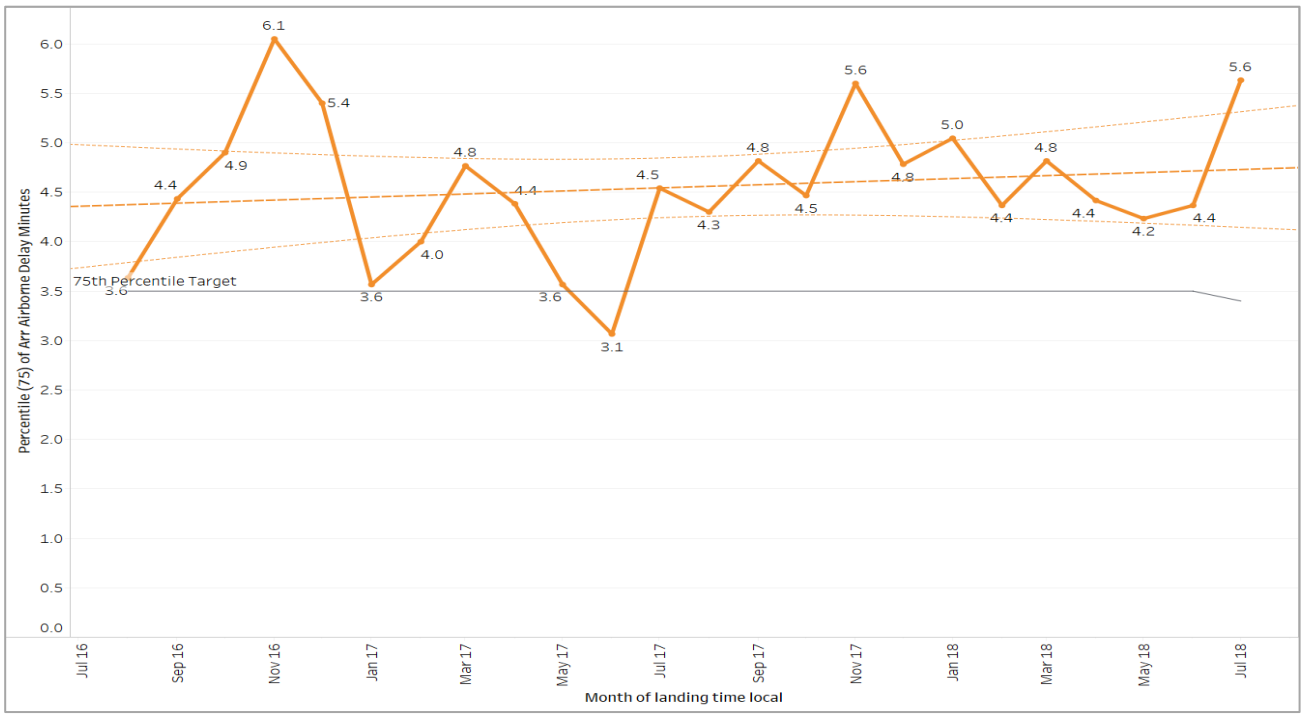

Figure 6: Melbourne airborne delay 75th percentile (last 24 months)

Notable events

The following commentary describes the most significant airborne delay events during July in Melbourne. There were a high number of planned single runway days with forecast turbulence which contributed to the 13 days in the month with notable events as follows:

- 03 July (0700-1100 Local) – Delay 13.3 minutes
  - Planned single runway operations with strong surface winds
  - MET-CDM factor applied to reduce rates due to possible severe turbulence and wind shear
  - High demand, including 19 heavy or super heavy aircraft in first three hours
  - Excess demand during the morning peak period led to increased airborne delay
  - Up to 50 knot winds at 3,000 feet

- 04 July (0800-1000 & 1500-1600 & 1900-2200 Local) – Delay 13.0 minutes
  - Single runway rates planned throughout the day due to forecast winds
  - Excess demand during the morning/afternoon peak period led to increased airborne delay
  - MET-CDM factor applied to reduce rates due to wind and turbulence
  - During the morning, 13 Heavy and super-heavy aircraft in arrival sequence in the first two hours, with four in the half-hour prior to the delay period
- 05 July (0800-0900 & 1900-2100 Local) – Delay 10.2 minutes
  - Single runway rates planned throughout the day due to forecast winds
  - Fog disruptions for Sydney departures (about 80 of the arrivals into Melbourne were Sydney departures) – this event was not planned for, with a GDP revision run at 0430 for Sydney as fog descend upon the airport
  - Excess demand during the morning/afternoon peak period led to increased airborne delay
- 06 July (0800-0900 Local) – Delay 6.3 minutes
  - Single runway rates planned throughout the morning due to forecast winds, with a tactical change to LAHSO an hour after delay subsided
  - Runway 27 arrivals: with 12 heavy and super-heavy aircraft and one medium aircraft able to land on runway 34 during delay period
  - Tactical rates increase by 2
  - Excess demand during the morning peak period led to increased airborne delay
  - Moderate to severe turbulence, wind and showers
- 13 July (1600-1800 Local) – Delay 7.1 minutes
  - Planned single runway operations for arrivals (arrivals on Runway 16, departures from Runway 27)
  - Excess demand during the afternoon peak period led to increased airborne delay
- 15 July (1800-2100 Local) – Delay 7.9 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
- 16 July (0800-1200 & 1700-1900 Local) – Delay 12.4 minutes
  - Excess demand during the morning/afternoon peak period led to increased airborne delay
  - Morning:
    - High winds, low rates and high demand
    - Non-compliant flights
  - Afternoon:
    - Decrease in tactical rates
    - Low rates and high demand

- 17 July (0800-1000 & 1900-2000 Local) – Delay 11.0 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the morning/afternoon peak period led to increased airborne delay
  - Morning:
    - MET-CDM factor applied to reduce rates due moderate to severe turbulence and winds
  - Afternoon:
    - MET-CDM factor applied to reduce rates due to thunderstorms, showers and winds
    - Runway change from 34 to 27 happened at 1800 (an hour later than planned) – rates were not reduced
- 18 July (0800-0900 & 1100-1200 Local) – Delay 8.5 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the morning peak period led to increased airborne delay
  - Moderate to severe turbulence, gusty winds
- 19 July (0800-1000 & 1800-2000 Local) – Delay 13.9 minutes
  - Single runway rates planned throughout the day (until 2100)
  - Excess demand during the morning/afternoon peak period led to increased airborne delay
  - Morning:
    - MET-CDM factor applied to reduce rates due to moderate to severe turbulence and winds
  - Afternoon:
    - Un-forecast CB and thunderstorms
    - Runway change: runway 34 arrivals before an hour of LAHSO applied tactically at 1600 (with arrival throughput only 21, with rates at 40), followed by a change to runway 27 arrivals
    - Returned flight (lightning strike) and go-arounds and medevac flight at Essendon
    - Weather deviations throughout TMA
    - MET-CDM factor applied to reduce rates due wind and showers
    - Level 2 GDP revision at 1850
- 22 July (1800-2000 Local) – Delay 9.0 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Gusts and turbulence

- 23 July (0800-1200 Local) – Delay 10.9 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the morning peak period led to increased airborne delay
  - MET-CDM factor applied to reduce rates due moderate to severe turbulence and winds
- 31 July (1700-1800 Local) – Delay 4.2 minutes
  - Single runway rates planned throughout the afternoon
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Tactical rates increase by two during the delay period, and for an hour prior
  - MET-CDM factor applied to reduce rates due moderate to severe turbulence, thunderstorm activity around TMA and showers

CTOT (Calculated take off time) variations

The morning peak (0700-1100 local) is in general the most constrained period of the day in Melbourne. Variations from CTOT during the early morning hours are the focus of this section due to regular concentration of demand leading to increases in delay.

The results depicted in Table 1 provide the flights within this period that departed either early or late with respect to their CTOTs (-5 to + 15 minutes) on more than one occasion. This facilitates collaboration to identify patterns and causes.

The CTOT against the ATOT (actual take off time) measure is used as a proxy until the COBT (calculated off blocks time) against AOBT (actual off blocks time) can be routinely reported on.

CTOT Variat..	ACID	ADEP	ADES	Local - ALDT HOUR	July 2018
Early	RXA3653	YMIA	Melbourne Arrivals	8	3
	QLK50D	YDPO	Melbourne Arrivals	7	2
	QLK77D	YMIA	Melbourne Arrivals	7	2
	RXA3752	YMTG	Melbourne Arrivals	8	2
Late	JST677	YPDN	Melbourne Arrivals	6	8
				7	3
	JST981	Perth Departures	Melbourne Arrivals	7	8
	VOZ824	Sydney Departures	Melbourne Arrivals	10	6
	QFA411	Sydney Departures	Melbourne Arrivals	9	5
	QFA401	Sydney Departures	Melbourne Arrivals	7	2
				8	2
	QFA415	Sydney Departures	Melbourne Arrivals	9	4
	JST473	YWLM	Melbourne Arrivals	7	3
	JST775	YPAD	Melbourne Arrivals	10	3
	QFA419	Sydney Departures	Melbourne Arrivals	10	3
	VOZ252	YSCB	Melbourne Arrivals	7	3
	JST475	YWLM	Melbourne Arrivals	10	2
	JST503	Sydney Departures	Melbourne Arrivals	9	2
	JST561	Brisbane Departures	Melbourne Arrivals	10	2
	QFA409	Sydney Departures	Melbourne Arrivals	9	2
	QFA417	Sydney Departures	Melbourne Arrivals	10	2
	TGG213	Sydney Departures	Melbourne Arrivals	8	2
	VOZ1313	YMHB	Melbourne Arrivals	7	2
	VOZ1361	YMLT	Melbourne Arrivals	7	2
	VOZ204	YPAD	Melbourne Arrivals	8	2
	VOZ808	Sydney Departures	Melbourne Arrivals	8	2
	VOZ816	Sydney Departures	Melbourne Arrivals	10	2

CTOT Variation
Early
Late

Table 1: CTOT variation for Melbourne arrivals 0700-1100 local – July 2018

Brisbane

Airborne delay

The 75th percentile performance figures for airborne delay at Brisbane are indicated in **Figure 7**. July performance did not meet the target for the median nor 75th percentile of airborne delay (1.1 and 3.8 minutes, respectively). Compared to the same month last year there was no change in the median and a decrease in the 75th percentile (from 4.3 minutes). The long-term trend for airborne delay at Brisbane is downwards, but no significant trend over the last 24 months.

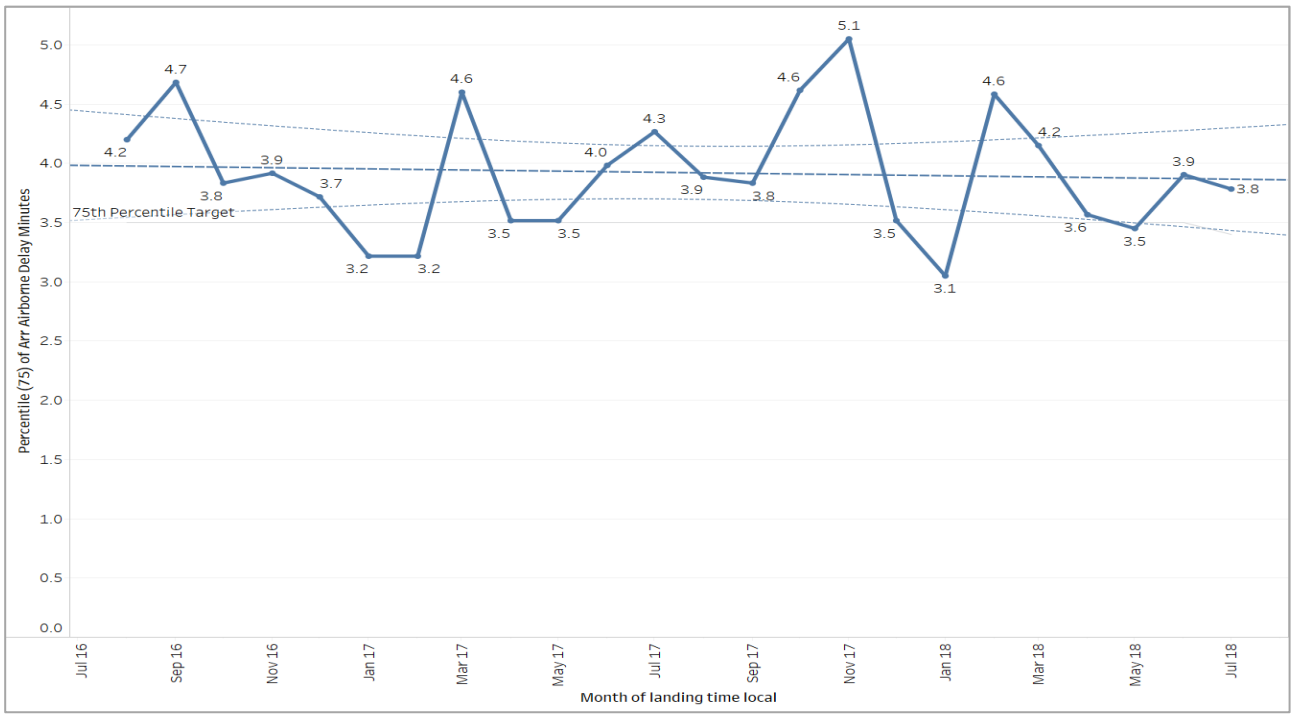

Figure 7: Brisbane airborne delay 75th percentile (last 24 months). The downward trend is not statistically significant.

Notable events

The following commentary describes the most significant airborne delay events during July in Brisbane:

- 02 July (1800-2000 Local) – Delay 3.9 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - During 1800-1900, 55 aircraft presented (in two hours) with a tactical capacity of 50 across this period with even higher concentrations during smaller periods – oversubscription
  - Uncertainty about weather conditions lead to IMC conditions, with winds aloft increasing in the evening

- 06 July (1800-2000 Local) – Delay 6.5 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Showers
- 08 July (1800-1900 Local) – Delay 3.7 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Two medical flights
  - Surface winds and winds aloft
- 09 July (1900-2000 Local) – Delay 4.5 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Surface winds and winds aloft
- 11 July (1800-1900 Local) – Delay 5.3 minutes
  - Single runway rates planned throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - MET-CDM factor applied to reduce rates due to chance of heavier shower meeting INTER conditions, showers increasing
- 19 July (2000-2100 Local) – Delay 5.1 minutes
  - Single runway rates planned throughout the evening
  - Excess demand during the evening peak period led to increased airborne delay
  - Tactical rates increase by 1 during delay period
- 25 July (1800-1900 Local) – Delay 4.2 minutes
  - Planned crossing runway operations rates planned throughout the delay period – tactical rate dropped by one from the planned rate during second hour
  - Excess demand during the evening peak period led to increased airborne delay

CTOT Variation

Variations from CTOT at Brisbane during the afternoon hours (1800-1900 local) are the focus of this section due to regular concentration of demand leading to increases in delay. Flights that appear at least twice have been included in the table below.

The results depicted in Table 1 provides the flights within this period that departed either early or late with respect to their CTOTs (-5 to + 15 minutes) on more than one occasion. This facilitates collaboration to identify patterns and causes.

The CTOT against the ATOT (actual take off time) measure is used as a proxy until the COBT (calculated off blocks time) against AOBT (actual off blocks time) can be routinely reported on.

CTOT Variat..	ACID	ADEP	ADES	Local - ALDT HOUR	July 2018
Early	QLK359D	YBRK	Brisbane Arrivals	18	2
	QLK517D	YBMK	Brisbane Arrivals	18	2
	VJE	YEML	Brisbane Arrivals	19	2
Late	VOZ341	Melbourne Departures	Brisbane Arrivals	19	16
	QFA628	Melbourne Departures	Brisbane Arrivals	19	11
	VOZ469	Perth Departures	Brisbane Arrivals	19	10
	VOZ337	Melbourne Departures	Brisbane Arrivals	18	9
	VOZ454	YPDN	Brisbane Arrivals	18	5
				19	4
	QFA626	Melbourne Departures	Brisbane Arrivals	18	8
	JST576	Melbourne Departures	Brisbane Arrivals	19	6
	QFA542	Sydney Departures	Brisbane Arrivals	19	6
	QFA544	Sydney Departures	Brisbane Arrivals	19	5
	VOZ1225	YSCB	Brisbane Arrivals	19	4
	JST484	YWLM	Brisbane Arrivals	18	3
	TGG532	Melbourne Departures	Brisbane Arrivals	18	3
	VOZ1266	YEML	Brisbane Arrivals	19	3
	VOZ965	Sydney Departures	Brisbane Arrivals	19	3
	VOZ973	Sydney Departures	Brisbane Arrivals	19	3
	QFA540	Sydney Departures	Brisbane Arrivals	18	2
	QFA562	Sydney Departures	Brisbane Arrivals	18	2
	QFA598	Perth Departures	Brisbane Arrivals	18	2
	QFA655	YBCS	Brisbane Arrivals	19	2
	QJE1550	YSCB	Brisbane Arrivals	19	2
	TGG314	YPAD	Brisbane Arrivals	19	2
	VEP	YSTW	Brisbane Arrivals	19	2
	VOZ1109	YWLM	Brisbane Arrivals	19	2
	VOZ2910	YGLA	Brisbane Arrivals	18	2
	VOZ333	Melbourne Departures	Brisbane Arrivals	18	2
	VOZ378	YBTL	Brisbane Arrivals	18	2
	VOZ786	YBCS	Brisbane Arrivals	18	2

CTOT Variation
Early
Late

Table 2: CTOT variation for Brisbane arrivals 18-20 local – July 2018

Perth

Airborne delay

The 75th percentile performance figures for airborne delay at Perth are indicated in **Figure 8**.

July performance (-0.2 minutes median and 2.0 minutes 75th percentile) met the targets. The median and the 75th percentile of delay decreased from (0.1 and 2.3 minutes, respectively) when compared to the same period last year. The long-term and 24-month trend for airborne delay at Perth is downwards.

There were two days exceeding 7 minutes at Perth, the first days to experience this since January.

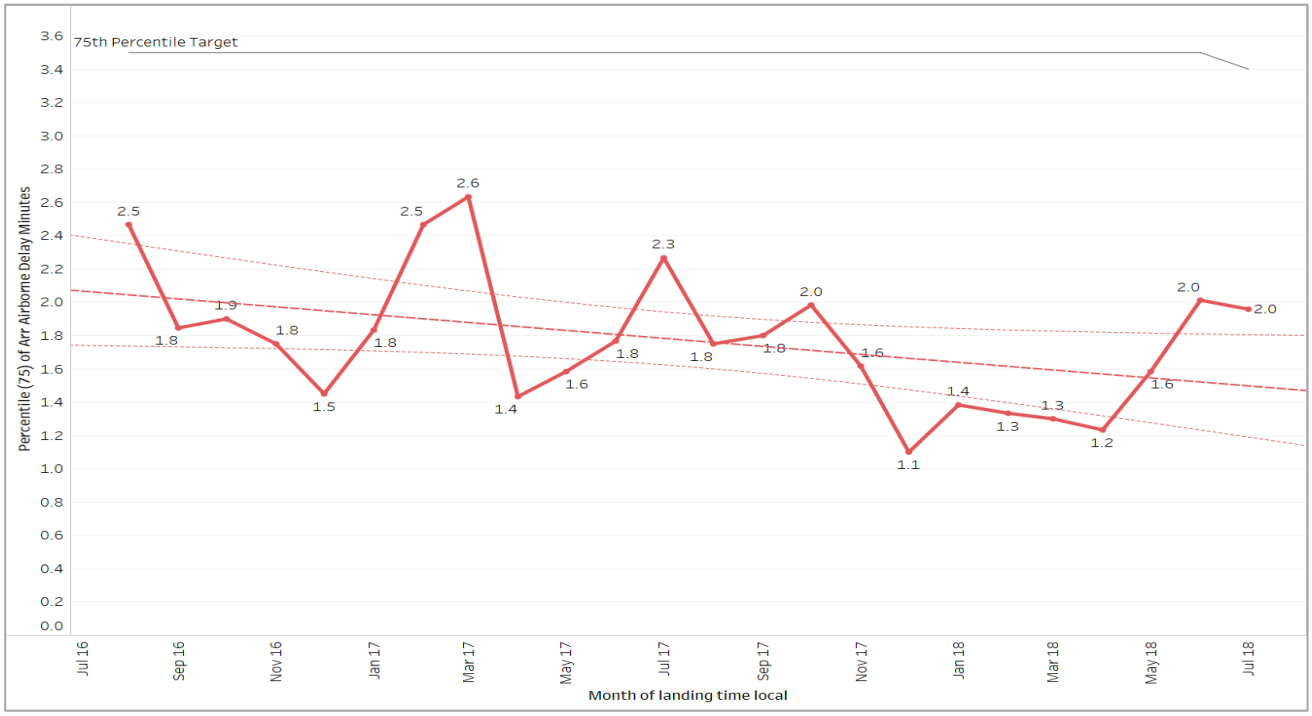

Figure 8: Perth airborne delay 75th percentile (last 24 months)

Notable events

The following commentary describes the most significant airborne delay events during July in Perth:

- 04 July (1000-1100 Local) – Delay 7.3 minutes
  - Predicted change from runway 03 occurred later than anticipated at 1040. The runway configuration at the change was also less favourable. This meant tactical rates were lower than planned.
  - MET-CDM factor applied to reduce rates to account for the thunderstorms, showers and winds aloft (risk of storms and wind shear near airport)

- 19 July (1800-1900 Local) – Delay 3.6 minutes
  - An aircraft with a low wheel pressure warning landing at 1830, required a runway inspection, with no arrivals for 10 minutes
  - Excess demand during the afternoon peak period led to increased airborne delay
- 24 July (1000-1100 Local) – Delay 5.6 minutes
  - During 0900 arrival throughput was 10 (with a tactical rate of 20), with all arriving after 0920 (four arrivals after 0945)
  - Excess demand during the morning peak period led to increased airborne delay
  - Eight flights scheduled to land during 0900 landed in the 1000 hour
- 25 July (1700-1900 Local) – Delay 8.7 minutes
  - Runway 24 arrivals had been forecast to begin two hours prior to, and extend through, the delay period, but an earlier period of runway 03 arrivals was extended until 1740
  - Forced runway configuration change due to winds (at 1740, runway 03 arrivals to runway 24)
  - Several runway changes had been forecast throughout the day
  - Excess demand during the afternoon peak period led to increased airborne delay
  - Decrease in tactical rate, from planned rate, from 1900 onwards due weather (strong winds and thunderstorms around the TMA)
  - Flight diverted back to Perth as unable to land at original destination airport

Other events

The following commentary describes events during July where the airborne delay was not excessive and are not included in Notable Events, but the event is likely to have caused some disruption:

- 17 July (1400-1620 Local)
  - Runway 03 utilised for an extra two hours to facilitate ILS calibration
  - During a period of variable weather conditions with cloud, wind and rain, ILS calibration was conducted which meant runway 03 was utilised for an additional two hours

Appendix A

Post Operational Performance Review: Sydney Airport 5 July 2018

Event Description

Fog impacted operations at Sydney during the morning of 5 July 2018. Initial METCDM rates for the 20z and 21z hours were set at 34 to manage the risk associated with a 20% chance of fog. Fog eventuated at 1826z. A Level 2 GDP Revision was undertaken at 1840z. This was less than one hour after the regular early morning revision in Sydney at 1800z.

Table 1 shows the rates before and after the revision. The fog rate (15) was implemented until 2245z. This timing is set by the business rules which require the fog rate for a period extending one hour past the forecast fog end time.

Time period (UTC)	Initial rate	New rate
1840-2000	curfew	0
2000-2230	34 (50 from 2200)	15
2230-2300	50	24*
2300-0000	50	34

Table 1 – ATFM rates before and after Level 2 GDP Revision at 1840z.

* Fog rate (15) continued until 2245 as per business rules and then increased to 34. Rate is averaged to 24 over the half hour period.

Conditions gradually improved and at 2144z six tacticals were offered via Whispir for flights arriving before 2300z. At 2155z, eight additional tacticals were offered via Whispir for flights arriving between 2300-2359z.

Figure 1 shows the 75th percentile of arrival airborne arrival delay and ground delay throughout the morning. There is a high level of ground delay which peaks at 130 minutes in the 23z hour.

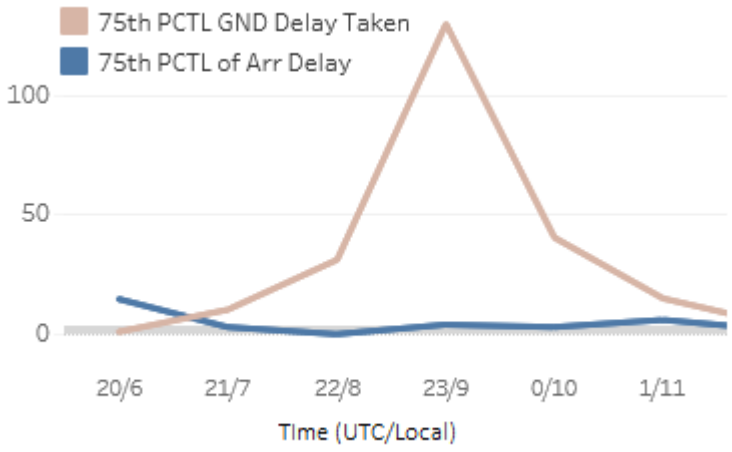

Figure 2 –75th percentile of airborne arrival delay (blue) and ground delay taken (beige) for flights arriving at Sydney during the morning of 5 July 2018.

Analysis

Figure 2 shows the number of arrivals by hour compared to the pre-tactical rates (after the Level 2 Revision) and the tactical rates. Tactical rates are significantly higher than rates implemented by the revision (2000-2359z). The achieved throughput (grey bars) is higher than the revision rates for most of this period including while fog was present in the 20z and 21z hours.

Figure 2 – Arrivals by hour, tactical and pre-tactical rates for 5 July 2018 by hour (UTC/local) at Sydney. Domestic arrivals in light grey, internationals in dark grey. Pre-tactical rates (after Level 2 Revision) shown by green triangles, tactical rates shown by red triangles. Blue line indicates end of the period of reduced rates.

At the time of the Whispir (2144z) there were no flights that had passed their ETD with a flight time short enough to land in Sydney by 2300z. Table 2 shows the flights that may have been able to arrive by 2300z if they were able to depart up to 30 minutes earlier than their ETD. Assuming a minimum of 15 minutes between the Whispir and take-off, there were only five such flights.

ACID	ADEP	ETD	Earliest possible TOT	Flight time	Earliest possible LDT
QLK37	YSDU	4/07/2018 22:15	4/07/2018 21:59	1:00	4/07/2018 22:59
PEL721	YTRE	4/07/2018 22:16	4/07/2018 21:59	0:52	4/07/2018 22:51
QLK1	YSTW	4/07/2018 22:22	4/07/2018 21:59	0:56	4/07/2018 22:55
QLK464D	YSCB	4/07/2018 22:41	4/07/2018 22:11	0:35	4/07/2018 22:46
VOZ629	YSCB	4/07/2018 22:50	4/07/2018 22:20	0:38	4/07/2018 22:58

Table 2 – Details of flights which may have been able to arrive in Sydney by 2300z if they were able to depart earlier than their ETD at the time of the first Whispir offering tacticals (2144z). The earliest possible take-off time is assumed to be 30 minutes before the ETD or 15 minutes after the Whispir, whichever is later.

Table 3 shows details for flights that were given tactical releases. There were a total of 14 flights which received a tactical release. These flights arrived between 2302z (4 July) and 0052z (5 July). None of these flights were able to conform to the original offer of six tactical releases for flights arriving before 2300z. As a result, a number of slots were lost from the morning program.

ACID	ADEP	ATOT	ALDT
QLK464D	YSCB	04/07/2018 22:28:00	04/07/2018 23:02:00
QFA872	YSCB	04/07/2018 22:40:00	04/07/2018 23:12:00
RXA456	YNAR	04/07/2018 22:15:00	04/07/2018 23:13:00
RXA454	YGTH	04/07/2018 22:12:00	04/07/2018 23:17:00
VOZ629	YSCB	04/07/2018 22:41:00	04/07/2018 23:23:00

QLK202D	YMAY	04/07/2018 22:30:00	04/07/2018 23:28:00
QFA501	YBBN	04/07/2018 22:10:00	04/07/2018 23:30:00
JST38	YMML	04/07/2018 22:29:00	04/07/2018 23:36:00

QFA404	YMML	04/07/2018 22:54:00	04/07/2018 23:54:00
TGG206	YMML	04/07/2018 22:56:00	04/07/2018 23:57:00
VOZ504	YBCG	04/07/2018 22:58:00	05/07/2018 00:14:00
VOZ815	YMML	04/07/2018 23:25:00	05/07/2018 00:26:00
VOZ819	YMML	04/07/2018 23:37:00	05/07/2018 00:34:00
JST614	YMAV	04/07/2018 23:48:00	05/07/2018 00:52:00

Table 3 – Details of flights to Sydney which received tactical releases on 5 July 2018.

The tactical rates and achieved throughput exceeding the fog rates suggests that the fog rates were too conservative for the conditions on 5 July 2018. Likewise, the limited ability to recover through tactical releases when conditions improved indicates that consideration could be given to revising the business rules relating to the duration of the fog rates.

The current process of waiting to observe fog conditions before revising the GDP resulted in a second revision occurring not long after the regular early morning Sydney revision at 1800z. It is possible that a more flexible approach could decrease the chance of multiple revisions without significant impact on the accuracy of rates.

Summary

Fog impacted operations at Sydney during the morning of 5 July 2018. A Level 2 GDP Revision was conducted at 1840z. This was less than one hour after the regular early morning revision in Sydney at 1800z. The fog rate (15) was implemented until 2245z. This timing is set by the business rules which require the fog rate for a period extending one hour past the forecast fog end time.

Tactical rates and achieved throughput was higher than the revised rates while the fog was present. Conditions then improved before the end of the fog rates and tactical releases were offered by Whispir at 2144 (six flights for arrivals before 2300z) and 2155z (eight flights for arrivals between 2300-2359z). There were very few flights that could have considered the original offer as most flight times were too long to adhere to a pre-2300z arrival. Ultimately, there were no flights granted tactical releases that landed before 2300z. As a result, a number of slots were lost from the morning program.

These outcomes suggest that there is potential for improving operations by reviewing the fog rates and duration, as well as the timing of revisions when fog is worse than forecast.

For further information please contact Network Performance and Analysis @
OPS_ANALYSIS_ADMIN@AirservicesAustralia.com

Post Operational Performance Review: Sydney Airport 20 July 2018

Event Description

At Sydney Airport on 20 July 2018 increased arrival airborne delay was observed in the afternoon and evening. The increase in delay was during an extended period of planned single runway operations where the program was full and achieved throughput was as planned. Similar outcomes have been regularly observed during days where the program is full for an extended period of high arrival demand and tactical rates match planned rates.

Figure 1 shows the planned and tactical arrival rates by hour compared to the achieved throughput (top panel). The matching arrival and ground delay, and runway configuration are shown in the middle and bottom panels, respectively. Arrival delay increased throughout the afternoon and evening. The 75th percentile of arrival delay peaked at 37 minutes in the 10z hour. Single runway operations (rate 23) were planned from 01z until the end of the program due to forecast strong westerly winds. On the day, parallel runways were maintained until 0148z (rate 44) and were available again at 1055z (rate 34).

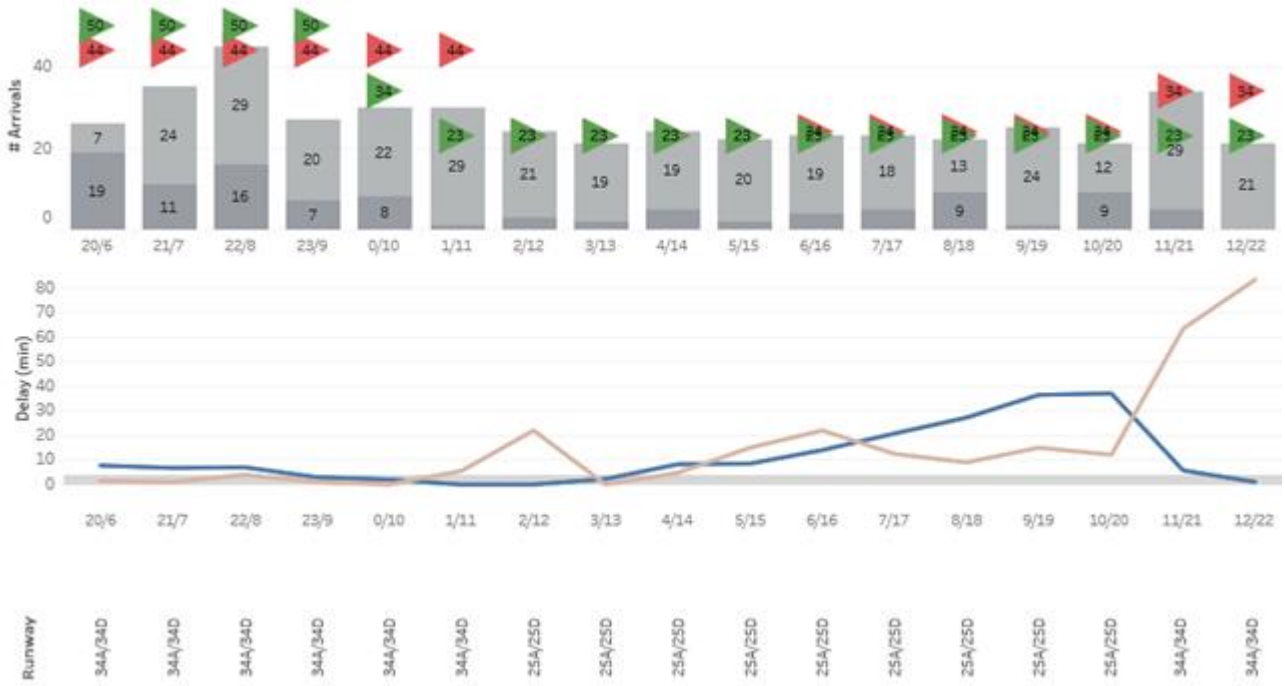

Figure 3 – Operational plans and outcomes for Sydney on 20 July 2018. (Top) Arrivals by hour (UTC/local). Domestic arrivals in light grey, internationals in dark grey. Pre-tactical rates shown by green triangles, tactical rates shown by red triangles. (Middle) 75th percentile of airborne arrival delay (blue) and ground delay taken (beige) for flights arriving at Sydney during hour indicated. (Bottom) Primary runway configuration during hour.

A Level 2 Ground Delay Program (GDP) Revision was conducted at 0815z to realign demand for the remainder of the GDP. During the re-run of the GDP, nine flights were erroneously omitted from the program (one cancelled VOZ flight; eight REX flights, two of which were cancelled). These REX flights that did operated were cleared to depart at approximately 30 minute intervals and therefore added to the demand of the revised GDP. This explains why airborne delay did not reduce as expected after the Level 2 Revision. This issue has been investigated with Metron and algorithm modifications are being developed to prevent this happening in the future.

At 1055z operations returned to parallel runways, delivering a tactical rate of 34 vice 23 planned by MET-CDM. This allowed all excess demand to be cleared (including the six REX flights which operated), and all remaining flights in the GDP were able to arrive before curfew.

Objectives

This review was instigated to examine the factors that contributed to the delay and consider the options for preventing these outcomes in the future. The review focussed on three major questions:

1. What factors contributed to the deterioration of the 'health' of the GDP into Sydney, accepting that tactical rates matched pre-tactical rates and there was little airborne delay at the commencement of single runway operations?
2. How can Airservices and industry collaboratively deliver predictability of arrival time leading up to the curfew?
3. Analysis on historical data for similar days indicates this behaviour to be systematic, how can single runway operations days at Sydney be better planned?

Analysis

Factors impacting delay

Figure 2 shows the airborne arrival delay annotated with the events that contributed most to the build-up in delay after transition to single runway operations at 0148z. The start of the increase was associated with demand that shifted from the 03z hour to the 04z hour due to three flights that took off more than 15 minutes after their assigned CTOT (flights compliant with COBT but impacted by taxi-out delay) as well as an unscheduled MEDEVAC flight adding to the total demand. Airborne delay increased again following another shift in demand from the 05z hour to the 06z hour associated with six flights that took off more than 15 minutes after their assigned CTOT (two late non-compliant with COBT, three compliant with COBT but impacted by taxi-out delay, and one early non-compliant with COBT but with significant taxi delay). Demand was further concentrated in 06z due to another MEDEVAC and two early international arrivals. Table 1 summarises the late-departing flights discussed above.

Following the Level 2 GDP Revision at 0815z, built up demand begins to clear. The arrival delay plateaued during the 09z and 10z hours before decreasing to 5.75 minutes in the 11z hour. Five of REX flights omitted from the GDP Revision departed during the 09z and 10z hours. This additional demand slowed the reduction in airborne delay. The reduction in delay may have also been slowed by two MEDEVAC flights during the 09z hour. Conditions allowed parallel runways to be operated in 11z and 12z hours, and delay decreased substantially.

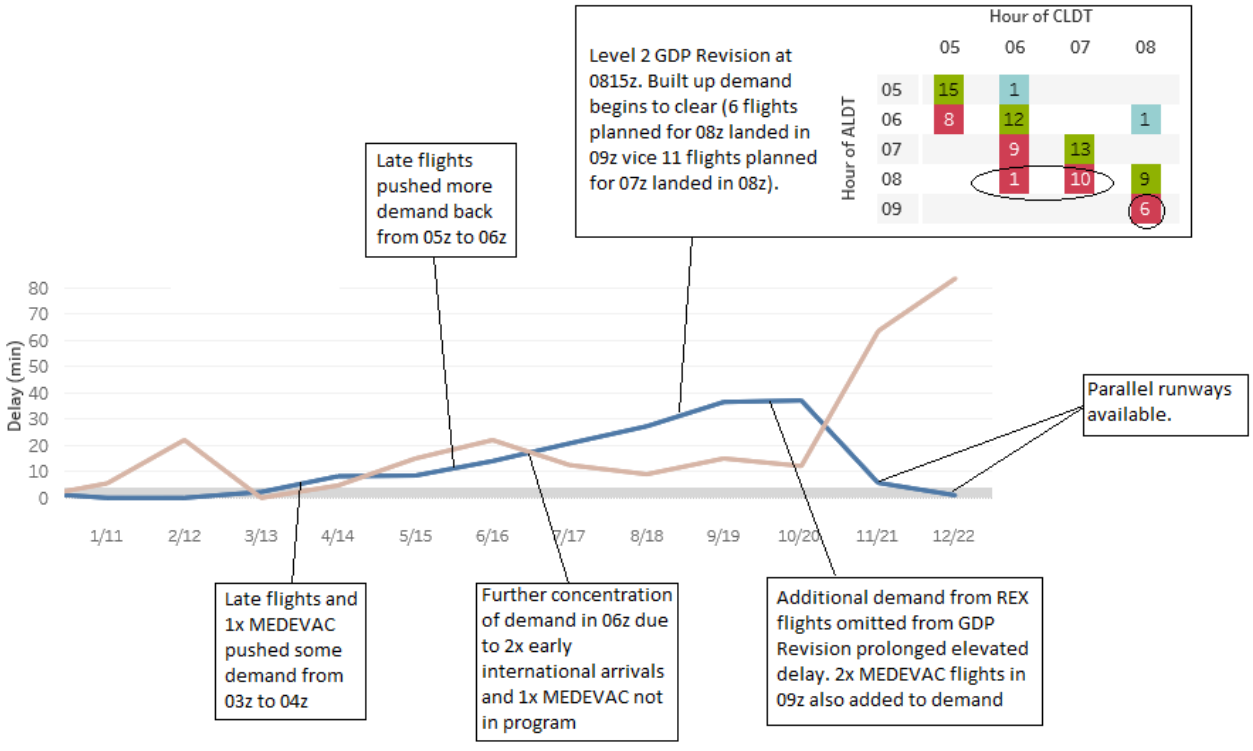

Figure 2 – Airborne arrival delay at Sydney on 20 July 2018 annotated with factors identified as contributing most to the profile of delay.

Figure 3 shows an alternative view of the build in up demand throughout the day. The estimated queue length is minimal until starting to build at 0400z. The queue length increases to a peak of 18 aircraft at 0900z. The queue then clears over the following three hours as the impact of the Level 2 GDP Revision (0815z) realigns the evening demand.

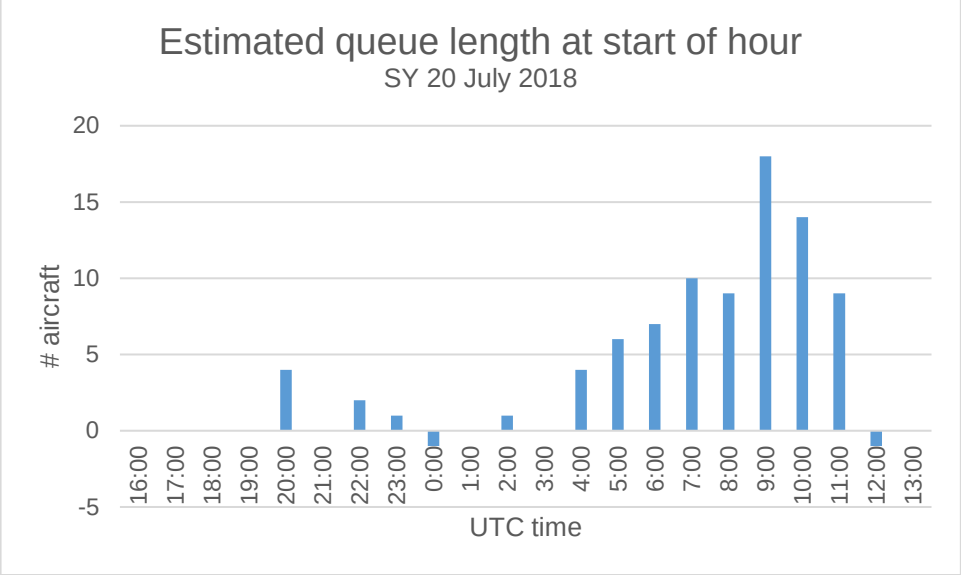

Figure 3 – Estimated queue length at beginning of hour for Sydney on 20 July 2018. Queue length estimated as number of flights within 250nm of destination that have passed their eta and not landed. Negative values indicate that the number of arrivals up until that time of the day was higher than predicted by eta's.

ACID	ADES	ATOT-CTOT (min)	AOBT-COBT (min)	Compliant	Estimate taxi-out delay (min)	Arrival hour impacted (UTC)
VOZ1164	YCFS	27	15	Yes	12	04
TGG397	YBPN	17	5	Yes	12	04
VOZ841	YMML	21	12	Yes	9	04
VOZ651	YSCB	48	47	No - late	1	06
QFA438	YMML	17	15	Yes	2	06
QLK480D	YSCB	16	15	Yes	1	06
TGG242	YMML	18	- 6	No - early	24	06
VOZ849	YMML	26	20	No - late	6	06
VOZ954	YBBN	17	13	Yes	4	06

Table 1 – Flights with ATOT more than 15 minutes after CTOT identified as contributing to build up in delay.

The impact of late departing flights described above illustrates the problems that can be caused by late non-compliance. This impact is particularly problematic at the beginning of a constrained period as there is no demand to take up the slots left by the late flights. Late non-compliant flights do not contribute as significantly to delay once holding has increased because there is already demand available to take their slots. However, it cannot be known in advance whether this demand will exist. If delay had not built up earlier in the day, late non-compliant flights in the late afternoon would have shown the same pattern of lost slots followed by increasing delay. Similarly, there were five late departing flights in the 01z hour that would have been likely to start an accumulation of delay if parallel runways had not been available for longer than planned.

Impact of Level 2 GDP Revision

As discussed above, the Level 2 GDP Revision assisted in capping the airborne delay that had increased throughout the afternoon and evening. At the time of the Level 2 GDP Revision (0815z), airborne delay

had increased to approximately 40 minutes per arrival. These delays would have propagated (and further increased) through the evening. This essentially meant that flights with a CLDT after 1220z had very low probability of arriving prior to the curfew due to the extent of airborne delay in the system.

If the Level 2 Revision at 0815z was not performed, airborne delay would have likely continued to increase for the same reasons as identified earlier in this analysis. At some point in the evening, this would have reached an unsustainable situation requiring ATC to call for a Level 2 or even Level 3 Revision. At such a late time in the evening, there would have been fewer options for operators to mitigate the impact of the GDP Revision. Late GDP revisions on constrained evening in Sydney have occurred in the past and required operators to cancel flights that had already boarded passengers.

Either way, revision or no revision, the demand in the GDP at 0815z would not have been able to be accommodated prior to curfew given at that point in time the probability of returning to parallel runway operations was very low. Therefore, the main objective of performing an early GDP revision, was to provide predictability to operators about the remainder of the evening, and significantly reducing the risk of a late GDP revision.

On the day, the Level 2 GDP Revision was only partial effective due to nine flights not being accounted for. This was caused by the extreme ground delays for these flight exceeding limits in the Harmony slot assignment logic causing nine flights to be purged from their slots. This issue has been investigated with Metron and algorithm modifications are being developed to prevent this from happening again. The return to parallel runway operations at 1055z resulted that any remaining oversubscription was able to be accommodated. All remaining flights in the GDP were able to arrive before curfew without any further cancellations or diversions.

Recommendations

A potential solution to the difficulties faced during extended periods with a full program would be to decrease the planned rates. This could either be a reduction for one or more short periods (firebreaks) during the middle of the program, or a uniform reduction across the program. The reduction in *planned* rates would have no impact on the *achieved* throughput during operations. The effect would be to smooth out tactical demand and reduce the holding required by these aircraft. This would help to avoid the need for revisions late in the program.

> ***It is recommended that further analysis be conducted by NP&A to model the impact of potential changes on delay. This analysis could also compare different pre-tactical arrival rate profiles to inform discussions about the most effective and least disruptive changes.***

Summary

At Sydney Airport on 20 July 2018 increased arrival airborne delay was observed in the afternoon and evening. The increase in delay was during an extended period of planned single runway operations with a full program.

Contributing factors

The increased airborne delay was associated with several periods of concentrated demand caused by late-departing domestic flights, off-schedule international flights, and MEDEVAC flights. These periods of increased demand were not able to be accommodated in a full program and a Level 2 GDP Revision was undertaken at 0815z to realign demand.

Following the GDP Revision, there was additional demand created by flights which had been erroneously omitted from the new program. This additional demand slowed the reduction in airborne delay.

Predictability of arrival times

The Level 2 GDP Revision assisted in capping the airborne delay. It also provided operators increased predictability about expected arrival times particularly in the lead up to the curfew.

Improved planning for single runway operations

Similar delay outcomes have been regularly observed during days where the program is full and tactical rates match programmed rates. A potential solution to these difficulties would be to reduce the planned rates during some or all of the program. This reduction would have no impact on the achieved throughput but would help to limit airborne holding and reduced the likelihood of revisions late in the program. ***It is recommended that further analysis be conducted to assess the potential benefit of different pre-tactical arrival rate profiles.***

For further information please contact Network Performance and Analysis @
OPS_ANALYSIS_ADMIN@AirservicesAustralia.com

Appendix B

Corporate Plan Key Performance Indicator Profile: Arrival airborne delay

Corporate Plan Description:

The median (and 75th percentile) excess time incurred during the arrival airborne phase of flight in reference to the estimated time of arrival for high-volume operations. (High volume operating environments defined as Brisbane, Melbourne, Perth and Sydney).

Corporate Plan Targets:

Year	17/18	18/19	19/20	20/21	21/22
75%	3.5	3.4	3.3	3.2	3.1
Median	0.6	0.6	0.6	0.6	0.6

What is it: Excess time incurred during the arrival phase of flight.

What is measured: It is measured by comparing the estimated flight time and actual flight time for the portion of the flight within 250 NM of the destination aerodrome.

Why 250NM: The 250NM threshold has been identified as the distance from the aerodrome at which tactical arrival demand/capacity balancing measures start taking effect. It is a true reflection of the tactical arrival management of the flight, and is not skewed by other non-related issues such as congestion at the departure aerodrome.

Why measure Median rather than Average/Mean: In some cases, the actual flight time within 250NM of the destination aerodrome will be less than the estimated flight time (e.g.: ATC has provide track shortening). In the dataset, this translates into a 'negative' value for that particular flight.

The Median shows the mid-point of the data set and allows us to demonstrate our impact on all flights, not just the ones that were delayed. Additionally, over short timeframes and small datasets (such as a daily report), Median measurement is more resilient to data errors and small groups of outliers which may skew the average.

Why measure the 75th percentile: This supplements the Median and is valuable to demonstrate how effectively we have managed the arrival of most of the fleet.

The last 25th percentile can typically contain arrival data from flights that were impacted by nonroutine events, such as Medical priority traffic or aircraft in an emergency or diversion.

How do we measure:

Uses the high-fidelity Dalí trajectory-based model. For Sydney, some assumptions are built in to calculations as the actual flight path is unique for each flight (open STARs).