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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2007-041
Final

Turbulence event – Adelaide Airport, SA

29 August 2007

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Abstract

On 29 August 2007, a SAAB Aircraft Company 340B-229 (SAAB) aircraft was being operated on a scheduled passenger service from Adelaide, SA to Mount Gambier. The aircraft departed from runway 05 soon after an Airbus A320-232 (Airbus) aircraft departed from the same runway. When the SAAB reached a height of 250 to 350 ft above ground level (AGL), the flight crew experienced abrupt, severe buffeting and an uncommanded roll to the left, followed by another roll to the right.

As a result of this occurrence, the aircraft operator advised that they reviewed their operating procedures relating to departures behind jet aircraft and will use the ATSB report as part of a safety promotion strategy directed at all company pilots. In addition, The Civil Aviation Safety Authority is reviewing the safety implications of this incident and is considering the development of a safety education program for flight crew and air traffic controllers.

FACTUAL INFORMATION

On 29 August 2007, a SAAB Aircraft Company 340B-229 (SAAB) aircraft, registered VH-ZLR, was being operated on a scheduled passenger service from Adelaide, SA to Mount Gambier with two flight crew, one cabin crew and 29 passengers on board. At 0840 Central Standard Time[1], the aircraft departed from runway 05 at Adelaide Airport (Figure 1). Approximately 30 seconds prior to this, an Airbus A320-232 (Airbus) aircraft, registered VH-VQH, had also departed from runway 05. When the SAAB reached a height of 250 to 350 ft above ground level (AGL), and at an indicated airspeed of about 130 kts, the flight crew reported an abrupt, severe buffeting and an uncommanded roll to the left. The angle of bank increased to over 30 degrees and was countered by full right aileron by the copilot, who was the flying pilot. That action initially produced no corrective aerodynamic response. However, after a short pause; the left roll stopped and was followed by an abrupt roll to the right. The copilot applied left aileron and levelled the aircraft. As the aircraft climbed through 800 to 900 ft AGL, further moderate buffeting was experienced.

The flight continued to Mount Gambier as planned.

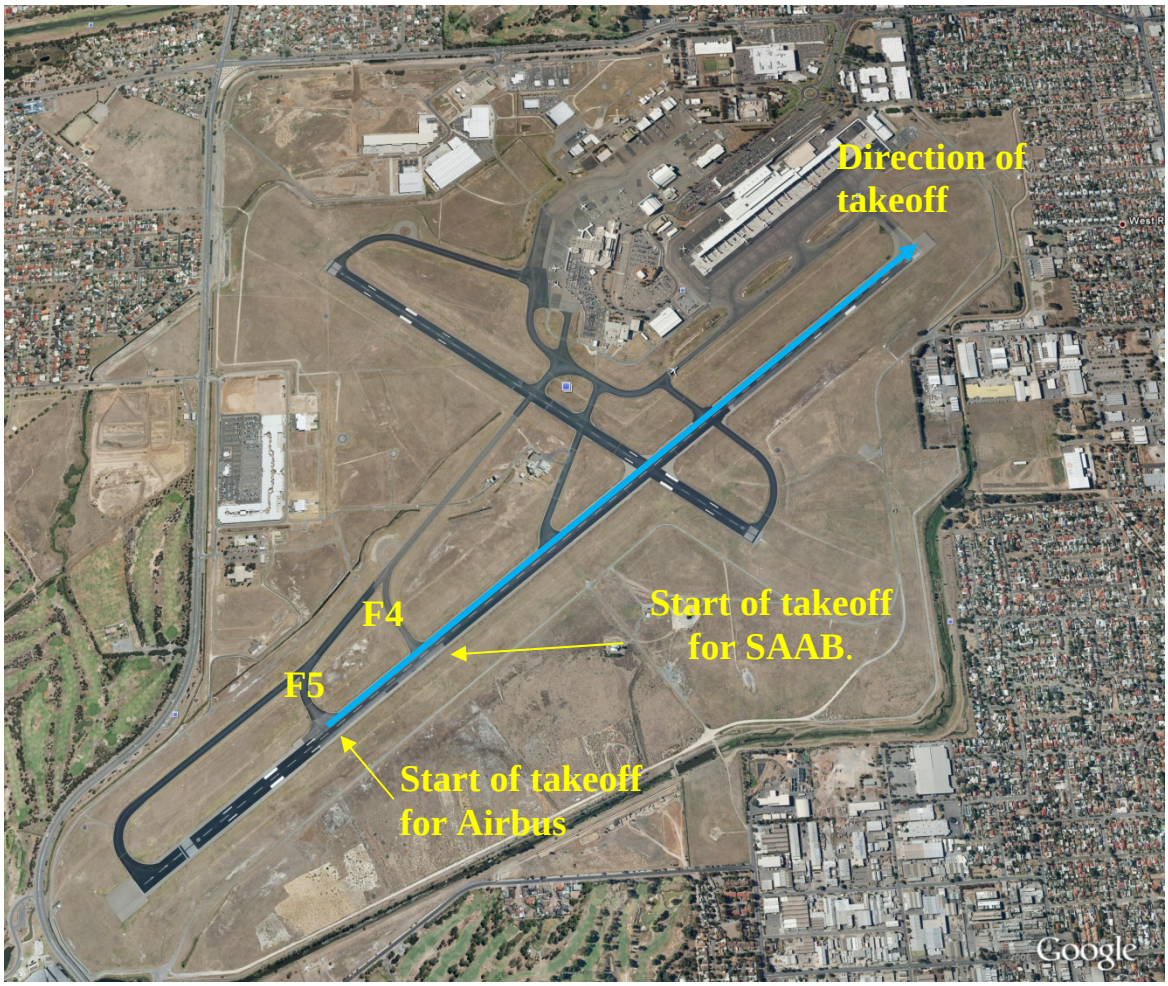
Pre-departure considerations

The flight crew of the SAAB commenced the take-off roll from their normal departure point for runway 05, which was at the intersection of taxiway F4. This was 351 m upwind of the taxiway F5 intersection with runway 05, and coincided with where the Airbus commenced its take-off roll less than 1 minute previously. The flight crew of the SAAB advised that their point of lift-off was normally the same as for jet aircraft that departed from the same taxiway/runway intersection position.

The flight crew of the SAAB also considered the possibility of any wake turbulence effect from the preceding departing Airbus. That included the consideration of the relative points of lift-off, the effect of any crosswind on any turbulence and that, while they had previously experienced wake turbulence from late model Boeing 767 and 737 aircraft, they had not experienced any effect from Airbus A320 aircraft.

1 The 24-hour clock is used in this report to describe the local time of day, Central Standard Time (CST) as particular events occurred. Central Standard Time was Coordinated Universal Time (UTC) + 9 hours 30 minutes.

Figure 1: Adelaide Airport showing positions of taxiways F4 and F5 (Google Earth)



The aircraft operator's procedures required the use of maximum available power in SAAB aircraft when atmospheric disturbances were suspected or known to exist in the take-off and/or initial flight path. The flight crew used maximum available power for this departure.

Weather conditions

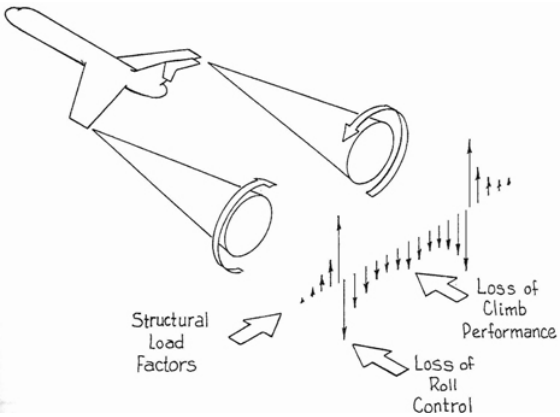
The weather conditions at the time were as forecast; with a clear sky, a surface temperature of 17^{0} C, a light crosswind from the right of runway 05, no downwind, no turbulence and with sun glare affecting runway 05 arrivals and departures. In this instance, that sun glare made the observation of the flight instruments difficult for the copilot.

Wake turbulence

Wake turbulence is the result of wingtip vortices that are produced by high pressure air below an aircraft wing moving towards the low pressure air on top of the wing; in particular, at the wingtip (Figure 2). The magnitude and intensity of the vortices is determined by four factors; the amount of lift the wing is generating, the aircraft's wing span, the air density and airspeed of the aircraft generating the turbulence.

Generally, the larger the aircraft, the larger the diameter of the vortex created, and the higher the rate of descent of the vortex. There are two factors that affect the dissipation of wing tip vortices; the aircraft configuration and the prevailing atmospheric conditions.

Figure 2: Effects of wake turbulence



Air traffic control procedures

Both the SAAB and Airbus were in the same 'Medium' wake turbulence category, as specified by the Manual of Air Traffic Services (MATS) and in the Aeronautical Information Publication (AIP). The 'Medium' wake turbulence category had the largest weight spectrum, encompassing aircraft with a maximum take-off weight (MTOW) of between 7,000 kg and 136,000 kg. The SAAB was at the lower end of the 'Medium' category, at 13,155 kg MTOW and the Airbus in the middle of the category at 73, 500 kg MTOW.

The wake turbulence separation standards in the MATS were designed to mitigate the effects of wake turbulence. However, those separation standards did not apply to aircraft that were within the same wake turbulence category.

International standards

The Australian Air Traffic Services MATS standards aligned with the requirements of the International Civil Aviation Organization (ICAO) standards. However, ICAO States were permitted to lodge national differences to those standards.

The United Kingdom Civil Aviation Authority (UK CAA) action to increase the number and specification of wake turbulence categories and the attendant wake turbulence separation standards[2] was an example of a difference to the relevant ICAO standard. The effect of the UK CAA information circular, if applied to this event, would have been that a 3-minute wake turbulence separation standard would have been applied by air traffic control between the SAAB and Airbus departures.

ANALYSIS

It was probable that the buffeting and uncommanded roll of the SAAB was induced by atmospheric disturbances from wake turbulence produced by the preceding Airbus takeoff.

The forecast and actual surface wind for Adelaide Airport during the incident was a north-easterly at 5 kts, with no associated turbulence. With calm or light wind conditions, the rate of dissipation of any generated wingtip vortices would be slow (Figure 2).

The wake turbulence categories and separation standards, as specified to air traffic controllers in the Manual of Air Traffic Services (MATS), provided some protection for aircraft operations from the hazards associated with wake turbulence encounters. However, those standards were not required to be applied to aircraft operating within the same wake turbulence categories. Hazards from wake turbulence may still be experienced within each wake turbulence aircraft category when no wake turbulence separation is required to be provided by air traffic control.

In this instance, the combination of the lift-off point of the SAAB in relation to that of the Airbus, the close departure spacing, and the prevailing weather conditions, resulted in the SAAB aircraft being affected by wake turbulence from the preceding departing Airbus aircraft.

The effect of an encounter with a wake turbulence vortex soon after takeoff, when airspeed and altitude are low and the flight crew workload is high, places a high demand on flight crews to regain control of the aircraft and recover to normal flight. The use of maximum available power by the SAAB flight crew significantly enhanced their ability to recover the aircraft from the uncommanded roll condition.

FINDINGS

Context

From the evidence available, the following findings are made with respect to the turbulence event involving the SAAB aircraft, registered VH-ZLR, at Adelaide Airport on 29 August 2007 and

2 UK CAA Aeronautical Information Circular 17/1999.

should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The lift-off point of the SAAB relative to the lift-off point of the Airbus and the close departure spacing, combined with the prevailing weather conditions, resulted in the SAAB aircraft being affected by wake turbulence from the preceding departing Airbus aircraft.
- Aircraft operating within the same wake turbulence weight categories were not subject to any specific wake turbulence separation standards, irrespective of the differences in weight and performance. *(Safety Issue)*

SAFETY ACTION

Wake turbulence separate standards

Safety Issue

Aircraft operating within the same wake turbulence weight categories were not subject to any specific wake turbulence separation standards, irrespective of the differences in weight and performance.

Action taken by aircraft operator

As a result of this occurrence, the aircraft operator advised that they reviewed their operating procedures relating to departures behind jet aircraft. In addition, company pilots are delaying their departures when behind 'larger' medium category aircraft where the effect of wake turbulence is considered to be a hazard.

The operator intends to use this ATSB investigation report in their safety management system newsletter as a safety promotion strategy directed at all company pilots.

Action taken by CASA

The Civil Aviation Safety Authority (CASA) advised that, as a result of this incident, they will review the specific wake turbulence issues identified in this report; in particular, noting the action by the United Kingdom Civil Aviation Authority (UK CAA) to expand the number and specification of wake turbulence categories in the UK.

In addition, CASA is considering the development of a safety education program for flight crew and air traffic controllers.

SOURCES AND SUBMISSIONS

Sources of information

The sources of information included:

- the aircraft operator of VH-ZLR
- the flight crew of VH-ZLR
- the Bureau of Meteorology
- Airservices Australia
- the Civil Aviation Safety Authority (CASA)
- the UK Civil Aviation Authority (UK CAA).

References

Figure 2. Wood, R. H. & Sweginnis, R. W., 2006. *Aircraft Accident Investigation.* 2nd ed. Wyoming, USA: Endeavour Books.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

Submissions were received from the aircraft operator, Airservices Australia and CASA. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.