



Australian Government

Australian Transport Safety Bureau

Operational non-compliance involving Airbus A380, 9V-SKQ

Sydney Airport, New South Wales, on 9 February 2020

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

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Addendum

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Safety summary

What happened

On 9 February 2020, an Airbus A380 aircraft, registered 9V-SKQ was being operated by Singapore Airlines on a scheduled passenger service from Singapore to Sydney, New South Wales.

During the approach to runway 16 right at Sydney, the aircraft encountered windshear and in response, the flight crew commenced the windshear recovery procedure and missed approach. During this time, air traffic control (ATC) instructed the flight crew to turn right onto a heading of 270°. The flight crew read back the heading, however, did not include the direction of the turn. Air traffic control did not correct the incomplete readback and the flight crew commenced turning the aircraft left instead of right.

Air traffic control issued a safety alert to the flight crew, advised them of a Bombardier DHC-8 aircraft about 6 NM (11 km) on final for runway 16 left, and instructed them to turn right and climb immediately. Air traffic control then instructed the flight crew of the DHC-8 to make a right turn in order to maintain separation with the A380. This resulted in a loss of separation between the DHC-8 and a Boeing 737 aircraft on approach to runway 16 right.

What the ATSB found

The ATSB found that the flight crew were likely experiencing high workload as a result of conducting the windshear recovery and published missed approach procedure. This, in combination with an expectation that they would be turning left, contributed to them mishearing the ATC instruction to turn right. As a result, the aircraft was turned left. In addition, the flight crew omitted information from their readback and ATC did not correct the flight crew's incomplete readback, which was a missed opportunity to correct the misheard instruction.

What has been done as a result

Singapore Airlines issued a notice to flight crew, highlighting strategies to manage high workload situations, as well as reiterating the importance of correct readbacks and acknowledgement from ATC.

Safety message

Compliance with ATC published procedures, such as readback procedures, provides assurance that instructions are correctly understood, which is especially important during high workload periods and/or in times of high traffic density. This incident highlights the importance of flight crew completing full readbacks, as well as controllers correcting any readback discrepancies immediately. The ATSB's aviation research and analysis report [Radiotelephony Readback Compliance and its Relationship to Surface Movement Control Frequency Congestion](#) (20060053) provides further information regarding readback compliance.

The investigation

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope investigation was conducted in order to produce a short investigation report, and allow for greater industry awareness of findings that affect safety and potential learning opportunities.

The occurrence

On the morning of 9 February 2020, an Airbus A380 aircraft, registered 9V-SKQ, was being operated by Singapore Airlines, on a scheduled passenger service from Singapore to Sydney, New South Wales. The captain was the pilot flying and the first officer (FO) was the pilot monitoring.¹ Prior to, and during the flight, the flight crew had noted the deteriorating weather conditions in Sydney and briefed on conducting a missed approach, following the published missed approach procedure.

On arrival at Sydney, the flight crew was cleared by air traffic control (ATC) for an instrument landing system² approach to runway 16 right (16R). At about 1122 Eastern Daylight-saving Time,³ while on approach and descending through about 1,000 ft, the A380 encountered windshear. The flight crew actioned the windshear recovery procedure and in response, commenced a missed approach, which included applying take-off/go-around thrust, flaps extended and a rate of climb of 3,000 ft per minute. At 1123:00, the flight crew advised ATC that they were 'going around due to windshear'. Air traffic control acknowledged the flight crew and at 1123:29, ATC instructed them to turn right onto a heading of 270° and to maintain 3,000 ft.

The FO gave an incomplete readback of the instruction, omitting the direction of the turn. Air traffic control did not correct the incomplete readback.

The flight crew believed that they heard ATC instruct them to turn left. They were also expecting ATC to issue instructions to turn left, once they had completed the published missed approach procedure, to avoid significant weather and aircraft traffic to the west of Sydney. The flight crew therefore commenced turning the aircraft left, crossing the approach path of the parallel runway (runway 16 left (16L)).

Air traffic control noticed the aircraft turning in the opposite direction to the instruction and 30 seconds after issuing the turn instruction, queried the flight crew as to whether the aircraft was turning right. The FO responded that the aircraft was not turning right. During this time, ATC had continuous communications with another aircraft. At 1124:17, ATC instructed the flight crew to turn the aircraft onto a heading of 060° and 19 seconds later, issued a safety alert. The safety alert advised the flight crew about a Bombardier DHC-8 aircraft in their 12 o'clock position,⁴ about 6 NM (11 km) away and on approach to runway 16L. At 1124:40, ATC instructed the flight crew of the DHC-8 to make a right turn in order to maintain separation with the A380. This subsequently resulted in a loss of separation⁵ between the DHC-8 and a Boeing 737 aircraft on approach to runway 16R.

¹ Pilot flying (PF) and pilot monitoring (PM) are procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances, such as planning for upcoming stages of the flight. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

² A precision instrument approach system, which normally consist of the following electronic components: VHF localiser, UHF glideslope, VHF marker beacons.

³ Eastern Daylight-saving Time (EDT): Coordinated Universal Time (UTC) + 11 hours.

⁴ The clock code is used to denote the direction of an aircraft or surface feature relative to the current heading of the observer's aircraft, expressed in terms of position on an analogue clock face. Twelve o'clock is ahead while an aircraft observed abeam to the left would be said to be at 9 o'clock.

⁵ An occurrence in which the spacing between two or more aircraft is less than prescribed separation minima in airspace where the aircraft is subject to an air traffic service.

The minimum distance between the two aircraft reduced to 2.6 NM (4.8 km) laterally and 1,300 ft vertically. Figure 1 shows the representative aircraft tracks at the time of the incident.

Figure 1: Aircraft tracks at the time of incident



Source: Google earth, modified by the ATSB

Context

Weather

The Sydney Airport automatic terminal information service⁶ issued at 1118 and current at the time of the incident, reported wind from an east-south-easterly direction at 20-40 kt, with a maximum crosswind of 29 kt. There was rain present, and a warning for windshear and turbulence on final approach was also current. A previous automatic terminal information service stated that severe windshear had been reported on final approach for runway 16R by the flight crew of another aircraft.

The Bureau of Meteorology⁷ defines windshear as ‘a wind direction and/or speed change over a vertical or horizontal distance. It is significant when it causes changes to an aircraft’s headwind or tailwind such that the aircraft is abruptly displaced from its intended flight path and substantial control action is required to correct it’. Although windshear can occur at any level, windshear below 2,000 ft can be particularly problematic to aircraft approaching stall⁸ speeds, predominantly seen in the take-off, initial climb, approach or landing phases of flight. This is even more so the case in larger jets, where there is a significant lag between applying and achieving thrust.

⁶ The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts during the hours when the unit responsible for the service is in operation.

⁷ Bureau of Meteorology (2014). Hazardous Weather Phenomena *Windshear*.

⁸ Occurs when airflow separates from the wing’s upper surface and becomes turbulent. A stall occurs at high angles of attack, typically 16° to 18°, and results in reduced lift.

Aircraft operations

Published missed approach procedure

A missed approach procedure is to be followed if an approach to land cannot safely continue. It specifies a point where the missed approach begins, and a point or an altitude where it ends. In this case, the missed approach procedure was to initially track on a heading of 155°, when at 600 ft above mean sea level turn right onto a track of 170° and climb to 3,000 ft, or as directed by ATC.

Windshear recovery procedure

A windshear recovery procedure is an operational abnormal manoeuvre used by flight crew to escape a windshear encounter. The Singapore Airlines recovery procedure involved applying take-off/go-around thrust and following the speed reference system until the aircraft was clear of windshear. Such manoeuvres are high in workload due to their dynamic nature, increasing an already high workload of the approach phase of flight.

Air traffic services

Summary of radio calls

The table below (Table 1) summarises the radio calls made by the flight crew of 9V-SKQ (Singapore 231) and ATC.

Table 1: Summary of radio calls

| Time (local) | Caller | Summary |
|---------------------|--------------------|--|
| 1123:00 | Singapore 231 | Singapore 231 communicate they are going around due to windshear |
| 1123:02 | ATC | ATC acknowledge the intentions of Singapore 231 |
| 1123:29 | ATC | ATC instruct Singapore 231 turn right on a heading of 270°, maintaining 3,000 ft |
| 1123:36 | Singapore 231 | Singapore 231 reads back the heading and altitude, but omits the direction of the turn |
| 1123:41 | ATC/Other aircraft | Continuous communications between ATC and another aircraft |
| 1123:59 | ATC | ATC contact Singapore 231 to confirm turning right on a heading of 270° |
| 1124:03 | Singapore 231 | Singapore 231 respond 'ah negative' |
| 1124:12 | Singapore 231 | Singapore 231 request heading from ATC |
| 1124:17 | ATC | ATC instruct Singapore 231 to continue flying on a heading of 060° |
| 1124:24 | Singapore 231 | Singapore 231 confirm heading |
| 1124:36 | ATC | ATC issue 'safety alert', advising Singapore 231 of traffic on final and issue instructions to turn immediately on a heading of 060° |
| 1124:45 | Singapore 231 | Singapore 231 confirm turning immediately |
| 1124:51 | ATC | ATC instructs Singapore 231 to climb immediately to 5,000 ft |
| 1124:55 | Singapore 231 | Singapore 231 confirm 5,000 ft |

Readbacks

A readback is a procedure whereby the receiver of a message repeats the message or an appropriate part thereof back to the transmitter, in order to obtain confirmation of correct reception and compliance. In aviation, flight crew are required to read back to ATC, safety-related parts of ATC clearances and instructions that are transmitted by voice. These items include, but are not limited to, altitude, direction of turn, heading and speed instructions. Specifically, the Airservices Australia Aeronautical Information Publication, section GEN 4.4, stated that this should include level instructions, direction of turn, heading and speed instructions. In response, the controller will listen to the readback to ascertain that the clearance or instruction has been correctly

acknowledged and will take immediate action to correct any discrepancies revealed by the readback.

Safety alert

The Airservices Australia and Department of Defence Manual of Air Traffic Services stated that, ATC will issue a safety alert to flight crew when they become aware that an aircraft is in a position that is considered to place it in unsafe proximity to other aircraft. This is to notify pilots of information that is of a time-sensitive and safety-critical nature. It is important pilots understand the critical nature of these instructions and respond in a timely manner to ensure the safe conduct of flight.

Separation standards

Separation standards are used by ATC to manage air traffic safely. They refer to the minimum horizontal and/or vertical distance, or time apart, that aircraft operating in controlled airspace must maintain. When the separation between two or more aircraft is less than the standard, there is a loss of separation event.

A surveillance separation standard is used when aircraft position information is derived from air traffic services' surveillance systems (including radar). The Manual of Air Traffic Services stated that, for two aircraft on independent parallel visual approaches, the required separation was 3 NM (5.6 km) horizontally or 1,000 ft vertically. However, Airservices Australia advised that, in accordance with section 9.7.5.2 of the manual, when determining whether an aircraft has passed a level on descent, a 400 ft tolerance was required to be made to the aircraft's altitude shown on the controller's situation display. Based on the 400 ft tolerance, a loss of separation occurred when the Boeing 737 and DHC-8 were within 3 NM laterally and less than 1,400 ft vertically.

Analysis

Workload and misheard instruction

Workload is considered to be 'the relation between the function relating the mental resources demanded by a task and those resources supplied by the human operator'.⁹ Considering the amount of information flight crew can deal with at any one time is limited, particularly during high workload phases of flight, it is possible to exceed individual processing capacity,¹⁰ increasing the risk of errors.

The approach phase of flight is associated with high workload for flight crew during normal operations. The flight crew of the A380 were experiencing a significantly higher level of workload than what is typically experienced during a normal approach, due to the weather and conducting a windshear recovery procedure, following the published missed approach procedure for runway 16R at Sydney. This involved managing a high-energy aircraft state, which included applying take-off/go-around thrust, flaps extended, and a rate of climb of 3,000 ft per minute. In addition, the published missed approach requirement for runway 16R at Sydney to level off at 3,000 ft, requiring the flight crew to reconfigure the aircraft in under a minute. The flight crew also did not expect to receive an instruction from ATC before completing the published missed approach procedure and the instruction to turn right was contrary to their expectations. This, combined with significantly increased workload, likely contributed to them mishearing the ATC instruction.

⁹ Parasuraman, R., Sheridan, T. B., & Wickens, C. D. (2008). Situation Awareness, Mental Workload, and Trust in Automation: Viable, Empirically Supported Cognitive Engineering Constructs. *Journal of Cognitive Engineering and Decision Making*, 2(2), 140–160. <https://doi.org/10.1518/155534308X284417>.

¹⁰ Civil Aviation Safety Authority (2006). Civil Aviation Advisory Publication *Navigation using Global Navigation Satellite Systems (GNSS)* (CAAP 179A-1(1))

Readbacks

The flight crew omitted the direction of the turn during readback of the ATC instruction and ATC did not correct the flight crew's incomplete readback. An uncorrected, incomplete readback may lead to an unintended deviation from ATC instruction and may not be detected until the controller visually observes the deviation. In addition, the absence of ATC correcting a readback is perceived by most flight crews as an implicit confirmation of the readback.¹¹ Research suggests that 'errors of omission largely associated with diverse aspects of concurrent task management, when not detected or corrected, are a major threat to aviation safety'.¹² In this incident, the incomplete readback by the flight crew and the absence of a readback correction by ATC was a missed opportunity to identify and correct the misheard instruction. This ultimately resulted in the flight crew turning the aircraft in the opposite direction to that instructed.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

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

From the evidence available, the following findings are made with respect to the operational non-compliance involving an Airbus A380 aircraft, registered 9V-SKQ, on 9 February 2020.

Contributing factors

- The flight crew misheard an air traffic control turn instruction, likely due to a combination of the high cockpit workload associated with the missed approach and their expected turn direction.
- The flight crew omitted the direction of the turn during the readback, which was not corrected by air traffic control. The absence of the readback correction by air traffic control, combined with the misheard turn instruction, resulted in the aircraft being turned in the wrong direction.

Safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out to reduce the risk associated with this type of occurrences in the future.

Singapore Airlines

After an internal investigation into the incident, Singapore Airlines issued a notice to flight crew, highlighting strategies to manage high workload situations, as well as reiterating the importance of correct readbacks and acknowledgement from ATC.

¹¹ Eurocontrol (2006) European Action Plan for Air Ground Communications Safety Edition 1.

¹² Loukopoulos, L. D., Dismukes, K., & Barshi, I. (2009). The multitasking myth: Handling complexity in real-world operations. Farnham, England: Ashgate Pub. Ltd.

Sources and submissions

Submissions

The sources of information during the investigation included the:

- Singapore Airlines
- Airservices Australia.

General details

Occurrence details

| | | |
|--------------------------|-----------------------------|--------------------------|
| Date and time: | 09 February 2020 – 1122 EDT | |
| Occurrence category: | Incident | |
| Primary occurrence type: | Operational non-compliance | |
| Location: | Sydney, New South Wales | |
| | Latitude: 33° 56.77' S | Longitude: 151° 10.63' E |

Aircraft details

| | | |
|-------------------------|---|----------------------|
| Manufacturer and model: | Airbus A380-841 | |
| Registration: | 9V-SKQ | |
| Operator: | Singapore Airlines | |
| Serial number: | 79 | |
| Type of operation: | Air transport high capacity - Passenger | |
| Activity: | Passenger | |
| Departure: | Changi, Singapore | |
| Destination: | Sydney, New South Wales | |
| Persons on board: | Crew – Unknown | Passengers – Unknown |
| Injuries: | Crew – None | Passengers – None |
| Aircraft damage: | None | |