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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2009-080
Final

Loss of separation assurance
222 km NW of Tennant Creek, Northern Territory
22 December 2009

Abstract

On 22 December 2009, at 0253 Central Standard Time, an air traffic controller took action to resolve a loss of separation assurance that occurred on airway route J30, 222 km north-west of Tennant Creek, Northern Territory between an Airbus A330-300 (A330) aircraft, registered B-HLV, and a Boeing Company B737-800 aircraft, registered VH-VUJ.

The aircraft were approaching each other at flight level 370 while tracking in opposite directions on the same airway route. The air traffic controller managing the airspace did not effectively control the resolution of the developing confliction.

The flight crews of both aircraft identified the traffic confliction and initiated avoidance action to maintain separation.

The investigation found that the controller did not implement a separation plan when the confliction was first identified and that action by the flight crew of the A330 prompted the controller to take action to re-establish separation assurance. In addition, a number of safety issues were identified, including that the controller had not received training in compromised separation recovery techniques and that there was no dedicated control room aisle supervisor during the then peak traffic period. Finally, ambiguity was identified between the Manual of Air Traffic Services (MATS) and the Aeronautical Information Publication (AIP) in relation to the assignment of non-standard cruising levels and the definition of an 'operational requirement'.

In response to this occurrence, Airservices Australia (Airservices) conducted an internal investigation, which recommended a number of actions to address the safety factors and issues that were identified by the Airservices investigation. The Australian Transport Safety Bureau (ATSB) is satisfied that the action taken by Airservices to clarify the relevant content in the MATS and AIP, and recommended by the Airservices investigation will, when implemented, adequately address the safety issues identified in this ATSB safety investigation.

FACTUAL INFORMATION

The information presented below, including any analysis of that information, was prepared from information supplied to the Bureau.

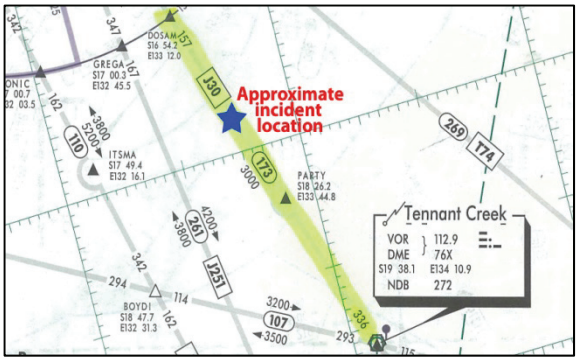
On 22 December 2009, at 0253 Central Standard Time[1], an air traffic controller took action to resolve a loss of separation assurance[2] between an Airbus A330-300 (A330) aircraft, registered B-HLV, and a Boeing Company B737-800 (737) aircraft, registered VH-VUJ, occurred on airway route J30, 222 km north-west of Tennant Creek,

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) + 9.5 hours.

2 'Loss of separation assurance' describes a situation where a separation standard existed but planned separation was not provided or separation was inappropriately or inadequately planned.

Northern Territory (NT) and south of reporting position DOSAM (Figure 1).

Figure 1: Map showing airways route J30 (highlighted)[3]



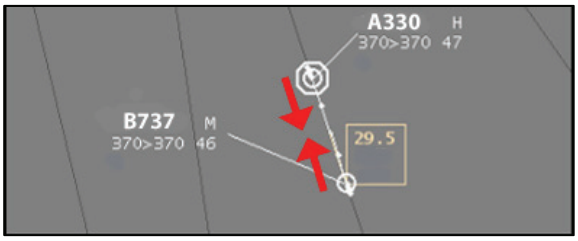
The A330 was southbound at flight level (FL)[4] 370 and the 737 northbound on the reciprocal track, at non-standard level FL 370 (see *Use of non-standard levels* section below). Both aircraft were operating under the instrument flight rules (IFR), in the regular public transport category and were under radar control.

The controller received coordination[5] on the A330 from a northern air traffic control (ATC) sector controller at 0151, indicating that the southbound A330 was operating at FL 370. The controller received coordination on the northbound 737 from a southern ATC sector controller at 0157, during which the southern controller specified that the aircraft was operating at a non-standard level.

The 737 subsequently entered the controller's airspace at FL 370 at 0223. The A330 entered the airspace at 0248. The controller reported that he intended to descend the 737 to a standard level to maintain separation but forgot to implement that plan.

At 0252:05, the controller was accepting voice coordination from another ATC sector controller, via an intercom line, when the flight crew of the A330 requested information on the opposite direction traffic at the same level as their aircraft. The flight crew had identified that traffic via their onboard Traffic Alert and Collision Avoidance System (TCAS). The aircraft were 29.5 NM (55 km) and about 2 minutes flight time apart at that time (Figure 2).

Figure 2: Proximity of the aircraft at 0252:05



The controller issued an instruction to the crew of the A330 to climb to FL 380, which was acknowledged by the crew. The controller resumed the voice coordination with the other sector controller.

At 0252:34, the crew of the A330 requested further confirmation that the reciprocal traffic was at FL 370, which was confirmed by the controller. That confirmation included advice of traffic '...20 miles [37 km] ahead [of the A330]'. The crew again requested clarification that the traffic was tracking from the opposite direction.

On receiving further confirmation from the controller of the reciprocal traffic at 0252:48, the crew of the A330 advised that they were deviating right of track. At 0252:55, the flight crew of the 737 advised that they were also diverting right of track. The controller then issued a clearance for the diversion by the 737.

The flight crews of both aircraft reported that they considered the situation to be significant enough to commence diversions right of track without obtaining an ATC clearance prior to their respective manoeuvres. Aeronautical Information Publication (AIP)[6] ENR 18.7 *Deviation from Track*, paragraph 18.7.1 stated that:

> In controlled airspace, any deviation from track requires prior clearance from ATC, except in an emergency.

3 Courtesy of Airservices Australia.

4 The height above ground of a surface of constant atmospheric pressure, expressed in hundreds of feet. FL 370 equated to 37,000 ft.

5 'Received coordination' is an air traffic control term referring to the transfer of responsibility for an aircraft from one controller to another.

6 A package of documents that provides the operational information necessary for the safe and efficient conduct of national (civil) and international air navigation throughout Australia and its Territories.

At 0253:05, the controller again returned to completing the coordination with the other sector controller, who was still on the intercom line. The decision to return to the coordination with the other controller was reportedly based on the controller's observation that the A330 responded immediately to the climb instruction.

The radar display indicated a high rate of climb by the A330 and the controller continued to monitor the aircraft's level change whilst completing the coordination. The radar data indicated that the A330's groundspeed[7] reduced from 470 kts to 400 kts.

At 0253:23, the flight crew of the A330 reported maintaining FL 380[8], and that that they were resuming track, following the deviation right of track. The radar data indicated that the aircraft were 10.2 NM (19 km) apart at that time (Figure 3).

Figure 3: Proximity of the aircraft at 0253:23

The crew of the 737 reported resuming the route after hearing that the A330 was maintaining FL 380.

Personnel information

General

The air traffic controller joined Airservices Australia (Airservices) in September 2008, after previous ATC experience through the performance of tower and approach control roles in the Royal Australian Air Force. Based on that experience, recognition of prior learning for a number of civil ATC training components was granted by Airservices and the controller was given an abridged ATC training course of just over 11 weeks duration, in lieu of the normal 44-week ab initio course. The controller did not receive Compromised Separation Recovery Training during the training course.

The controller's training notes indicated a number of deficiencies in the controller's core ATC competencies during final field training. Those deficiencies included ineffective conflict recognition, particularly in relation to opposite direct traffic, and inadequate scanning.

The controller subsequently completed the necessary on-the-job training, during which the identified deficiencies were considered to have been addressed, and was licensed for sector radar and procedural control in August 2009. The controller's sector radar and procedural control endorsements were renewed on 18 December 2009; 3 days prior to the incident.

The controller had a change of roster 4 days previously and a day off on 20 December 2009. On 21 December 2009, the controller worked from 0530 to 1330 and, on the day of the occurrence, commenced work at 2330. The controller reported feeling fit for duty at that time.

Workload

The controller reported that their workload and the traffic complexity at the time of the occurrence were average for that period.

Peak traffic workloads within the controller's area of responsibility were reported to occur from about 0030 to 0130. Staff numbers were higher in the controller's ATC group during night shifts in comparison with other ATC groups to take account of the elevated traffic levels.

Aircraft information - traffic alert and collision avoidance system

The traffic alert and collision avoidance system (TCAS) is designed to independently alert flight crews to possible conflicting traffic. TCAS identifies a three-dimensional airspace around appropriately-equipped aircraft based on the closure rate of other similarly-equipped traffic and, if the defined vertical and horizontal parameters are satisfied by the evolving potential conflict, TCAS generates a visual and aural alert.

7 Aircraft's speed relative to local earth.

8 Aircraft are determined to be maintaining a level when within +/- 200 ft of the assigned level.

In this occurrence, both aircraft's TCAS equipment generated Traffic Advisory (TA)[9] alerts. As a result of the TA alert in the A330, the flight crew queried the level and proximity of the 737, before initiating track diversions for conflict resolution.

Air Traffic Control

Separation assurance

The MATS described separation assurance as the preference for controllers to proactively plan to de-conflict aircraft, rather than to wait for or allow a conflict to develop before its resolution. The intent was to prioritise conflict prevention over conflict resolution.

In order to assure separation, the MATS required controllers to:

1. Apply standards to ensure and apply separation, to avoid conflicts;
2. Plan traffic to guarantee separation, rather than having to resolve conflicts after they occur;
3. Execute the plan to ensure that separation is maintained; and then
4. Monitor the plan to ensure it succeeds.

Separation standards

The horizontal radar separation standard applicable between the aircraft was 5 NM (9 km) and the vertical separation standard was 1,000 ft. A breach of either standard between the aircraft would have constituted a breakdown of separation.

In this instance, separation assurance did not exist at the time of the occurrence and a breakdown of separation was imminent.

Use of non-standard levels

One of the primary system defences for ensuring separation was through the assignment of cruising levels as defined in the MATS and AIP (Table 1). The application of those cruising levels was intended to minimise the possibility of aircraft tracking in opposite directions on a two-way route at the same level.

Table 1: Table of Cruising Levels –IFR

5. TABLES OF CRUISING LEVELS (NORTH OF 65° S)

TABLE A - IFR

Magnetic Tracks	From 000° through East to 179°		From 180° through West to 359°	
Cruising Altitudes (Area QNH)	3,000 5,000	7,000 9,000	2,000 4,000 6,000	8,000 10,000
Cruising Flight Levels (1013HPA)	110* 130 150 170 190 210 230 250 270	290 310 330 350 370 390 410 450 490	120* 140 160 180 200 220 240 260 280	300 320 340 360 380 400 430 470 510

The A330 was tracking southbound on a track of 157° magnetic (M) at FL 370 in accordance with the table of cruising levels.

The 737 was tracking on a reciprocal track of 336° M at the non-standard cruising level of FL 370. That level had been assigned to the aircraft about 2 hours prior to the incident by a controller on a previous sector. The change of level was reported to have been requested by the flight crew in response to light turbulence being experienced at the time.

The MATS allowed for the assignment of non-standard cruising levels by controllers that were applying procedural separation[10] only when required by traffic or other operational circumstances. In the case of radar surveillance separation, the MATS stated that non-standard cruising levels may be assigned without the need to confirm an operational requirement with pilots.

AIP ENR 3.1 *Selection of levels*, paragraph 3.1.2.1, stated that a level not conforming to the table of cruising levels must only be requested as a result of an operational requirement and that, in those circumstances:

> ...the phrase 'DUE OPERATIONAL REQUIREMENT' must be included with the level change request.

The request to the previous sector controller for a non-standard cruising level by the 737 flight crew did not specify an 'operational requirement'. The

9 A Traffic Advisory provides pilots with information about other appropriately-equipped traffic within +/- 1,200 ft and 45 seconds in time from their aircraft.

10 Used when the information derived from an Air Traffic Service surveillance system (for example radar) is not required for the provision of air traffic control services, and involving the use of vertical, time, distance or lateral separation standards.

previous sector controller, who was applying procedural separation at the time, did not confirm that requirement prior to approving the change of level.

Controller separation planning

The controller stated that their original plan for separating the aircraft, when the conflict was first sighted, was to descend the 737 to a standard level, as the aircraft was landing at Darwin NT, and would be requesting descent well before the A330, which had a destination of Melbourne, Victoria.

Compromised separation

Separation is considered to be compromised when either ATC separation standards have broken down, or where separation assurance is lacking to the extent that a breakdown of separation is imminent. The requirement for controllers to issue safety alerts in the case of lost or compromised separation, and the required supporting ATC phraseology, was detailed in MATS. A safety alert was defined as:

> The provision of advice to [the pilot of] an aircraft when an ATS [air traffic services] Officer becomes aware that an aircraft is in a position which is considered to place it in unsafe proximity to terrain, obstructions or another aircraft.

Airspace

The controller was operating two control sectors that were combined in the standard operating configuration for night shift operations. The controller reported that the default sector configuration at night required the use of a large range display on the control screen, and that it could be challenging to operate in that configuration. The aircraft were operating in Class A airspace, which required an ATC separation service to be provided to all aircraft.

Night operational supervision

Operational Command Authority for the ATC operations room was exercised by the Systems Supervisor (SS), who was responsible for system oversight and the supervision of the operations room, including monitoring air traffic and staff.

The SS was occupied in another area of the Operations Room, addressing a different issue, when the incident occurred. On night shifts, the supervision of the Operations Room was the responsibility of the SS, as Aisle Managers finished duty between 2030 and 2130.

Flight crew comments

The flight crew of the 737 stated that they observed the A330 at FL 370 on their aircraft's TCAS display when it was about 35 NM (65 km) away. The crew discussed the controller's possible intentions and decided to request a climb to FL 380.

When the controller issued a climb instruction to the flight crew of the A330, the flight crew of the 737 elected to remain at FL 370. The aircraft's TCAS indicated that the A330 commenced its change of level when the aircraft were about 25 NM (46 km) apart.

The flight crew recalled their TCAS indicating that the A330 approached within 20 NM (37 km) of the 737 at 400 ft above their level. Shortly after, the flight crew of the A330 advised the controller that they were diverting right of track. The 737 crew decided to take the same action.

The flight crew of the A330 reported observing opposite direction traffic at their level on their TCAS when that traffic was 35 NM (65 km) ahead. The flight crew recalled confirming the proximity of the traffic with the controller, before commencing a 60° right turn off track.

The A330 flight crew's recollection was that in response to a second request from the flight crew to confirm the details of the approaching (737) traffic, the controller instructed the flight crew to climb the aircraft to FL 380.

Previous investigation

ATSB investigation 200203094 examined the breakdown of separation that occurred about 324 km north-north-east of Melbourne Aerodrome, Victoria on 8 July 2002 and involved Boeing Company 737-476 aircraft, registered VH-TJT and Cessna Aircraft Company 500 aircraft,

registered VH-HKX. The significant findings from that investigation included that:[11]

> The approval for the Citation pilot to operate at a non-standard level for the track flown cancelled a defence provided to the air traffic control system by the use of standard levels.

As a result of that investigation, a number of safety recommendations were issued to Airservices. Of those, recommendation R20030057 stated:

> The Australian Transport Safety Bureau recommends that Airservices Australia conduct a review to establish the extent of the use of non-standard levels in situations initiated by pilots and in situations initiated by controllers.

On 17 February 2011, Airservices provided an update on its actions to address the safety recommendations from investigation 200203094. That update is included in the *Safety action* section of this report.

ANALYSIS

The controller's separation plan was not implemented when the conflict between the two aircraft was first identified, resulting in no separation assurance and an imminent breakdown of separation.

The actions of both flight crews were significant in alerting the controller to the conflict and ensuring the safety of the aircraft through the subsequent controller-initiated level change and flight crew-initiated diversions right of track.

The flight crew of the 737 had requested and been assigned a non-standard flight level by a previous sector controller about 2 hours prior to the incident. Given the light turbulence that was reported by the crew at the time, that approval was authorised by the Manual of Air Traffic Services (MATS). Similarly, the application by the incident controller of radar surveillance separation also allowed for the assignment of non-standard levels, even if there were no traffic or operational requirements.

The requirement in the Aeronautical Information Publication for a pilot to ensure that requests for a non-standard cruising level resulted from an operational requirement, and that specified phraseology was used, was not consistent with the requirements of the MATS as they affected the radar surveillance separation of those aircraft. This ambiguity did not contribute to the development of the occurrence.

The investigation found that there was no requirement in the MATS for an aircraft to be returned to a standard level when the operational requirement or traffic confliction was no longer valid. However, allowing an aircraft to operate at a non-standard level for a prolonged period, without an operational requirement, removed a primary system defence supporting the maintenance of vertical separation.

Once alerted to the situation, the controller did not issue a safety alert as detailed in the Manual of Air Traffic Services. The relative positions of the aircraft at that time were such that the issuance of a safety alert and relative traffic information was a mandatory component of the positive resolution of the situation. The lack of traffic information when the flight crew of the A330 specifically requested that information indicated a reduced awareness of the criticality of the situation by the controller.

The incident demonstrated a less-than-effective recovery action by the controller in response to the lack of separation assurance. As the controller had not received training in compromised separation recovery techniques, he was inadequately equipped to manage the imminent conflict.

Due to the large volume of airspace for which the controller was responsible, the controller was using a large range display on the in-use control screen. The use of a smaller range scale in this scenario would have been more appropriate, and given the controller the option to 'zoom in' via a smaller display range display during the resolution of the potential conflict.

The lack of a dedicated control position supervisor required the Systems Supervisor to monitor traffic, staff and any other events in the operations room in addition to the primary role of system oversight and controller supervision. That increased responsibility had the potential during the peak

11 See http://www.atsb.gov.au/publications/investigation_reports/2002/aair/aair200203094.aspx

traffic period to reduce the effectiveness of any controller supervision. However, the investigation was unable to establish that a dedicated shift supervisor would have prevented this occurrence.

Airservices granted the controller significant recognition for prior learning that reduced the initial training provided to just over 11 weeks duration, though the controller had never operated in the en route partition previously. Some of those prior learning accreditations resulted in the controller commencing final field training without the suitable skills or knowledge required at that stage of training.

FINDINGS

From the evidence available, the following findings are made with respect to the loss of separation assurance between an Airbus A330-300 (A330) aircraft, registered B-HLV, and a Boeing Company 737-800 (737) aircraft, registered VH-VUJ and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The controller did not implement a separation plan when the traffic confliction was first identified.
- The controller did not re-identify the traffic confliction until prompted by the flight crew of the A330.
- The flight crew of the 737 had been cleared to operate at a non-standard flight level for an extended period.

Other safety factors

- The controller's climb instruction did not include a safety alert or traffic information.
- The controller had not received training in compromised separation recovery techniques. *[Significant safety issue]*
- The controller attempted to monitor the resolution of the traffic confliction using an inappropriate control screen range display.
- There was no dedicated aisle supervisor during the peak traffic period.
- The recognition of the controller's prior learning resulted in the controller commencing final field training with a level of knowledge and skills that was below the required standard.
- Ambiguity existed between the Manual of Air Traffic Services and the Aeronautical Information Publication in relation to the assignment of non-standard cruising levels and the definition of an 'operational requirement'. *[Minor safety issue]*

Other key findings

- The flight crews of both aircraft identified the traffic confliction and initiated avoidance action to maintain separation.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Airservices Australia

Compromised separation recovery training

Significant safety issue

The controller had not received training in compromised separation recovery techniques.

Assignment of non-standard cruising levels

Minor safety issue

Ambiguity existed between the Manual of Air Traffic Services and the Aeronautical Information Publication in relation to the assignment of non-standard cruising levels and the definition of an 'operational requirement'.

Action taken by Airservices Australia

In response to this occurrence, Airservices Australia (Airservices) commenced its own safety investigation. The Airservices investigation made 11 internal recommendations, including that

Airservices should:

- Review and provide clear guidance and definitions within the Manual of Air Traffic Services as to when the exceptions to the rules regarding the assignment of levels conforming to the table of cruising levels may be applied.
- Liaise with the Civil Aviation Safety Authority to provide a definition in the Australian Aeronautical Information Publication of the term 'Operational Requirement' affecting a pilot request for a non-standard level, in order to restrict the use of this phrase to genuine operational need.
- Ensure that appropriate supervision within the air traffic control group's location in the Operations Room is provided on night shifts.
- Audit and review of the Recognised Prior Learning assessment process.
- Ensure that Compromised Separation Recovery training is included as part of air traffic control training delivered to all Enroute candidates at the Learning Academy, and that the delivery of this material is not excluded via the RPL process.

In addition, Airservices has implemented a compromised separation recovery training module for en route air traffic control groups, with the intention that all controllers will undertake that training in the 2010/11 financial year. In addition, a dedicated compromised separation recovery training module is now delivered at the Airservices Learning Academy.

Updated safety action by Airservices Australia in response to ATSB safety recommendations R20030056 and R20030057

On 17 February 2011, Airservices provided an update on action taken in response to two previous ATSB safety recommendations (R20030056 and R20030057). Those recommendations related to the use of non-standard routes and levels. In summing up, Airservices stated:

Since the release of this report in 2003, Airservices has been investigating the issue of non standard routes and non standard levels in respect of recommendations R20030056 and R20030057.

As you would be aware, flight planning errors of this type are routinely and reliably tracked through the ESIR [electronic safety incident report] application. Airservices analysed this data and ascertained that non standard routes are not normally a significant contributory factor to Breakdown of Separation.

Nonetheless, over the past several years we have invested significantly in examining technical solutions that would detect flight planning errors and highlight them to the controller.

Our investigations determined that it was not feasible to use either NAIPS (Airservices' flight planning system) or to develop a separate database to process flight plans prior to entering the Eurocat system. Further, we determined that the cost of implementation in Eurocat for a warning system is high, and as Airservices has now commenced work on its future ATS [air traffic services] system the lead time and cost does not support further work in this area

We discussed the use of non standard levels with CASA [Civil Aviation Safety Authority] a number of years ago and it was determined that the number of changes of level that would be incurred if standard levels were required to be utilised in all cases would introduce an increased level of risk into the system.

In addition, since this incident a number of changes have been introduced to improve instruction to both pilots and air traffic controllers on the use of non standard levels.

The Aeronautical Information Publication (AIP) was updated on 18 November 2010 and now specifically states that a pilot must only request a non conforming level when it is determined by the pilot in command to be essential to the safety of the flight and its occupants. [In such circumstances, the phrase 'DUE OPERATIONAL REQUIREMENTS' must be included in the level change request.]

Airservices' Manual of Air Traffic Services (MATS) captures this same procedure and this will be further enhanced in June with an additional requirement that the controller must make an assessment of the safety impact to all traffic against any operational penalty to the aircraft prior to assigning the non conforming level and that this assessment must be updated regularly. [June 2011 amendment]

> The other key safety enhancement is that a pilot must now report to ATC [air traffic control] when the aircraft can return to a conforming level. ATC is required to make this request if not volunteered by the pilot.

ATSB assessment of action

The ATSB notes the action by Airservices related to R20030056 and R20030057 and in response to the issues identified in this investigation. The ATSB is satisfied that, the combined action in response to R20030056 and R20030057 and that recommended by the Airservices investigation will, when implemented, adequately address the identified safety issues.

SOURCES AND SUBMISSIONS

Sources of Information

The main source of information during the investigation was Airservices Australia (Airservices).

References

- Airservices Investigation Report ESIR No: 200906294.
- Manual of Air Traffic Services.
- Australian Aeronautical Information Publication.
- Civil Aviation Safety Authority (CASA) Flight Safety Australia publication, January-February 2011.

Submissions

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

A draft of this report was provided to Airservices, the sector controller, CASA and the aircraft operators. Submissions were received from Airservices and one of the aircraft operators. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.