Australian Government

Australian Transport Safety Bureau

Loss of separation assurance involving A330 9V-STQ and A320 VH-VFH

Near Tindal, Northern Territory, 24 April 2014

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Addendum

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Safety summary

What happened

On 24 April 2014, an Airbus A330 en route from Brisbane, Queensland to Singapore was maintaining 36,000 ft when the air traffic controller cleared an Airbus A320 on a reciprocal track en route from Darwin, Northern Territory (NT) to Brisbane, to climb through the A330's level. This resulted in a loss of separation assurance about 73 km east-south-east of Tindal, NT.

Recorded data from the two aircraft showed that the minimum vertical separation was 224 ft at 0249:04 Eastern Standard Time, when the two aircraft were 9.96 NM (18.45 km) apart horizontally. The minimum horizontal separation was 2.21 NM (4 km) at 0249:40, when the aircraft were 1,720 ft apart vertically. There was no loss of separation as the surveillance separation standard of 5 NM (9.26 km) was maintained when the 1,000 ft vertical separation standard did not exist. In addition, the vertical separation standard re-established before the surveillance separation standard was compromised.

What the ATSB found

The ATSB determined that the en route controller did not identify the potential confliction and assigned direct tracking and climb to the southbound A320 aircraft. The controller had occupied an active air traffic control position for a period of about 3 hours and 55 minutes during a night shift, without a formal rest break, and was likely experiencing the effects of fatigue at the time of the occurrence.

The ATSB identified safety issues relating to Airservices Australia’s utilisation of shift sharing practices for the Tops controllers resulting in them sustaining a higher workload over extended periods without a break, during a time of day known to reduce performance capability. The requirement for skills-based training for effective compromised separation recovery actions was also identified.

What's been done as a result

Airservices Australia has undertaken a number of safety actions relating to compromised separation recovery training. In addition, Airservices reported that they were reviewing the application of published fatigue risk management system guidelines for air traffic control staff undertaking night shift duties.

Safety message

This occurrence is a reminder of the potential for errors to occur when experienced personnel are working for extended periods during periods of circadian low without effective risk mitigators to manage fatigue induced error or consideration of traffic volume and complexity.

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The occurrence

On 24 April 2014, a loss of separation assurance (LOSA)[1] occurred between:

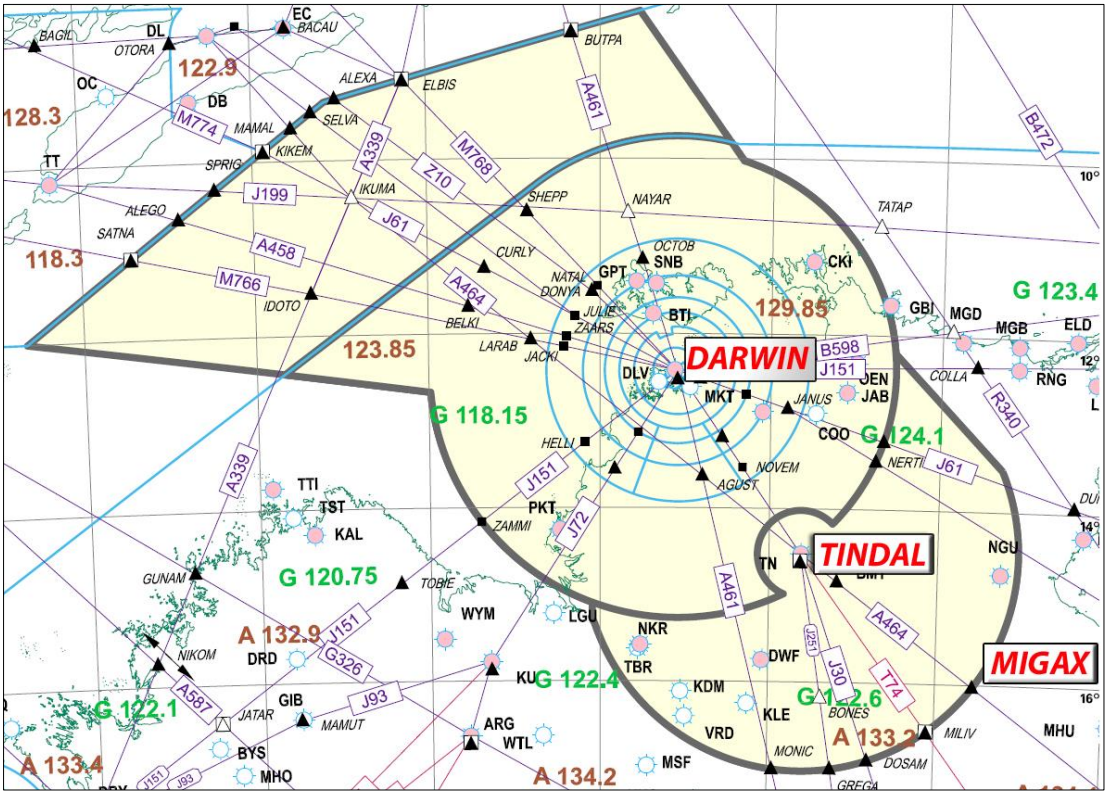
- an Airbus A330 (A330) aircraft, registered 9V-STQ, operating a scheduled passenger service from Brisbane, Queensland to Singapore, and
- an Airbus A320 (A320) aircraft, registered VH-VFH, operating a scheduled passenger service from Darwin, Northern Territory, to Brisbane.

Both aircraft were under air traffic control (ATC) radar surveillance coverage at the time of the occurrence, on reciprocal tracks.

An Airservices Australia (Airservices) air traffic controller in Brisbane Centre was working a night shift on the Tops Group. Their shift commenced at 2300 Eastern Standard Time[2] on 23 April 2014 and ceased at 0615 the following morning. For about the first 3 hours of the shift, the controller (Controller 1) had jurisdiction of all Tops Group airspace sectors until a handover/takeover at 0158 on 24 April 2014. Jurisdiction for the eastern sectors of the group was then assumed by another controller (Controller 2) at an adjacent console. That was normal practice on the night shift, due to increasing traffic levels at that time.

Controller 1 maintained jurisdiction of the Territory, Coburg and Katherine sectors, which were referred to as Tops Central (Figure 1).

Figure 1: Territory, Coburg and Katherine airspace sectors (Tops Central) map showing air route A464



Source: Airservices Australia. Image modified by the ATSB.

[1] 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.

[2] Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

At that time, Controller 1 had a number of aircraft on frequency, including a southbound A330 tracking via overhead Darwin for Melbourne, Victoria, at flight level (FL)[3] 370. They were also aware of two A330 aircraft tracking northbound at FL 380 and FL 360 respectively. Those aircraft would later transit through the Territory sector but were presently located in a southern sector. The controller reported that they considered that both northbound A330s were tracking via the standard published two-way air route A464, via position MIGAX, which was a waypoint positioned on the southern boundary of the Territory sector (Figure 1). Controller 1 reported that the factors contributing to that conclusion included:

- the position of the aircraft on their air situation display (ASD)
- the large display scale
- the expectation that those aircraft would track as they did on most nights.[4]

At 0215, the flight crew of the first northbound A330 contacted Controller 1 and reported maintaining FL 380 as the aircraft tracked via air route A464, approaching MIGAX and the Territory sector boundary.

At 0222, after observing indications that the radar at Tindal was briefly unavailable then appeared serviceable again, Controller 1 contacted the Systems Supervisor.[5] They were located at the front desk in the Operations Room and had operational command authority for the Brisbane Flight Information Region. The Systems Supervisor advised that they were not aware of a reported problem and though it appeared that the radar had returned to service, they would follow up with the technicians. The radar remained serviceable for the rest of Controller 1's shift.

At 0226, Controller 1 was contacted by the A320 flight crew on climb out of Darwin and tracking as per their flight plan to overhead Tindal, Northern Territory, then via air route A464 to MIGAX. The controller assigned further climb to their flight planned altitude of FL 350.

The flight crew of a Boeing 737 (737), positioned about 10 NM (18.5 km) behind the A320 and also climbing out of Darwin, contacted Controller 1. The controller assigned climb to amended FL 350 and advised that further climb for their flight planned altitude of FL 370 would be provided later if available.

About 1 minute later, the A320 flight crew requested climb to an amended altitude of FL 370. Controller 1 responded that they would advise. They then cleared the aircraft direct to MIGAX, which would re-position it to the east of air route A464 and provide lateral track segregation with the following 737. Controller 1 rerouted the aircraft's flight data record in the ATC computer system. That resulted in the automatic display of the aircraft's route on the controller's ASD for 2 seconds.

At that time (0228), the positions of the aircraft were (

Figure 2):

- The A320 was south of Darwin was passing FL 130 on climb to FL 350, with a groundspeed of 370 kt.
- The 737 was about 14 NM (26 km) behind the A320, passing 9,600 ft on climb to FL 350 with a groundspeed of 280 kt.
- A southbound A330 maintaining FL 370 was about 3.8 NM (7 km) behind the 737, with a groundspeed of 570 kt.

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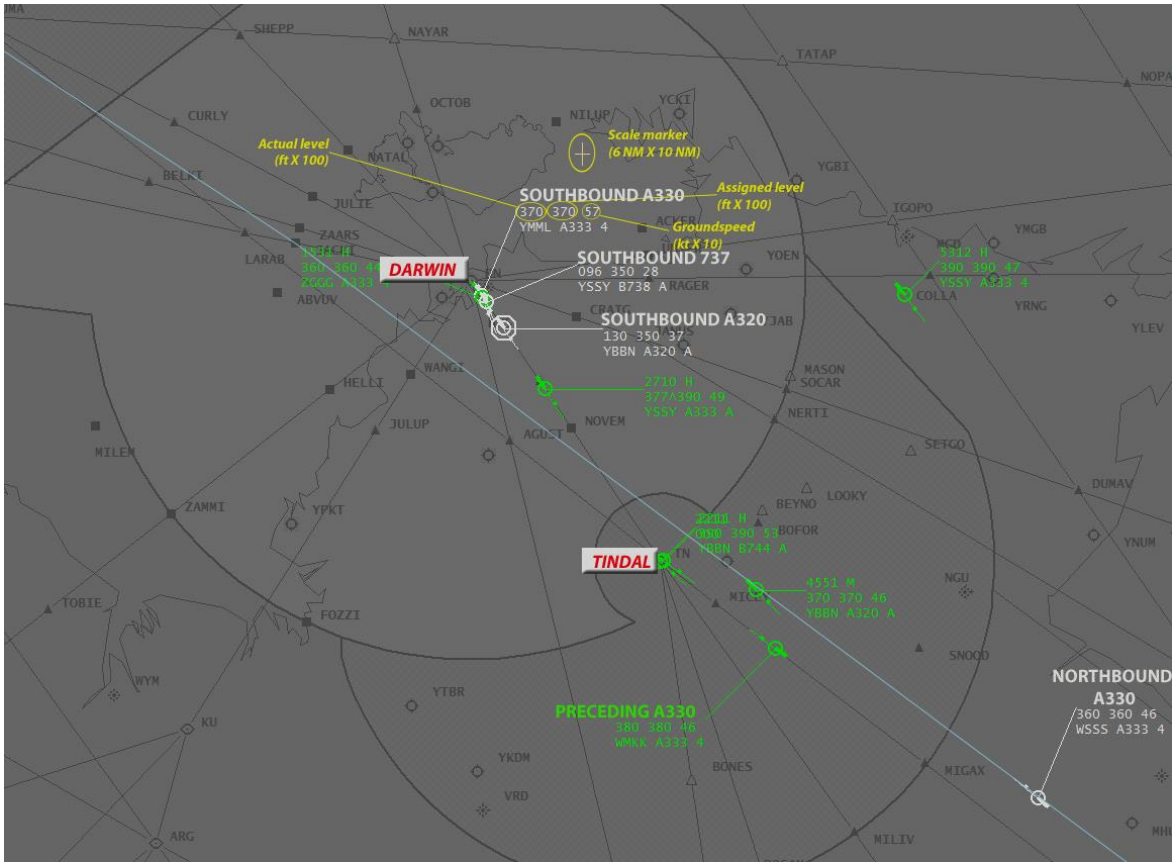
[3] At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 370 equates to 37,000 ft.

[4] Airservices Australia's internal investigation report stated that the pairing of the two A330 aircraft tracking northbound had operated on the same route on four out the last five shifts worked by Controller 1.

[5] The primary role of a Systems Supervisor was the oversight and management of all operational facilities that support air traffic service delivery. That task required the general supervision of operational staff to ensure a safe and efficient air traffic service. A Systems Supervisor was required to be on duty at all times and held operational command authority for their respective Flight Information Region outside of the duty hours of the Operations Room Manager.

- The first northbound A330 was midway between MIGAX and Tindal.
- The second northbound A330 at FL 360 was in the still in the adjoining southern sector, about 40 NM south-east of MIGAX.

Figure 2: Proximity of aircraft in Tops Central airspace at 0228:10



Source: Airservices Australia. Image modified by the ATSB.
Note: The scale used in this figure is smaller than that set on the controller's air situation display.

The southbound A330 was the vertical limitation for the southbound A320 and 737 out of Darwin and resulted in those aircraft being assigned the conforming and vertically separated altitude of FL 350.

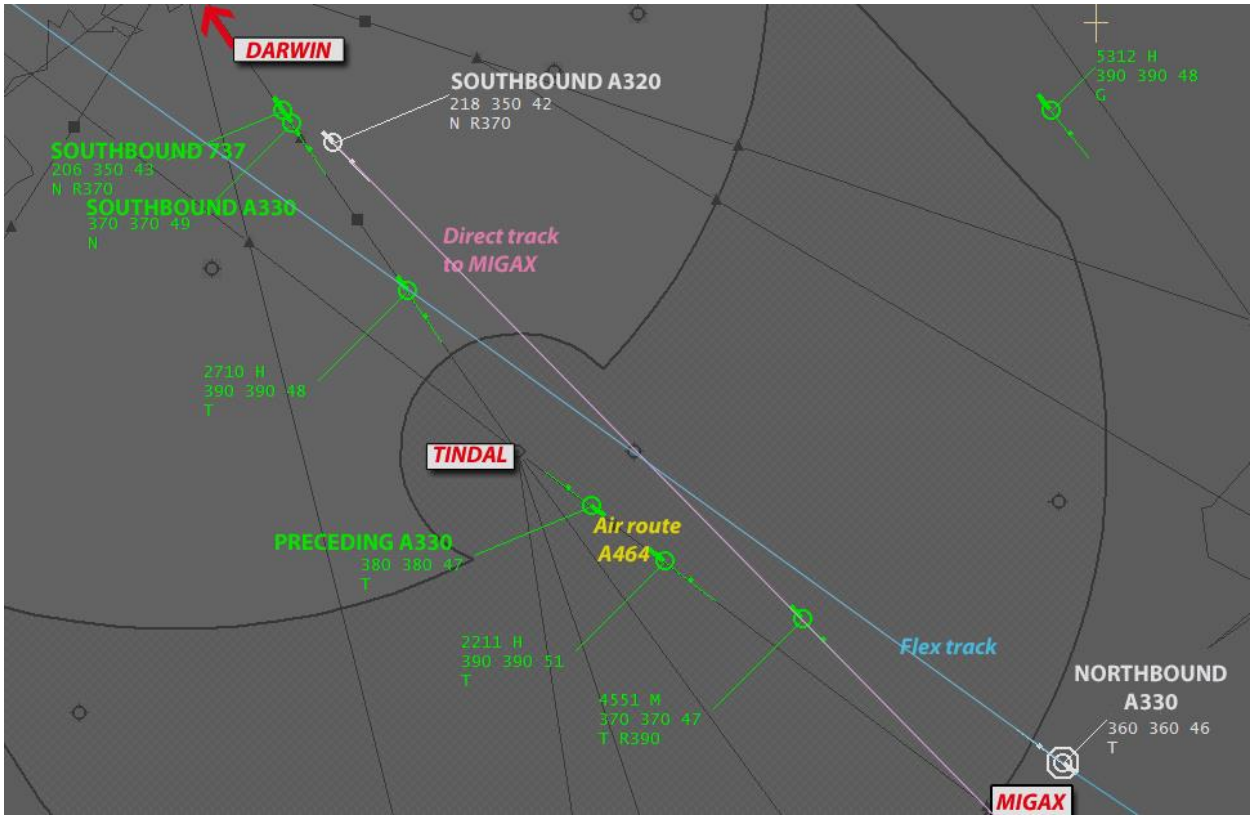
Controller 1 expected another controller (Controller 3), to relieve them from duty at 0230, but that controller did not arrive. Controller 3 had commenced their night shift at the same time and slept for the first part of the shift in the Centre's stand-down room facilities, as was normal practice. Controller 1 asked other controllers in the vicinity, after completion of their handover/takeovers for other sectors, to try to locate Controller 3.

At 0233, a controller from the international airspace sector adjoining the Territory sector boundary to the north called Controller 1. They reported that they were experiencing problems with their ATC computer system, which resulted in the automatic cross-boundary messaging between the two systems no longer functioning.

Shortly after, Controller 1 accepted jurisdiction of the second northbound A330, which was positioned abeam MIGAX. On accepting jurisdiction, the aircraft's route automatically displayed on the controller's ASD for 2 seconds.

At 0234, the second northbound A330 flight crew transferred to Controller 1's frequency. The A330 was maintaining FL 360 and operating on a flex track[6] that was displayed on the controller's ASD as a light blue line. At that time, the A320 was positioned to the north-north-west of Tindal, climbing through FL 218 and there was 244 NM (452 km) between the aircraft (Figure 3).

Figure 3: Proximity and positions of aircraft at 0233:37



Source: Airservices Australia. Image modified by the ATSB.
Note: The scale used in this figure is smaller than that set on the controller's air situation display.

Loss of separation assurance

At 0241, the controller issued the A320 flight crew with clearance to climb to FL 370. This resulted in a LOSA between the A320 and the northbound A330. There was no assurance that the vertical separation standard of 1,000 ft would exist when the aircraft passed on their reciprocal tracks, at a point where there could be less than the required radar separation standard distance laterally of 5 NM (9.26 km).

At 0245, the controller transferred the A320 flight crew to another control frequency in their airspace, due to coverage limitations. There was 74.4 NM (138 km) and 3,500 ft between the occurrence aircraft, as the A320 climbed through FL 325 and the northbound A330 maintained FL 360.

By 0247, Controller 3 arrived at the console and the handover/takeover commenced. At about 0248:25, during the handover/takeover with Controller 1 still responsible for the airspace, the ATC system's Short Term Conflict Alert (STCA) activated. It alerted the controllers to a potentially imminent loss of separation (LOS)[7] between the A320 and northbound A330, which were about 20 NM (37 km) and 700 ft apart, with a closing speed of about 920 kt.

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6 A non-fixed air traffic services route calculated on a daily basis to provide the most efficient operational flight conditions between specific city pairs.

7 Controlled aircraft should be kept apart by at least a defined separation standard. If the relevant separation standard is infringed, this constitutes a loss of separation (LOS).

Compromised separation recovery

At 0248:33, Controller 1 initiated compromised separation recovery actions. They instructed the A320 flight crew to turn left onto a heading of 150° (which would have been a right turn). The controller then instructed the A330 flight crew to turn right onto a heading of 360°.

Both crews acknowledged the instructions, with the A330's traffic collision avoidance system (TCAS)[8] being heard over the ATC frequency to have generated a traffic advisory (TA)[9] at the time of that crew's acknowledgement.

Controller 1 then instructed the A320 flight crew to descend to FL 350 due to traffic. The crew responded shortly after that they had a TCAS resolution advisory (RA).[10] The controller instructed the A330 flight crew to turn right onto a heading of 360° immediately, due to traffic. The crew responded that they were established on that heading already and had a TCAS RA.

The A330 TCAS RA instructed the flight crew to climb, with the aircraft reaching 37,336 ft before the crew commenced descent back to FL 360. The A320 TCAS RA instructed a rate of descent in excess of 1,000 ft per minute and the crew descended the aircraft from 35,748 ft to 34,980 ft, before returning to the ATC assigned altitude of FL 350.

At 0249:45, the A330 flight crew advised Controller 1 that they were descending back to FL 360. The A320 flight crew then reported that they were clear of the traffic and descending to FL 350.

Recorded data from the two aircraft showed that the minimum vertical separation was 224 ft at 0249:04, when the two aircraft were 9.96 NM (18.45 km) apart horizontally. The minimum horizontal separation was 2.21 NM (4 km) at 0249:40, when the aircraft were 1,720 ft apart vertically. There was no loss of separation as the surveillance separation standard of 5 NM (9.26 km) was maintained when the 1,000 ft vertical separation standard did not exist. In addition, the vertical separation standard re-established before the surveillance separation standard was compromised.

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[8] Traffic collision avoidance system (TCAS) is an aircraft collision avoidance system. It monitors the airspace around an aircraft for other aircraft equipped with a corresponding active transponder and gives warning of possible collision risks.

[9] Traffic Collision Avoidance System Traffic Advisory, when a TA is issued, pilots are instructed to initiate a visual search for the traffic causing the TA.

[10] Traffic Collision Avoidance System Resolution Advisory, when an RA is issued pilots are expected to respond immediately to the RA unless doing so would jeopardise the safe operation of the flight.

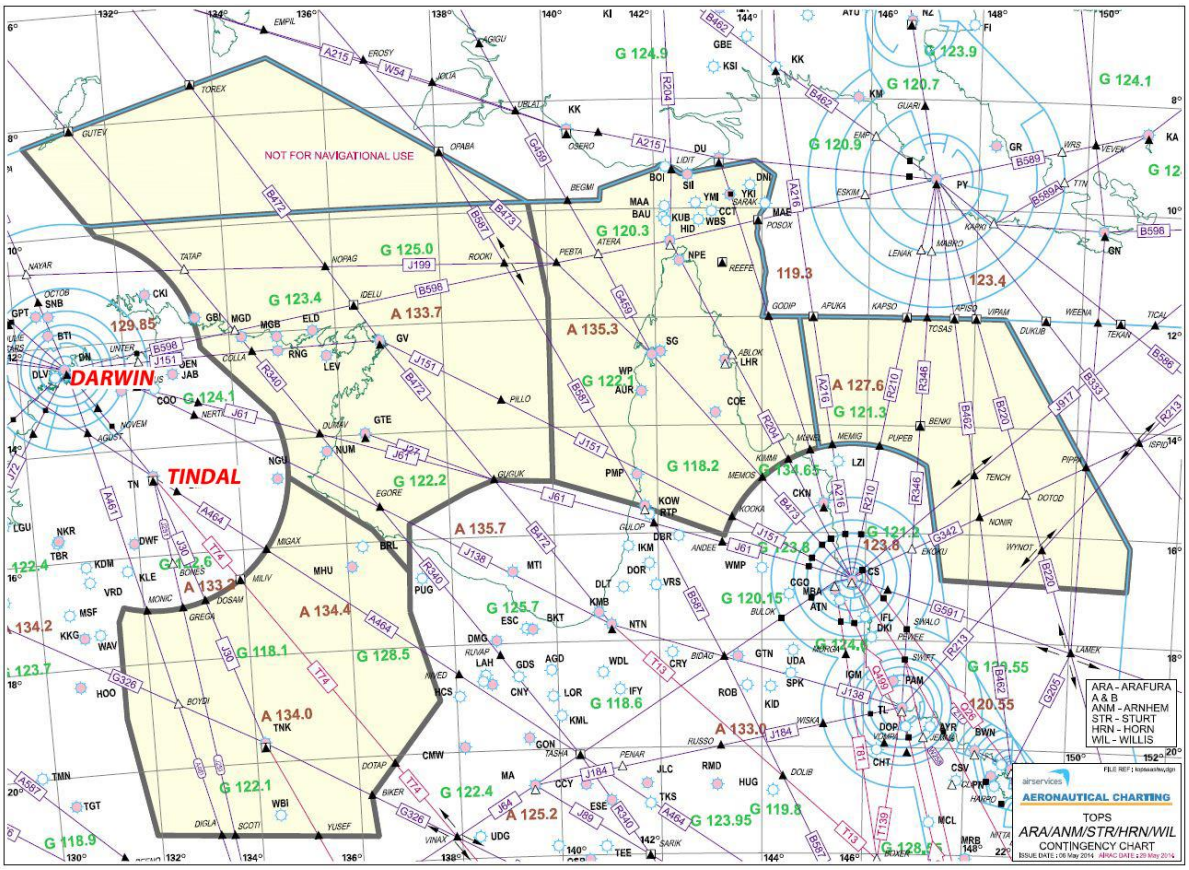
Context

Airspace information

Tops Group

When Controller 1 commenced the occurrence shift they had jurisdiction of the group of airspace sectors referred to as Tops East, in addition to Tops Central. Tops East consisted of five sectors and was positioned abutting the Tops Central sectors, from the east of Darwin, down to south of Tindal, over the Gulf of Carpentaria and Cape York Peninsula to the Coral Sea (Figure 4). Controller 1 handed over jurisdiction for the Tops East sectors to another controller (Controller 2) at 0158.

Figure 4: Tops East airspace sectors



Source: Airservices Australia. Image modified by the ATSB.

The loss of separation assurance (LOSA) occurred within the Territory (TRT) airspace sector. At the time of the occurrence, the TRT sector was combined with the Coburg (COG) and Katherine (KTN) sectors. Collectively the TRT, COG and KTN sectors were referred to as Tops Central (Figure 1).

The TRT sector was a high level procedural/surveillance sector that provided air traffic services (ATS) to aircraft operating from flight level (FL) 285 to FL 600 over the Northern Territory (NT) and north over the Arafura Sea. The provision of ATS included processing overflying international aircraft to neighbouring air navigation service providers and aircraft arriving to, and departing from, Darwin, NT.

COG sector was a surveillance sector that provided ATS to aircraft operating from the base of control area to FL 285, to aircraft primarily arriving to, and departing from, Darwin. KTN sector was a procedural/surveillance sector that provided ATS to aircraft operating in the Darwin and Tindal,

NT area. It had an upper limit of FL 285 where it was positioned below the TRT airspace volume and an upper limit of the base of the control area where it was positioned below the COG airspace volume.

Australian Organised Track Structure

The Australian Organised Track Structure (AUSOTS) commenced in 2005. It was a collection of daily generated flex tracks in both directions between South East Asia and Brisbane, Sydney and Melbourne.

A flex track was defined as a non-fixed ATS route calculated on a daily basis to provide the most efficient operational flight conditions between specific city pairs. Flex tracks were designed to provide cost saving opportunities for airlines and benefits to the environment through significant reduction in fuel burn. They originated and finished at published waypoints, known as 'gates'. All users were required to fly the complete flex track from gate to gate.

Flex tracks were created by Airservices Australia (Airservices) by 'Trackmasters' who were personnel based in the organisation's National Operations Centre in Canberra. Airservices documented that:

> Airservices Australia facilitates the development and design of each individual Flex Track. This input ensures the integrity of the air route system is maintained and permits the provision of separation with existing ATC system tools and standards.

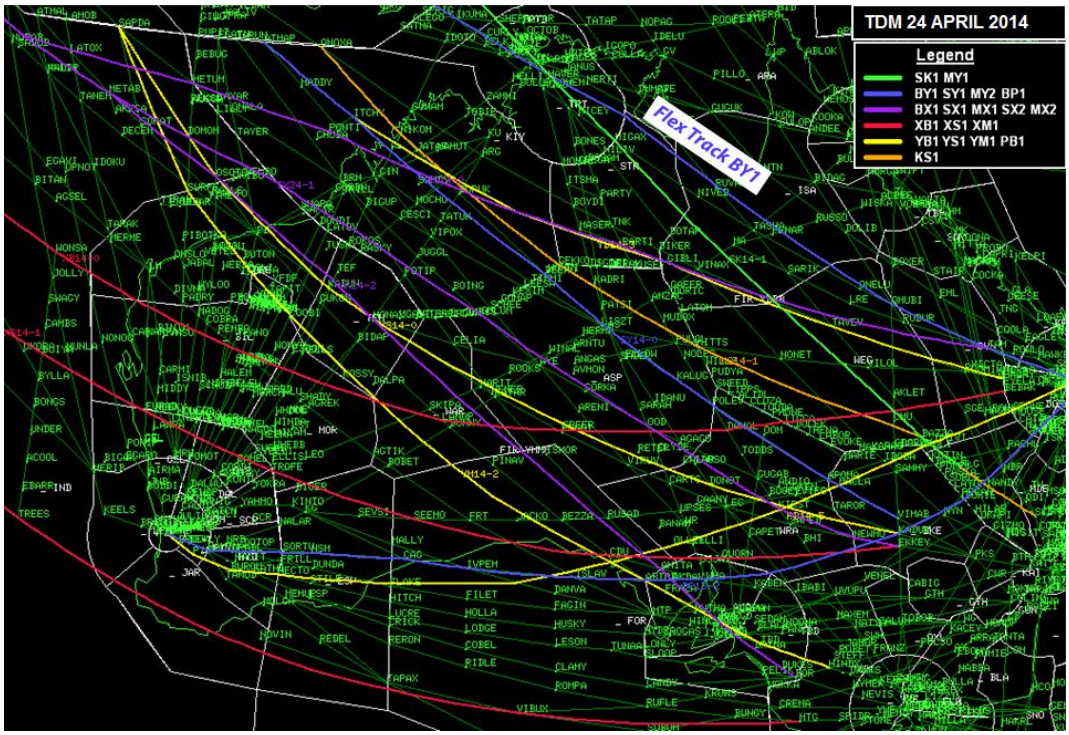
Flex track planning criteria was documented in Airservices' *Off Air Routes Planning Manual* (OARP). The flex track designator for the city pair of Brisbane to Singapore was BY1. A flex track for flights operating from Singapore to Brisbane was designated as YB1. The A330 involved in the occurrence was operating on a BY1 flex track. The documented validity period for the BY1 flex track was from 2100-0800.

Flex tracks were published to industry in three ways:

- via the Aeronautical Fixed Telecommunications Network to airlines that requested the associated Track Definition Messages
- via Notices to Airmen (NOTAM)[11]
- on the Airservices website, which provided the AUSOTs picture which provided a visual representation of the flex tracks for each day (Figure 5).

[11] A Notice To Airmen advises personnel concerned with flight operations of information concerning the establishment, condition or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to safe flight.

Figure 5: AUSOTS picture showing flex tracks for period of the occurrence



Source: Airservices Australia. Image modified by the ATSB.

The flight plans of the aircraft operating on flex tracks outlined the tracking points defined by the associated Track Definition Message but did not include the numbering of the associated track or any other indication for controllers that the aircraft was operating via a Flex Track. The OARP stated that:

> Flex Track designators and ATS route designators (within the Flex Track area) shall not be shown in the filed Flight Plan.

Flex tracks were published to operational controllers via NOTAM. Controllers on the Tops Group reported that the first graphic indication of flex tracks in their airspace sectors was when the tracks appeared on their air situation display (ASD) as light blue lines, with text designation (Figure 6) at about 1400 each day.

Information display

Separation between aircraft under surveillance coverage was applied based on the distance between the centres of position symbols on the ASD. Controllers were required to ensure that the edges of position symbols did not touch or overlap unless vertical separation was applied between aircraft.

On the large range scale required to display the TRT Central and East sectors combined, a surveillance track symbol representative of an aircraft was about 15 NM (27.8 km) wide on the ASD. There was about 20 NM (37 km) between the standard air route A464, on which the preceding A330 was operating, and the flex track BY13 on which the occurrence A330 was operating.

The flex track was illustrated on the ASD as a light blue line with positions on the track and the flex track designator ‘TRKBY13’ marked at points along the track in light blue. Standard air routes were displayed in light grey (Figure 6).

Figure 6: Air situation display image of track positions at the time of the occurrence showing flex track labels and involved tracks and routes

Source: Airservices Australia. Image modified by the ATSB.
Note: The scale used in this image is smaller than that set on the controller's air situation display.

When a controller accepted jurisdiction of a track, the aircraft's route would automatically display on the ASD in pink for a period of 2 seconds. There were no faults with the automatic route display function during the occurrence shift.

Organisational fatigue management processes and practices

Fatigue Risk Management System

In September 2004, Airservices published a report to the National Consultative Council Occupational Health and Safety Sub Committee on Fatigue Management within Airservices Australia Air Traffic Services (ATS) (referred to as the ATS Fatigue Management Report. The report outlined results from an internal Fatigue Management Working Group supported by external subject matter experts. The study was conducted through audits of ATC rosters, a review of fatigue management research and literature and through a risk assessment workshop process. A total of 54 recommendations were made to industry relating to fatigue and the impact of shift work on performance, some of which have been referenced within this report.

Airservices Fatigue Risk Management requirements were first introduced in 2005. The requirements were significantly revised in 2012 and published as part of the Airservices Safety Management System documentation in July 2012. Its purpose was defined in 2012 as follows:

> The standard defines the minimum requirements for the management of oversight of fatigue-related risk…these requirements form the scope of a Fatigue Risk Management System (FRMS). The purpose of an FRMS is to…ensure that workers are sufficiently alert when at work so that they operate at a satisfactory level of performance and safety, [and] prevent or minimise the risk of a fatigue-related occurrence by giving due consideration to all aspects of work-related fatigue.

The requirements advocated a shared model of responsibility for fatigue management between workers and the organisation. Workers were responsible for 'ensuring they make appropriate use of rest periods between shifts…[and] are adequately rested and recovered for the shift ahead (i.e. fit for duty)'. In turn, the organisation was responsible for managing fatigue-related risk through 'rostering practices, working arrangements, education and working conditions'. It also documented Airservices' policies relating to planned rosters and work cycles, risk controls, methods for instigating changes to rosters, education requirements and assurance mechanisms.

The following documents also related to Airservices' Fatigue Risk Management System (FRMS) policies and processes:

- The Fatigue Assessment and Control Tool (FACT) Guide governed risk assessments relating to roster changes
- The Fatigue Risk Management Air Traffic Service Procedure defined how fatigue-related risk (primarily through work scheduling and education) was to be managed in accordance with the Requirements.
- The Brisbane Centre Local Instructions included a section called Rest Management. 'Rest' referred to time on shift away from the console, and 'napping' related to sleeping, conducted in the stand down rooms.
- The Local Instructions for Brisbane Centre Shift Managers and Systems Supervisors provided guidelines for night shift operations. It outlined the night staffing arrangements and break directions and considerations for each ATC Group.

Rest breaks from duty during night shifts

The Airservices FRMS Fatigue Assessment and Control Tool (FACT) Guide stated that:

> As a general practice, rest breaks should be provided approximately every two hours. Operational managers and supervisors who have the responsibility for managing rest breaks will need to consider a range of factors which may impact on the particular situation, including extremes of workload (be it very high or very low). The period between rest breaks should not be more than four hours.
>
> A short rest break should last at least 15 minutes and a long rest break at least 30 minutes. From a practical sense, we are looking for opportunities for workers to consume a quick snack and/or have a drink, go to the toilet and attend to any urgent personal matter(s). At other times in the shift, a break long enough for a person to prepare and consume a meal and have time to refresh their mind and body should be provided.

Additionally, to alleviate long periods on a console, Airservices had implemented a short break procedure. A short break was defined as a period away from the console not expected to exceed 20 minutes. Controllers could ask the Systems Supervisor or another controller who was not endorsed for the position/function to maintain a listening watch and/or relay to an aircraft verbatim recorded instructions, issued by an appropriately endorsed controller for that console or position. Some controllers reported that they did not favour the short break procedure as they considered it preferable for only a controller who held current endorsements to monitor their airspace during a break.

For the Tops Group, the night staffing was documented as five controllers, 7 days per week (3 for Tops East and Tops Central, and 2 for Tops West). The rest break directions were for 'tactical break management as endorsement mix permits'.

Sleep/napping during rest breaks

Airservices' Brisbane Centre Local Instructions stated that staff must be present at work at shift commencement, and that the approval or anticipation of napping does not allow ATS staff to present for work unfit for duty. When napping during a rest break was approved, staff must:

- ensure the Shift Manager and other relevant controllers were advised of their whereabouts
- wake in sufficient time to compensate for the effects of sleep inertia.

Workload for Tops controllers

Airservices Australia used the practice of combining and de-combining sectors to distribute workload.

Supervision

At the time of the occurrence, Operational Command Authority for the Brisbane Operations Room was exercised by the Systems Supervisor (SS). That position was responsible for system oversight and the supervision of the operations room, including monitoring air traffic and staff.

The SS was based at the main desk at the front of the Operations Room and could be contacted by controllers through the console communications system. The SS was also responsible for the administration of the stand-down rooms and held a second set of keys to each room in case of emergency.

The Aisle Shift Managers and Operations Room Manager positons were not manned, nor were they required to be under organisational policy and procedures. The Aisle Shift Manager position for the location of the Tops Central and East sectors was manned until 2000, with the SS responsible for supervision during the night shift.

Airservices Australia reported in their internal investigation report that the shift sharing prearrangement for Tops Group controllers on the night shifts was a routine, standing situation known and accepted by operational management. The Tops Group was not the only ATC Group in Brisbane Centre to have such an arrangement when two or more controllers were rostered for a night shift on the same sectors/positions.

Personnel information

Controller 1

Controller 1 was an experienced fully endorsed controller who held endorsements and worked on the Tops Group, and former equivalent airspace sectors, for over 20 years. In addition to having worked in the Group Training Specialist role for the group and periodically performed a check controller role, they were also an on-the-job training instructor and workplace assessor.

Controller 1 was not working their normal rostered shift at the time of the occurrence due to a shift swap with another controller. That swap resulted in Controller 1 working a single night shift on the second of three rostered days off in their roster pattern.

They reported that they were fit for duty at the commencement of the shift and had prepared for the duty by sleeping for about 4 hours at home in the evening, before driving to work for the duty. Controller 1 had a number of strategies to assist with managing fatigue experienced during night shifts, including drinking coffee. They reported that it could be difficult to remain alert during the circadian low associated with the early hours of the morning and would look forward to their break at about 0230.

Controller 1 stated that they first viewed the two northbound A330s while working all of the Tops Central and East airspace sectors combined. Their air situation display (ASD) was set at a very large range scale to present all of the airspace under their jurisdiction on the one screen.

At that time, the two A330s were in a southern sector, both appearing to track via standard air route A464 and not yet in Controller 1's airspace. Controller 1 reported that the proximity and tracking of two A330s, with those particular flight number call signs, was a situation that they observed regularly on the night shift. Both flights usually tracking via A464 through the Tops Central airspace.

Controller 1 reported that later on, when they accepted jurisdiction for the second A330, the route of the second aircraft automatically displayed on their ASD for a period of 2 seconds, as was the normal system process. The controller did not identify that the aircraft was operating on a flex track. They maintained the expectation that it was tracking via A464, as was the preceding A330. In addition, Controller 1 stated that the large range scale required to display the combined air traffic sectors, on their ASD, resulted in the second A330's operation on a flex track being indistinguishable from the standard air route A464 located in close proximity.

Controller 1 stated that the standard practice to achieve strategic separation assurance with northbound aircraft, and unrestricted climb, was to track aircraft climbing out of Darwin direct to a waypoint on their flight plan on the 150 NM (278 km) Tindal range ring. That practice was taught to trainees during simulator and on-the-job training for the Tops Central endorsements. The controller also reported that procedural separation, such as the application of the 1,000 ft vertical standard, were easier to apply and monitor during the night shift. However, in the absence of a procedural separation standard, the application of radar separation requires that controllers observe the relative positions pf aircraft on their display to ensure the minimum radar standard is established and maintained. On the larger ASD range scale such as was being used in this particular occasion, a surveillance standard would require close monitoring in its application and a smaller ASD range scale may be needed.

Controller 1 recalled that in issuing climb to FL 370 for the southbound A320, they had considered that the aircraft was strategically separated. The northbound A330 was at FL 360 and tracking on what the controller thought was A464, which they believed separated it from the A320 tracking direct to MIGAX.

Controller 1 reported that there were a number of distractions during the shift, particularly in the period leading up to the occurrence. These included intermittent failures of the primary Tindal radar and unserviceability of the ATC computer system of the foreign air traffic services provider adjoining the sector boundary to the north. The computer system unserviceability increased Controller 1's workload as automated coordination messages were no longer functioning.

Controller 2 was newly rated and endorsed on the Tops East sectors. In the absence of an Aisle Supervisor during the night shift, Controller 1 considered that they had a duty of care to monitor and support Controller 2, which required a level of attention.

When Controller 3 did not arrive at 0230 for a handover, Controller 1 was required to also divert their attention from ATS tasks to ask another controller, who was about to commence their break, to try to locate the incoming controller. It was not known by Controller 1 if they were in the building. While some controllers would advise colleagues of their presence on arrival at the commencement of the shift, it was not standard practice and there was an assumption that the SS would know and advise of any absences.

When Controller 3 arrived at the console and reported ready to accept responsibility for Tops Central, Controller 1 commenced the handover using the standard handover/takeover checklist.

Just as Controller 1 reached the section of the handover in which the traffic situation was to be conveyed, the ATC computer system's Short Term Conflict Alert (STCA) activated. Controller 1 reported their first assessment of the confliction was that the northbound A330 was incorrectly positioned to the right of the standard air route A464 and the occurrence was not controller attributable. They commenced compromised separation recovery actions using the existing range display scale and did not change the ASD display settings to enable viewing of the confliction on a smaller scale. Controller 1 reported that they had not been taught during compromised separation recovery training to zoom in on a confliction on their ASD.

Following the occurrence, Controller 1 reported that they were shaken by the conflict and already felt tired at that time. This was in part due to the expectation that they would have been on a rest break by then. They recognised that their compromised separation recovery actions were ineffective.

Controller 1 last completed compromised separation recovery simulator training on 16 April 2013 and compromised separation recovery computer based training (CBT) on 18 February 2014, followed by a newly developed CBT package less than 1 month prior to the occurrence on 25 March 2014.

Controller 2

Controller 2 received their initial ATC ratings and endorsements on the Tops East sectors on 31 March 2014. On the 23 April 2014 night shift, they assumed responsibility for the Tops East airspace sectors from Controller 1 at 0158.

Controller 3

Controller 3 received their initial ATC ratings and endorsements on the Tops East airspace sectors in October 2012 and gained their Tops Central endorsements in February 2014, becoming a fully endorsed controller.

On arrival at work on 23 April 2014 for the first of two night shifts in their roster pattern, Controller 3 reported to the SS to obtain the key to their allocated stand-down room. They then went to have a sleep prior to working the second half of the shift. They did not advise Controller 1 that they were in the building as there was an expectation that reporting to the SS to pick up their key was adequate notification that they had arrived for the shift.

Controller 3 used their mobile phone to set an alarm to wake at 0215 for a 0230 handover in the Operations Room. For an undetermined reason, the alarm did not operate or Controller 3 slept through the alarm, which they reported had not occurred previously. In response to a controller knocking on the stand-down room door at about 0240, Controller 3 woke, apologised and advised that they would be in the Operations Room shortly. The other controller advised that the situation was managed and not to rush.

Controller 3 quickly prepared to go into the Operations Room. They arrived at the console where Controller 1 was located at about 0245. Controller 3 reported that they were fit for duty and felt very alert. They later reported that they were aware of possible sleep inertia through Airservices' fatigue risk management system training but as they were not feeling any adverse effects, they made a considered decision that they were ready to accept a handover.

As Controller 1 conducted the handover using the checklist and commenced the traffic segment, the Short Term Conflict Alert activated. From where Controller 3 was sitting, they could not see the levels of the aircraft concerned but could identify that the confliction involved opposite direction traffic, with one aircraft climbing through the level of the other.

Controller 3 reported that although the compromised separation recovery actions used by Controller 1 did not appear to be effective, they felt unable to intervene or assist as Controller 1 was the jurisdiction controller, and also highly experienced.

Following the flight crews' reports of traffic collision avoidance system (TCAS) resolution advisories (RAs), Controller 3 advised Controller 1, who was shaken by the occurrence, that they would assume jurisdiction of the airspace. Controller 1 unplugged from the console.

Controller 3 last completed compromised separation recovery simulator training on 28 July 2012 and compromised separation recovery CBT on 17 October 2013. They completed the newly developed CBT package after the occurrence, on 29 April 2014.

Compromised separation recovery

Separation is considered to be compromised when separation standards have been infringed, or where separation assurance is absent to the extent that a breakdown of separation is imminent.

In accordance with the *Manual of Air Traffic Services*, controllers were required to issue safety alerts to pilots of aircraft as a priority, when they became aware that aircraft were in a situation considered to be in unsafe proximity to other aircraft, unless a pilot had advised that action was being taken to resolve the situation or that the other aircraft was in sight.

ATC provided avoiding action advice in critical situations if aware that there was a collision risk, and only to aircraft in receipt of an air traffic surveillance service. Avoiding action advice was prefixed with the term 'AVOIDING ACTION' and included instructions to the pilot for avoiding the

other aircraft. The phraseology to be used by ATC when providing safety alerts and avoiding action was contained in the *Australian Aeronautical Information Publication*.

Airservices documented that the Executive General Manager of Air Traffic Control (ATC) had determined that 'all operational staff must successfully complete annual training and assessment in compromised separation recovery training'. The training was required to assess a controller's knowledge and/or skills in the following areas:

- Pilot actions and aircraft performance
- ACAS and TCAS
- ATS systems and alerts (STCA)
- Controller actions.

All controllers that completed compromised separation recovery training were assessed for competency and it was to be recorded on each controller's file.

The ATC Line Manager (ALM) who held the Training Portfolio for the ATC Group was accountable for developing local specific scenarios to support the classroom and online training, and for the 'development of appropriate simulator exercises for skills-based training and assessment'. That requirement was documented in the ATS Training Operations Manual.

There was no documented requirement for compromised separation recovery training to include a team resource management[12] component.

Compromised separation recovery training was required to be included in all ATC endorsement training courses, with particular emphasis on skills-based training in the simulator. It was a mandatory requirement that 'all controllers are assessed in skills-based simulator Compromised Separation Recovery training at intervals not exceeding three years'.

Similar occurrence

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.[13]

The aircraft were approaching each other at FL 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. Action by the A330 flight crew prompted the controller to take action to re-establish separation assurance. In addition, a number of safety issues were identified, including:

- the controller had not received training in compromised separation recovery techniques
- the controller attempted to monitor the resolution of the traffic confliction using an inappropriate control screen range display
- there was no dedicated control room aisle supervisor during the then peak traffic period.

In response to that occurrence, Airservices conducted an internal investigation, which recommended a number of actions to address the safety factors and issues that were identified during their investigation. These included the recommendation that appropriate supervision within the air traffic control group's location in the Operations Room is provided on night shifts.

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12 Team resource management (TRM): strategies for the best use of all available resources – information, equipment and people – to optimise the safety and efficiency of Air Traffic Services.

13 ATSB investigation AO-2009-080, see www.atsb.gov.au

Safety analysis

Introduction

A loss of separation assurance occurred when the Tops Central controller cleared the flight crew of a southbound Airbus A320 (A320), registered VH-VFH, to climb through the level maintained by a northbound Airbus A330 (A330), registered 9V-STQ, on a reciprocal track.

There are multiple risk controls in place to reduce the likelihood that safety-critical air traffic control (ATC) personnel would make an error resulting in aircraft coming within close proximity and other system defences designed to reduce collision risk if a controller error resulted in an undesired state. However, in this occurrence, some of the risk controls did not work effectively.

This analysis discusses the relevant controller actions, local conditions, risk controls in terms of flex track design and implementation, shift and fatigue management and compromised separation recovery.

Aircraft processing

Due to the large range scale required to display Controller 1's jurisdiction airspace, the track symbol representative of an aircraft was 15 NM (27.8 km) wide on the air situation display (ASD). In consideration of the 5 NM (9.26 km) surveillance standard and requirement for the symbols to never touch or overlap unless vertically separated, separation with the A320 would have been maintained if the northbound A330 was operating on standard air route A464. As A464 was about 20 NM (37 km) south-west of the flex track, at the position where the aircraft's tracks crossed, the distance between the edges of the symbols would have about the minimum 5 NM requirement at the time of passing. That distance was enough to visually discern on the ASD that the symbols would not touch, maintaining the requirement.

Controller 1's plan to establish separation assurance between the A320 and A330, by tracking the A320 out of Darwin direct to the waypoint MIGAX, was based on an incorrect assessment of the traffic picture. They did not identify that the aircraft's tracks were in conflict and therefore could not effectively assess a situation which they did not fully comprehend. As such, the controller did not use the traffic assessment stools available to evaluate the separation between the occurrence aircraft. The available system tools included:

- the graphic route function
- velocity vectors on a larger setting
- the time of passing function.

While the ATC computer system's automatic route display functioned as designed, it did not act a prompt for Controller 1 to identify the tracking of the northbound A330.

It is also likely that the direct tracking decision may have been influenced by the restrictions for further climb presented by the overflying southbound A330 at FL 370, and the following Boeing 737 (737) out of Darwin. At the time that further climb to FL 370 was issued to the A320 flight crew, Controller 1 did not consider the northbound A330 as a potential conflict, although in the absence of a prescribed procedural separation standard, separation between the aircraft was contingent upon the application of a radar standard that required the controller to observe and monitor the displayed positions of the aircraft to ensure that the radar standard would be achieved and maintained at all times. Given that the scale in use on the ASD was such that the air route and flex track were indistinguishable, it is difficult to reconcile how the controller intended to establish and ensure the maintenance of radar separation

While controllers do incorporate their mental model of a traffic situation into decision making, the process of assessing traffic for potential conflictions before issuing an instruction, remains an integral requirement and defence in assuring separation. Additionally, fatigue and distraction can adversely affect a controller's decision making and effective assessment of potential conflictions.

These issues should be considered by controllers both at the time a control instruction is issued and as they periodically scan and review the traffic situation.

Controller fatigue

Defining fatigue

Air traffic control is a 24-hour activity, and consequently there will always be some level of fatigue associated with controllers conducting shift work. The International Civil Aviation Organization (ICAO 2012) defined fatigue as:

> A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties.

Effects of fatigue

Fatigue can have a range of adverse influences on human performance, such as slowed reaction time, increased variability in work performance, and more lapses or errors of omission (Battelle Memorial Institute 1998). Studies relating to ATC operations also noted that the skills affected included the following:

- attending to complex information while filtering out distractions
- following a situation and recognising the need to apply new strategies,
- lateral thinking and innovation
- the ability to self-monitor performance
- the ability to communicate effectively (Signal 2000)

In this case, controller 1 did not identify the imminent loss of separation (which could be considered as needing to attend to 'complex information') until the STCA sounded. Controller 1 also reported that his compromised separation recovery actions were ineffective and he was disappointed with his performance (which could be considered to be following a situation that needed a new strategy).

Earlier on during the handover/takeover, Controller 3 reported identifying outstanding actions when they assumed responsibility for Tops East, such as revised operational information that had not been entered into the ATC computer system, and a revised boundary estimate required to be advised to the adjoining foreign ATS provider.

Time of day and shift work

Time of day can be important for determining whether an individual is in a circadian low or high. The Civil Aviation Safety Authority (2012) outlines the following:

> The circadian cycle has two periods of sleepiness, known as the circadian trough and the circadian dip. The circadian trough occurs typically between 0200 and 0500 hours (or dawn). During the circadian trough the body's temperature is at its lowest level and mental performance, especially alertness, is at its poorest.

Shift work, by its nature, is scheduled outside of normal daytime hours. There is significant and long-standing research conducted into the effects of working night shifts, particularly those that span the circadian low. High levels of performance cannot be sustained for as long on night shifts as they can during the day' (Spencer and others 1997).

Around the time of the occurrence (0230), Controller 1 reported feeling tired. This was in a timeframe consistent with a known circadian low, during a night shift. It was therefore considered likely that the time of day negatively impacted on Controller 1's level of fatigue.

Workload

Workload can also impact on fatigue levels. The relationship between workload and fatigue can be complex, predominantly as both underload and overload can contribute to fatigue (Grech and others 2009). Performance on a complex task involving both vigilance and the need to multi-task declined significantly across night shifts (Signal and Gander 2007). Workload is experienced differently from one controller to another, depending on experience, skills, motivation and tiredness (Transport Canada citing Hopkin, 1995).

Around the time of the occurrence, Controller 1's workload included control of Tops Central, the attention paid to overseeing Controller 2 on Tops East, and the supplementary tasks resulted from an issue with Ujung ATC and the Tindal radar outage. Controller 1 also reported that the busiest traffic period on the Tops Central airspace is usually between 0200 and 0430. Additionally, from 0230 to 0235 Controller 1 was also focused on the whereabouts of Controller 3 who had not yet arrived to take over the Tops Central duty.

In summary, the workload of Controller 1 appeared to have been elevated by a number of factors, which in turn may increase the risk of fatigue. However, given the complex and individualistic nature of workload on fatigue, the extent of this increased risk cannot be quantified.

Breaks from duty

One method to alleviate fatigue includes taking breaks from duty. During a period of work, a 10-15 minute break has been shown to be sufficient to overcome performance deficits associated with 75 minutes (or more) of high workload activity. The number and duration of breaks should ideally be linked to the nature of the workload. Longer breaks have a more sustained effect than shorter breaks, and the more frequent the break, the greater their effectiveness in reducing fatigue as well (Spencer and others, 1997).

Controller 1 reported that they were only able to leave the console for a few short breaks of a couple of minutes each. They were therefore occupying an active ATC position for 3 hours and 55 minutes without an adequate break. This was beyond the recommended Airservices' FRMS break requirements, and it was likely to significantly increase the risk of fatigue.

Summary

The errors made by Controller 1 were consistent with the effects of fatigue, and were not explained by any other factors. Therefore, based on the nature of the errors, time of day and extended time on task, controller 1's performance was likely to have been fatigue impaired.

The effect of shift sharing on fatigue management for Tops controllers

The pre-arranged sharing night shifts was reportedly favoured amongst controllers and condoned by management. It also facilitated an extended rest break for controllers during their shift, whereby sleep could be obtained. However, it also created residual fatigue-related risks, including the following:

- The ability for the Tops controllers actively occupying the ATC position to take a break of more than a few minutes was limited by the availability of the other rostered and appropriately endorsed controllers to cover the sector in their absence, because the third controller was on an extended rest break and therefore not readily available.
- From 2300 to 0200 the workload of the active Tops controller included control of both Central and East sectors. The availability of all three Tops controllers would facilitate more flexible options in managing workload, particularly with the increase in traffic volume that occurs after about 0200.
- The pre-arranged nature of shift sharing increases the risk that controllers commence their shift not 'fit for duty', in anticipation of sleeping during the extended rest period. This was raised as part of the ATS Fatigue Management Report (2004), whereby it was cautioned that if napping opportunities are routinely provided, the expectation of them could lead to controllers

coming to work tired. In the case where the extended break cannot be given, this controller may have a level of fatigue that affects their performance.

In summary, the utilisation of shift sharing practices on the night shift likely resulted in Tops controllers sustaining a higher workload over an extended period with an inability to take a break, during a time of day known to reduce performance capability, as it did in this case.

Compromised separation recovery training

Compromised separation situations can be for a number of reasons, not only air traffic services attributable. Controllers need to be adequately equipped to deal with such situations regardless of how they occurred. Arguably, the most important defence against a mid-air collision when a separation standard is lost is an air traffic controller, who is trained and experienced at resolving such situations.

Simulator based training

Compromised separation recovery actions are important, emergency response actions that need to be implemented by controllers promptly and accurately.

It is widely recognised that to ensure emergency response actions are conducted effectively, they need to be regularly practiced. Skill decay is more likely to occur when tasks are rarely performed (Arthur and others 1998), as is the case for compromised separation recovery actions during actual controlling. It is also more likely to occur for procedural tasks rather than hand-eye co-ordination tasks (Casner and others 2014, Wisher and others 1999), and for tasks that are only learned to a proficiency level, rather than over-learned or practiced significantly after reaching a proficiency level (Arthur and others 1998). As noted by Casner and others (2013), emergency training also needs to be carefully designed to ensure that the nature and context of the abnormal events vary so that they are not predictable.

Mandatory skills-based simulator compromised separation recovery training, ‘at intervals not exceeding three years’ for Airservices’ controllers, did not provide a regular opportunity for controllers to practice their skills. It also limited the opportunity for controllers to refresh their knowledge of recovery actions and required phraseology in a practical context.

Flight crews of high capacity regular public transport (RPT) aircraft are required to conduct simulator training at intervals not exceeding 6 months, during which they practise a range of scenarios, including emergency response procedures. However, controllers responsible for the provision of separation between high capacity RPT aircraft may only be provided practical refresher training in compromised separation recovery techniques at prolonged intervals.

As identified by Airservices in their investigation report for the occurrence, the computer based training package for compromised separation recovery may have been useful for the revision of knowledge related to recovery of the situation. However, it did not provide an opportunity for skills rehearsal and so ‘was of little benefit in assisting Controller 1 maintain overall competency required to execute an effective recovery from compromised separation’. This was further evidenced by Controller 1 not using the standard safety alerting phraseology in their state of shock and surprise. In addition, the required phraseology was unfamiliar as it was last practiced in the simulator about 1 year prior.

There are opportunities for simulator based compromised separation recovery training to be enhanced and provide controllers with more effective resolution techniques for application in the operational environment.

Controller 1 did not change the display settings on their air situation display (ASD) to enable closer viewing of the confliction. They reported that during compromised separation recovery training they had not been taught to adjust the ASD scale to zoom in on a confliction. Other controllers reported that they would likely zoom in a conflict to assist with the effectiveness of their compromised separation recovery instructions, but could not recall if they had been taught that technique in training. Such a technique may assist in the effectiveness of compromised separation

recovery instructions issued by a controller. It may provide a larger, clearer presentation of the situation and make it easier to see and evaluate the conflict.

There are a number of potential benefits in providing sector specific compromised separation simulator training. It could provide a valuable opportunity for controllers to apply and trial compromised separation recovery techniques, in a controlled training environment, for the airspace on which they are endorsed, with aircraft types and flight number call-signs with which they are familiar.

Scenarios involving known potential confliction points, in addition to unexpected locations, may be considered more relevant by controllers and be more easily recalled in the event of a real conflict. Emergency training for flight crews in a simulator environment is usually tailored to their aircraft type, rather than a generic model and provides them opportunities to apply emergency procedures in a relevant, familiar aircraft, which may assist recall in the event of a real emergency.

Team Resource Management

Team Resource Management (TRM) is defined by Eurocontrol[14] as 'strategies for the best use of all available resources – information, equipment and people – to optimise the safety and efficiency of Air Traffic Services'. Eurocontrol developed one of the first TRM training programs with modules covering teamwork, roles, communication, situation awareness, decision making and stress. Additional modules were added later to cover the management of error and violation and the impacts of automation. Eurocontrol stated that:

> Effective TRM in ATC requires the best use of all available resources in support of a safe and efficient operation which reduces both the incidence of error and the consequences of residual error. A focus on TRM is especially designed to improve the functioning of air traffic control teams. It does this by increasing the awareness and understanding of interpersonal behaviour and human factor capabilities as they are likely to affect operational safety.
>
> There is also evidence to show that CRM [Crew Resource Management] principles can be successfully applied to air traffic management. TRM training can reduce teamwork-related incidents and enhanced task efficiency.

While crew resource management is an established training requirement for flight crews, the corresponding concept of TRM for ATC was not an established training course for Airservices' controllers at the time of the occurrence.

The provision of TRM training may assist controllers in effectively managing compromised separation recovery actions. Through an integrated understanding that human performance elements may affect controller actions, the application of TRM skills in a stressful situation may enhance conflict resolution instructions, regardless of controller experience or perceived hierarchy.

In this occurrence, Controller 1's compromised separation recovery actions were not effective. That situation was identified by Controller 3 at the time, but they felt it inappropriate to assist the more experienced controller or intervene with the provision of more effective conflict resolution techniques. In this instance, TRM skills may have assisted Controller 3 to successfully intervene earlier.

[14] European Organisation for the safety of air navigation.

Findings

From the evidence available, the following findings are made with respect to the loss of separation assurance involving between an Airbus A330, registered 9V-STQ, and an Airbus A320, registered VH-VFH that occurred near Tindal, Northern Territory on 24 April 2014. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

Contributing factors

- Controller 1 assigned climb to the southbound A320 through the level of the northbound A330 without ensuring separation between the aircraft would exist at all times.
- Controller 1's mental model was influenced by a commonly used practice within the Tops Group to achieve lateral segregation between north and southbound aircraft. However, where no procedural separation standard existed, controllers were still required to establish and maintain radar separation through observation of the relative position of aircraft on the Air Situation Display.
- The large Air Situation Display range scale in use did not allow for adequate monitoring of the relative positions of the two aircraft and adversely affected the controller's conflict detection and resolution opportunities.
- The large Air Situation Display range scale in use adversely impacted on the controller's ability respond to the Short Term Conflict Alert and apply effective compromised separation recovery techniques.
- At the time of the occurrence, Controller 1 was likely experiencing a level of fatigue known to have a demonstrated effect on performance, predominantly due to the time of day combined with an extended time on task.

Other factors that increased risk

- **The utilisation of shift sharing practices for the Tops controllers resulted in them sustaining a higher workload over extended periods without a break, during a time of day known to reduce performance capability. [Safety issue]**
- **Airservices Australia had not provided en route air traffic controllers with effective simulator-based refresher training in identifying and responding to compromised separation scenarios, at intervals appropriate to ensure that controllers maintained effective practical skills. [Safety issue]**

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and 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 directly involved parties were provided with 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.

The initial public version of these safety issues and actions are repeated separately on the ATSB website to facilitate monitoring by interested parties. Where relevant the safety issues and actions will be updated on the ATSB website as information comes to hand.

Air traffic control shift management practices

Number:	AO-2014-074-SI-01
Issue owner:	Airservices Australia
Operation affected:	Aviation: Airspace management
Who it affects:	All Airservices Australia air traffic controllers operating on night shifts

Safety issue description:

The utilisation of shift sharing practices for the Tops controllers resulted in them sustaining a higher workload over extended periods without a break, during a time of day known to reduce performance capability.

Proactive safety action taken by Airservices Australia

Action number: AO-2014-074-NSA-009

On 30 March 2016, Airservices Australia advised the ATSB that:

> Airservices is currently reviewing the application of published Fatigue Risk Management System (FRMS) guidelines for ATC staff undertaking night shift duties. The review considers the application of risk assessment, the appropriateness of work cycles/rest periods, the adequacy of staffing arrangements in relation to the volume and complexity of night time traffic, and any variations that may exist between ATC groups. This review also includes updating the National ATS Administration Manual (NAAM) to include responsibilities regarding the application of FRMS principles for Operational Command Authority (OCA)/Supervision authorities. The updated provisions in the NAAM will be published in April 2016.

ATSB comment in response

The ATSB acknowledges the safety actions being taken by Airservices Australia which, when complete, have the potential to address the safety issue. The ATSB will monitor the outcomes and actions arising from the review.

Current status of the safety issue

Issue status: Safety action pending.

Compromised separation recovery training

Number:	AO-2014-074-SI-02
Issue owner:	Airservices Australia
Operation affected:	Aviation: Airspace management
Who it affects:	All Airservices Australia en route air traffic controllers

Safety issue description:

Airservices Australia had not provided en route air traffic controllers with effective simulator-based refresher training in identifying and responding to compromised separation scenarios, at intervals appropriate to ensure that controllers maintained effective practical skills.

Proactive safety action taken by Airservices Australia

Action number: AO-2014-074-NSA-001

On 1 September 2014, Airservices Australia (Airservices) advised the ATSB of safety action relating to compromised separation recovery training.

Airservices established the SkySafe Taskforce which conducted a review into compromised separation recovery training, with respect to both content and management of the training. The review identified 14 recommendations for continuous improvement in these areas, to ensure a quality training program for air traffic controllers. All actions were completed by mid-March 2014.

A recommendation to undertake consultation with industry on Australian Aeronautical Information Publication (AIP) phraseology to ensure a common understanding of the urgency and application of procedures in compromised separation occurrences was addressed through the provision of a Safety Bulletin provided to the broader aviation community on 7 March 2014.

A recommendation to examine and update for consistency the safety alerting sections of the Manual of Air Traffic Service (MATS) and the AIP was completed through revision of AIP and MATS and the subsequent release of amendments on 21 August 2014 to ensure alignment.

In response to nine recommendations relating to the provision, documentation and management of compromised separation recovery training requirements, amendments were made to Airservices' Air Traffic Services (ATS) Training Operations Manual.

Compromised separation recovery training learning resources were developed in accordance with two recommendations relating to updating all compromised separation training to include details on traffic collision and alerting system functionality and pilot perspectives, Short Term Collison Alert parameters, differing control intervention requirements depending on differing escalation factors, guidance on actions to be taken where the subject aircraft are not under surveillance, and the means of making controllers aware of the updated compromised separation recovery training content. The learning resources support the delivery of online, classroom and simulator training. .

The 14th recommendation to 'Identify and include in the Safety Investigation Procedure the method and forum where systemic and significant safety issues are escalated' was completed through the creation of an internal Letter of Agreement between Airservices' Safety Services and ATC sections.

On 25 July 2014, following development work and consultation with Airservices' ATS Operational Training section, a Standardisation Directive communication was issued to controllers to clarify the structure and phraseology of the air traffic control response (ATC) in relation to compromised separation recovery situations.

On 8 August 2014, a summary of the ATC Compromised Separation Recovery Training and ATC structure response was presented at Airservices' 31st ATS/Airline Safety Forum as part of broader industry consultation and collaboration.

On 30 March 2016, Airservices advised of additional outcomes from the SkySafe Taskforce, which included:

- review of the quality assurance and governance around the content of training material
- codification of the competency elements of an effective compromised separation recovery response to reconcile the need for a response to contain certain elements whilst still providing the flexibility to tailor responses to each scenarios. This has led to the creation of the technique known as 'TRUCT' (Trigger, Resolve, Urgency, Confirm, Traffic).
- implementation of a 6-month assessment regime that includes a requirements for ATC to demonstrate the use of compromised separation phraseology in a challenge-response situation with the check supervisor
- implementation of increased warning time of Short Term Conflict Alert (STCA) in the en route airspace from 60 seconds to 90 seconds which provides additional window of opportunity to identify and respond to compromised separation scenarios.

Airservices also reported that the organisation was taking action to provide a part-task simulator solution in support of the 6-month assessment regime on compromised separation skills.

> This solution will be suitable for en-route and terminal area (TMA) and will also be examined for feasibility to be introduced into the tower environment. The part-task simulator is under trail at this time and depending on the outcomes, may form part of the annual compromised separation training requirement.

Current status of the safety issue

Issue status: Adequately addressed.

Justification: The ATSB is satisfied that this safety action satisfactorily addresses the safety issue.

Additional safety action

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. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Team Resource Management

Proactive safety action taken by Airservices Australia

In relation to there being no documented requirement for compromised separation recovery training to include a team resource management (TRM) component, Airservices Australia reported in March 2016 that Non-Technical Skills (NTS) training is currently being developed and will cover TRM.

General details

Occurrence details

Date and time:	24 April 2014 – 0249 EST	
Occurrence category:	Incident	
Primary occurrence type:	Loss of separation assurance	
Location:	About 73 km east-south-east of Tindal, Northern Territory	
	Latitude: 14° 39’ 12” S	Longitude: 133° 02’ 03” E

Aircraft 1 details

Manufacturer and model:	Airbus A330-343
Year of manufacture:	2010
Registration:	9V-STQ
Operator:	Singapore Airlines
Serial number:	1149
Type of operation:	Air Transport High Capacity
Damage:	None

Aircraft 2 details

Manufacturer and model:	Airbus A320-232
Year of manufacture:	2012
Registration:	VH-VFH
Operator:	Jetstar Airways
Serial number:	5211
Type of operation:	Air Transport High Capacity
Damage:	None

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- involved air traffic controllers
- Airservices Australia
- aircraft operators
- Manual of Air Traffic Services
- Australian Aeronautical Information Publication

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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 the involved air traffic controllers, Airservices Australia, the aircraft operators and the Civil Aviation Safety Authority.

A submission was received from Airservices Australia. The submission was reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.