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- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

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Breakdown of separation, VH-VXU and A6-EMT 60 km south-east of Mildura, Victoria 3 September 2009

Abstract

On 3 September 2009 at about 1859 Eastern Standard Time, a Boeing Company 737-838 aircraft was en route from Sydney, New South Wales to Adelaide, South Australia and a Boeing Company 777-31H aircraft was en route from Melbourne, Victoria to Singapore. The aircraft were on crossing tracks and both were cruising at flight level 300. The air traffic control separation standard was infringed and there was a breakdown of separation.

The air traffic controller responsible for separation of the aircraft had recently completed the air navigation service provider's approved training, but had not recognised the potential conflict between the two aircraft.

As a result of this incident, Airservices Australia has amended the compromised separation recovery component of an air traffic controller's training, and introduced a compromised separation recovery element into its final controller field training.

FACTUAL INFORMATION

Sequence of events

On 3 September 2009, a Boeing Company 737-838 (737) aircraft, registered VH-VXU, had departed Sydney, New South Wales (NSW) on a scheduled passenger service to Adelaide, South Australia (SA). On board were the pilot in command, the copilot, five cabin crew and 143 passengers. The crew was cleared by air

traffic control to cruise at flight level (FL) 300.¹ The aircraft was tracking from east to west, direct to the MAXEM instrument flight rules (IFR) waypoint.² The MAXEM waypoint was about 32 NM (60 km) south-east of Mildura, Victoria (Vic.).

A Boeing Company 777-31H (777) aircraft, registered A6-EMT, had departed Melbourne, Vic. on a scheduled passenger service to Singapore. On board were the pilot in command, the copilot, 15 cabin crew and 276 passengers. The crew was cleared by air traffic control to climb to cruise at FL 300. The aircraft's track was from the south-south-east to the north-north-west and would take the aircraft in the vicinity of MAXEM. On first contact with the controller at 1841.51 Eastern Standard Time³, the crew of the 777 reported on climb to FL 300. The controller acknowledged the crew's transmission, but did not observe the pending conflict with the 737.

Five minutes later, when the controller completed the onwads coordination⁴ for the 777, he again did not observe the pending conflict with the 737.

1 A level of constant atmospheric pressure related to a datum of 1013.25 hectopascals, expressed in hundreds of feet. Therefore, FL300 indicates 30,000 ft.

2 Predetermined and accurately known geographical position forming the start or end of an air route segment.

3 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

4 Notification of flight details to the next controller to manage a flight.

At 1858.51, when the controller completed the onwards coordination for the 737, the aircraft were now less than 10 NM (19 km) apart at the same level and closing. The controller did not notice the reducing proximity of the two aircraft.

At 1859.11, the short-term conflict alert (STCA) function activated on the controller's air situation display, alerting him to the pending conflict between the two aircraft. The STCA is a collision avoidance tool designed to assist in the identification of potential collisions in radar controlled and surveillance airspace.

Reacting to the alert, the controller transmitted instructions to the crew of the 777 to turn right heading 040° (magnetic (M)) and to descend the aircraft to FL 290. There was no response from the crew.

Fifteen seconds later, the controller again transmitted instructions to the crew of the 777 to turn right heading 040° M and to descend to FL 290. There was still no response from the crew.

The controller was then interrupted by another controller, who was coordinating the movement of another aircraft, before he attempted a third call to the crew of the 777, 18 seconds after the second call.

At 1859.51, the controller instructed the crew of the 737 to '...turn right now heading 300'. The crew acknowledged the instruction and turned their aircraft. The radar separation standard was compromised when it reduced to 4.9 NM (9.1 km) at 1859.56. The required air traffic control (ATC) separation standard was 5 NM (9.3 km) horizontal separation by radar, or 1,000 ft⁵ vertically. There was a breakdown of separation.

The crew of the 737 later reported that they heard the controller attempting to call the crew of the 777 and that they had observed a target on their aircraft's traffic alert and collision avoidance

system (TCAS). The target symbol indicated an aircraft at their level about 10 NM (19 km) away in their 1030 o'clock position⁶ and closing.

Realising that separation was compromised and that a radar standard would not be maintained, the controller instructed the 737 crew to climb to FL 310. The climb instruction was issued at 1900.05, which was 54 seconds after the STCA first activated. Radar separation continued to reduce and was 3.6 NM (6.7 km) before vertical separation was reported to be established by the crew of the 737 maintaining FL 310 at 1901.01.

The controller then cleared the crew of the 737 direct to the WOONA IFR waypoint and subsequently re-established two-way communication with the crew of the 777. The controller handed over his duties to a relieving controller and was 'stood down'⁷ at 1902.36.

Recovery from compromised separation

In accordance with the Manual of Air Traffic Services (MATS) 9-10-690, controllers were 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. The following phraseology is an example of the words to be used:

(Callsign) TRAFFIC ALERT (position of traffic if time permits) TURN LEFT/RIGHT (specific heading, if appropriate), and/or CLIMB/DESCEND (specific altitude if appropriate) IMMEDIATELY.

The controller did not issue a safety alert to the pilots of either aircraft.

The controller's de-confliction instructions were not heard by the crew of the 777. The audio replay indicated that the controller's transmission of the callsign of the 777 was not clear and distinct.

The controller engaged in routine coordination with another controller regarding less critical traffic and did not assign priority to the aircraft in conflict.

5 Vertical separation minima detailed in the Manual of Air Traffic Services (MATS) 10-35-900 was Minima V2 - 1,000ft to:

- a. all aircraft, up to and including FL 290
- b. aircraft with RVSM approval except military formation flights, operating in airspace providing Class A service from FL 290 to FL 410 inclusive.

6 A position referenced to the points of a clock face relative to the heading of the aircraft.

7 Removal of the controller from operational duties until assessed as competent to return to an operational control position.

Personnel information

The controller was newly endorsed on the control position and had met the recency, familiarisation and endorsement requirements of Airservices Australia (Airservices). The controller held a current Civil Aviation Medical Certificate (Class 3) issued by the Civil Aviation Safety Authority and was reported to be well rested prior to the commencement of his shift.

The controller was responsible for a large volume of airspace encompassing two ATC sectors - CANTY and GRIFFITH (CAN and GTH) - of the East Coast Services South group (ECS-South). The airspace overlaid parts of SA, Vic. and NSW from FL 245 up to FL 600.

The controller had completed a 3-year Aviation Management degree prior to taking up ATC training and employment with Airservices. The ATC training involved theoretical subjects and simulator training over an 11-month period at the Airservices' Learning Academy in Melbourne. Following the successful completion of training at the college, simulation exercises were conducted at the simulator facility of the Melbourne Operations Centre. This was followed by 2 months of on-the-job training (OJT) with live aircraft before being assessed as competent on 31 August 2009.

Examination by the Australian Transport Safety Bureau (ATSB) of the controller's ATC training records indicated an ineffective scanning technique and an inability to provide separation assurance during the middle of the OJT phase.⁸ A training report dated 4 July 2009 included these following comments:

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- 8 MATS 10-10-320. Separation assurance. Tactical separation assurance places greater emphasis on traffic planning and conflict avoidance rather than conflict resolution and requires that Controllers:
- be proactive in applying of separation standards to avoid rather than resolve conflicts
 - plan traffic to guarantee rather than achieve separation
 - execute the plan so as to guarantee separation; and
 - monitor the situation to ensure that plan and execution are effective.

...scanning is good for the most part. The last day however, involved two occasions where firstly 2 crossing track aircraft at the same level (FL 410) were missed as being in conflict until they were within around 60 NM [111 km] of the crossing point...

and that:

...the second occasion was the same scenario but in a different area. Unfortunately, (name) did not identify that conflict and I had to point it out to him when it became close.

On 7 August 2009, a training report commented:

Projecting and Planning - ...don't focus solely on the ML [Melbourne] sequence to the detriment of your conflict recognition.

and:

Maintaining Separation - 2 crossing track conflicts at same level not picked up.

Overall Comments - Still a couple of issues early in the shift again with missed cross-track conflicts. Separation is more important than sequencing so don't focus all your attention on the latter.

The controller's training records had no details to indicate that he had been provided with 'recovery from compromised separation events' during the final field phase of training. However, Airservices advised that records indicated that the controller was provided with such training during the en route theory and simulator phases at the Learning Academy.

The section on *Aspects of Training* from the International Civil Aviation Organization (ICAO) Human Factors Digest No. 8, *Human Factors in Air Traffic Control*, published in 1993, states in part at paragraph 4.22 that:

The training must also ensure that the controller can cope with the workload required to control the traffic offered. This means knowing what the correct actions and procedures are in all circumstances, as well as executing them properly. The controller also needs to be able to learn how to schedule work efficiently. Training aims to teach the controller how to plan ATC and to deal successfully with any unexpected situations. Important objectives of training are to instil good skills, knowledge and habits, and to reinforce them so that they are durable and retained...

Paragraph 4.23 of the ICAO digest states in part that:

...the controller must never become so totally absorbed in a single problem as to fail to notice what else is happening. This might entail breaking the habit of concentrating on a single task until it has been completed and forming the new habit of frequent scanning of the radar screen or other displays to check all is well. Training must encourage this constant scanning and alertness.

In his discussion of controller experience and the need for supervision of newly-trained controllers, Hopkins (1995) writes:⁹

Supervisors and colleagues keep a watchful eye on inexperienced controllers, provide help and guidance when it is due, and ensure that inexperience never hazards safety.

Traffic alert and collision avoidance system

Both aircraft were equipped with a TCAS that provided a visual and aural alert to flight crews when suitably-equipped aircraft were operating within defined proximity limits. TCAS provides crews with either a traffic advisory or a resolution advisory (RA). An RA directs flight crew to manoeuvre to avoid the other aircraft. In this occurrence, none of the crews involved received a TCAS alert or warning.

Previous occurrence

Earlier that day, the controller was involved in an occurrence where he became confused about the coordinated level of an aircraft that was to be handed off to him. Rather than discuss the situation with the other controller, he reported it to the supervisor and an incident report was subsequently raised. The controller had his ATC privileges withdrawn, which were later reinstated after the incident was reviewed. When interviewed after this occurrence, the controller suggested that his pre-occupation with the earlier incident and the resultant incident report, may have been a distracting influence on his subsequent performance.

In accordance with Airservices' *National ATS Administration Manual*¹⁰, controllers directly or

indirectly involved in an air safety incident within the National Airways System (NAS) were to be removed from the operational position. This was to protect the NAS and the interests of the individual. Airservices reported that any human factors implications as a result of a person's involvement in an occurrence were taken into account prior to the affected controller resuming operations.

ANALYSIS

The constant application of separation assurance techniques is effective in the prevention of conflicts. For example, when the crew of the 777 first contacted the controller on climb to FL 300, the controller could have observed that they and the 737 were on crossing tracks and likely to be in conflict; the controller could then have amended the assigned flight level of the 777 to assure separation. That would have enabled the controller more time to scan and assess the situation. It is probable that the controller did conduct a scan of the display looking for conflicts, but did not identify the conflict.

The controller was unaware that the two aircraft were in conflict until the activation of the short term conflict alert.

A major part of any controller's training and development is the need to instil the practice of effective scanning of the controller's air situation display. Constant assessment and reassessment of the total air situation is essential to the safe and efficient management of air traffic. The controller's training reports indicated that his instructors had identified deficiencies with his scanning techniques and his ability to identify conflicts. However, he was subsequently deemed competent to operate safely on his own without direct supervision. The fact that the controller did not recognise the conflict at any stage would indicate that he had not resolved the deficiencies identified in his performance during training.

The short term conflict alert is a function of the controller's equipment that provides a window of opportunity for a controller to be alerted to, and act to resolve, a conflict before a collision

9 Hopkins, V. David, (1995). *Human Factors in Air Traffic Control*, London, UK: Taylor & Francis, p329.

10 National ATS Administration Manual, Part 5.

becomes imminent. Despite being alerted to the pending conflict, the lack of urgency in the resolution of the conflict reduced the usefulness of the alert. Had the controller issued safety alerts to the crews of both aircraft in a timely manner, the situation may have been recovered and a separation standard re-established sooner than occurred. Also, a safety alert would have ensured that the crews of both aircraft were aware of the situation; that is, separation was about to be, or had been, compromised.

The extent to which the previous occurrence was a factor in the subsequent breakdown of separation could not be established. However, it is possible that the controller may have been pre-occupied by the occurrence and his stand-down and reinstatement.

Regardless of what contributed to an error, the effect on safety depends on whether controllers detect and respond to errors before they lead to an undesired state or an unsafe outcome. In this occurrence, a controller missed a conflict and also was unable to effectively resolve the compromised separation before a breakdown of separation occurred.

FINDINGS

From the evidence available, the following findings are made with respect to the breakdown of separation occurrence involving a Boeing 777 aircraft, registered A6-EMT and a Boeing 737 aircraft, registered VH-VXU, that occurred 32 NM (60 km) south-east of Mildura, Victoria and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The controller's technique for scanning and assessing traffic for conflicts was not effective.
- The controller did not initially provide a separation standard or any assurance of separation between the 777 and the 737.
- The controller did not identify the potential conflict between the two aircraft at any time before the short-term conflict alert activated.
- The controller's response to the compromised separation was initially ineffective, leading to a breakdown of separation.

- Despite the reducing proximity between the two aircraft, the controller did not issue a safety alert to the crew of either aircraft.

Other safety factors

- During an earlier sequence in the controller's shift, the controller reported a suspected coordination error to his supervisor. As a result, an incident report was submitted and the controller may have become pre-occupied with the way he had handled that event.
- The controller had not received any 'recovery from compromised separation events' during final field training.
- The training and assessment system was ineffective in this case, because it placed an individual with deficiencies in scanning and conflict resolution in a control position. [*Minor safety issue*]

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

Effectiveness of the training, assessment and rating system

Minor safety issue

The training and assessment system was ineffective, in this case, because it placed an

individual in a control position with deficiencies in scanning and conflict resolution.

Action taken by Airservices Australia

Airservices advised that, in response to this event, they have:

...reviewed the situation and determined there are no systematic issues with the assessment regime. However, to strengthen our training, additional refresher modules in compromised separation training have been incorporated into the curriculum. A dedicated compromised separation training module is now delivered, in addition to the existing content that is in place before the final simulator assessment period in the Learning Academy. Compromised separation training is now included in final field training.

A draft of this report was provided to the controller, Airservices, the Civil Aviation Safety Authority and the operators of the aircraft involved.

Submissions were received from Airservices, the controller and one of the aircraft operators. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly

ATSB assessment of action taken

The ATSB is satisfied that the action taken by Airservices adequately addresses the training aspects of the safety issue. The ATSB is investigating another occurrence¹¹ with related factors, and will consider the role of controller assessment in that, and subsequent investigations.

SOURCES AND SUBMISSIONS

Sources of information

The main sources of information during the investigation included:

- Airservices Australia (Airservices)
- the aircraft operators
- the International Civil Aviation Organization.

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.

¹¹ See http://www.atsb.gov.au/publications/investigation_reports/2009/air/AO-2009-080.aspx