Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2010-104
Final

Breakdown of separation near Melbourne Airport, Victoria 5 December 2010

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Publication 2 May 2012r

ISBN 978-1-74251-259-4

Released in accordance with section 25 of the Transport Safety Investigation Act 2003

Abstract

On 5 December 2010, at 1422 Eastern Daylight-saving Time, a breakdown of separation occurred between a Boeing Company B737-7Q8 (737), registered VH-VBF, and a Boeing Company B767-338 (767), registered VH-OGU, on departure from Melbourne Airport, Victoria. The flight crew of the 737 had reduced their aircraft's speed in order to meet a height requirement of the Standard Instrument Departure. The following 767 aircraft climbed at a faster speed.

When the aircraft were transferred from the aerodrome controller to a departures controller, there was 3.4 NM (about 6.3 km) separation between them. The departures controller expected them to climb at a similar speed, and did not recognise the loss of separation assurance. The controller's actions to manage the compromised separation were not fully effective. At one point, radar separation had reduced to 1.9 NM (3.5 km) and vertical separation to 500 ft.

On 12 October 2011, a similar breakdown of separation occurred at Melbourne between an Airbus A320-232 and a Boeing Company 737-8BK. This incident involved different controllers to those involved in the 5 December 2010 incident.

The ATSB identified a safety issue in that the procedures for takeoffs at Melbourne Airport allowed for aircraft to depart relatively close to each other, with no documented requirements to ensure jet aircraft would maintain a set climb speed or to require flight crews to advise air traffic control if that speed could not be achieved. Although the Melbourne procedures were based on those used in Sydney, the Sydney procedures specified a minimum climb speed. The safety assessment report for the Melbourne procedures did not include a detailed comparison of the procedures used in the two locations. In response to the identified safety issue, Airservices Australia has commenced action to establish a standard speed profile for use at radar terminal area aerodromes in Australia, and to ensure that pilots of jet aircraft notify air traffic control when operating at a significantly lower speed than stipulated in that profile.

FACTUAL INFORMATION

Sequence of events

At 1422 Eastern Daylight-saving Time[1], a breakdown of separation occurred near Melbourne Airport, Victoria between:

- a Boeing Company B737-7Q8 (737), registered VH-VBF, and operating from Melbourne to Brisbane, Queensland
- a Boeing Company B767-338 (767), registered VH-OGU, and operating from Melbourne to Sydney, New South Wales.

Both aircraft were conducting scheduled passenger services under the instrument flight rules (IFR).

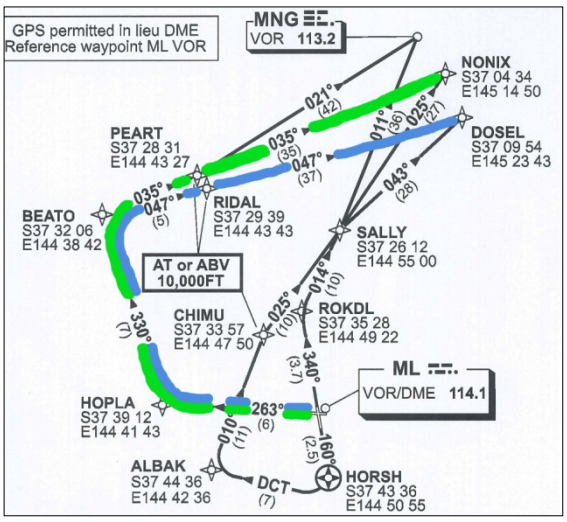
Initial events

At 1417, the 737 departed from runway 27 on the NONIX NINE Standard Instrument Departure (SID) that had been issued to the flight crew by air traffic control (ATC). As indicated by the green line on Figure 1, the SID required the aircraft to fly for

1 Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

6 NM (11.1 km) on a track of 263° magnetic to position HOPLA, and then turn right onto a track of 330° to position BEATO, a further 7 NM (13.0 km). From BEATO, the aircraft was to turn right again and track 035° for 5 NM (9 km) to position PEART, where it was required to be at or above 10,000 ft above mean sea level (AMSL) to ensure separation with inbound tracks.

Figure 1: Standard Instrument Departure tracks



Note: Green highlighting indicates SID issued to the 737

Blue highlighting indicates SID issued to the 767

Unless cancelled by ATC, departing aircraft at Melbourne were restricted to a maximum indicated airspeed of 250 kts. There was no required minimum speed (see *Speed restrictions*).

At 1418, the 767 departed from runway 27. ATC cleared the flight crew to depart via the DOSEL SEVEN SID. As indicated by the blue line on Figure 1, that SID tracked by the same points as the NONIX NINE SID until BEATO, where the aircraft was to turn right and track 047° to RIDAL. At that point, it was required to be at or above a height of 10,000 ft.

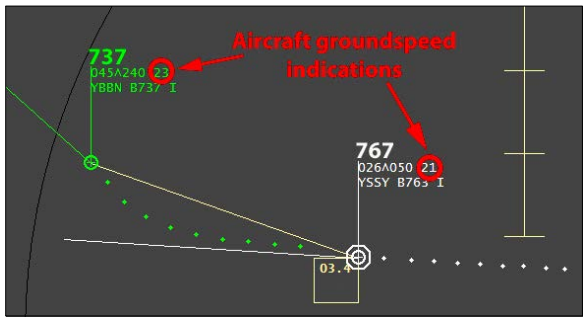
The Aerodrome controller (ADC) transferred the 737 flight crew to the Departures North controller who had responsibility for the airspace that contained the NONIX NINE and DOSEL SEVEN SIDs. At 1418:38, the 737 flight crew called the Departures North controller, who issued the crew a clearance to climb to flight level (FL)[2] 240.

The ADC ensured that there was a radar separation of 3.4 NM (6.3 km) between the 767 and the preceding 737 before instructing the 767 flight crew to contact the Departures North controller. The required radar surveillance standard was 3 NM (5.6 km) and the vertical standard was 1,000 ft.

At 1419:47, the 767 fight crew established radio contact with the Departures North controller, who issued the crew a clearance to climb to FL 240. At that time, there was 3.4 NM (6.3 km) and 1,900 ft between the two aircraft.

At 1419.47, the 737 had commenced the SID-required turn at HOPLA with a groundspeed[3] 20 kts faster than the 767. As indicated in Figure 2, the controller's air situation display provided a visual indication of the aircrafts' groundspeeds as well as their positions and altitudes.

Figure 2: Proximity of the aircraft at 1419:47



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Note: Each graduation on the scale marker is 1 NM (1.85 km)

The 737 flight crew later reported that, when they commenced the right turn at HOPLA, their aircraft encountered a significant tailwind. The aircraft was heavy due to the fuel and passenger loads, and the captain advised the first officer that they would not accelerate the aircraft to 250 kts initially as the aircraft would then have difficulty climbing to achieve the 10,000 ft height requirement by PEART.

Identification of conflict

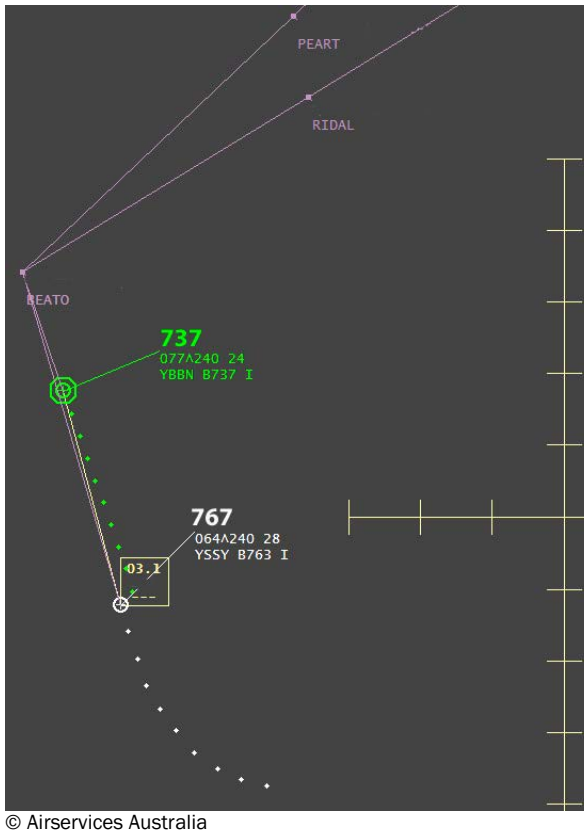
At 1421:01, there was 3.1 NM (5.7 km) and 1,300 ft separation between the 737 and 767, with a closing groundspeed of 40 kts (Figure 3).

2 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.

3 Aircraft's speed relative to local earth. Groundspeed appeared in units of tens on the display, with 21 indicating a groundspeed of 210 kts.

After noticing the situation, the Departures North controller cancelled the SID clearance issued to the 737 flight crew and instructed them to track the aircraft direct to position KASEY, which was the next flight planned position after NONIX, then as per their flight planned route. The controller later advised that he thought this action would take the 737 further away from the 767.

Figure 3: Proximity of the aircraft at 1421:01



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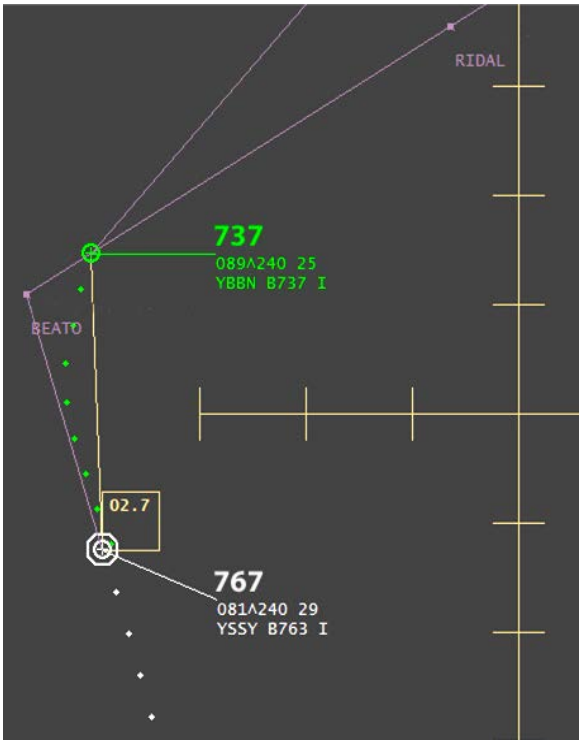
Note: Each graduation on the scale marker is 1 NM (1.85 km)

A breakdown of separation[4] occurred 11 seconds later, at 1421:12, when the separation reduced to 2.9 NM (5.4 km) and 900 ft respectively.

When the controller reassessed the situation and realised that the separation had not increased, he took further actions. At 1421:30, he cancelled the SID clearance for the 767, and instructed the flight crew to turn right onto a heading of 050°. At that time there was 2.7 NM (5.0 km) and 800 ft separation, with a closing groundspeed of 40 kts (Figure 4).

Figure 4: Proximity of the aircraft at 1421:30



© Airservices Australia
Note: Each graduation on the scale marker is 1 NM (1.85 km)

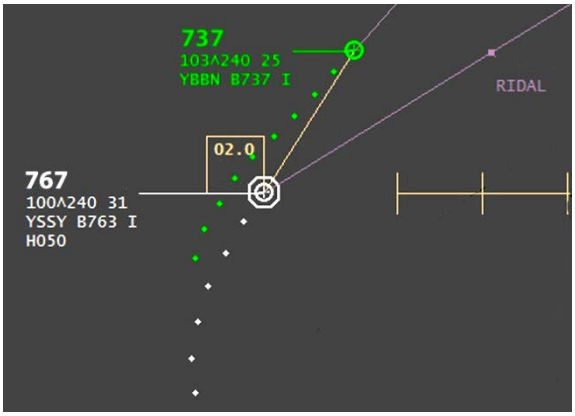
Shortly after, when the 767 was passing 8,700 ft on climb, the controller instructed the flight crew to stop the aircraft's climb at 9,000 ft. The 767 flight crew advised the controller that their aircraft had climbed through that altitude. Radar data indicated that the 767 was climbing through 9,300 ft at that time (1421:48), and that there was 60 kts closing groundspeed and 500 ft vertically between the aircraft. The controller confirmed the requirement to maintain 9,000 ft, and the crew commenced descent from 10,000 ft to the newly assigned level.

During these transmissions, the controller asked the 767 flight crew whether they had the preceding aircraft in sight, and the crew replied that that had visual contact with the 737 'the whole time'. In contrast to standard procedures, at no stage did the controller issue a traffic alert to the crew of either aircraft.

At 1422:07, separation between the aircraft reduced to 2.0 NM (3.7 km) and 300 ft, with 60 kts closing groundspeed (Figure 5). At about that time, the Australian Advanced Air Traffic System (TAAATS) Short Term Conflict Alert (STCA) activated, and the Departures North controller acknowledged the alert.

4 Failure to establish or maintain a separation standard between aircraft which are being provided with an air traffic separation service.

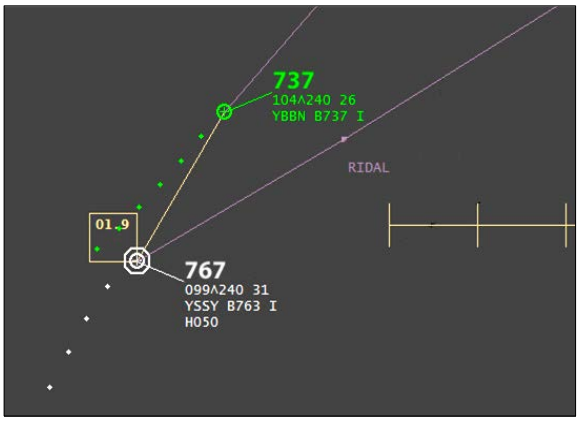
Figure 5: Proximity of the aircraft at 1422:07



© Airservices Australia
Note: Each graduation on the scale marker is 1 NM (1.85 km)

Five seconds later, at 1422.12, separation between the aircraft was 1.9 NM (3.5 km) and 500 ft, with 50 kts closing groundspeed (Figure 6). A separation standard of 1,000 ft was re-established 19 seconds later (1422:31) with the distance between the aircraft increasing to 2 NM (3.7 km).

Figure 6: Proximity of the aircraft at 1422:12



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Note: Each graduation on the scale marker is 1 NM (1.85 km)

Shortly after, the 767 flight crew requested the groundspeed of the 737 from the Departures North controller and the controller advised that it was 280 kts. The controller then queried the 737 flight crew as to their Climbing Indicated Airspeed (CLIAS)[5] below 10,000 ft, and was advised that it had been 210 kts initially, to make the SID height requirement at PEART. The 767 flight crew advised that their aircraft had been climbing at 250 kts CLIAS from 3,000 ft.

The flight crew of the 767 later reported that they had the 737 in sight throughout the incident and did not receive any traffic alert and collision avoidance system (TCAS) alerts. The flight crew of the 737 also reported that they did not receive any TCAS alerts.

Personnel information

The Departures North controller had 5 years experience in that control position, and 12 years total experience as a controller. He reported that he was fit for duty at the time of the occurrence.

The controller advised that, at the time of the occurrence, the traffic level was light to moderate, with some sequencing into Melbourne necessary. Based on his experience, he expected that the 737 and 767 would climb at similar speeds. After having issued both aircraft with clearances to climb to FL 240, he had directed his attention to the traffic sequence into Melbourne from the north.

The controller had recently completed Compromised Separation Recovery training, which encompassed a simulator component.

Air traffic control

Airspace

The Departures North airspace extended east-west from the centreline of runway 27 at Melbourne Airport to 30 NM (56 km), with an arc around to the north and up to the north-east. There were various airspace splits to facilitate the Approach sector's processing of aircraft arrivals from the Sydney direction onto runway 16. Departures North was also responsible for approaches from the north-west. The standard assignable level for departing jet aircraft was FL 240.

The Departures North airspace was defined as Class C[6] airspace and was within the ATC Terminal Control Area[7] for Melbourne Airport.

5 Aircraft instrument indication of the relative velocity between the aircraft and surrounding air during the climb phase.

6 A class of airspace established in the control area steps associated with controlled aerodromes, excluding control area steps classified as Class D airspace.

Separation standards

The horizontal radar separation standard applicable between the aircraft was 3 NM (5.6 km) and the vertical separation standard was 1,000 ft.

Visual separation is a means of spacing aircraft through the use of visual observation by a Tower controller or by a pilot when assigned separation responsibility. The *Manual of Air Traffic Services* (MATS) detailed the requirements for the application of visual separation when the responsibility was assigned to a pilot. It stated:

> You may only assign responsibility for visual separation to a pilot when aircraft are operating at or below 10,000 ft and the pilot of one aircraft reports sighting the other aircraft and is instructed to maintain visual separation with, pass behind or follow that aircraft.

The Departures North controller reported that, after the 767 flight crew confirmed visual contact with the preceding 737, he considered that a visual separation standard existed and that a lateral separation standard would then need to be established before the visual separation standard requirements could no longer be met. However, a review of recorded communications found that the flight crew were not instructed to maintain visual separation with the other aircraft. The controller advised that he did not know why the visual separation standard was not applied appropriately.

Separation assurance

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

In order to assure separation, MATS required controllers to:

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

Speed restrictions and variations

Aeronautical Information Publication (AIP)[8] ENR 65 *Aircraft Speeds* outlined the speed requirements for civil aircraft. However, for IFR aircraft operating in Class C airspace, the AIP stated that a defined speed was 'N/A [not applicable], except where specified in ERSA [*En Route Supplement Australia* (ERSA)[9]] for a particular location.'

For aircraft operating to or from Melbourne Airport, ERSA stated that the required maximum airspeed below 10,000 ft was 250 kts, with further restrictions documented for arriving aircraft in visual meteorological conditions. The publication stated that the speeds were for ATC separation and runway capacity purposes and that they were mandatory unless ATC advised 'cancel speed restrictions'. There was no required minimum speed for departing aircraft.

There was no documented requirement in the AIP or ERSA for a pilot to advise ATC of a speed variation in the climb or cruise phases of flight, unless they were unable to comply with an ATC-issued speed instruction.

In contrast, there was a requirement in AIP ENR 12 *Descent and Entry* for pilots of jet aircraft to advise ATC of speed variations in the descent phase of flight. In that regard, paragraph 12.1.1 stated:

7 A control area normally established at the confluence of Air Traffic Services routes in the vicinity of one or more major aerodromes in which air traffic services are provided by Approach and Departures Control.

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

9 *En Route Supplement Australia* is an airport directory for Australian aerodromes. It has pictorial presentations of all licensed aerodromes and includes aerodrome physical characteristics, hours of operation, visual ground aids, air traffic services, navigation aids, and lighting.

> Most companies operating jet aircraft have agreed to a standard descent profile which is specified in the operations manual for the aircraft. Pilots must adhere to the profile unless operational reasons require, or ATC instructs or approves, otherwise. A speed variation of more than +/- 10 kt or +/- M0.025 must be advised to ATC.

For controller knowledge and situational awareness, MATS documented the speeds of particular types of aircraft for different phases of flight, both generic and specific to Australian operators. The table was not applicable in this occurrence as both aircraft were subject to the maximum speed restriction prescribed for Melbourne Airport.

Auto Release procedures

Standard procedures known as 'Auto Release' were promulgated for use between the ADC and Departures control positions at Melbourne Airport, and they were active at the time of the occurrence. The procedures minimised voice coordination between Tower and Departures controllers in order to facilitate departures.

When Auto Release procedures were active, the ADC was responsible for managing the departing aircraft to establish and/or maintain the required separation minima before transferring control jurisdiction to the Departures controller(s).

Chapter 9-70 of the Airservices National ATS (Air Traffic Services) Procedures Manual outlined Auto Release procedures and stated in part:

> The use of Auto Release for departing aircraft is the default method of operation at aerodromes where the Auto Release procedure is used.
>
> Local Instructions shall specify agreed SIDs and headings associated with a runway configuration and any additional Auto Release procedures.
>
> The use of Auto Release procedures does not preclude voice coordination between the ADC and DEP [Departures] at any time.

When Auto Release procedures were not active, the ADC was required to voice coordinate departing aircraft with the Departures controller, who was then required to issue specific heading and/or altitude instructions for each aircraft to establish and/or maintain the required separation minima.

During the occurrence, after the separation had reduced to less than 3 NM (5.6 km), the Departures South controller expressed concern to the Shift Supervisor about the in-trail departure sequence established by the ADC. The Shift Supervisor stated that he contacted the control tower to pass on the concern, and the tower advised him that there had been 3 NM (5.6 km) between the aircraft and they considered that appropriate separation had been established.

Safety assessment

Airservices conducted a safety assessment for the Melbourne Airport Auto Release procedures implementation, with the final documentation dated 6 July 2005. The assessment stated that, during the design process for the procedures, a decision was made to adopt the concepts of the Auto Release model in use at Sydney Airport, based on its proven reliability, integrity and the experience gained in the use of those procedures in Sydney. In addition, consistency with the Sydney procedures provided standardisation within the Melbourne flight information region.

At the time of the occurrence, the ERSA-documented speed restrictions for Sydney Airport differed to those at Melbourne Airport. More specifically, the Sydney Airport restrictions included:

> All jet ACFT [aircraft] departures must commence acceleration to 250 kt IAS [indicated airspeed] no later than 3,000 ft, then must maintain 250 kt until leaving 10,000 ft. Pilots unable to comply must advise ATS [Air Traffic Services] with Airways Clearance Request.

The safety assessment report for the Melbourne Auto Release procedures stated that all deviations from the adopted Sydney model had been examined and managed to a level of risk as low as reasonably practicable. However, the assessment did not include a detailed comparison of the Sydney and Melbourne procedures and related risk controls, and it did not explain why the speed restrictions in use at Sydney were not applicable for Melbourne.

The assessment report stated that hazards associated with the new procedures were identified by workshops with relevant personnel, simulator trials, and reports by controllers during training for the new procedures. During this process, a range of potential hazards were

identified and mitigated. However, the list of considered hazards did not include a breakdown of separation between two departing aircraft due to a speed differential.

During the investigation, Airservices advised the Australian Transport Safety Bureau (ATSB) that speed variation was not included in the hazards log as it was not an issue specific to Auto Release but applied across all phases of flight. Airservices stated that controllers needed to be alert to aircraft speed whenever there was any possibility of an in-trail separation issue during climb, cruise or descent.

On 15 March 2011, Airservices published a safety education document, known as a 'Safetybyte', for its air traffic controllers. Titled 'Aircraft Speed Profiles', it stated that a contributing factor in a number of separation breakdowns had been controllers' knowledge of aircraft performance and the integration of that knowledge into separation plans. In addition, the document advised:

> These days it seems that everyone is flying a different speed profile and this has added a new dimension of guesswork into ATC, especially where sequencing is concerned, and requires controllers to be much more on their toes.....The bottom line is that controllers need to be alert to aircraft speed whenever there is any possibility of an in-trail separation issue: climb, cruise or descent. Even disregarding the effects of wind profile, it's possible for considerable closing to develop at any time and without any warning to the controller, and this applies just as much in the procedural environment as within surveillance coverage.....The only answer to this problem is that to assure separation controllers must peg speeds if there is any possibility at all of a separation issue developing.

Occurrences involving Auto Release procedures

Airservices advised that there had been no breakdown of separation occurrences associated with Auto Release procedures at Sydney. In addition, prior to December 2010, there had been no such occurrences at Melbourne. However, on 12 October 2011, another breakdown of separation associated with Auto Release procedures occurred at Melbourne (see the section of this report titled *Occurrence on 12 October 2011*).

System alerting

The STCA was a situational display alert in TAAATS that indicated a system-detected critical event requiring immediate controller intervention. MATS defined the parameters for STCA activation in the Terminal Control Area as 2.1 NM (3. 9 km) or a controller warning time of 60 seconds. In this occurrence, the STCA activated and was acknowledged by the Departures North controller.

Compromised separation

Separation is considered to be compromised when either ATC separation standards have broken down, or where separation assurance is lacking to the extent that a breakdown of separation is imminent.

MATS detailed the requirement for controllers to issue safety alerts in the case of lost or compromised separation, and the required supporting ATC phraseology. A safety alert was defined as:

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

MATS provided the following phraseology as 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.

Occurrence on 12 October 2011

Sequence of events

A breakdown of separation on 12 October 2011 occurred between:

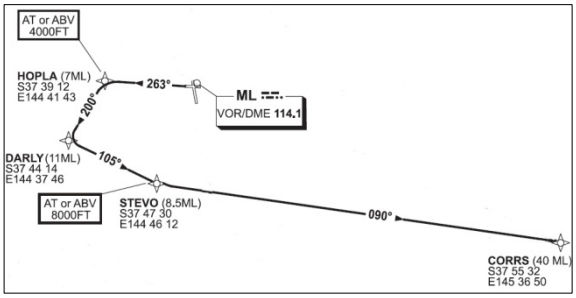
- an Airbus A320-232 aircraft (A320), registered VH-VGR, and operating from Melbourne to Auckland, New Zealand
- a Boeing Company B737-8BK (737), registered VH-VOD, and operating from Melbourne to Gold Coast, Queensland.

Both aircraft were operating as scheduled passenger services under the IFR. Auto Release procedures were active between the ADC and Departures controllers, and the promulgated

speed restrictions for Melbourne Airport were unchanged from the requirements current at the time of the 5 December 2010 occurrence.

At 1039:50 Eastern Daylight-saving time, the ADC cleared the A320 for takeoff from runway 27 on the CORRS SIX SID, on climb to 5,000 ft. The SID required the aircraft to track for 6 NM (11.1 km) on the runway heading of 263° to HOPLA, with a requirement to be at or above 4,000 ft by that position. At HOPLA, the aircraft was to turn left 200° to track to DARLY (Figure 7).

Figure 7: CORRS SIX Departure



At 1039:59, the ADC cleared the 737 flight crew to line up and wait on runway 27. Thirty-nine seconds later, the ADC instructed the flight crew to be ready for an immediate take-off clearance, as he was going to try to depart the 737 before the next aircraft arrival.

At 1041:04, the ADC cleared the 737 flight crew for an immediate takeoff from runway 27 on the NONIX NINE SID (Figure 1), on climb to 5,000 ft.

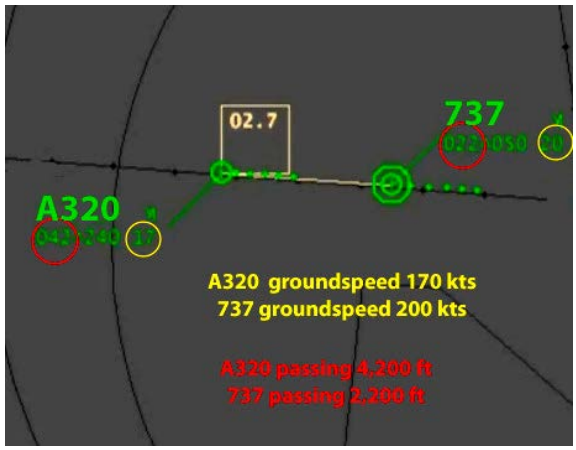
At 1041:14, the ADC transferred the A320 to Departures South, as that ATC position had control jurisdiction for the airspace containing the CORRS SIX SID. Fifteen seconds later, the A320 flight crew contacted Departures South and were instructed to climb to 8,000 ft, with minimum delay on the climb due to other traffic. The Departures South controller instructed the A320 flight crew to climb to FL 240 at 1041:53.

At 1042:21, there was 3.0 NM (5.6 km) and 2,000 ft between the A320 and 737, with the A320 climbing through 3,600 ft and the 737 climbing through 1,600 ft. The A320's groundspeed was displayed as 160 kts and the 737's groundspeed as 170 kts.

The A320 flight crew later reported that their aircraft climbed at a reduced speed on departure as it was heavy for the flight to Auckland. In addition, to meet the height requirement of 4,000 ft or above at HOPLA, they had to reduce the aircraft's climb speed. The flight crew stated that when operating on that SID with a heavy aircraft, the aircraft's climb would often be slow in order to meet the HOPLA height requirement.

At 1042:49, the ADC transferred the 737 to Departures North, as that ATC position had control jurisdiction for the airspace containing the NONIX NINE SID. At that time, the radar data indicated that there was 2.7 NM (5.0 km) and 2,000 ft between the A320 and the 737, with a closing groundspeed of 30 kts (Figure 8).

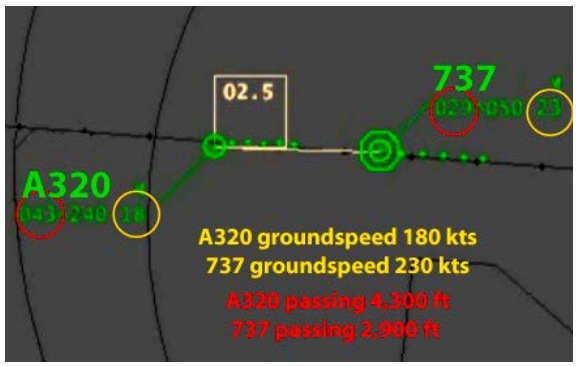
Figure 8: Proximity of the aircraft at 1042:49



Following the 737 flight crew's first transmission after the frequency transfer, the Departures North controller asked if they had visual contact with the A320 ahead, to which the flight crew responded in the negative as their aircraft was in cloud. The Departures North controller then instructed the 737 flight crew to maintain 4,500 ft. Shortly after, the 737 was cleared to climb to FL 240.

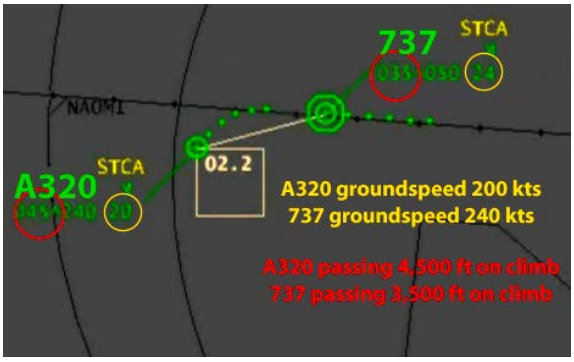
At 1043:02, after the A320 had commenced the left turn at HOPLA, there was 2.5 NM (4.6 km) and 1,400 ft between the A320 and 737, with 50 kts closing groundspeed (Figure 9).

Figure 9: Proximity of the aircraft at 1043:02



At around 1043:15, a STCA activated on the air situation displays of the Departures North and South controllers. At that time there was 2.2 NM (4 km) and 1,000 ft between the aircraft, with 40 kts difference in groundspeed (Figure 10).

Figure 10: Proximity of the aircraft at 1043:15



At 1043:22, a breakdown of separation occurred between the A320 and the 737, as radar separation reduced to 2.1 NM (3.9 km) and vertical separation to 800 ft, with 50 kts difference in groundspeed (Figure 11).

Figure 11: Proximity of the aircraft at 1043:22

As the A320 continued the left turn to DARLY, radar separation with the 737 increased. Shortly after, the 737 commenced the right turn to BEATO and a radar standard of 3 NM (5.6 km) was re-established.

No traffic alerts were provided to the flight crews of the A320 or 737 by ATC.

Aerodrome controller

The ADC had worked as a controller since 2000, and had held ratings and endorsements in Departures, Approach, enroute and Tower partitions. He was rated in the Melbourne ADC position in May 2011.

The ADC reported that, after he transferred the 737 to Departures North, he observed on the radar monitor that there was closing groundspeed between the A320 and 737, but he was not concerned as the A320 was about to make a left turn on the SID and therefore the radar separation standard would be maintained. When he checked the radar monitor again, the A320 had commenced the left turn, but there was still closing groundspeed between the aircraft. As the tracks of the A320 and 737 were diverging, he did not believe there was a risk of collision.

The ADC reported that, based on his experience, he had considered that the A320 and 737 were like-type aircraft, with very similar climb profiles.

Fight crew reports

Both the A320 and the 737 flight crews advised that did not receive any TCAS alerts associated with the occurrence.

The 737 flight crew reported that they were aware of the preceding A320 and, once airborne, they monitored the progress of the A320 on their TCAS display. They noticed the A320 commence a left turn at HOPLA and were satisfied that there was no potential for conflict with their aircraft.

ANALYSIS

During the breakdown of separation between the two departing aircraft near Melbourne on 5 December 2010, the separation reduced to 1.9 NM (3.5 km) and 500 ft. As the aircraft were travelling in a similar direction, the closing speed was relatively low and there was a significant period for the problem to be detected and rectified.

Nevertheless, the investigation into the occurrence, and a similar occurrence on 12 October 2011, revealed limitations with the risk controls in place for departures at Melbourne that had the potential to lead to higher-risk situations, particularly during high-workload periods.

Loss of separation assurance

During the 5 December 2010 occurrence, when the following 767 aircraft was issued a take-off clearance, there was a loss of separation

assurance[10] with the preceeding 737. Both the Aerodrome controller (ADC) and Departures North controller had no means of assuring that the radar surveillance separation minima would be maintained as they were unaware of the actual speeds at which the aircaft would climb. These speeds are critical information required to maintain a radar separation standard between aircraft departing on the same track with close to the radar surveilliance separation minima between them, and with no alternate means of separation applied.

Alhough the ADC provided the Departures North controller with 0.4 NM (0.7 km) in excess of the required 3 NM (5.6 km) radar separation minima, the period for the Departures North controller to maintain the standard with a faster following aircraft was relatively short.

The Departures North controller did not recognise the loss of separation assurance and assigned both aircraft FL 240 in quick sucession. Before assigning FL 240 to the 767, the controller had an opportunty to restore separation assurance by confirming the aircrafts' climbing indicated airspeeds with the respective flight crews and determining a separation plan, based on acurate aircraft performance knowledge. Such a plan may have including track shortening, vertical separation and/or cancellation of the SID height requirement for the 737.

During the subsequent 12 October 2011 occurrence, there was a loss of separation assurance between an A320 and a following 737 when the 737 flight crew were cleared for takeoff. The ADC was not aware of the planned climbing speeds of the aircraft, and therefore a radar separation standard could not be assurred before the tracks of the aircraft diverged on the SIDs.

Speed differentials

On 5 December 2010, the Departures North controller assumed that the climb profiles of both the 737 and 767 would be similar and subsequently focused his attention on other traffic. Similarly, on 12 October 2011 the ADC established the separation between the A320 and the 737 based on an assumption that the performance of the two aircraft would be similar, and that the promulgated runway separation standard would transition into a radar standard.

In both cases, the crew of the slower, preceding aircraft had legitimate reasons for using a slower than normal climb speed. Evidence indicated that the use of such speeds were not isolated events.

Risk controls associated with speed differentials

Airservices stated that controllers need to remain aware of aircraft speeds whenever there is a possible in-trail separation issue, and to 'peg' speeds when there is a possibility of an in-trail separation issue developing.

Although controller awareness is obviously important, the Auto Release procedures at Melbourne Airport allowed for aircraft to be departed at close to the separation standard (3 NM or 5.6 km) with limited controls in place to assure and maintain separation if a speed differential developed. If a controller did not detect the situation, due to factors such as high workload, expectancy or distraction, or if there was a loss of radar or radio communication, there was a significant likelihood of a breakdown of separation developing.

More specifically, the procedures at Melbourne required no minimum speeds for departing aircraft, and also did not require flight crews to advise air traffic control if their speeds would be unusual. In contrast, the Auto Release procedures at Sydney Airport documented fixed speeds for departing aircraft, and a requirement for crews to notify if the speed could not be achieved. Accordingly, controllers could plan separation based on accurate rather than assumed speed information. The lack of any related occurrences at Sydney, compared to two in Melbourne, suggests that these speed requirements are useful risk controls.

Safety assessment process

The safey assessment for the Melbourne Auto Release procedures involved several processes to identify hazards. However, the assessment report did not discuss hazards or scenarios involving an in-trail separation issue. Although such scenarios can occur in a range of situations, it is specifically

10 A separation standard existed; however, planned separation was not provided or separation was inappropriately or inadequately planned.

relevant to the context of Auto Release procedures. Accordingly, the safety assessment report would have provided more assurance that all hazards had been considered and appropriately mitigated if it had included and discussed the issue.

Similarly, even though the Melbourne procedures were based on those in use at Sydney, the assessment report did not include a detailed comparison of all the relevant procedures at both locations. Such a comparison would have provided more assurance that risk controls such as minimum speed restrictions had been considered.

Compromised separation recovery

During the 5 December 2010 occurrence, the Departures North controller did not effectively manage the compromised separation situation. More specifically, he did not issue a traffic alert to either flight crew, and he did not correctly establish a visual separation standard. In addition, the timing of the instruction issued to the 767 flight crew to maintain 9,000 ft did not provide the flight crew with the necessary time to arrest the aircraft's climb without climbing through the newly assigned level.

The controller had recently received Compromised Separation Recovery Training. However, in this case, he believed that his initial actions would resolve the situation. In contrast, the separation continually reduced.

Similarly, no traffic alerts were provided to either flight crew during the 12 October 2011 occurrence. In that case, the ADC considered that the tracks of the aircraft were diverging and that there was a low collision risk.

Even though the risk associated with a compromised separation situation may not appear to be significant, it is still important for controllers to provide prompt and effective intervention, including issuing traffic alerts to flight crews. Situations can deteriorate rapidly due to a range of factors, and the use of alerts enhances the situation awareness of crews and can facilitate their prompt action to any controller instructions.

FINDINGS

Context

On 5 December 2010, at 1422 Eastern Daylight-saving Time, a breakdown of separation occurred between a Boeing Company B767-338 (767), registered VH-OGU, and a Boeing Company B737-7Q8 (737), registered VH-VBF, on departure from Melbourne Airport, Victoria.

During the course of the investigation, a similar incident occurred at Melbourne on 12 October 2011 involving an Airbus A320-232 and a Boeing Company 737-8BK. Due to the similarity between the two occurrences, the second was investigated in conjunction with the 5 December 2010 occurrence to determine the existence or otherwise of any systemic safety issues.

From the evidence available, it was determined that common factors existed between the occurrences. Although the following findings relate directly to the 5 December 2010 occurrence, similar findings also apply to the 12 October 2011 occurrence. The findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The Departures North controller expected the two aircraft to climb at similar speeds, did not recognise the loss of separation assurance, and assigned both aircraft the same flight level.
- The Auto Release procedures at Melbourne Airport allowed for aircraft to be departed at or close to the separation minima, with no documented requirements to ensure jet aircraft would maintain a set climb speed or flight crews would advise air traffic control if the speed could not be achieved. *[Significant safety issue]*

Other safety factors

- The Departures North controller did not effectively manage the compromised separation recovery.
- Although the Melbourne Airport Auto Release procedures were based on those in use at Sydney Airport, the safety assessment report did not provide a detailed comparison of the procedures in use at both locations.

Other key findings

- The Boeing Company B737-7Q8 aircraft climbed at a reduced profile speed, approved under local speed restrictions, to meet the Standard Instrument Departure height requirement.
- The Boeing Company B767-338 flight crew maintained visual contact with the preceding aircraft.

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.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

Airservices Australia

Melbourne airport speed restrictions

Significant safety issue

The Auto Release procedures at Melbourne Airport allowed for aircraft to be departed at or close to the separation minima, with no controls in place to ensure aircraft would maintain a minimum speed or flight crews would advise air traffic control if the speed could not be achieved.

Action taken by Airservices Australia

Airservices Australia (Airservices) reported that in response to this safety issue, it had instigated a review of the relevant domestic and international documented requirements and discussed the current practices used at radar terminal area aerodromes in Australia. On the basis of that review, Airservices submitted a proposal to the Civil Aviation Safety Authority (CASA) on 23 March 2012 to amend the Australian *Aeronautical Information Publication* to establish a standard speed profile, and to ensure that pilots of jet aircraft notify air traffic control when operating at a significantly lower speed than stipulated in that profile.

Airservices stated that:

> Following review by CASA, Airservices will undertake industry consultation with the intent to align the implementation of the AIP amendment with the Aeronautical Information regulation and Control (AIRAC) date of 25 August 2012.
>
> As an interim measure, Airservices will investigate the implementation of procedures at Melbourne in accordance with our Safety Management System.

and advised that:

> Airservices considers our commitment to continually improving safety and reducing occurrences of this nature are demonstrated through the following key initiatives:
>
> Compromised separation recovery refresher training was mandated training for controllers during the financial year (FY) 2010/11. This training has again been mandated for completion during the FY 2011/12.
>
> During the FY 2011/12 Airservices will be delivering separation assurance training to all operational Air Traffic Controllers. The training will focus on the importance of separation assurance ATC techniques drawing on lessons learnt from previous occurrences. This training will also be made available to Airservices' Safety Investigators and Learning Academy Air Traffic Control Instructors.

ATSB assessment

The ATSB is satisfied that the action taken by the Airservices will satisfactorily address this safety issue.

SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included:

- Airservices Australia (Airservices)
- the aircraft operators.

References

- Manual of Air Traffic Services

- National ATS (Air Traffic Services) Procedures Manual
- Australian Aeronautical Information Publication
- En Route Supplement Australia.

Submissions

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

A draft of this report was provided to Airservices, the Departures controller and Shift Supervisor who were involved in the 5 December 2010 occurrence, the Aerodrome controller who was involved in the 12 October 2011 occurrence, the Civil Aviation Safety Authority and the aircraft operators.

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