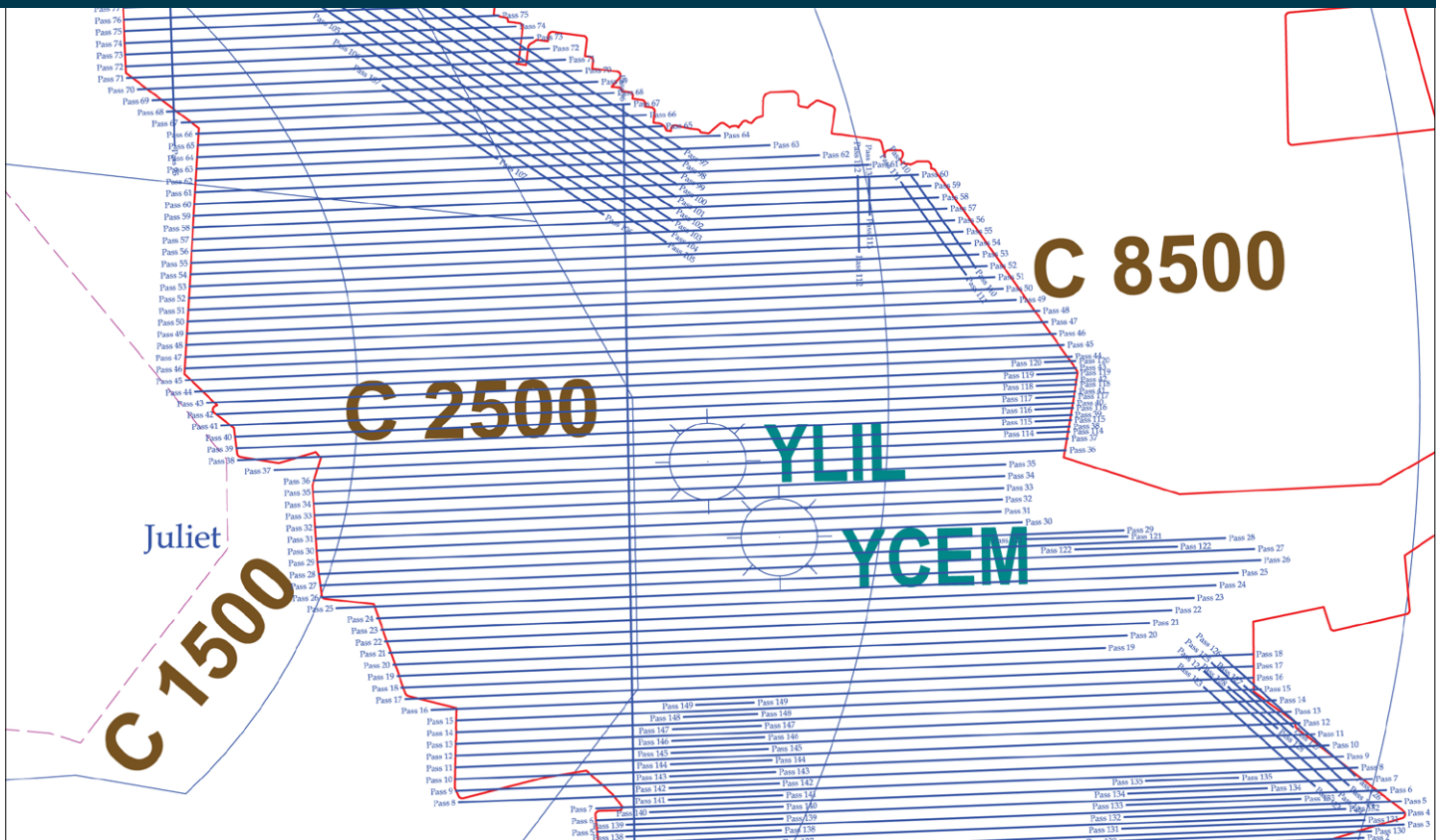




Loss of separation involving GAF Nomad N22C, VH-ATO and two Boeing 737s, VH-VZA and VH-TJY

17 km NE of Melbourne Airport, Victoria | 16 February 2012



Investigation

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Addendum

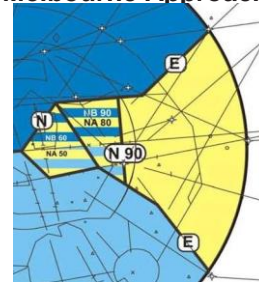
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Safety summary

What happened

On 16 February 2012, a Government Aircraft Factory N22C, registered VH-ATO (ATO), was conducting a survey flight north-east of Melbourne Airport, Victoria when it was involved in two losses of separation with two Boeing 737 aircraft. The 737s, registered VH-VZA (VZA) and VH-TJY (TJY), were on approach to runway 27 at Melbourne Airport. All of the aircraft were in receipt of an air traffic control service.

Melbourne Approach East airspace



Source: Airservices Australia

What the ATSB found

Although air traffic control intended that the pilot of ATO should keep his aircraft separate from VZA and TJY using visual observation (visual (pilot) separation), not all the prerequisites for using this separation method were met. As a result, the onus remained on air traffic control to maintain either a vertical separation standard of 1,000 ft or a surveillance separation standard of 3 NM (5.6 km). Losses of separation occurred when separation between ATO and VZA reduced to 1.5 NM (2.8 km) and 300 ft, and between ATO and TJY when separation reduced to 1.7 NM (3.2 km) and 700 ft.

The ATSB also identified that the controller was not aware of how specific aspects of the survey operation were to be conducted and therefore could not be assured that separation would be maintained.

Additionally, the ATSB identified that limited guidance and training was provided to controllers operating outside the towered environment in the application of the visual (pilot) separation standard, increasing the risk of the incorrect application of the standard.

What's been done as a result

In response to these occurrences, Airservices Australia amended the Manual of Air Traffic Services to include a number of factors to be considered by air traffic controllers prior to assigning visual (pilot) separation. In addition, the training package for Melbourne Airport arrivals controllers was reviewed and updated to ensure that visual separation, transfer of separation responsibilities and associated phraseologies were adequately addressed. Finally, the controller checking regime was strengthened to ensure that any identified training and/or knowledge deficiencies in relation to assigning visual separation, and their impact on controller performance, were addressed.

Safety message

The use of visual (pilot) separation transfers responsibility for separation between aircraft operating in controlled airspace from the air traffic controller to the flight crew of one of the aircraft. This occurrence highlights that, for the standard to be effective, all parties must have a shared understanding. Correct application of the visual (pilot) separation standard ensures that all involved flight crew are aware of their responsibility, thereby assuring that aircraft will not come into unsafe proximity.

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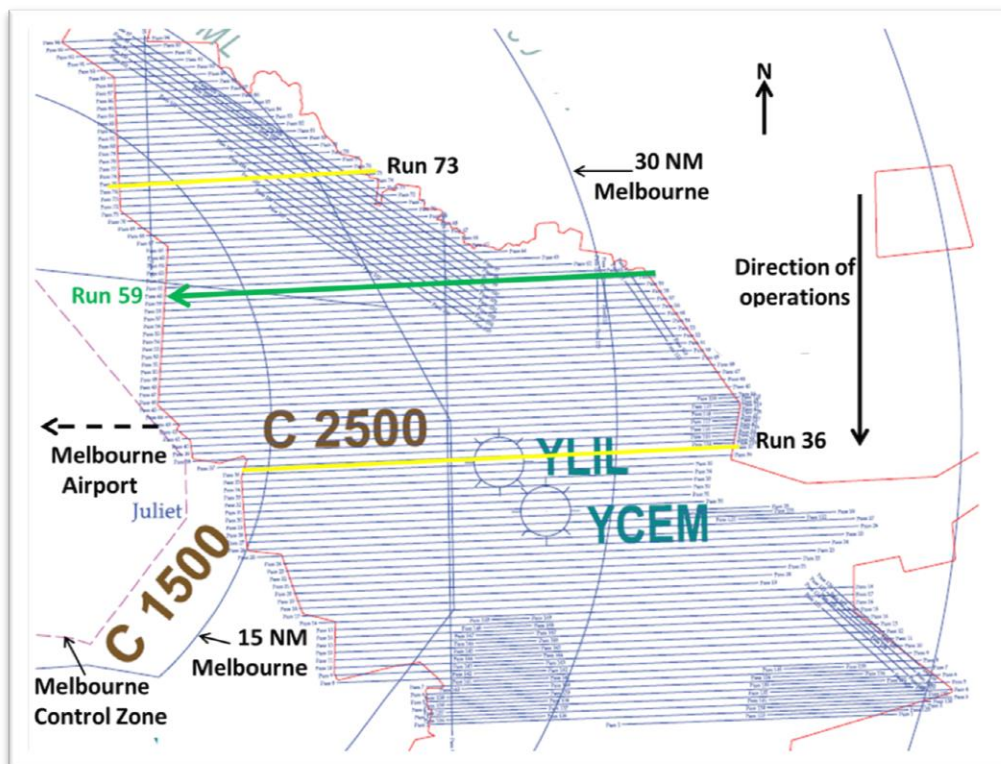
The occurrence

At 0700 Eastern Daylight-saving Time¹ on 16 February 2012, the pilot of a Government Aircraft Factory N22C, registered VH-ATO (ATO), emailed details of a proposed aerial survey operation to the air traffic control (ATC) centre at Melbourne Airport, Victoria. The survey was planned as a high priority task for the fire control authority and was time critical.

Maps of the intended survey area were included in the pilot’s email (Figure 1), together with a request to conduct operations through east-west aligned runs from Run 73 south to Run 36. The scale of the survey map was different to that of the surveillance display used by ATC and did not contain details of the direction or size of the repositioning turns at the end of each of the survey runs. The western end of the intended survey area infringed airspace used by any aircraft arriving from the north of Melbourne Airport that were being positioned to land on runway 27.

Following a telephone call to the Melbourne Terminal Area Coordinator (TAC) (see the section titled *Melbourne Airport information*), the pilot of ATO submitted an instrument flight rules (IFR)² flight plan for the survey flight. Although the flight was planned under the IFR, the pilot of ATO needed to remain in visual meteorological conditions (VMC)³ to maintain separation from terrain in the survey area. Fine weather conditions permitted operations in VMC.

Figure 1: Survey area map with relevant detail added

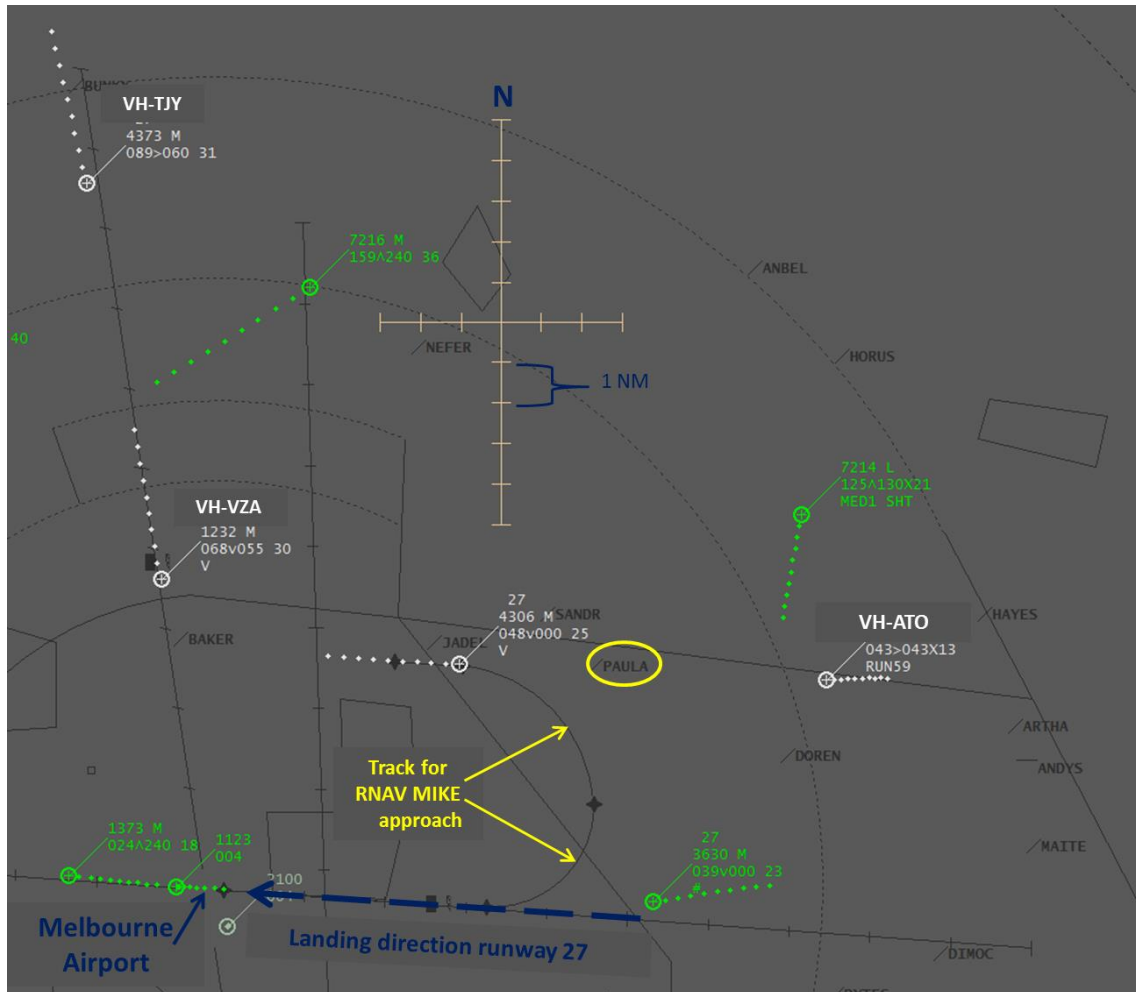


Source: Survey operator, modified by the ATSB

¹ Eastern Daylight-saving Time (EDT) was Coordinated Universal Time (UTC) + 11 hours.
² Instrument flight rules permit an aircraft to operate in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules. Procedures and training are significantly more complex as a pilot must demonstrate competency in IMC conditions, while controlling the aircraft solely by reference to instruments. IFR-capable aircraft have greater equipment and maintenance requirements.
³ Visual meteorological conditions (VMC) is an aviation flight category in which visual flight rules (VFR) flight is permitted – that is, conditions in which pilots have sufficient visibility to fly the aircraft maintaining visual separation from terrain and other aircraft.

When the TAC approved ATO's survey operations, runway 34⁴ was in use at Melbourne Airport. However, prior to the commencement of the survey operation, the runway in use at Melbourne changed to runway 27 (Figure 2). The TAC permitted the survey operation to continue following the change of runway. The pilot of ATO contacted the Melbourne Departures North controller (Controller 1) at 0957, prior to the first of the survey runs, and was advised that the changed runway configuration at Melbourne would impact on the survey operations, as the western sections of the survey area infringed the approach path of aircraft inbound to runway 27 from the north.

Figure 2: Surveillance display highlighting relevant detail, including the runway 27 landing direction (in blue)



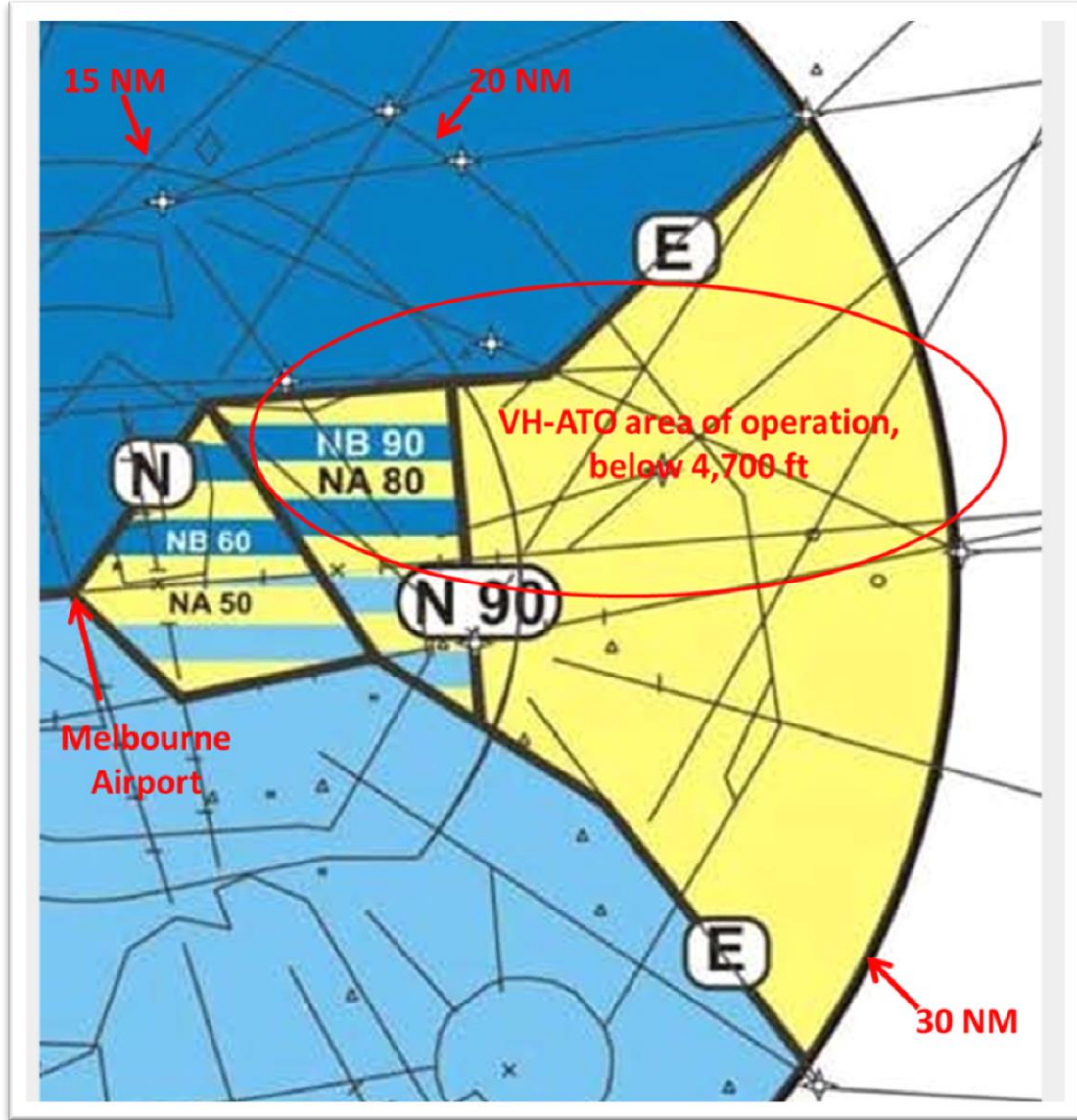
Source: Airservices Australia, modified by the ATSB

At 1020, ATO entered the Melbourne Approach East (MAE) airspace (Figure 3), which was under the jurisdiction of another controller. From this time, ATO's planned operations kept it in MAE airspace. A handover (see the section titled *Controller handovers*) of the MAE control position was conducted at 1127, during which the relinquishing controller advised the incoming controller (Controller 2) that ATO was becoming difficult to separate with aircraft inbound to Melbourne from

⁴ Runways were named by a number representing the magnetic heading of the runway.

the north via the ARBEY Standard Arrival Route (STAR)⁵ (see the section titled *Melbourne arrivals*).

Figure 3: Melbourne Approach East airspace depicted in yellow, showing the approximate position of the survey area



Source: Airservices Australia, modified by the ATSB

Following completion of a rest break at 1302, Controller 1 accepted responsibility for the MAE airspace from Controller 2. At that time, there were a number of scheduled passenger aircraft on approach to runway 27 and ATO was about 26 NM (48 km) to the north-east of Melbourne Airport tracking east on Run 60 (immediately north of Run 59 in Figure 1). Another aircraft within the MAE airspace was conducting a practice instrument approach into Essendon Airport and was just to the south of Melbourne Airport. During the handover of responsibility, Controller 1 was advised of ATO's operating altitude. No advice on the western extent of ATO's runs, or the direction and size of the aircraft's turns from the end of one run to the start of the next was provided, nor was that

⁵ STARs are designed to satisfy the requirements of noise abatement procedures, segregate airspace, maximise traffic handling capacity and reduce in pilot/controller workload and air/ground communications. They also assure tracking and stabilised approaches by allowing controllers and flight crews to base separation and profile on published tracks.

level of detail stipulated in the controller handover checklist (see the section titled *Controller handovers*).

At 1314, while ATO was 21 NM (39 km) north-east of Melbourne Airport and tracking west at the cleared altitude of 4,300 ft, a number of scheduled passenger flights were tracking south and east to position for landing on runway 27. As the use of surveillance or vertical separation would have been difficult to apply in the circumstances (see the section titled *Aircraft information*), Controller 1, anticipated the need to use visual (pilot) separation (see the section titled *Separation*) between ATO and the passenger aircraft. In preparation, Controller 1 advised the pilot of ATO of the requirement to sight these aircraft (Figure 2 – relevant aircraft in white). The controller additionally queried the pilot of ATO a number of times to obtain detail of his intended tracking.

At 1315, in response to Controller 1's request, the pilot of ATO advised that there were 8 NM (15 km) remaining on the westerly-oriented Run 59 prior to the need to turn (Figure 1). At 1316, the pilot of a Boeing 737 aircraft, registered VH-VZA (VZA), contacted MAE when 12 NM (22 km) north of Melbourne and was assigned 5,500 ft on an area navigation (RNAV)⁶ MIKE runway 27 approach via the ARBEY STAR. Shortly after, Controller 1 provided traffic information on VZA to the pilot of ATO. At that time VZA was 9 NM (17 km) north of Melbourne Airport and about 11 NM (20 km) west of ATO.

In preparation to establish visual (pilot) separation between ATO and VZA, Controller 1 identified the arrival path for runway 27 to the pilot of ATO by requiring that he sight an aircraft that was tracking via the STAR ahead of VZA. At 1317, after confirming that the pilot of ATO could remain visually clear of the runway 27 arrival path, Controller 1 cleared the flight crew of VZA to descend through ATO's operating altitude. At that point, a loss of separation assurance (LOSA)⁷ occurred between ATO and VZA as visual (pilot) separation had not been applied in accordance with the requirements of that standard – the pilot of ATO had not reported having VZA in sight, and the phrase 'maintain separation with' had not been used. Thirty-six seconds later, when VZA was 7 NM (13 km) directly ahead of, and 1,900 ft above ATO, the pilot of ATO reported VZA in sight.

At 1318, an ATC system Short Term Conflict Alert (STCA) (see the section titled *Compromised separation recovery*) activated in respect of ATO and VZA with 7 NM (13 km) lateral and 800 ft vertical separation between the aircraft. Believing that the responsibility for separation had been transferred to the pilot, Controller 1 took no action. Soon after, the flight crew of VZA turned right on the STAR.

One minute later, a loss of separation (LOS)⁸ (see the section titled *Separation*) occurred between ATO and VZA when the existing separation standard of 3 NM (5.6 km) or 1,000 ft was infringed just before ATO completed Run 59 (Figure 4). The separation standard was infringed for 45 seconds and, at their closest point, the separation of the aircraft reduced to 1.5 NM (2.8 km) and 300 ft with the aircraft flying in opposite directions.

Shortly after the 3 NM (5.6 km) surveillance separation standard was re-established, the flight crew of VZA reported that they had responded to a traffic alert and collision avoidance system⁹

⁶ RNAV – An instrument approach that uses the global navigation satellite system (GNSS) and computerised on-board systems to provide accurate navigation without the need for ground-based systems.

⁷ LOSA – A 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.

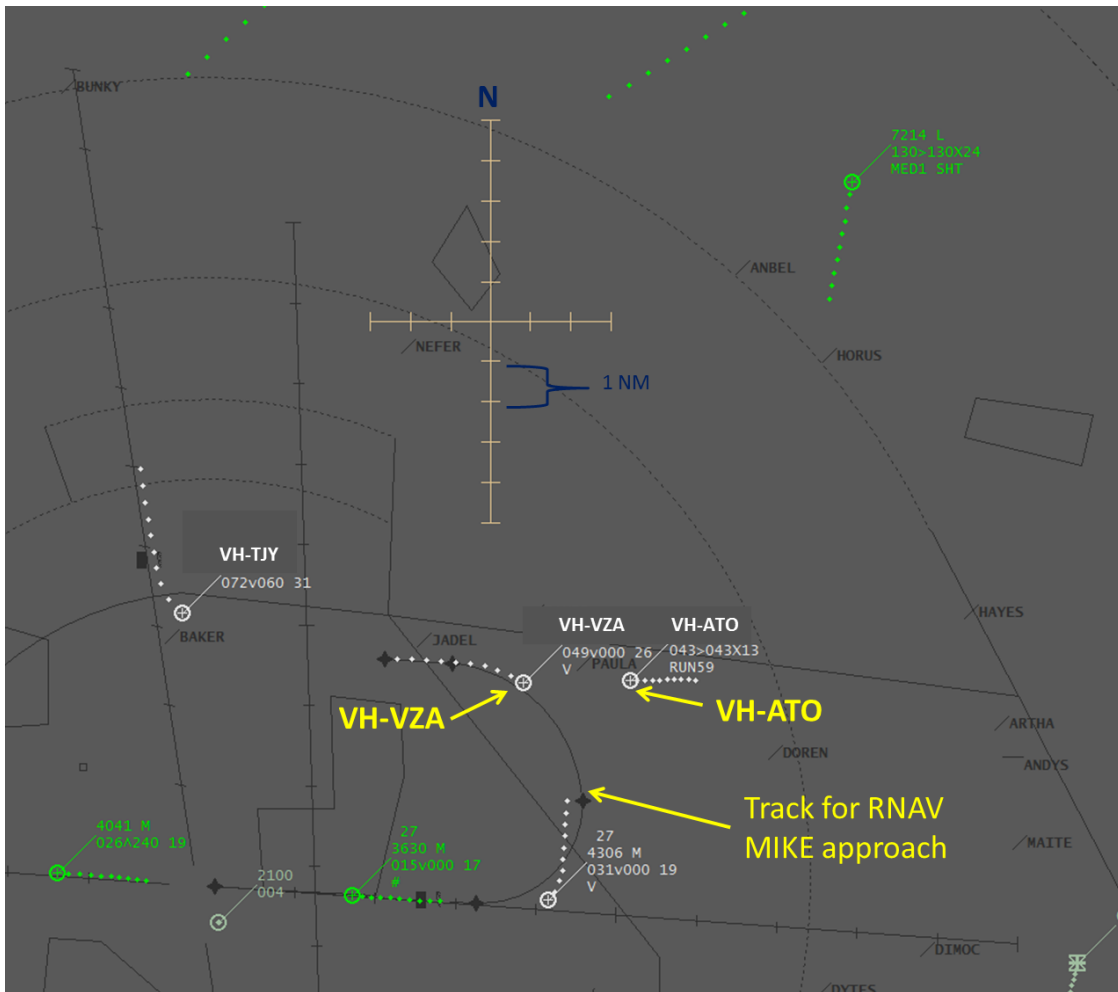
⁸ A loss of separation (LOS) was an occurrence in which two or more aircraft came into such close proximity that a threat to the safety of the aircraft existed, or might have existed, in airspace where the aircraft was subject to an air traffic separation standard.

⁹ Traffic alert and 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 a warning of possible collision risks.

resolution advisory (RA)¹⁰ to ‘adjust vertical speed’. This required the pilot to change the aircraft’s rate of descent. The controller confirmed that VZA was now clear of the conflict and reported the RA to the supervisor.

As ATO completed Run 59 the aircraft entered a right turn and advised the controller that he was ‘...turning right, keeping away from the traffic as much as possible.’ Controller 1 advised the pilot of ATO that there was another inbound 737 aircraft, registered VH-TJY (TJY), about 8 NM (15 km) in their 12 o’clock position,¹¹ also on the ARBEY STAR, and asked if ATO would remain visually clear of that aircraft’s track. The pilot responded in the affirmative and stopped the right turn on a northerly heading. At that time, the crew of TJY were not monitoring Controller 1’s frequency as the aircraft had not yet entered MAE airspace (Figure 3).

Figure 4: Surveillance display highlighting VH-ATO and VH-VZA, and the track for the RNAV MIKE approach



Source: Airservices Australia, modified by the ATSB

The flight crew of TJY contacted Controller 1 when their aircraft was 6 NM (11 km) north-east of Melbourne Airport maintaining 6,000 ft and 8 NM (15 km) from ATO. TJY was 6 NM (11 km) from ATO when Controller 1 cleared the aircraft to 3,000 ft resulting in a LOSA as, though ATO was on

¹⁰ TCAS Resolution Advisory (RA), when an RA is issued pilots are expected to respond immediately to the RA unless doing so would jeopardize the safe operation of the flight.

¹¹ The clock code is used to denote the direction of an aircraft or surface feature relative to the current heading of the observer’s aircraft, expressed in terms of position on an analogue clock face. Twelve o’clock is ahead while an aircraft observed abeam to the left would be said to be at 9 o’clock.

a northerly heading and tracking away from the path of TJY, the controller did not know the specific tracking intentions of ATO's pilot.

At 1320, when TJY was 3 NM (5.6 km) south-west of ATO, ATO commenced turning left towards TJY (Figure 5). In response, Controller 1 asked the pilot of ATO if he had the 737 in sight. When the pilot of ATO reported in the negative, the controller initiated compromised separation recovery actions and immediately instructed the pilot of ATO to fly a heading of 210°. Shortly after, the STCA activated and there was a LOS, as the altitude between the two aircraft reduced to less than 1,000 ft while the aircraft were less than 3 NM (5.6 km) apart. The pilot did not read back the heading instruction, instead advising the controller that TJY was sighted and well clear. Controller 1 did not restate or cancel the heading instruction and the pilot of ATO continued the left turn with TJY in sight.

Controller 1 reported that, as the pilot of ATO had sighted the 737, he believed that visual (pilot) separation was in place and therefore no further compromised separation recovery action was required. However, the LOS remained as the correct visual (pilot) separation phraseology had not been used, and the flight crew of TJY had not been issued traffic information on ATO or advised that the pilot of ATO had been assigned responsibility for separation. The LOS existed for 51 seconds, with separation reducing to 1.7 NM (3.2 km) and 700 ft before being re-established through the divergent tracking of the aircraft.

Figure 5: Surveillance display highlighting VH-ATO and VH-TJY and the tracking points for the ARBEY STAR



Source: Airservices Australia, modified by the ATSB

Context

Personnel information

Controller 1 was issued with the appropriate endorsements to provide an air traffic service for aircraft operating within 30 NM (56 km) of Melbourne Airport by Airservices Australia (Airservices) in June 2010. At the time of the occurrences, Controller 1 had jurisdiction over the airspace to the east of Melbourne (see the section titled *Airspace*). Controller 1 was on the second morning shift following a single rostered day off, starting at 0700 and finishing at 1415. A review of the controller's roster by the Australian Transport Safety Bureau (ATSB) indicated that it was unlikely to have resulted in work-induced fatigue.

Airservices' investigation following these two losses of separation (LOS) found that Controller 1 was unaware of one of the components of the visual (pilot) separation standard. Specifically, the controller was unaware of the need to advise the pilot of an instrument flight rules (IFR) flight that separation responsibility had been assigned to the pilot of another aircraft.

The controller's 6-monthly checks and yearly examinations had not identified a training or knowledge deficiency.

Aircraft information

Both Boeing 737 aircraft, registered VH-VZA (VZA) and VH-TJY (TJY), were fitted with traffic alert and collision avoidance system (TCAS) equipment. Although VH-ATO (ATO) was not fitted with TCAS, the aircraft's transponder was operating normally, allowing the TCAS units in the 737 aircraft to detect the survey aircraft, monitor its altitude and range, and advise of its location or indicate collision avoidance action if required.

The type of survey being conducted by ATO relied on the use of pulsed laser beams. To achieve the high resolution data required from the survey, ATO had to be flown at a specific height above the ground. As the laser beams posed a hazard in the airspace directly below the survey aircraft, Controller 1 did not have the option of clearing the arriving 737 aircraft to operate below ATO's cleared level of 4,300 ft.

Melbourne Airport information

Airspace

The Melbourne Terminal Control Unit (TCU) had jurisdiction over aircraft in Class C airspace¹² within 30 NM (56 km) of Melbourne Airport up to flight level (FL)¹³ 245, except that airspace associated with the Melbourne and Essendon air traffic control (ATC) towers. The airspace, known as the Melbourne Terminal Airspace, was within radar coverage and was divided into three areas of responsibility that varied according to the runway configuration at Melbourne. At the time of the occurrences, ATO, VZA and TJY were operating in airspace under the jurisdiction of the Melbourne Approach East (MAE) controller (Figure 3).

¹² Class C: This is the controlled airspace surrounding major airports. Both IFR and VFR flights are permitted and must communicate with air traffic control. IFR aircraft are positively separated from both IFR and VFR aircraft. VFR aircraft are provided traffic information on other VFR aircraft.

¹³ At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL245 equates to 24,500 ft.

Survey operations

Aerial survey and photographic operations were a regular operation in the vicinity of capital city airports and the Australian Aeronautical Information Publication (AIP)¹⁴ outlined the following requirements for those operations:¹⁵

Pilots and operators intending to conduct aerial photography or survey operations in controlled airspace should liaise with the ATC unit responsible for the area(s) concerned prior to submitting flight plans. ATC clearance limitations and restrictions on times, tracks and/or levels, which could inhibit the proposed operation(s), may apply in the desired airspace. Preflight approval will enable pilots to plan tasks accordingly, thus minimising disruption to programs.

The En Route Supplement Australia (ERSA)¹⁶ Melbourne Airport entry noted that pilots planning aerial work within the Melbourne Terminal Airspace required prior ATC approval and that a time slot was to be obtained by phoning the Melbourne traffic manager, which was a role of the Terminal Area Coordinator (TAC).

Melbourne arrivals

Aircraft arriving at Melbourne were sequenced to ensure an orderly landing flow and allow for aircraft departures. A number of Standard Arrival Routes (STARs) linked an aircraft's track to a location at or near the destination airport. The arriving aircraft, VZA and TJY, were tracking via the runway 27 ARBEY STAR that routed the aircraft from the north to a position north-east of Melbourne, where they were cleared for an approach.

When runway 34 was active, aircraft arriving at Melbourne would normally track to the west of the airport, well clear of ATO's survey area. Aircraft approaching runway 34 from the east would be at an altitude vertically separated from ATO's cleared operating altitude of 4,300 ft. With runway 27 active, arriving aircraft tracked through the survey area, particularly when ATO was being repositioned at the completion of each westbound survey run.

The flight crew of VZA were cleared via the area navigation (RNAV) MIKE approach, requiring the aircraft to be flown in an arc from the end point of the STAR, descending to not below 2,200 ft until the aircraft was aligned with runway 27 (Figure 4), and then to land. The flight crew of TJY were cleared via a visual approach from the end point of the STAR that required the flight crew to track via IFR position PAULA to a position where the aircraft was aligned with runway 27 (Figure 5), while descending to not below 1,500 ft, before completing the approach with visual reference to the ground.

The STAR being conducted by TJY brought that aircraft into closer proximity to the survey run being conducted by ATO than the STAR conducted by VZA.

Organisational and management information

Separation

Separation is the concept of ensuring an aircraft maintains a prescribed minimum distance from another aircraft or object. Within controlled airspace, ATC provided separation using standards specified in the Manual of Standards Part 172¹⁷ and listed in the Manual of Air Traffic Services

¹⁴ 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.

¹⁵ AIP EN ROUTE (ENR) 66 – SPECIAL REQUIREMENTS, paragraph 66.7 *Aerial Photography and Survey Operations*.

¹⁶ 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.

¹⁷ Manual of Standards (MOS) Part 172 *Air Traffic Services* outlined the requirements and standards for air traffic services in compliance with Civil Aviation Safety Regulation (CASR) 1998 Part 172 *Air Traffic Service Providers*, including aircraft separation.

(MATS).¹⁸ Only one separation standard was required to be in place between aircraft at any one time, but another standard had to be established by a controller prior to the current separation minimum being infringed.

The objectives of ATC included the prevention of collisions between aircraft, the expedition and maintenance of an orderly traffic flow and the provision of advice and information useful for the safe and efficient conduct of flights. Controllers based the method of separation on operational advantage and the type of separation used depended on a number of factors. In the case of IFR aircraft in the MAE airspace, a controller could use a surveillance standard of 3 NM (5.6 km), a vertical standard of 1,000 ft or a visual (pilot) standard.

The use of visual (pilot) separation transferred separation responsibility from ATC to the pilot of an aircraft and required that pilot to ensure their aircraft remained clear of other aircraft, without specifying any minimum separation parameters. The use of that standard therefore allowed a reduction in the parameters that would have been in place for a controller-managed standard. Responsibility for visual (pilot) separation could only be assigned to a pilot when affected aircraft were operating at or below 10,000 ft and the pilot of one of the aircraft had reported sighting the other aircraft and was instructed by a controller to maintain visual separation with, pass behind, or follow the other aircraft. To establish the visual (pilot) separation method, the controller was required to use the following phraseology:¹⁹

MAINTAIN SEPARATION WITH (or PASS BEHIND or FOLLOW) (aircraft type or identification)
[instructions or restriction]

Further, when a crew was instructed to maintain separation from or pass behind an IFR aircraft, the controller was required to issue traffic information to the IFR aircraft, including advice of the assignment of responsibility for separation to the other aircraft. Failure to use the correct phraseology or issue traffic information to IFR aircraft meant that a visual separation standard did not exist and, in the absence of another separation standard, a LOS.

Separation assurance

MATS stipulated that separation assurance, both strategic and tactical, must be applied by ATC and defined strategic separation assurance as:

Strategic separation assurance is the designing of airspace, air routes, air traffic management plans and air traffic control practices, to reduce the likelihood that aircraft will come into conflict, particularly where traffic frequency congestion or system performance, amongst other considerations, may impair control actions.

Tactical separation assurance was the responsibility of individual controllers and emphasised the importance of traffic planning and conflict avoidance, rather than conflict resolution. Controllers were required to proactively apply separation to avoid rather than resolve conflicts and plan traffic to guarantee rather than achieve separation. Once executed, controllers are required to monitor the situation to ensure that the plan and execution are effective.

Supervision

The TAC supervised the TCU and the associated airspace to ensure safe, effective and efficient operations, taking into consideration a number of operational issues. These included the runway in use at Melbourne and overseeing aerial work, such as survey flights, to maximise utilisation of

¹⁸ MATS was a joint Department of Defence (Defence) and Airservices document, based on the rules published in MOS Part 172 and the International Civil Aviation Organization standards and recommended practices, combined with the rules specified by Airservices and Defence. The requirements and obligations in MATS were in accordance with provisions and regulations of the *Air Navigation Act 1920*, the *Air Services Act 1995*, and Defence Instructions. MATS was not publically available.

¹⁹ AIP GENERAL (GEN) 3.4 – COMMUNICATION SERVICES, Section 5 *PHRASEOLOGIES*, paragraph 5.5 *General Phrases* 2.p.

the airspace. At the time of the two LOSs, the TAC was absent from the TCU and the responsibilities of that position had reverted to the Operations Room Manager.

Controller handovers

The process to be followed when one controller handed responsibility for an ATC position to another controller was formalised in a handover checklist. This included a requirement for the handing-over controller to brief the taking-over controller on any aircraft relevant to the affected ATC position. The checklist did not detail any specific aircraft characteristics that were required to be included in the brief.

Priorities

The AIP stated that an aircraft first able to use the airspace in the normal course of its operations would be given priority. However, in a capital city terminal area during periods when all operations could not be accommodated, priority would be based on operation type.²⁰ This included scheduled commercial air transport operations being given priority over survey flights.

Controller 1 reported that, although a survey aircraft was not a priority over scheduled commercial air transport aircraft, once a survey aircraft had started a run, they considered that there was a level of expectancy that the run be completed, as otherwise the entire run would need to be repeated. In addition, as the TAC had approved ATO to operate in that area, Controller 1 reported feeling that the survey operation should be facilitated to the extent possible.

Compromised separation recovery

The Short Term Conflict Alert (STCA) was an ATC system-generated alert that required immediate controller intervention. As the alerting system could not detect if the visual (pilot) separation standard was in use, following receipt of a STCA, the controller was required to assess its validity.

If the controller assessed the STCA as valid and that aircraft were, or would be, in unsafe proximity, the controller was required to issue a safety alert. A safety alert was to be issued by ATC with the following prescribed phraseology:

(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

If the STCA was assessed as valid, but the criteria for a safety alert were not present, the controller was to issue traffic information unless the visual (pilot) separation standard was in place. Traffic information was to be concise, and include relevant information to alert a pilot to traffic that might be in proximity to the aircraft's position, or intended flight path, and to help the pilot avoid a collision. Further, the AIP stated that, when a separation standard did not exist, ATC would provide traffic information.²¹

Training and endorsements

ATC training for the TCU environment was a combination of theory, simulator and on-the-job, with a recurring 6-monthly check following an initial endorsement check. Controllers also completed written examinations annually and refresher training as required – for example, on actions to be taken when compromised separation was identified.

Following an incident, the controller's manager was required to review the incident and assess the controller's competency to determine if their endorsement should be withdrawn. If the review identified controller attribution, a remedial process could be put in place, including a formal

²⁰ AIP ENR 1.4 – ATS AIRSPACE CLASSIFICATION, Section 10 *REGULATION OF FLIGHT – ASSESSMENT OF PRIORITIES*, paragraph 10.3.

²¹ AIP GEN 3.3 – AIR TRAFFIC SERVICES, Section 2 *FLIGHT INFORMATION SERVICES (FIS)*, paragraph 2.14 *Traffic Information in Controlled Airspace* 2.14.1.

program of re-training and re-assessment of controller competence. If assessed as competent, the controller's endorsement would be reinstated.

Airservices Australia internal investigation

An investigation of these and two similar occurrences in 2012 was conducted by Airservices. That investigation identified the need to review a number of guidance and training issues in relation to the use of visual (pilot) separation by controllers working in the terminal and en route environments.

Previous occurrences

A review of the ATSB occurrence database identified six previous LOS occurrences involving the use by a controller of visual (pilot) separation in the 10 years prior to these events, and two in 2013. Of these, two were investigated by the ATSB:²²

- Investigation 200402648. In its investigation of a 2004 LOS near Hamilton Island, Queensland the ATSB found that the prescribed phraseology for the pilot to sight and to maintain visual separation with, pass behind, or follow the other aircraft was not used, nor was the pilot of an IFR aircraft advised that the pilot of another aircraft had been assigned responsibility for separation.
- Investigation AO-2010-014. In its investigation of a 2010 LOS occurrence near Perth, Western Australia the ATSB found that the pilot of an IFR aircraft was advised that the pilot of another aircraft had been assigned responsibility for separation only after the surveillance standard of 3 NM (5.6 km) had been compromised.

The controllers involved in the 2004 occurrence investigated by the ATSB, and four of the other occurrences, were employed by Airservices. The Airservices investigations of these occurrences²³ found instances where the pilot of an IFR aircraft had not been advised that the responsibility for separation had been assigned to a pilot of another aircraft, or that incorrect phraseology had been used.

The controllers involved in the remaining three occurrences were employed by the Department of Defence (Defence). The Defence investigation of these occurrences found that, in each case, the pilot of an IFR aircraft was not advised that responsibility for separation had been assigned to the pilot of another aircraft.

The ATSB research report *AR-2012-034 Loss of separation between aircraft in Australian airspace – January 2008 to June 2012*, noted that about 40 per cent of all losses of procedural and visual separation involving an ATC action included communication issues. The report also found that inadequate controller knowledge, skills, or experience, and insufficient training and assessment of controllers were factors in a number of occurrences.

²² Available at www.atsb.gov.au.

²³ These did not include the two 2012 occurrences discussed in the section titled *Airservices Australia internal investigation*.

Safety analysis

When the pilot of VH-ATO (ATO) was first approved to conduct the survey operations, lateral and vertical separation existed between it and aircraft arriving at Melbourne Airport via runway 34. When runway 27 became the active runway however, the western part of the survey area infringed airspace used by aircraft arriving from the north and being positioned to land. Continuation of the survey operation under these circumstances required the use of visual (pilot) separation whenever arriving aircraft came in proximity to ATO as it approached the end of its westbound survey run, or re-positioned from that position for the next eastbound run.

Use of visual (pilot) separation transferred responsibility for separation between affected aircraft from the air traffic controller to the flight crew of one of the aircraft. Correct application of the visual (pilot) separation required the controller to identify the aircraft that was to be avoided to the crew responsible for separation, together with an instruction that they maintain separation with that aircraft. That crew was required to confirm sighting the other aircraft before transfer of separation responsibility had effect. In addition, if the aircraft to be avoided was operating under the instrument flight rules (IFR), its crew was to be advised that an aircraft in proximity had been assigned separation responsibility and would be remaining clear of them. To avoid confusion in giving effect to this separation standard, specific controller phraseology was required. If these requirements were not met, visual (pilot) separation would not be in place and responsibility would remain with the controller to ensure maintenance of either the 3 NM (5.6 km) lateral or 1,000 ft vertical separation standard.

In anticipation of using visual (pilot) separation between ATO and both VH-VZA (VZA) and VH-TJY (TJY) as they tracked for runway 27 via the Standard Arrival Route (STAR), the controller asked the pilot of ATO to report sighting a preceding aircraft that was also following the STAR. The pilot reported that aircraft in sight and, after observing the track taken by that aircraft, advised the controller that ATO could remain visually clear of the arrival route. While the controller's actions illustrated the intended arrival path of both VZA and TJY to the pilot of ATO, the visual (pilot) separation standard did not apply as the associated specific phraseology was not used. As a result, when the flight crew of VZA was cleared to descend through the level occupied by ATO, there was a loss of separation assurance. That was followed by a loss of separation (LOS) when the 3 NM (5.6 km) lateral and/or 1,000 ft vertical separation standard between the two aircraft was infringed.

Subsequently, as TJY approached the western part of the survey area, the pilot of ATO was tracking in a northerly direction away from the STAR, having reported to the controller that he was keeping away from the traffic. However, the two aircraft came into proximity when ATO turned left and towards TJY, in preparation to commence another survey run. On observing this turn the controller immediately provided compromised separation recovery instructions to the pilot of ATO. However, once the pilot of ATO reported TJY in sight, he was not instructed to maintain separation with that aircraft, nor was the crew of TJY advised that separation responsibility had been transferred from the controller to the pilot of another aircraft. As these visual (pilot) separation standard requirements had not been met, there was a second LOS.

Contributing to the second LOS was that the controller was unaware of the specific details of ATO's track at the completion of the westbound survey runs. The controller had not had the opportunity to observe an entire westbound run and the scale and detail of the survey maps provided in the pilot's email did not assist the clear identification of the survey run end points nor the procedure turns being used. Although the controller sought tracking information from the pilot, the provision of that information in either the documentation provided by the survey operator, or in the handover from Controller 2, would have better prepared the controller to assure separation.

Analysis by the Australian Transport Safety Bureau of previous LOS occurrences in Australian airspace identified that a number involved the incorrect application of visual (pilot) separation due to factors including inadequate controller knowledge, skills, or experience, and insufficient training

and assessment of controllers. That conclusion was consistent with the findings of the internal investigation of these occurrences conducted by Airservices Australia (Airservices). Specifically, that investigation identified deficiencies in the guidance or training provided to their controllers operating outside the towered environment in the application of visual (pilot) separation. In response to those findings, Airservices has taken proactive action to improve safety in this area.

Findings

From the evidence available, the following findings are made with respect to the losses of separation that occurred between a Government Aircraft Factory N22C, registered VH-ATO, and two Boeing 737 aircraft, registered VH-VZA and VH-TJY, about 17 km north-east of Melbourne Airport, Victoria on 16 February 2012. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- All of the components of the visual (pilot) separation standard were not correctly applied, resulting in two losses of separation when the distance between the affected aircraft reduced to less than the stipulated 3 NM (5.6 km) and/or 1,000 ft separation standard.
- The controller was unaware of the intended tracking of the survey aircraft at the completion of its westbound survey runs and therefore could not be assured that separation would be maintained with other traffic.

Other factors that increased risk

- **The limited guidance and training provided to controllers operating outside the towered environment in the application of the visual (pilot) separation standard increased the risk of the incorrect application of the standard. [Safety issue]**

Safety issues and actions

The safety issue identified during this investigation is 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.

Application of visual (pilot) separation standard

Number:	AO-2012-029-SI-01
Issue owner:	Airservices Australia
Operation affected:	Aviation: Airspace management
Who it affects:	All controllers operating outside the towered environment

Safety issue description:

The limited guidance and training provided to controllers operating outside the towered environment in the application of the visual (pilot) separation standard increased the risk of the incorrect application of the standard.

Proactive safety action taken by Airservices Australia

Action number: AO-2012-029-NSA-039

Airservices Australia (Airservices) advised of the following action in response to this safety issue:

In order to address the safety issue, Airservices has amended the Manual of Air Traffic Services (MATS), specifically Section 10.8.1.1.1, to include a number of factors to be considered by ATC [air traffic control] prior to assigning visual separation responsibility to a pilot...

In addition, the Melbourne TMA [Terminal Control Area] training package was reviewed and updated to ensure that visual separation, transfer of separation responsibilities and associated phraseologies are adequately addressed...

Airservices ATC checking regime was also strengthened to ensure any identified training and/or knowledge deficiencies in relation to assigning visual separation and [their] impact on ATC performance are addressed appropriately. This includes emphasising the importance of relevant questioning during ATC performance checks as part of Airservices Compliance and Standardisation Supervisor (C&SS) meetings and workshops held in October 2012.

Current status of safety issue:

Issue status: Adequately addressed

Justification: The ATSB is satisfied that the actions taken by Airservices have adequately addressed the safety issue.

Additional safety action

The ATSB did not identify any organisational or systemic issues in respect of the conduct of the survey operation that might adversely affect the future safety of aviation operations. However, the ATSB has been advised of the following proactive safety action in response to this occurrence.

Proactive safety action taken by the operator of VH-ATO

The operator intends adding the findings from this investigation report to its incident register. The findings will then be incorporated into the operator's training regime as an educational tool for flight staff, survey planners and management in high traffic environment operations.

General details

Occurrence details

Date and time:	16 February 2012 – 1319 EDT	
Occurrence category:	Serious incident	
Primary occurrence type:	Loss of separation	
Location:	17 km north-east of Melbourne Airport, Victoria	
	Latitude: 37° 33.83' S	Longitude: 144° 58.70' E

Aircraft details – VH-ATO

Manufacturer and model:	Government Aircraft Factory N22C
Registration:	VH-ATO
Serial number:	108
Type of operation:	Aerial Work – Survey/photography

Aircraft details – VH-TJY

Manufacturer and model:	Boeing 737-476
Registration:	VH-TJY
Serial number:	28151
Type of operation:	Air Transport High Capacity – Passenger

Aircraft details – VH-VZA

Manufacturer and model:	Boeing 737-838
Registration:	VH-VZA
Serial number:	34195
Type of operation:	Air Transport High Capacity – Passenger

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the operator and pilot of VH-ATO (ATO)
- Airservices Australia (Airservices).

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 Civil Aviation Safety Authority (CASA), Airservices, the pilot and operator of ATO, the operator of VH-VZA and VH-TJY, the Department of Defence and Controller 1.

Submissions were received from CASA, Airservices and the operator of ATO. The submissions were 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 fare-paying passenger operations.

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.

Investigation

ATSB Transport Safety Report Aviation Occurrence Investigation

Loss of separation involving GAF Nomad N22C, VH-ATO and two Boeing 737s, VH-VZA and VH-TJY, 17 km NE of Melbourne Airport Victoria on 16 February 2012

AO-2012-029

Final – 29 August 2014

Australian Transport Safety Bureau

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