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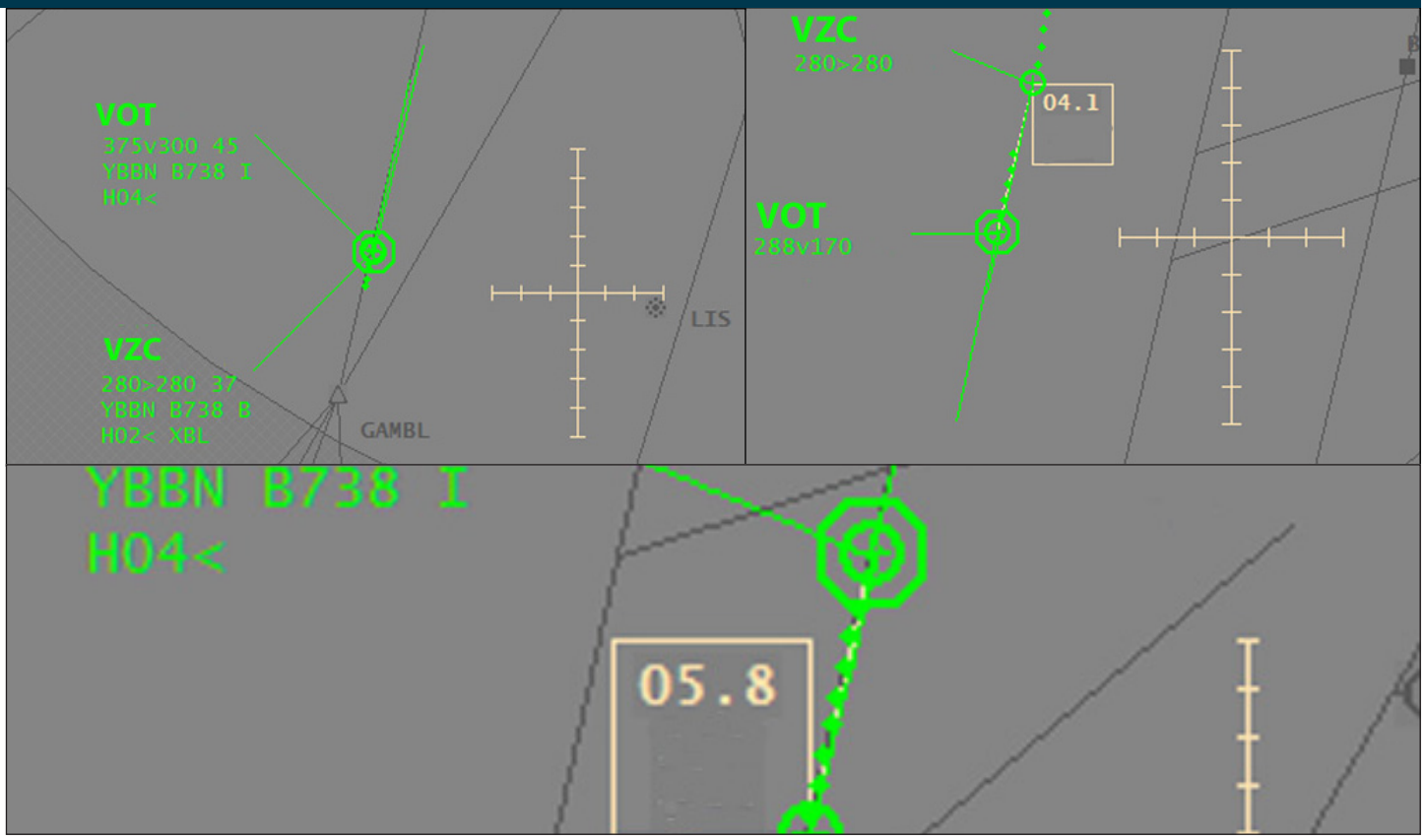
Loss of separation involving Boeing 737, VH-VZC and Boeing 737, VH-VOT at BLAKA

93 km south-south-east of Brisbane Airport, Queensland | 29 July 2011



Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2011-090
Final – 6 March 2013

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation
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Loss of separation involving Boeing 737, VH-VZC and Boeing 737, VH-VOT at BLAKA 93 km south-south-east of Brisbane Airport, Queensland, 29 July 2011

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

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SAFETY SUMMARY

What happened

On 29 July 2011, at 0756 Eastern Standard Time, a loss of separation occurred between a Boeing Company 737-838 aircraft, registered VH-VZC (VZC), and a Boeing Company 737-8FE aircraft, registered VH-VOT (VOT), in the holding pattern at BLAKA, an IFR reporting point south-west of Brisbane, Queensland. The aircraft were inbound to Brisbane on the same air route, with a requirement to hold at BLAKA for sequencing.

The air traffic controller, who had been recently endorsed on the control position, did not identify that the sequence in which the two aircraft entered the holding pattern had changed, and twice assigned VOT descent through the flight level of VZC. The flight crew of VZC identified the confliction and queried the controller, who then took action to recover the compromised separation situation. Separation reduced to 3.9 NM (7.2 km) and 400 ft. The required separation standard was either 5 NM (9.3 km) or 1,000 ft.

What the ATSB found

The Australian Transport Safety Bureau (ATSB) identified that the controller received a reduced amount of on-the-job training, was allocated multiple training officers, and was required to intermittently staff another control position during and immediately following their training on the Gold Coast en route sector. As a result, the controller probably had not consolidated effective control techniques for the sector, particularly for high workload situations.

The ATSB also found that, even though the quality of the controller's training had been affected by several factors, the controller's planned on-the-job training period had been reduced from 6 weeks to 4 weeks. More importantly, there was no requirement for a systematic risk assessment to be conducted and documented when the planned amount of training for a controller was reduced.

What has been done to fix it

Airservices Australia advised that it would develop a training variation form to systematically assess risk associated with amendments to the planned length of controller training programs, and completion of the form required the involvement of the controller's line manager and the Operational Training Manager. Airservices also indicated several other proposed enhancements to its controller training.

Safety message

In order for the training of operational personnel to be managed safely and effectively, organisations should have a structured risk assessment process in place to evaluate proposed changes to a training program.

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Loss of separation involving Boeing 737, VH-VZC and Boeing 737, VH-VOT, at BLAKA, 93 km south-south-east of Brisbane Airport, Queensland, 29 July 2011

Prepared By

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THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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 safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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 appropriate, or to raise general awareness of important safety information in the industry. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

TERMINOLOGY USED IN THIS REPORT

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing safety factor: a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor: a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

Other key finding: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

Safety issue: a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Risk level: the ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

Safety action: the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

FACTUAL INFORMATION

Sequence of events

At 0756:55 Eastern Standard Time[1] on 29 July 2011, a loss of separation[2] occurred in the holding pattern at BLAKA, an instrument flight rules (IFR) reporting point about 93 km south-south-east of Brisbane Airport, Queensland. The two aircraft involved were:

- a Boeing Company 737-838 aircraft, registered VH-VZC (VZC), operating a scheduled passenger flight from Melbourne, Victoria to Brisbane
- a Boeing Company 737-8FE aircraft, registered VH-VOT (VOT), operating a scheduled passenger flight from Melbourne to Brisbane.

VZC was planned to operate at flight level (FL)[3] 370 with an estimated arrival time of 0804, and VOT was planned to operate at FL390 with an estimated arrival time of 0807. The two aircraft were on the same air route.

At the time of the occurrence, the Brisbane automated terminal information service was advising flight crews to expect an instrument approach for landing due to weather conditions. Because of this situation and the amount of traffic, air traffic control (ATC) was required to delay arriving aircraft.

Sequencing instructions

At 0730:21, the flight crew of VZC contacted the Inverell sector (INL) en route controller, who assigned them a standard arrival route (STAR) clearance for Brisbane, and instructed them to hold at position BLAKA and expect to depart the holding pattern at 0802. The controller approved the flight crew to reduce speed, and the crew reported that they were reducing their aircraft's speed.

At 0733:23, the flight crew of VOT contacted the INL controller, who assigned them a STAR clearance for Brisbane, with an instruction to hold at BLAKA and expect to depart the holding pattern at 0804. The controller also approved VOT's flight crew to reduce speed, but the crew did not indicate whether they would do so. At this time, VOT was 12.1 NM (22.4 km) behind and 2,000 ft above VZC.

The INL controller issued the flight crews with speed reduction approvals to give them the option of slowing their aircraft down, and thus absorbing some of the required delay before reaching the holding pattern to minimise the amount of time they spent in the holding pattern. The crews were not required to reduce speed.

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1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) +10 hours.

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

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

At 0738:19, VZC's flight crew requested a clearance to descend. The INL controller assigned them FL280, with a requirement for the aircraft to be established at that level by BLAKA. The controller cleared VOT's flight crew to descend when ready from FL390 to FL340 at 0742:36.

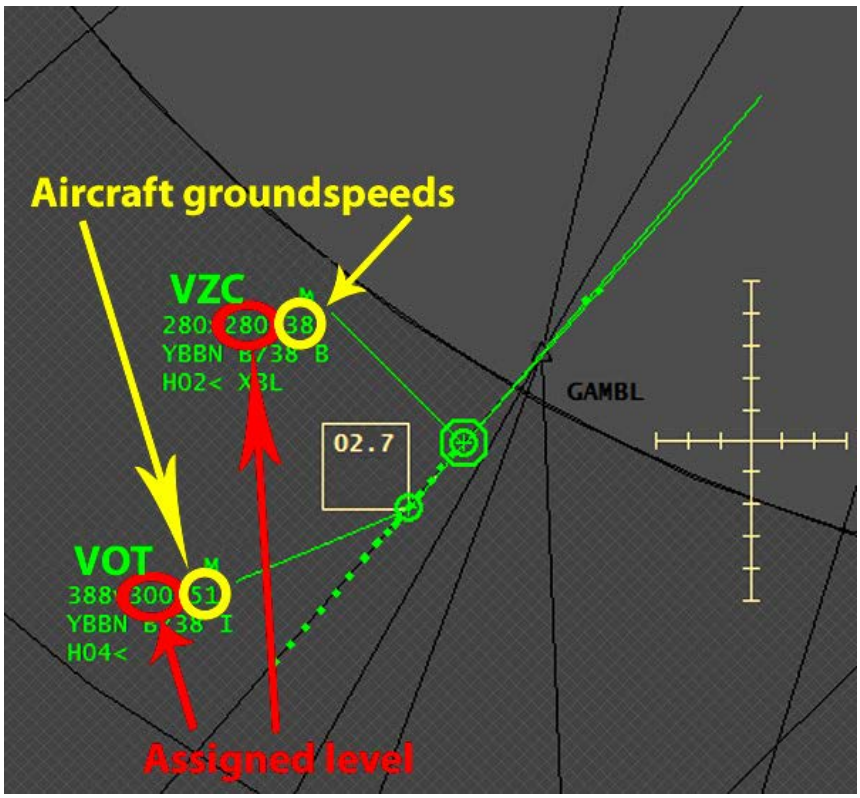
Transfer to Gold Coast sector

The INL controller transferred VZC to the Gold Coast en route (GOL) sector frequency at 0744:42, and transferred VOT 17 seconds later. There was no audio recording of any verbal coordination between the INL and GOL controllers regarding the level requirement for VZC or details of the speed reduction approvals.

The flight crew of VOT reported leaving FL390 for their assigned level of FL340, and the GOL controller instructed them to descend to FL300.

At 0746:31, VZC was maintaining FL280 and VOT was 2.7 NM (5.0 km) behind and 10,800 ft above VZC. At 0746:34 there was 130 kts closing groundspeed between the aircraft as VZC had reduced speed and VOT had not (Figure 1).

Figure 1: Proximity of the aircraft at 0746:34



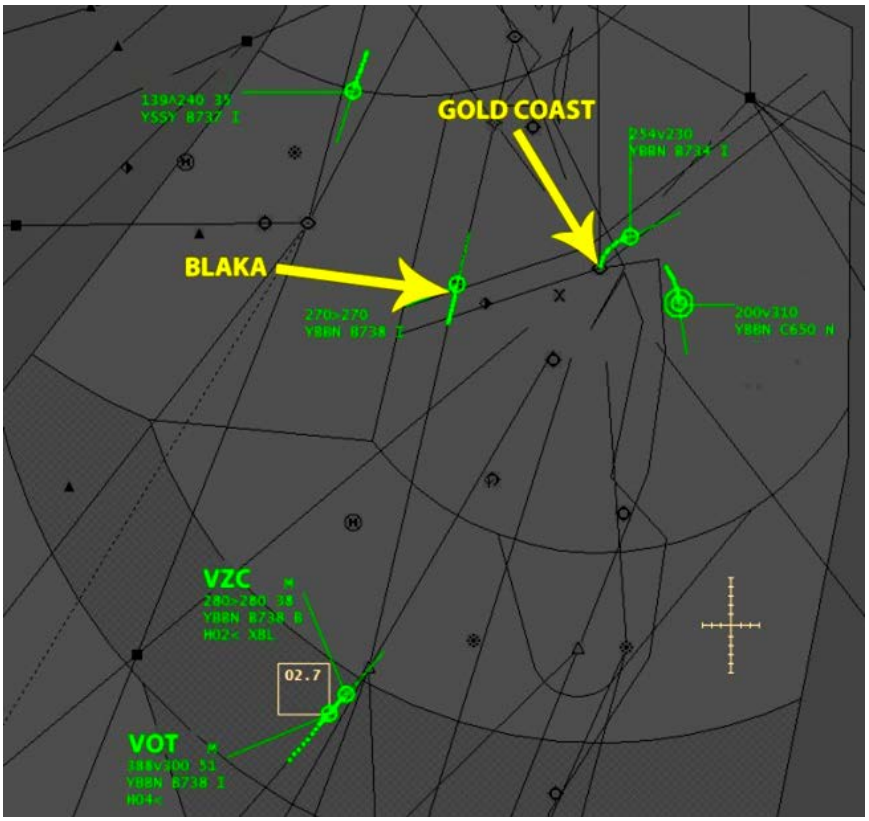
Note: Each graduation on the scale marker is 1 NM (1.85 km). Groundspeed is displayed in knots in units of 10.

The GOL controller had four other aircraft on frequency, with one of those aircraft tracking overhead BLAKA to enter a left holding pattern and two operating in a right holding pattern overhead the Gold Coast for arrival into Brisbane. The fourth aircraft had departed Brisbane for Sydney, New South Wales (Figure 2). From 0746:54 to 0752:02, the GOL controller managed the aircraft sequence out of the Gold Coast holding pattern, in addition to the southbound aircraft out of Brisbane.

During that period, at around 0748:03, VOT overtook VZC with a groundspeed 80 kts faster than VZC and at a height of 9,500 ft above VZC (Figure 3). The

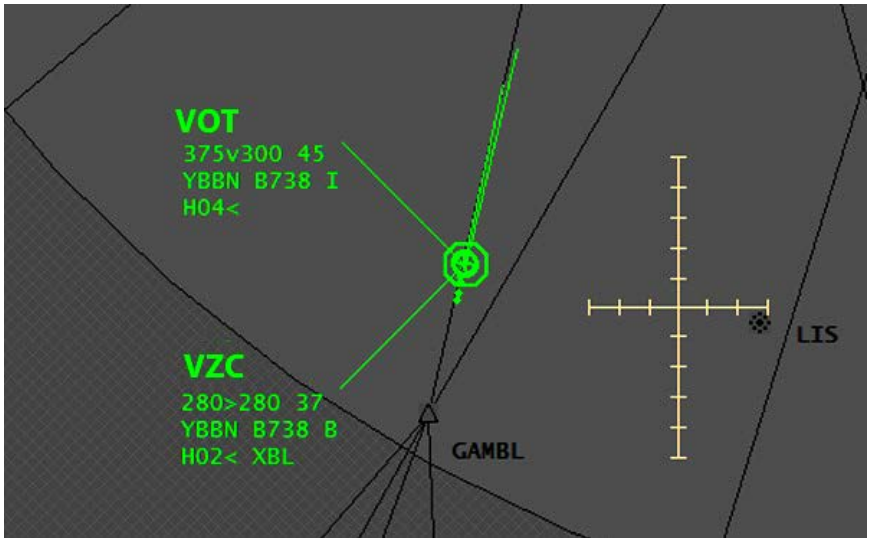
controller reported that they did not observe VOT overtake VZC or recognise that the aircraft had changed positions in the sequence. They subsequently processed VOT as if it was the first and lower aircraft in the arrival sequence.

Figure 2: GOL sector traffic at 0746:34



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

Figure 3: Proximity of the aircraft at 0748:03

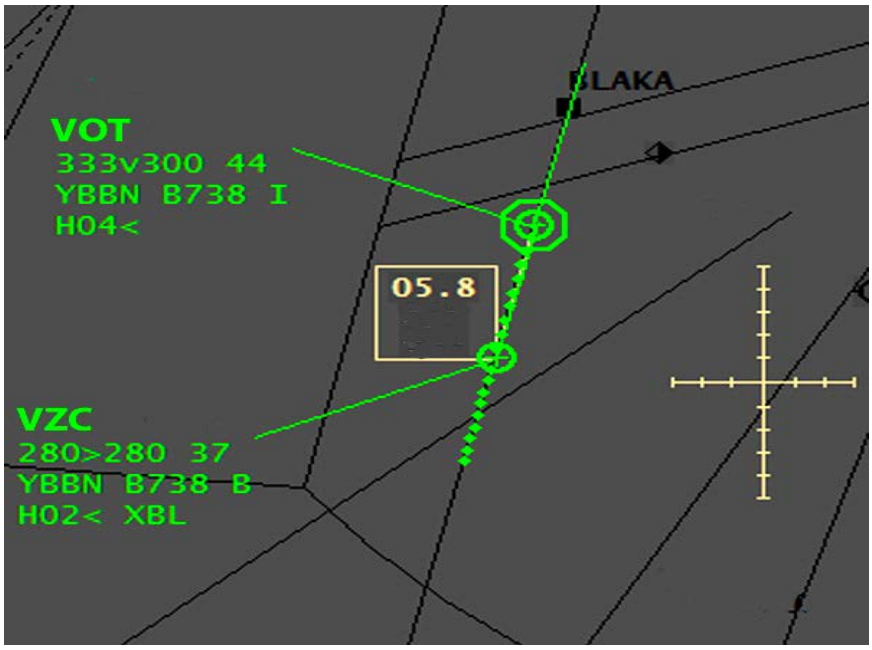


Note: Each graduation on the scale marker is 1 NM (1.85 km).

Loss of separation assurance

At 0752:09, the GOL controller assigned VOT descent to FL270, which resulted in a loss of separation assurance (LOSA)[4] between VOT and VZC. At that time, VZC was maintaining FL280, and VOT was 5.8 NM (10.7 km) ahead and 5,300 ft above VZC, and descending (Figure 4).

Figure 4: Proximity of the aircraft at 0752:09



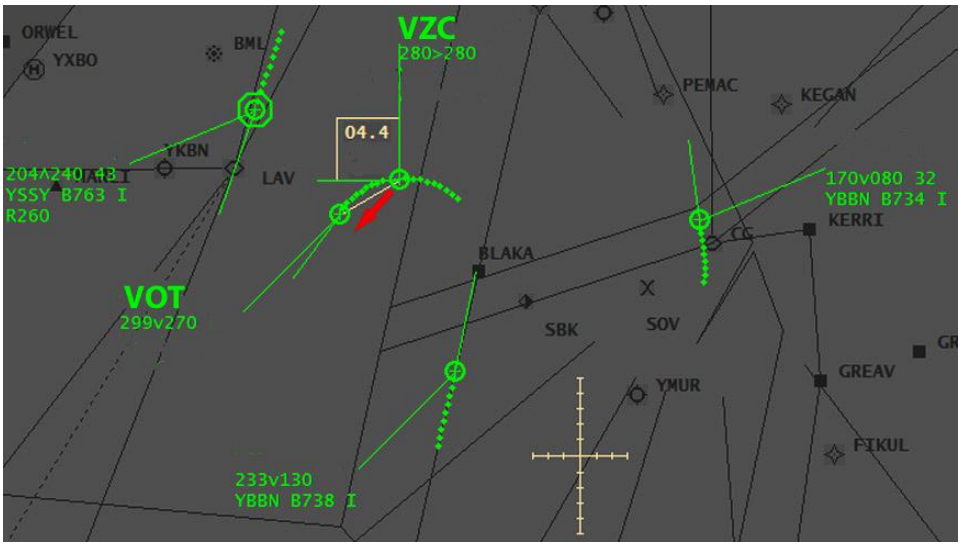
Note: Each graduation on the scale marker is 1 NM (1.85 km).

At 0752:50, VOT commenced the BLAKA holding pattern while continuing descent and also reducing speed. VZC entered the holding pattern about 1 minute later.

At 0755:31, the GOL controller issued VOT's flight crew further descent to FL170 and required them to report prior to commencing the inbound turn in the holding pattern. At that time, VOT was 4.4 NM (8.1 km) ahead and 1,900 ft above VZC (Figure 5). The GOL controller continued to control the other aircraft under their jurisdiction and made numerous transmissions, including an apology to one flight crew for a delay in actioning their flight level request, as the controller was 'a bit busy before...'.

[4] A separation standard existed; however, ATC planning, or ATC or flight crew execution of those plans, did not ensure that separation could be guaranteed.

Figure 5: GOL sector traffic at 0755:31

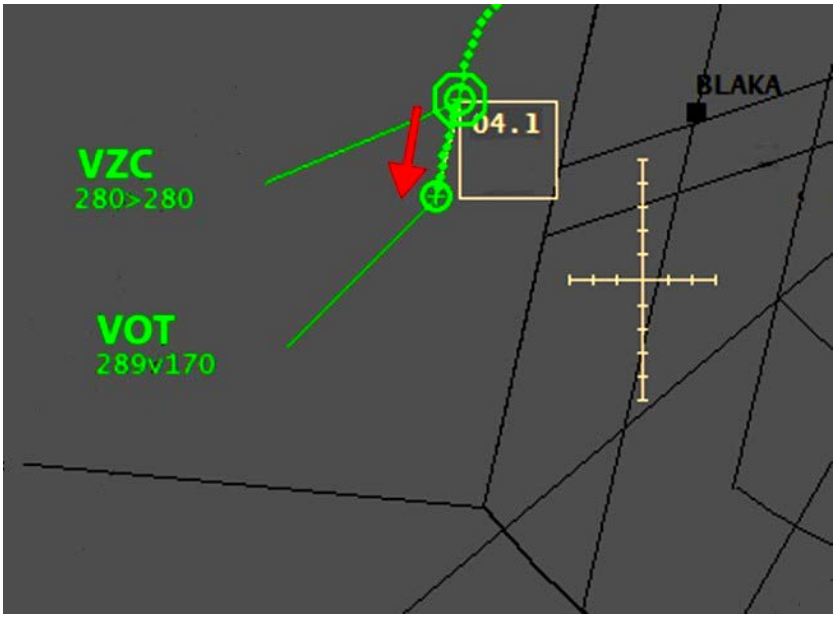


Note: Each graduation on the scale marker is 1 NM (1.85 km).

Loss of separation

At 0756:55, a loss of separation occurred between VOT and VZC, when separation reduced to 4.1 NM (7.6 km) and 900 ft as VOT descended through FL289 (Figure 6). The required separation minimum was 5 NM (9.3 km) by radar when there was less than 1,000 ft vertical separation.

Figure 6: Proximity of the aircraft at 0756:55



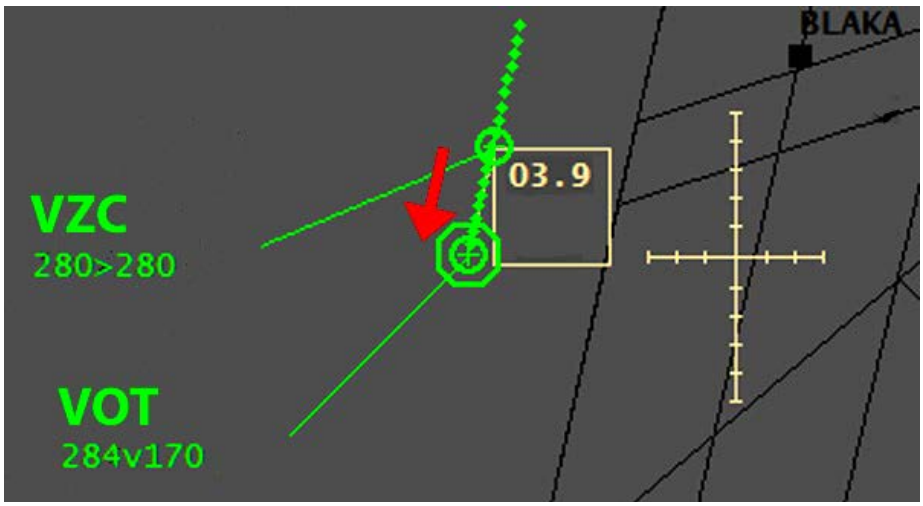
Note: Each graduation on the scale marker is 1 NM (1.85 km).

At 0757:08, VZC's flight crew asked the GOL controller for information regarding an aircraft 4.1 NM (7.6 km) ahead and descending through FL288. The crew had identified the aircraft on their aircraft's traffic alert and collision avoidance system (TCAS)[5] equipment.

The GOL controller then identified the loss of separation, thanked VZC's flight crew and issued them an instruction to turn right, before changing it to a requirement to descend to FL250. With no break in transmissions, the GOL controller instructed VOT's flight crew to maintain FL285, and then provided a traffic alert to the flight crew of VZC, informing them that there was an aircraft 4 NM (7.4 km) ahead and instructing them to descend to FL270. At that time, VOT was passing FL285 on descent and 4 NM (7.4 km) ahead of VZC, which was maintaining FL280.

At 0757:34, the separation between VOT and VZC had reduced to 3.9 NM (7.2 km) and 400 ft (Figure 7). The flight crew of VZC asked the controller for clarification of their newly assigned flight level, but the controller did not respond to the query at that time. The next GOL transmission was an instruction for VOT to climb to and maintain FL290, which that flight crew acknowledged. The controller then instructed VZC to descend to FL270, and the flight crew responded that they had previously been cleared to FL250. The controller then amended VZC's clearance to FL250. At 0758:00, the required vertical separation standard was re-established.

Figure 7: Proximity of the aircraft at 0757:34



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

Controller information

The GOL controller had 10 years total experience in ATC, having previously worked as a controller in the Tower environment for 8 years, in five different locations, before moving to the en route ATC stream in 2008. To move 'cross-stream', the controller was provided with a 15-week course in radar and procedural en route ATC in Brisbane. The controller obtained their first en route control position endorsement on the Ocean sector (OCN) in October 2009. They

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

received good ratings on performance checks and were reported to be a confident controller.

Due to staffing requirements, the controller was transferred to the Byron Group in May 2011. The controller completed the GOL theory and simulator training on 15 June 2011, and commenced on-the-job training (OJT) on 16 June 2011. They were initially scheduled to conduct a progress check on 14 July and a final check on 29 to 30 July 2011. However, as a result of their acceptable performance on the progress check, it was changed to the final check and the controller was endorsed on the GOL sector on 15 July 2011.

At the time of the incident, the controller had not completed compromised separation recovery training. The Australian Transport Safety Bureau (ATSB) also identified that they had an incorrect understanding of how the Australian Advanced Air Traffic System (TAAATS) functionality for holding aircraft operated (see *Human-machine interface*), and had limited exposure to high workload traffic situations on the GOL sector prior to the occurrence on 29 July 2011. Further details of the controller's training and consolidation are provided in *Controller training and consolidation*.

The controller was off duty on 23 and 24 July and worked day shifts during 25 to 28 July 2011, with the shift on 28 July ending at 1600. They reported that on 29 July, the day of the occurrence, they were fit for duty. They commenced duty at 0600 and worked the GOL sector for about an hour before taking a break. On return from that break, they went to relieve the controller from the OCN sector so that person could take a 30-minute break, but the OCN controller declined the offer. The occurrence controller returned to take over the GOL sector again at 0730, and the loss of separation occurred at 0757.

Air traffic control

Airspace

The en route ATC group involved in the occurrence was designated as the Byron Group and it consisted of the Gold Coast (GOL), Inverell (INL) and Grafton (GRN) sectors. The GOL sector's airspace was located to the south of Brisbane and encompassed overhead the Gold Coast and the Northern Rivers area of New South Wales (Figure 8), and the INL sector was located to the south of GOL. GRN airspace included lower level airspace underneath INL and GOL.

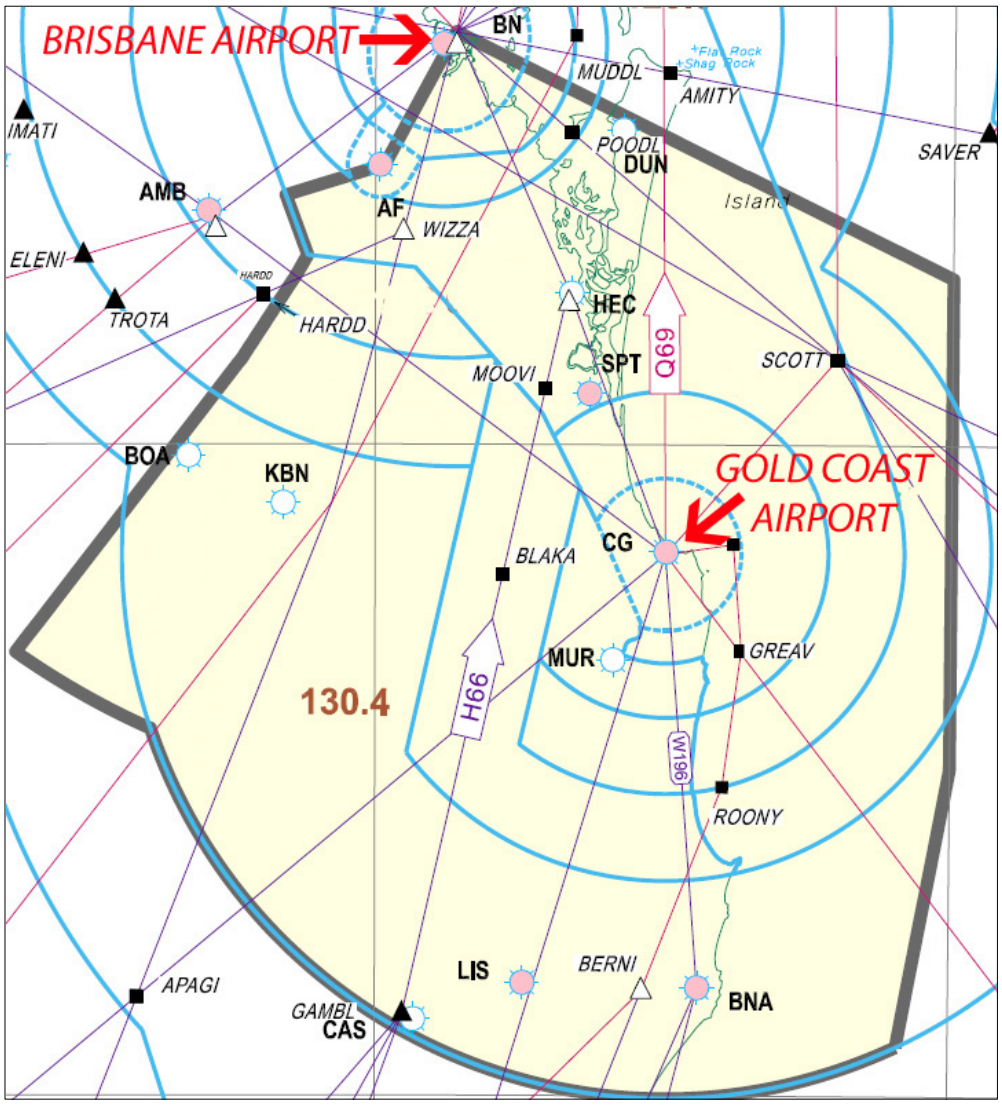
The INL controller was responsible for issuing STARs and sequencing instructions to aircraft inbound for Brisbane and the Gold Coast. A role of the position was to provide assistance to the GOL controller in setting up the required spacing before aircraft entered the GOL airspace.

The GOL controller was responsible for managing the sequence into Brisbane from the south and for any required aircraft holding by ensuring that set course times were maintained, through the use of a variety of control techniques such as speed control, vectors and adjustments to holding pattern legs. A role of the position was to proactively communicate with the INL controller to ascertain that aircraft to be placed in sequence entered GOL airspace with the required positioning, level assignment and speed control to assist the GOL controller to achieve the required

spacing with minimal intervention. Promulgated holding patterns in the GOL sector included BLAKA and overhead the Gold Coast.

In addition to the three control positions, the Byron Group included a Planner (PLNR) position that assisted the executive controllers when they were busy with tasks such as updating the TAAATS human-machine interface (HMI), conducting coordination with other sectors, and monitoring executive controllers' traffic. The PLNR position was usually combined with the GRN control position.

Figure 8: Gold Coast sector



Source: Airservices Australia

Group structure

The Byron Group had two ATC line mangers (ALMs), one responsible for the safety, procedures and licensing portfolios, and the other responsible for administration, training and liaison portfolios. The ALM assigned the training portfolio was responsible for ensuring that the group had sufficient and appropriately qualified staff to meet business requirements, and that annual refresher training was documented and completed on time.

A shift manager was responsible for the overall provision of air traffic services of one or more groups during a shift. The shift manager role for the Byron Group also included two other groups in the same aisle. The shift manager provided general supervision of operational staff, as well as managing the published rosters and staffing requirements. Although many ALMs held shift manager endorsements, there was no requirement for shift managers to be an ALM, or for shift managers or ALMs to have the endorsements associated with the ATC sectors for which they were supervising.

Each group had a check and standardisation supervisor (CSS), who was responsible for ensuring that nationally standardised methods, practises and procedures were applied at a high level of consistency and proficiency by the group's controllers. There was also at least one other check controller per group, who could perform a checking role in addition to the CSS.

Each group also had a number of group training specialists (GTSs), who were responsible for the provision of the theory and simulator components of ab-initio, endorsement, ongoing, remedial and some refresher training modules. The on-the-job training instructor (OJTI) roles were fulfilled by a number of the group's fully endorsed controllers, for the provision of training in the operational live environment.

Workload

According to senior controllers in the group, GOL was one of the busiest ATC sectors in Australia. It often involved highly-complex traffic patterns, particularly when using multiple holding patterns in close proximity. The BLAKA holding pattern was non-standard, requiring aircraft turns to the left, in order to help minimise potential conflict with the Gold Coast holding pattern. However, this meant that it could also lead to potential conflicts with aircraft departing Brisbane to the west of BLAKA. The risks associated with the complexity of the air route design had been considered by the ATC organisation and controller training for the GOL sector incorporated instruction on techniques for the management of the holding patterns and conflicting routes.

In the period leading up to the occurrence, the controller was managing two aircraft in the Gold Coast holding pattern, one aircraft in the BLAKA holding pattern, the two aircraft approaching the BLAKA holding pattern (VZC and VOT), and a departure from Brisbane. At one stage (about 0754), the controller advised the FLOW controller, who was responsible for the traffic sequence into Brisbane, that the two aircraft coming out of the Gold Coast holding pattern were about 1 minute late for the required set course times. If an aircraft was more than 30 seconds late, it had the potential to adversely affect the traffic sequence into Brisbane Airport. The controller was also concerned about the potential conflict between the southbound aircraft and the aircraft in the BLAKA holding pattern.

The controller could not recall having previously seen a scenario in which aircraft did not enter the holding pattern in the order that they were required to depart. Other controllers reported such scenarios were not frequent, but were likely to be experienced by all GOL controllers. They considered that the fundamental ATC skill of scanning would identify the aircrafts' positions, proximity to one another, actual altitudes and assigned altitudes.

Overall, the GOL controller reported that their workload had been on a scale of eight out of ten at the time of the occurrence. Controllers experienced on the GOL sector advised that the traffic pattern at the time of the occurrence was complex, but not unusual.

Supervision and monitoring

The shift manager was responsible for general supervision of ATC services of the group's controllers during a shift. They were not responsible for actively supervising the performance of each controller.

Although it was not formally documented, senior controllers reported that newly-rated controllers were closely monitored in the period after receiving a rating, particularly in terms of traffic complexity or workload. The shift manager reported that, on the day of the occurrence, they noted that the GOL controller was newly rated and asked the other controllers to ensure they were monitoring how much traffic the new controller was handling.

At 0753:49, the GRN/PLNR controller also assumed responsibility for the INL sector, with the two control sectors combined onto one ATC console. The GRN/PLNR controller reported that they observed the INL controller issue the sequencing instructions to VZC and VOT, then transfer the aircraft to the GOL controller. About 5 minutes later, they decided to combine the INL and GRN sectors as the wave of traffic had moved through INL to GOL, and the traffic levels on GRN were low. The GRN/PLNR controller reported that combining the INL and GRN positions provided some additional capacity for the controllers on shift to take breaks.

At the time that the INL and GRN sectors were being combined, the LOSA situation in the GOL airspace, between VZC and VOT, was already established and would have been identifiable by another controller if they had scanned the traffic in the GOL sector. It was common practice for the GRN/PLNR position to monitor the traffic of the other sectors when those controllers were busy. However, the extent to which a controller on one sector would identify a problematic situation on another sector would be dependent on the tasks they were performing at the time. In this case, the GRN/PLNR controller, who was also the group's CSS, stated that they did not see a problematic situation developing in the GOL airspace, and that in hindsight they perhaps should have kept GRN open and focused more on monitoring GOL.

The combining of sectors was at the discretion of the controllers, in consultation with and agreement from the shift manager. During the investigation, some controllers reported that they considered that there was pressure to combine sectors due to staffing restrictions.

Human-machine interface

TAAATS had a functionality that allowed for aircraft operating in a holding pattern to be managed effectively by the system processors. The functionality included a Hold Window, which was displayed when an aircraft's symbol had been selected by a controller to hold over a certain point, such as BLAKA, and the aircraft then flew over that position. In radar surveillance locations, the aircraft's label display would then change to show only the call sign, altitude and cleared flight level. The

aircraft's groundspeed was not displayed. When the system processed an aircraft using the holding functionality, the TAAATS Short Term Conflict Alert[6] (STCA) was not available.

The Hold Window sorted and displayed flights by their cleared level, with the aircraft assigned the lowest level at the bottom of the list. The GOL controller reported that, prior to the occurrence, they understood that the window sorted and displayed flights relative to the holding pattern departure time for each aircraft, with the first out of the pattern at the bottom of the list. After they assigned VOT descent through the level of VZC, the Hold Window displayed VOT at the bottom of the list, which confirmed the controller's (incorrect) mental model of the aircrafts' sequence.

Training personnel reported that they had not observed any indications that the controller had not known the correct Hold Window display mode or used the function incorrectly. They indicated that if they had been aware of the deficiency, they would have rectified it immediately.

The ATSB was unable to determine if the controller was provided with training on the correct Hold Window functionality during their initial TAAATS training. The controller reported that their initial cross-stream training was conducted using a computer system that emulated TAAATS, but did not have that system's full functionality. The ATSB identified that other controllers also did not understand how the order of aircraft in the Hold Window was determined.

The controller had used the Hold Window for about 2 years on the OCN sector without incident. That sector was a large portion of airspace located overwater to the east of Sydney and dealt largely with international aircraft operating into and out of Sydney from the east. The controller stated that on OCN they used a 'scratchpad'[7] to record the aircrafts' times out of the holding patterns, as the tool used for sequencing traffic for Sydney (Maestro) was very dynamic and the times changed frequently. The controller had to note down what times they had assigned the flight crews and monitor those times against Maestro. The Hold Window was not used to monitor aircraft times or position in the sequence.

During the controller's OJT on GOL, one of their instructors advised them to use the Hold Window rather than the scratchpad to note down the set course times, so the controller changed their method of recording and monitoring the times. Following the incident, other Byron Group controllers reported that they did not consider that the use of the Hold Window for monitoring aircraft times was the correct method, and that they used the Hold Window only as a way of ensuring that the TAAATS human-machine interface had correctly applied the aircraft into the system holding configuration.

Separation assurance

The primary aim of the ATC system is to ensure that controlled aircraft are always kept apart by at least a defined standard of separation. The standard may vary depending on a number of factors, including the type of airspace in

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[6] The STCA was a situational display alert in TAAATS that indicated a system-detected critical event requiring immediate controller intervention.

[7] Notepad used by air traffic controllers for annotations.

which the aircraft are operating, and may specify horizontal or vertical distances. Sometimes ATC planning, or ATC or flight crew execution of those plans, may not ensure that separation can continue to be guaranteed. When such a situation occurs, it constitutes a loss of separation assurance (LOSA). A LOSA, if not rectified, may result in the relevant separation standard being infringed, which is what happened in this occurrence.

The Manual of Air Traffic Services (MATS) described tactical 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.

In order to assure separation, MATS required controllers to:

1. be proactive in applying separation to avoid rather than resolve conflicts;
2. plan traffic to guarantee rather than achieve separation;
3. execute the plan so as to guarantee separation; and
4. monitor the situation to ensure that plan and execution are effective.

If a LOSA is not rectified, it is possible that aircraft will not maintain the required separation. That constitutes a loss of separation.

Compromised separation

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

At the time of the occurrence, MATS required controllers to issue safety alerts to pilots of aircraft as a priority when they became aware that aircraft were in a situation considered to be in unsafe proximity to other aircraft. The following phraseology was an example of the words to be used:[8]

> (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.

In addition to the occurrence controller, the investigation identified that other controllers in the group had not received compromised separation recovery training. The ATSB investigation AO-2009-080 examined a LOSA that occurred 222 km north-west of Tennant Creek, Northern Territory on 22 December 2009. The findings from that investigation included:[9]

> The controller had not received training in compromised separation recovery techniques. *[Significant safety issue]*

In response, Airservices Australia (Airservices) implemented a compromised separation recovery training module for its ATC groups. In addition, a dedicated compromised separation recovery training module was introduced at the Airservices

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[8] In June 2012, Airservices Australia initiated a change to the phraseology for traffic alerts with changes to the MATS and the Australian Aeronautical Information Publication (AIP) implemented.

[9] http://www.atsb.gov.au/publications/investigation_reports/%202009/aair/ao-2009-080.aspx

Australia Learning Academy, as part of initial ATC training. The compromised separation recovery training was to be provided to all en route controllers during each financial year period, commencing in the 2010-11 financial year.

Controller training and consolidation

Training documentation

The *Airservices Training Operations Manual* (ATOM) applied to all training activities within Airservices and defined components that had to be included in courses that had national application. It required that each unit responsible for ATC training maintain documentation pertaining to its training role. Prescriptive training requirements and the content of the training programs for en route ATC were promulgated in training manuals relative to each ATC group.

The latest version of the Byron Group's training manual was issued on 2 March 2005. The organisation's intranet site listed the document as 'Current (Overdue)' and 'under review'. A sample of other group training manuals also noted that several of them were under review.

In 2010, the Civil Aviation Safety Authority (CASA) conducted an audit of the organisation's Learning Academy and issued a Request for Corrective Action (RCA) for out of date training documentation, which included the Byron Group's training manual. At that time, the Byron Group's ATC Line Manager (ALM) responsible for training determined that the training manual would require a significant amount of time and effort to bring it up to date and this was not achievable with their available resources. With agreement from the Learning Academy, it was determined that the issue would be managed through a process in which the actual training delivery material was updated locally, but the training manual would not be processed to reflect those changes. The training manual was subsequently withdrawn and the organisation advised CASA that the RCA had been actioned.[10]

At the time of the occurrence, the Byron Group lesson plans for the GOL training program were maintained by the group. Although they contained updated material compared to the training manual, they still contained some out of date material, including designations for a major Restricted Area and references for the Gold Coast STARs.

An ALM reported that the Byron Group updated the training packages locally and that the occurrence controller was provided with training based on current procedures and documentation. They advised that the group training specialists (GTSs) had limited time and resources to update the written course documentation, but did so when able.

A GTS was responsible for providing simulator and theory training to controllers, and maintaining the group's training documentation. The position was often rotated

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[10] In September 2011, CASA conducted an audit of the documentation for the Byron Group and issued another RCA for the Group's training material not being documented in a training manual, as no manual could be presented and the Group was not aware that the out of date manual had been reloaded onto the intranet system. Airservices advised that the Byron Group training manual was subsequently updated to incorporate the current material.

amongst suitably qualified group controllers. A GTS reported that they were not responsible for updating or changing training packages, and only one of the controllers who fulfilled the role had the appropriate qualifications to make such changes.

Sector selection for training

The typical entry sector for ab-initio ATC trainees to the Byron Group was INL. After being endorsed and having a period of consolidation on INL of about 6 months, a controller would train on GOL, followed by consolidation and then GRN. When a controller was rated on the GOL and INL sectors, the training for the PLNR role was usually combined with GRN training. Although trainees were usually started on the INL sector, there were a number of occasions in which experienced controllers, who had previously held ATC endorsements in other Groups, had successfully transitioned to the Group directly via the GOL or GRN sectors.

As another controller had recently commenced training on INL, the occurrence controller was allocated GOL. As they had previous en route experience on OCN, which handled aircraft arriving into Sydney from the east, they were considered to have arrivals sector experience and therefore to be capable of a successful transition to the Byron Group via the GOL sector.

In the organisation's training documentation, OCN and GOL were not considered to be 'like-type' sectors. A number of Byron Group controllers reported that there were significant differences in the skills required for the GOL and OCN sectors. For example, on the OCN sector usually only one holding pattern is used, and the sequencing of aircraft that require holding is carried out by the same controller.

Training needs analysis

Prior to a controller commencing any training, a GTS prepared a training needs analysis (TNA). The analysis outlined the summary of the training requirements, the particular controller's work history, a gap analysis and training strategy, and the assessment requirements.

The TNA's consultative group included the controller, the GTS and an ALM. An ATC Learning Advisor reviewed the analysis to ensure that it was in accordance with the requirements of the curriculum and the ATOM, and the Service Delivery Line (SDL) Manager then endorsed the training strategy as acceptable to the business group.

Simulator training

The normal GOL course consisted of theory and simulator-based instruction delivered over 8 training days by a GTS. The course was designed on the basis that a trainee would already have experience on INL, and therefore have an understanding and knowledge of the STAR clearances, methods of sequencing, Byron Group airspace and local procedures.

The occurrence controller's TNA identified a number of areas that required additional training to assure any learning gaps were addressed. These additional theory components were addressed by classroom presentations. While waiting for

the availability of a check controller to conduct the simulator check, the controller completed additional simulator work from the busier training sessions.

The simulator training was completed during the period from 1 to 14 June 2011, with the check completed on 15 June. The GTS who provided the simulator course reported that they had been concerned about the controller's progress as they appeared to find the high traffic levels and fast tempo of the exercises very challenging, and that the controller did not have the benefit of operational experience on the INL sector. The controller reported finding the course difficult as it had been developed for controllers who had experience on the INL sector and the majority of the simulator sessions provided the trainee with limited opportunity for consolidating skills before being exposed to a combination of new scenarios with busy and complex traffic patterns. The simulator was also not as dynamic as the operational environment.

On-the-job training

The TNA stated that the controller's OJT would consist of 6 weeks, including a 1-day progress check after 4 weeks and a 2-day final endorsement check after 6 weeks. The 6-week OJT period was the normal duration allocated to both ab-initio and experienced controllers for the GOL sector. The controller commenced OJT on the GOL sector on 16 June 2011. They completed 14 training shifts, from 16 June to 13 July 2011 inclusive, during which time 57.5 hours was spent training on GOL.

Over the duration of the OJT, the controller had eight different training officers, with three separate training officers on the second day. It was reported that roster constraints did not allow for the occurrence controller to be rostered with one instructor for the duration of their OJT. The controller reported that the significant number of training officers was not ideal, as they had different styles and provided conflicting advice on several issues, such as the use of the Holding Window. There were no documented requirements limiting the number of training officers provided to a controller.

The controller's training records indicated that they had been performing to an acceptable standard.[11] The workload and complexity for most of the sessions was rated as low or moderate. The training officer who conducted five of the last eight training sessions had a substantial amount of controlling, training and checking experience on the Byron Group. They reported that, as of the last training session on 13 July 2011, the controller was progressing well, but needed the additional 2 weeks of training as they had not yet had enough experience with high traffic levels and would benefit from the extra training period to consolidate. The officer reported that they had advised the trainee of this assessment.

During the occurrence controller's OJT training period, they were also required to conduct work on the OCN sector. The situation arose due to a potential staffing issue on the OCN sector due to another controller's personal situation, which may have required them to take an undetermined period of leave with very limited

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[11] Each session included detailed notes by the training officer, documented in a training booklet, regarding the trainee's situation awareness, execution of control actions, communication and operation of facilities, in addition to the grading of situational factors experienced during the session, such as traffic volume and complexity, weather and abnormal conditions.

notice. The occurrence controller was the only available person who would be able to work the OCN position if the other controller became unavailable, and the ALMs considered that having the controller working on the OCN sector and training on the GOL sector was achievable. The controller did 5 hours as a familiarisation shift on OCN on 8 July 2011, and 4 hours controlling on the sector on 12 July 2011.

The GOL controller later reported that they were trying to support the organisation and had accepted the requirement to work on the OCN sector at the same time as training on the GOL sector, even though they did not consider the situation 'ideal' at the time. There were no documented requirements limiting the extent to which a controller could work on other control positions while conducting training on a new sector.

Progress and final check

The controller's TNA outlined that a 1-day progress check would be conducted after approximately 4 weeks, and a 2-day final endorsement check after approximately 6 weeks. Under the section on assessment requirements, the TNA stated that these checks 'may be modified as deemed appropriate by the Byron ALM or Byron Checking Controller'. There was no documented requirement for those personnel to refer to the consultative group, ATC Learning Advisor or SDL Manager to modify the assessment requirements, or any documented risk controls or required risk assessment process to be applied if the assessment requirements were modified. In addition, there was no documented requirement for the organisation's Learning Academy to maintain oversight over any modifications to the TNA.

The occurrence controller's progress check was scheduled to be conducted on 14 July and the final check on 28 and 29 July 2011. On the morning of the scheduled progress check on 14 July, the training officer who had conducted five of the last eight training sessions advised the CSS that the controller needed the additional 2 weeks of training.

The Byron Group's CSS had a substantial amount of experience on the Byron Group in controlling and training roles and had been the CSS for 11 years. They reported that, during the progress check, the occurrence controller appeared to be progressing at the rate expected of an experienced controller. The CSS stated that the traffic levels were 'generally light' during the check, and the session included some discussion about various situations and scenarios.

The CSS's overall impression of the trainee's performance was that it was of a rating standard and the trainee was ready to work solo, so the progress check became Day 1 of a 2-day final check. The controller successfully completed Day 2 of the check, which was conducted by another check controller on 15 July 2011. That check controller's comments stated that the controller demonstrated 'a sound ability to sequence aircraft on a moderately busy day', but also noted that the 'INL/GRN [controllers] were generally suggesting traffic configurations rather than this being lead [sic] by GOL [the controller being checked]'. The comments also stated that 'a period of consolidation on GOL is now required to assist in locking in these skills and provide opportunity to experience more scenarios prior to the summer weather arriving'. A total of 8.75 hours of contact time on GOL was completed over the 2-day check.

Although some progress checks can be converted into a final check, it was not normal practice, particularly for a complex sector such as GOL. The training officer reported that they were very surprised when they heard that the trainee's progress check was changed to a final check, contrary to their recommendation. Several other senior controllers also expressed surprise regarding the decision. The training officer advised that it would be suitable for a progress check to be changed to a final check if the training officer recommended it, after the trainee had demonstrated a high level of competency, worked high traffic levels and experienced some complex, different scenarios. They noted that, had they been aware that the progress check could have been converted into a final check, they would have provided a more detailed overall assessment of the controller's progress in the controller's training book, rather than providing comments on each training session individually and verbally briefing the CSS. There was no documented requirement for training officers to summarise a controller's overall progress at the stage of a progress check.

Several managers and senior controllers reported that maintaining a roster with a sufficient number of controllers to cover all required positions was an ongoing concern in the Byron Group and other groups.[12] At the time of the occurrence, the Byron Group had a significant number of controllers who were not endorsed on all positions, which complicated the rostering process. It was reported that there was some concern within the group that the occurrence controller may be recalled back to the other group to work on OCN. However, the CSS did not indicate that there was any pressure to endorse the controller early in order to help reduce rostering difficulties.

Controller consolidation

Part 3-2-18 of the Airservices National ATS Administration Manual stated:

> After each initial Endorsement, the person must be given every opportunity to consolidate their skills on that position/function, to ensure that competencies only recently acquired are not eroded or degraded.

The minimum periods for consolidation were not prescribed, although the manual did state that recreation leave should not normally be granted during consolidation periods, but significant life events may have justified leave approval. Airservices advised that, under the particular circumstances, the granting of recreation leave was permissible though not recommended.

After being endorsed on GOL, the controller had two rostered days off, then worked 6 hours on OCN and 0.5 hours on GOL on 18 July 2011. They worked seven more shifts over the next 10 days, completing a further 28.5 hours on GOL and 1.8 hours on OCN. During that period, they had two rostered days off and one shift of recreational leave.

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[12] Airservices Australia was undergoing a number of change management processes in recent years, including the implementation of the Service Delivery Environment infrastructure. During the investigation, CASA advised the ATSB that they were conducting national Civil Aviation Safety Regulation (CASR) Part 172 surveillance of ATC staffing and fatigue management changes.

ANALYSIS

The loss of separation between VH-VZC (VZC) and VH-VOT (VOT) occurred in a holding pattern in a potentially busy and complex sector of airspace. The problem was first identified by the flight crew of VZC, before the Gold Coast sector (GOL) controller initiated compromised separation recovery action. The two aircraft came within 3.9 NM (7.2 km) and 400 ft before separation increased and a standard was re-established.

When aircraft are in holding patterns, controller workload is generally increased. In addition, the air traffic control system's short term conflict alert function is no longer available. Therefore, there is increased importance in ensuring that other risk controls are effective in preventing any compromised separation situation.

In this case, the loss of separation resulted from the GOL controller not detecting that VOT had overtaken VZC, assigning the flight crew of VOT descent through the level of VZC, and then not identifying the resulting loss of separation assurance (LOSA). These errors were associated with a number of factors, including limitations in the risk controls used by the air traffic control provider to ensure that the controller had the necessary skills and experience.

Speed reduction approvals

The speed reduction approvals issued to both aircraft by the Inverell sector (INL) controller did not assure that the aircraft would enter the holding pattern in an arrangement that would assist the GOL controller to achieve the required spacing with minimal intervention. When the INL controller was advised by VZC's flight crew that they were reducing their aircraft's speed, that controller probably had the opportunity to proactively instruct VOT's flight crew to descend at a similar speed. It is likely that the aircraft would have then entered the holding pattern in the order that they were planned to exit.

The GOL controller was not proactive in managing the oncoming sequence as they did not communicate positive directions to the INL controller to ensure that the required sequencing between VZC and VOT was maintained, instead relying on that controller to provide appropriate instructions to maintain traffic configuration. Such a reliance on the INL controller was noted during the GOL controller's final check.

Effective communication and coordination are fundamental elements of air traffic control, which can enhance situation awareness and decision making, and controllers are trained and assessed in these skills throughout their careers.

Although aircraft entering the holding patterns in a less than optimal position relative to one another was a situation that could be expected to occur infrequently, an inexperienced controller with limited exposure and subject to high workload and distraction would have significantly benefited from the aircraft being positioned in trail.

Controller workload

The controller had limited experience and exposure to high traffic levels and workload on GOL, with only 4 weeks training on the sector and generally low to medium traffic levels experienced during that time. They probably became task focused on the late sequence from the Gold Coast holding pattern and were trying to divide their attention between scanning the air situation display, and monitoring aircraft to ensure that the set course times were met out of the two holding patterns, including the two aircraft that they had vectored to meet their set course times overhead the Gold Coast. The controller had misjudged the timings for those two aircraft, which resulted in those aircraft then passing overhead the Gold Coast later than required, with the potential to affect the whole traffic sequence into Brisbane.

There was about 3.5 minutes between the controller's descent instruction to VOT that resulted in a LOSA, and the subsequent instruction for further descent that reinforced the situation. For a considerable period of time, the controller did not identify the LOSA, or the subsequent loss of separation, until prompted by a query from VZC's flight crew.

A well-known effect of high workload is attentional narrowing, which reduces the number of information sources a person will access, and the frequency or amount of times they are accessed (Staal 2004). In this case, the controller's scanning appeared to be significantly affected by workload and distraction, to the point that they did not observe or identify that VOT had overtaken VZC, and they relied on their expectation of the aircraft positions, relative to one another and the sequence. It is likely that their scan narrowed to the call signs and Hold Window display, but did not encompass the aircrafts' actual or assigned altitudes displayed on the air situation display. The controller maintained an expectation that the leading aircraft was the lower aircraft and issued descent instructions to position VOT accordingly.

Overall, the controller was dealing with a moderately complex situation in the period leading up to the occurrence, but their workload was increased due to the sequencing techniques applied to the two aircraft in the Gold Coast holding pattern that resulted in those aircraft being delayed later than required. Due to the controller's low experience levels on the GOL sector, they had not yet had the opportunity to embed skills and establish a level of familiarity with managing holding patterns and sequencing in a small, dynamic piece of airspace with significant time pressures, which would reduce the associated cognitive workload.

Hold Window functionality

The controller's understanding of the functionality of the Hold Window was not challenged during the 2-year period that they worked on the oceanic sector, due to the nature of operations in that airspace and their use of a notepad to record the set course times for aircraft. Furthermore, the controller's misunderstanding of the functionality had not been identified during the GOL simulator or on-the-job training (OJT) phases so could not be addressed. If the controller had used the same method to monitor aircrafts' holding times that they had employed on the oceanic airspace, they may not have misidentified the sequence.

Although it was identified, following the occurrence, that other en route controllers misunderstood the way in which the Hold Window displayed data, it was also widely understood that the Hold Window was not the optimal or primary means for

sequence monitoring. Therefore, the potential for other controllers' misunderstanding of the Hold Window to result in a compromised separation situation was minimised.

Training and experience

Air traffic controlling is a highly skilled activity that requires substantial practice in a new sector to consolidate and embed appropriate knowledge and techniques. The role often requires a controller to perform several tasks simultaneously and they must develop the cognitive ability, through learned skills and knowledge, to perform familiar tasks with minimal attention, and to perform the most familiar tasks automatically. Specialist training is required to ensure that a controller has these essential skills and knowledge, and such training needs to be consistent and include monitored exposure to busy and complex traffic situations.

The OJT provided to the controller was not structured in a manner that could be considered optimal. Multiple training officers did not allow for a consistent training approach or mentoring of the controller. It also introduced additional frustration and confusion for the controller with individual, varied information and approaches to training. In addition, the requirement for the controller to staff another control position that was not similar to the sector on which they were training further reduced consistency.

The check controller who conducted the second day of the final check had noted that the occurrence controller would require a consolidation period on GOL. However, following the controller's endorsement on GOL, they were not provided with a consistent consolidation opportunity, as they were required to continue occasional staffing of the dissimilar OCN sector, and a day of recreation leave was granted, which Airservices advised was not recommended practice.

Combining of positions

The decision to combine the other ATC Group control positions, when the recently endorsed controller was subject to a period of high workload on the Gold Coast sector, removed an opportunity for experienced controllers to monitor and assist. The LOSA situation would have been easily identifiable from the aircrafts' label displays, with an opportunity available to recover the compromised separation before a loss of separation occurred.

However, there was insufficient evidence to conclude that the decision to combine the other control positions contributed to the occurrence. The LOSA actually occurred almost 2 minutes prior to the sectors being combined. In addition, it may have been difficult for other controllers to note that the GOL controller was experiencing a high workload at the time and therefore required additional monitoring.

Compromised separation recovery

When the occurrence controller issued VZC with an instruction to turn right, as a compromised separation recovery action, it was a safe and effective means to re-establish separation as there was 2,000 ft vertical separation assurance between

VZC and the southbound aircraft to their right. However, the controller had not clearly identified that vertical separation existed and subsequently amended their control instruction. The controller then proceeded to issue instructions without clear or concise phraseology that resulted in the involved flight crews further querying the clearances issued. As the controller had not been provided with training in compromised separation recovery techniques, they had limited skills or knowledge to provide effective control instructions to restore separation.

The Australian Transport Safety Bureau (ATSB) identified that other Byron Group controllers were also not provided with compromised separation recovery training (CSRT) until after the occurrence. As noted in other ATSB investigations, Airservices has reported that it has been addressing this issue in recent years.

Risk management of training variations

Although the occurrence controller had 2 years en route experience on another sector, a training needs analysis identified gaps in the knowledge and experience required by that controller to enter the Byron Group directly via GOL, and documented mitigators to address those gaps. The mitigators included additional theory modules during the simulator training phase.

The controller was initially scheduled for a final field training period of 6 weeks, which was the normal duration allocated for that phase. That training period was reduced when the check and standardisation supervisor (CSS) assessed the controller's ability to be of a suitable standard for endorsement, and that was confirmed by another check controller on the second day of the final check.

However, there were many variations to the occurrence controller's training program that should have been considered when varying the training period. These included:

- the non-standard entry path to a complex, busy sector
- the provision of many on-the-job training instructors
- the requirement for the controller to conduct others tasks and the subsequent interference with learning continuity
- the normal and recommended training period was 6 weeks
- training officer recommendation that the controller complete the full 6-week final field training period
- limited exposure to high traffic complexity to date.

The CSS was experienced in assessing controllers' performances and making decisions regarding their suitability for endorsement. However, there was no process to ensure that all the factors that could have affected the quality of the training were systematically considered and documented. In addition, there was no formal process for the training officer's views to be recorded, nor a formal mechanism for those views to be reviewed in conjunction with the CSS's assessment and all of the potential factors that may have adversely affected the quality of a controller's training. If there were potential factors affecting training quality, a review process could identify risk mitigators, which may include the controller completing the full training period or even additional training.

Resource constraints

Many organisations experience limitations in available resources at different times. In such cases, an organisation needs to ensure that it has a robust process for identifying the potential effects of these limitations and ensuring that these are appropriately managed. In other words, the resource limitations themselves are not necessarily a safety issue, but the way they are managed can be a safety issue.

In this case, resource constraints affected several aspects of the controller's training and consolidation. These issues included:

- the strategy to cover the possible short notice loss of a controller for the Ocean sector (OCN)
- the provision of multiple training officers during the occurrence controller's training
- significant delays in the provision of CSRT to controllers.

Although the Byron Group's inability to update and maintain their ATC Group Training Manual was also due to resource constraints, this did not directly contribute to the reduced quality of training and consolidation that the occurrence controller received. However, it had the potential to affect training and was not effectively managed by the organisation's Learning Academy.

In summary, there were resourcing limitations present that were affecting the delivery of training and consolidation. More importantly, as previously discussed, the controller check and training system did not treat proposed changes in training as an issue requiring a formal change management or risk management process. A robust and comprehensive risk assessment process should identify potential risks, particularly involving any variations to controller training, and document the strategies and controls employed to manage those risks. If such a process had been undertaken in this situation, there would have been identifiable opportunities for proactive risk controls to be implemented, with the likelihood that the occurrence would not have taken place.

FINDINGS

From the evidence available, the following findings are made with respect to the loss of separation between on a Boeing Company 737-838 aircraft, registered VH-VZC (VZC), and a Boeing Company 737-8FE aircraft, registered VH-VOT (VOT), on 29 July 2011. They should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The unrestricted speed reduction approvals issued to both aircraft did not ensure that the aircraft would enter the holding pattern optimally positioned to assist the controller to achieve the required sequencing.
- The controller did not observe or identify that VH-VOT overtook VH-VZC prior to the aircraft entering the holding pattern.
- The controller twice assigned VH-VOT descent through the flight level of VH-VZC, and did not detect the resulting loss of separation assurance.
- Due to a complex traffic situation and limited experience on the Gold Coast sector, the controller was experiencing a high workload at the time of the occurrence.
- The controller received a reduced amount of on-the-job training, was allocated many training officers, and was required to intermittently staff another control position during and immediately following their training on the Gold Coast sector. As a result, the controller probably had not consolidated effective control techniques for the sector, particularly for high workload situations.
- The controller had incomplete knowledge of the Australian Advanced Air Traffic System's Hold Window functionality.
- Resource constraints affected several aspects of the controller's training and consolidation, and ultimately these constraints were not effectively managed.
- There was no requirement for a systematic risk assessment to be conducted and documented when the planned amount of training for a controller was reduced. *[Significant safety issue]*

Other safety factors

- The decision to combine the other Air Traffic Control Group control positions, when the recently endorsed controller was subject to a period of high workload on the Gold Coast sector, removed an opportunity for experienced controllers to monitor and assist.
- The controller did not manage the compromised separation recovery effectively.
- The controller had not received training in compromised separation recovery techniques.
- The Byron Group's training manual was not current at the time of the occurrence, although the relevant material was being updated at a local level.

Other key findings

- The traffic proximity query from VH-VZC's flight crew led to the controller's identification of the loss of separation.

SAFETY ACTION

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

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

Airservices Australia

Training variance risk assessment

Significant safety issue

There was no requirement for a systematic risk assessment to be conducted and documented when the planned amount of training for a controller was reduced.

Action taken by/Response from Airservices Australia

Airservices Australia (Airservices) advised that it would develop a training variation form 'to systematically assess risk associated with amendments to the planned length of controller training programs.' More specifically, it stated:

> Training Programs are contained in Learning Agreements, Group Training Manuals or Training Needs Analyses. Any variation in training, to either lengthen or shorten the training period is stipulated in these documents and will require completion of the Training Variation Form. ATC Line Managers will complete the form supported with the reasons for the change and forward it to the Operational Training Manager. The Operational Training Manager will be required to ensure that the appropriate Learning Academy training process is followed. Remedial Training Plans will be developed when Training Programs are extended or varied due to competency issues.

ATSB assessment of response/action

The ATSB is satisfied that this safety action will, when implemented, satisfactorily address the safety issue.

Other safety action

Airservices advised that its Learning Academy had been restructured and two new Operational Training Managers had been appointed to improve the effectiveness of

operational training, which would encompass the management and revision of the involved ATC Group's Training Manual.

Airservices also advised that:

> Furthermore, Airservices' Air Traffic Services Training Delivery Group has commenced discussions to address the following safety concerns identified in the investigation.
>
> - Implementation of training scenarios where aircraft do not enter the holding pattern in the order that they are required to depart.
> - Standardisation and improvement of the understanding of the Eurocat Hold Window functionality and limitations.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of information

The sources of information during the investigation included the:

- aircraft operators
- occurrence controller
- on-the-job Training Instructor (OJTI)
- Senior Byron Group Training Specialist
- Byron Group Training Specialist
- Byron Group Check and Standardisation Supervisor
- Shift Manager
- Byron Group ATC Line Manager
- Airservices Australia (Airservices)
- Civil Aviation Safety Authority (CASA).

Resources

Manual of Air Traffic Services

Australian Aeronautical Information Publication

Airservices National ATS Administration Manual

Airservices National ATS Procedures Manual

Airservices Training Operations Manual

Staal, MA 2004, *Stress, cognition, and human performance: A literature review and conceptual framework*, National Aeronautics and Space Administration, Technical Memorandum TM – 2004–212824.

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 CASA, the aircraft operators, the Gold Coast sector controller, the on-the-job Training Instructor, the Check and Standardisation Supervisor, the Air Traffic Control Line Manager, the Group Training Specialist and the Shift Manager.

Submissions were received from Airservices, CASA, the operator of VH-VOT, the OJTI and the Group Training Specialist. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

Loss of separation involving Boeing 737, VH-VZC and Boeing 737, VH-VOT, at BLAKA ,

AO-2011-090
Final – 6 March 2013